

# ROADWORKS SIGNING

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# CHAPTER 13



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NOTE : Sign inventory requirements for standard roadworks signing applications are indicated in un-numbered tables throughout Sections 13.8 to 13.12.



## CHAPTER 13: ROADWORKS SIGNING

### 13.1 INTRODUCTION

#### 13.1.1 General

- 1 The temporary and continually variable nature of road construction and maintenance operations on roadways which are open to traffic makes such sites potentially more dangerous than a permanent hazard since even a driver familiar with the route cannot rely on his previous knowledge to predict conditions. In order to clearly identify these temporary conditions from permanent ones, exclusive signs with a yellow background are used.
- 2 As part of an holistic approach to roadworks signing, a significant increase in the use of symbols is recommended. In this context, the meaning of the "ROAD WORKMAN" symbol has been broadened to encompass the general meaning of "ROADWORKS", whether or not manual labour is in progress and whatever the scale of roadwork activity. In this way, the use of advance signs displaying text messages, such as "ROADWORKS AHEAD", is avoided.
- 3 Any work activity which results in a reduction in the road space available to drivers should be preceded, where space permits, by an adequate number of temporary road signs. The number and spacing of these signs is dependent on the site conditions and the design speed of the roadway.
- 4 All appropriate temporary road signs should be in position prior to the commencement of work. The crew placing the signs should use a vehicle which has been specially designed to make it highly visible to approaching drivers.
- 5 Great care should be taken that only those temporary signs appropriate to the current work activity are displayed. **All actions required of a driver should appear obviously realistic to him. When work conditions are variable, the temporary signing must be maintained so that the signs correctly represent the conditions applicable the given time.** Signs which only apply during daylight or only to specific circumstances should be removed or concealed when their significance does not apply. Nothing encourages a disregard of signs more than regulatory or warning signs displayed for non-existent conditions or hazards.
- 6 Only temporary road signs covered by the South African Road Traffic Signs Manual should be used. The use of signs not covered by the manual negates on-going efforts to achieve a high degree of standardisation of temporary signing practices. This high degree of standardisation is in the interest of the general safety of road users and site staff and failure to achieve it can result in the actual creation of hazards and confusion on the part of drivers.
- 7 Where a roadway is closed, partially closed, or diverted, or where an obstruction exists in the roadway, the alignment to be

followed by vehicles should be delineated by delineators, cones, barricades, barriers, roadstuds or road markings, or an appropriate combination of these devices. Delineation should be created in such a manner as to give an impression of continuity, both by day and night. The delineation devices used should be kept free of anything which could create a hazard should the device be struck by a passing vehicle.

- 8 The manner in which a roadway may be affected by construction or maintenance operations varies considerably. Complete standardisation of practices for signing and delineating such sites is impractical. However, it is important that design and site staff adopt a disciplined approach to the traffic management of roadworks sites. A systematic approach should be used to present the driver with changes in conditions, one change at a time, by the use of standardised sub-components. In this way the action or reaction of the driver can be anticipated and provided for with an acceptable degree of certainty and effectiveness.

#### 13.1.2 Objectives of Roadworks Signing

- 1 In order to achieve the safest possible operating environment the following objectives should be sought with disciplined attention to detail:
  - (a) to establish, as far as possible, a standard pattern of traffic control devices for typical road construction and maintenance operations which is simple and clear to understand;
  - (b) to develop in drivers, by means of exclusive signs which are visible and have a simple and easily understood message, a high level of awareness that a reduced standard of roadway exists ahead of them, **and the knowledge that this requires their increased vigilance;**
  - (c) to generate a high level of driver respect and familiarity for the efficiency and adequacy of the traffic management used at roadworks;
  - (d) to maintain roadway capacity and traffic flow at the highest possible levels, particularly on the higher class routes, where large traffic volumes would otherwise result in congestion, delay and accident potential;
  - (e) to keep roadwork related accident levels at a minimum;
  - (f) to provide adequate information to redirect drivers *via* alternative routes when detours are implemented;
  - (g) to provide designers of traffic management systems, and the site staff who implement them, with adequate tools with which to accomplish the above objectives;

- (h) to make designers and site staff aware of the need for a very high degree of discipline in the management of their sites on a day to day basis.

### 13.1.3 Norms to be Applied to Roadworks Signing

1 The norms listed below comprise the principles, criteria or standards by which the signing of roadworks sites should be developed:

- (a) all temporary signs shall conform to the exclusive colour code except for regulatory control signs e.g. STOP, YIELD and NO ENTRY, and existing direction signs which can be easily re-positioned at traffic deviations (see paragraph 13.2.2.2);
- (b) signs from the regulatory, warning or guidance (direction and diagrammatic) classes may all be used, either individually or in combination, as appropriate, in the exclusive colour code with the exceptions noted in paragraph 13.1.3.1(a) above – in this respect regulatory signs must always conform to the size requirements specified for various roadworks applications (see also paragraph 13.1.3.1(i));
- (c) all signs should have retroreflective backgrounds and regulatory and warning signs should have retroreflective borders;
- (d) diagrammatic guidance signs should generally use a vertical rectangular format and display a pictorial representation of the road condition immediately ahead;
- (e) the design of temporary diagrammatic guidance signs embodies the following principles:
  - (i) red retroreflective areas shall be used to indicate an obstruction in the road ahead;
  - (ii) one arrow shall be used per lane of traffic in the direction of travel to which the sign applies;
  - (iii) unless necessary for effectiveness of the sign message, one or more lanes of opposing traffic shall be indicated by one arrow;
- (f) when red areas of retroreflective material are applied to yellow retroreflective background materials the reflective index of the yellow material should be at least 3,5 times that of the red material;
- (g) distance information plates shall be used wherever possible to:
  - (i) indicate the length of a site (only appropriate to sites over 2 km in length - distances given in kilometres only e.g.. "6 km");
  - (ii) indicate the distance to a change in road conditions (transition area - normally 100 m, 200 m, 300 m or 400 m, up to 1 km);
  - (iii) indicate the distance for which a particular traffic configuration applies (can be used to "countdown" a long site to reassure motorists e.g. "For 14 km");
- (h) speed limits should be applied realistically and should, where appropriate, be capable of being altered to suit changing local conditions and/or time of day;
- (i) regulatory and warning sign sizes should be increased for rural applications to a minimum size equivalent to that applicable to a 100 km/h design speed, irrespective of the speed limit within the roadworks; the same principle should be applied in urban areas wherever possible using a minimum sign appropriate to an 80 km/h design speed;
- (j) when high approach speeds and/or large traffic volumes pertain, sign messages should be repeated along the length of a roadway, and, in the case of dual carriageway roadways should be displayed on both sides of the roadway (see paragraph 13.1.4.6),
- (k) the **minimum** spacing between repeated signs along the length of a roadway should be 100 metres on high speed roads and 60 metres on lower speed roads where space permits;
- (l) the spacing of delineation devices should be related to the rate of change of direction, using closer spacings for sharper changes of direction;
- (m) the lateral and vertical positioning of temporary signs at roadworks should, wherever possible, adhere to the norms applicable to permanent signs - see Volume 1, Chapter 1, Table 1.4 - however, it will often not be possible to adhere to these norms - recommended norms for the positioning of temporary signs in such instances are given in Table 13.1;
- (n) temporary direction signs used to redirect traffic to alternative routes should use the exclusive colour code and comply with all other design parameters of permanent direction signs; the use of DIN 1451 Style "A" compressed lettering is recommended for temporary direction signs to minimise sign area;
- (o) standard road markings, which may cause confusion, particularly at changes of direction, should be obliterated; temporary road markings should be used to emphasise the new alignment;
- (p) to maintain the capacity of the roadway, taper and crossover design should be directly related to the design speed of the temporary change of alignment;
- (q) a lane reduction taper should **never** extend over a width of more than one lane (or at the most a lane plus a shoulder); if the required reduction in width amounts to two lanes or more, two or more tapers should be used, each to extend over a maximum of one lane at a time and be separated along the roadway by a stabilising area;
- (r) to achieve a major change in alignment, without significant or further reduction in roadway width, a reverse curve should be used;
- (s) to reduce complex traffic management conditions to an acceptable level of simplicity, complex changes in width and alignment should be undertaken one stage at a time i.e.. a lane drop and a reverse curve should not occur at the same place.

### 13.1.4 Placement of Temporary Signs at Roadworks

1 Several of the norms listed in Subsection 13.1.3 relate to the correct placement of temporary roadworks signs. In particular



- paragraphs 13.1.3.1 (k) to 13.1.3.1 (m) state the general norms applicable to sign positioning at roadworks.
- 2 The position of a temporary sign can be specified in three ways, namely:
    - (a) longitudinally in relation to the roadway alignment;
    - (b) laterally in relation to the roadway cross section;
    - (c) vertically.
  - 3 The longitudinal positioning of temporary signs at roadworks is specified for each of the typical layouts covered in Sections 13.8 to 13.12. One of the most important aspects of longitudinal positioning of roadworks signs is the separation longitudinally between successive signs. **This separation should not become less than recommended in paragraph 13.1.3.1 (k).** If provision of such separations is difficult to achieve, consideration should be given to reducing number of signs because closer spacings will render the signs ineffective in any case. Certain signs, such as DELINEATOR signs TW401 and TW402, should be positioned at close longitudinal spacings to achieve their intended effect. The longitudinal spacing requirements for such signs are covered in Section 13.5 and Table 13.4.
  - 4 The lateral positioning of temporary signs at roadworks is often constrained by site conditions. Wherever possible the lateral clearances applicable to permanent signs should be achieved. These are covered in Volume 1, Chapter 1, in Figures 1.23 and 1.24. The basic requirements of these figures are repeated in Figure 13.19 together with recommended absolute minimum values for roadworks situations.
  - 5 Due to the temporary or portable method of mounting signs at roadworks it is not practical to position signs vertically to conform to the norms for permanent sign installations. If a temporary sign is to be mounted on a pole support which is placed in the ground, the mounting height should be as for a permanent sign. Guidelines are given in Table 13.1 and illustrated in Figure 13.19 for the vertical mounting of temporary or portable signs on stands placed on the road or verge surface. Such stands may be ballasted to limit accidental movement but are generally not other-wised fixed to the road surface.
  - 6 Throughout this chapter it is recommended that temporary signs be repeated on the right side of one way roadways such as carriageways of dual carriageways. The placing of any temporary sign at the roadside in itself represents a hazard. This is one of the factors which must be taken into account when deciding on the reduction in speed limit appropriate to a roadworks site. It can be argued that the placing of temporary signs on the right side of the roadway is more hazardous than on the left side. (However, this argument is dependent on the design standards of the median separating the two carriageways i.e. a wide grass median versus a concrete barrier.) The following factors should be considered before deciding whether to use right side temporary signs, and the signs could be considered likely to be effective if a positive answer can be given to any of the questions:
    - (a) is traffic likely to be so dense that the numbers of vehicles, and particularly large vehicles, is likely to significantly obscure left side signs to drivers in a second or third lane from the signs?

**TABLE 13.1 RECOMMENDED MINIMUM VERTICAL CLEARANCE (mm) FOR TEMPORARY TRAFFIC CONTROL DEVICES (1)**

| Sign Class or Type             | 85%ile Approach Speed |                   |           |
|--------------------------------|-----------------------|-------------------|-----------|
|                                | <60 km/h              | 60 km/h – 80 km/h | > 80 km/h |
| Short term <sup>(4)</sup>      | 200                   | 200               | 200       |
| Cluster stand                  | 200                   | N/A               | N/A       |
| Delineators                    | 200                   | 200               | 200       |
| Barricades                     | 600                   | 750               | 750       |
| Chevrans                       | 600                   | 750               | 1200      |
| Regulatory <sup>(2)</sup>      | 200                   | 750               | 1500      |
| Advance warning <sup>(2)</sup> | 200                   | 750               | 1500      |
| Diagrammatic                   | 800                   | 800               | 1200      |
| High visibility                | 800                   | 800               | 1200      |
| Traffic signals <sup>(5)</sup> | 2300                  | 2300              | 2300      |

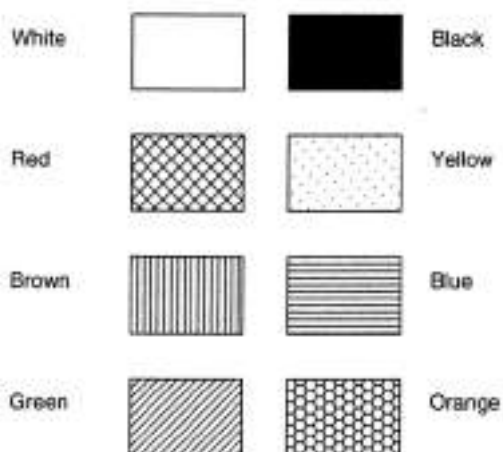
**NOTE:**

- (1) The recommended minimum vertical clearance given is between the underside of the sign and the edge of the travelled way.
- (2) Wherever possible a greater than minimum vertical clearance should be provided.
- (3) Signs should preferably not be mounted in the vertical clearance range 1500 mm to 2000 mm to avoid the risk of signs hitting vehicle windscreens during collisions.
- (4) Short term work should be limited to work of duration of 24 hours or less.
- (5) The vertical clearance of a traffic signal is specified as being between the centre of the lowest lens and the edge travelled way.

- (b) is there a change of roadway conditions ahead on the right side of the carriageway?
- (c) is traffic from left being diverted towards the right?
- (d) is the work load of drivers on the right side of the carriageway so much greater than the normal workload for such an environment that drivers' concentration on traffic is likely to result in them missing left side temporary signs?
- (e) will right side signs be a no greater a hazard than left side signs?

### 13.1.5 Road Traffic Sign Colour Indication

- 1 The chapters of Volume 2 of the South African Road Traffic Signs Manual (SARTSM) are not prepared in colour. Relevant examples used to illustrate appropriate signs, signals and markings are shaded in a black and white coding which is illustrated below.
- 2 The basic principles of the road traffic sign colour coding system are shown, in colour, in the SADC-RTSM Volume 1, Chapter 1, Section 1.4, and in the Contents sections of relevant Volume 1 and 4 Chapters.



## **13.2 TYPES OF TEMPORARY SIGNS**

### **13.2.1 General**

- 1 Almost any type of standard or permanent sign may be produced as a temporary type of sign by using the exclusive colour code of a black symbol, letter or border on a yellow background in place of the standard white symbol, letter or border on a white, blue or green background. When used with temporary signs, all forms of supplementary, distance or information plates shall also conform to the temporary sign colour code. Details of the relevant signs in each of the major sign categories are given in subsequent sections.
- 2 There are certain exceptions to the use of the temporary colour code. Those relating to regulatory signs are covered in Subsection 13.2.2.
- 3 The contents of this chapter deal with the use of temporary signs at roadworks. The signs may also be used for other temporary signing activities such as:
  - (a) general maintenance (e.g. tree cutting);
  - (b) police or other roadblocks;
  - (c) interview traffic surveys;
  - (d) sports events;
  - (e) school activities.
- 4 Details of the manner in which temporary road traffic signs should be applied are given in later sections.

### **13.2.2 Temporary Regulatory Signs**

- 1 Regulatory signs are necessary to inform users of traffic laws or regulations and to indicate the applicability of these legal requirements. As a result of the restrictions in roadway width common to roadworks sites the modification of permanent regulatory signs to temporary regulatory signs and the use of additional temporary regulatory signs are commonly required.
- 2 Regulatory signs related to traffic control DO NOT adopt the temporary sign colour code. These are:
  - (a) the STOP sign R1;
  - (b) the YIELD sign R2;
  - (c) the NO ENTRY sign R3;
  - (d) the ONE WAY sign R4;
  - (e) YIELD TO ONCOMING TRAFFIC sign R6.
- 3 In order to maintain driver respect for standard and temporary regulatory signs these should not be used without a commitment from the road authority to enforce the relevant regulations as and when necessary. Failure to do so will result in an increased lack of compliance with regulations, not just at the site in question, but generally.
- 4 If a speed limit is reduced at roadworks by the use of a **TEMPORARY SPEED LIMIT** sign TR201, a return to the normal speed limit shall be indicated by the appropriate standard **PERMANENT SPEED LIMIT** sign R201.
- 5 When localised reductions in speed limit are deemed necessary, it is recommended that the temporary **SPEED LIMIT** sign TR201 be combined with a relevant temporary

warning sign, which indicates the reason for the speed limit reduction, such that the regulatory sign sits above the warning sign.

- 6 The shape, proportions and dimensions of all temporary regulatory signs and the dimensions of all symbols used on temporary regulatory signs remain the same as used on standard regulatory signs. Examples are given in Figures 13.1 to 13.3.

### **13.2.3 Temporary Warning Signs**

- 1 Temporary advance warning signs may be used in sequences of signs approaching a change of direction or transition area at roadworks sites, or they may be used individually to warn of specific local temporary hazards within sections of roadway, detours or temporary roadways.
- 2 The shape, proportions and dimensions of temporary warning signs and the dimensions of all symbols used on temporary warning signs remain the same as used on permanent warning signs.
- 3 In order to improve the target value of the basic triangular temporary warning sign the conspicuity of the sign may be increased by incorporating it into a rectangular background sign with a retroreflective yellow colour and a black border. The triangular border used within such temporary **HIGH VISIBILITY** warning signs has been modified to improve the proportions of these signs. Examples of typical temporary **HIGH VISIBILITY** warning signs are given in Figures 13.4 and 13.10.
- 4 **HIGH VISIBILITY** signs may be square or rectangular in shape. They should only be manufactured in one of the following standard sizes (width x height):
  - (a) square:
    - (i) 900 mm x 900 mm;
    - (ii) 1200 mm x 1200 mm;
    - (iii) 1800 mm x 1800 mm;
  - (b) standard rectangle (one included sign):
    - (i) 900 mm x 1200 mm;
    - (ii) 1200 mm x 1600 mm;
    - (iii) 1800 mm x 2400 mm;
  - (c) large rectangle (two included signs):
    - (i) 900 mm x 1800 mm;
    - (ii) 1200 mm x 2400 mm;
    - (iii) 1800 mm x 3400 mm

For further details see Volume 4, Chapters 2 and 3.
- 5 Due to the often confusing nature of the approach to certain temporary hazards, it is recommended that distance plates be used in conjunction with temporary advance warning signs. It is also recommended that temporary advance warning signs used on their own on high speed approaches, be specified one size larger than would be used for a permanent installation.
- 6 It may be advisable, when the situation being signed is particularly hazardous, to repeat the warning message using a second sign.

### 13.2.4 Temporary Guidance Signs

1 A number of temporary guidance signs are available for use at roadworks. These fall into the following sub-categories:

- (a) Diagrammatic;
- (b) Direction.

2 Temporary guidance signs are particularly effective at the more complex roadworks site where drivers need the highest possible level of positive guidance in order that they may proceed through the site safely and with the minimum of delay and disruption.

3 DIAGRAMMATIC guidance signs have been developed to give drivers a pictorial representation of changes in conditions on the road ahead. This need has arisen from major rehabilitation work which has become necessary on the higher class roads in the country. Their application is of greatest effect on dual carriageway roads but they are equally applicable to less complex sites to give a clear and simple message to the driver.

4 **The diagram on each sign must represent only one simple change in road conditions.** If the roadworks site requires more than one basic transition or change of circumstances, then each transition should be signed separately, using the appropriate sequence of signs according to the degree of change involved, the traffic speed, and/or volume.

5 The number of diagrammatic sign designs is limited to those which represent the more common single traffic management techniques available to control traffic. These represent sub-systems within the overall traffic management system for a given roadworks site. It is recommended that the traffic management of a site be designed around these standardised sub-systems and signs, rather than by creating new and unnecessarily complex systems and signs. The following are the standard categories of DIAGRAMMATIC guidance sign based on the type of roadworks circumstance they represent:

- (a) Traffic Movement Affected by an Obstruction (or apparent obstruction) - TGS101 series;
- (b) Lane Use Control by Regulation - TGS301 series;
- (c) Lanes Merge/Converge - TGS401 series;
- (d) Heavy Vehicle Guidance and Control - TGS501 series;
- (e) Unique Overhead Signs - TGS600 series;
- (f) Overhead versions of other sign types - TGS6000 series

Available DIAGRAMMATIC guidance signs are illustrated in Figures 13.11 to 13.15. For further details see Volume 1, Chapter 4.

6 As indicated in paragraph 13.2.4.5 by the category description DIAGRAMMATIC guidance signs commonly indicate some aspect relating to a change in condition of a lane of a roadway. The lane may be the only lane for traffic travelling in one direction (commonly on a two-way road), or it may be one of several on a carriageway (commonly one carriageway of a dual carriageway road). Hazards represented by physical obstructions, or apparent obstructions at a sudden change in direction for instance, are represented on DIAGRAMMATIC guidance signs by large red blocks.

7 DIAGRAMMATIC guidance signs are rectangular in shape. The basic sizes match those of standard rectangular HIGH VISIBILITY signs as follows (width x height):

- (a) 900 mm x 1200 mm;
- (b) 1200 mm x 1600 mm;
- (c) 1800 mm x 2400 mm.

When a multiple lane layout requires a wider format, the basic width may be increased in regular increments as follows (width x height):

- (d) 900 mm to 1125 mm or 1350 mm x 1200 mm;
- (e) 1200 mm to 1500 mm or 1800 mm x 1600 mm;
- (f) 1800 mm to 2250 mm or 2700 mm x 2400 mm.

For further dimensional details see Volume 4, Chapter 8.

8 DIRECTION guidance signs may be manufactured using black symbols, letters or borders on a yellow retroreflective background to guide drivers to destinations by temporary alternative routes. The signs may be used in any of the following typical situations:

- (a) when dual carriageway traffic has been diverted to one carriageway under contraflow conditions and original permanent signs on the closed carriageway are too remote for adequate visibility by day and night;
- (b) when a route is completely closed to all through traffic and an alternative route is available;
- (c) when the capacity of a route is severely restricted by major roadworks such as a bridge site and an alternative route with adequate capacity is available;
- (d) when partial closures of routes, street networks or freeway interchanges become essential to the efficient progress of a roadworks site.

9 A modified, temporary GORE EXIT direction sign TGA 4(V) has been developed which occupies a minimum side space. This is particularly appropriate to temporary alignments of freeway off-ramps. Alternatively, for better visual impact, a black and yellow version of the standard GA4 GORE EXIT sign numbered TGA4 may be used if space permits (see Figure 13.18).

10 Temporary DIRECTION guidance signs should be manufactured according to the appropriate standards as covered by the Volume 4. Attention should be paid to the approach speed of traffic as this may permit a reduction in sign sizes. Typical examples of temporary direction signs are given in Figure 13.16. The use of DIN 1451 Style "A" compressed lettering is recommended in order to minimise sign sizes.

### 13.2.5 Temporary Information Signs

1 Temporary INFORMATION signs play an important support role to temporary regulatory, warning and guidance signs at roadworks. INFORMATION signs are commonly used in temporary circumstances to supplement other signs by giving additional information to improve driver awareness of circumstances ahead. The most commonly used types of

temporary INFORMATION signs which are illustrated in Figure 13.17 are:

- (a) COUNTDOWN signs TIN1, TIN2 and TIN3;
- (b) CUL-DE-SAC signs TIN4, TIN5 and TIN6 (used mainly in urban areas);
- (c) SUPPLEMENTARY PLATE signs TIN11.

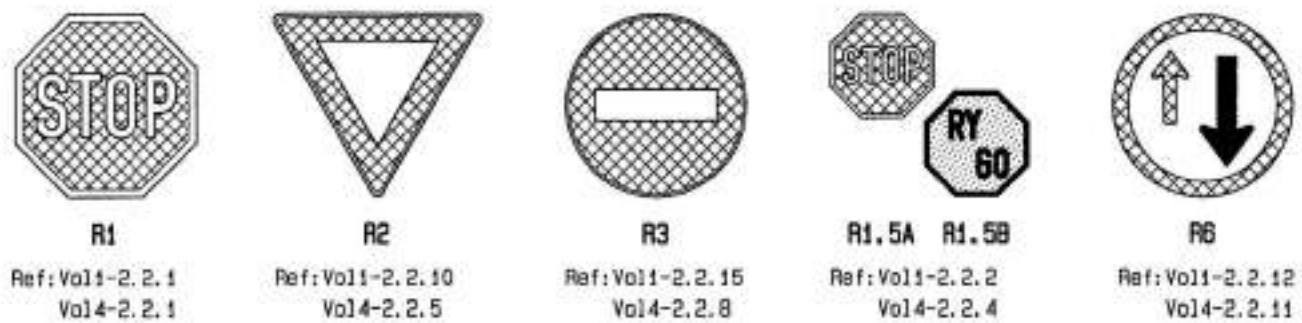
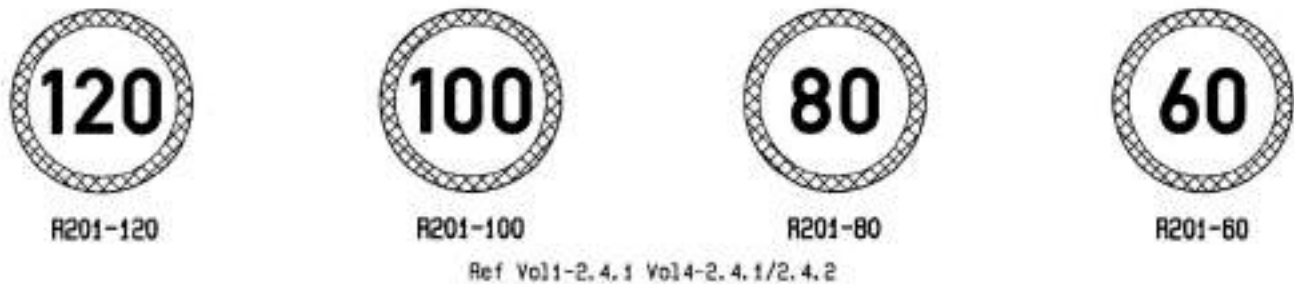
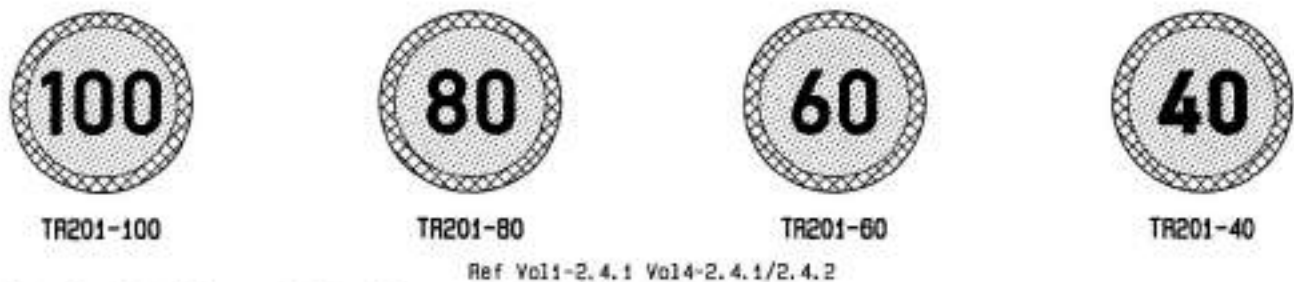
- 2 Countdown signs may be used in advance of temporary freeway off-ramps which are often, of necessity, sited in such a manner that standard visibility distances cannot be realised. The generally confused environment common to a busy roadworks site may also make the use of such signs, with distance plates, of value.
- 3 SUPPLEMENTARY PLATE signs are recommended for use with all classes of sign in temporary signing situations because standard siting may not be possible for various reasons. The use of distance supplementary plates also offers the opportunity to countdown the distance to an obstruction in the roadway or change of direction, particularly on higher speed approaches. Distance plates should match the width of the sign which they supplement.

should conform to the positional requirements for temporary signs given in Figure 13.19 and Table 13.1.

- 4 If temporary traffic signals are required at a roadworks site they may be manufactured to be moveable, but they shall conform to the requirements of legislation, in terms of size, number, position and modes of operation (see Volume 1, Chapter 6).

### **13.2.6 Other Forms of Temporary Road Traffic Signs**

- 1 In terms of the statement made in paragraph 13.2.1.1, road markings and traffic signals may be used in temporary situations. However, there are no specific colour code or other visible variations of road markings or traffic signals for temporary use. If road markings or traffic signals are required to be used for a temporary period, **they shall be used according to the normal visual and size requirements and specifications for permanent use.**
- 2 It should, however, be remembered that the removal of road markings is often difficult and can result in confusing visual messages to drivers, particularly on wet surfaces and at night-time or when the angle of the sun is low. The use of removable adhesive retroreflective tapes is recommended for short lengths of temporary road marking, but tests should be carried out to ensure that the materials perform as manufacturers say they will. Alternatively innovative use of high rate of wear paints, such as water-based paints, may be appropriate for short term applications depending on the nature of the road surface.
- 3 The needs of roadworks, in terms of temporary signs, can be many and varied. The wide range of signs illustrated in this section provides for most situations. **Indeed an effort should always be made to try to design the temporary traffic management configuration within this range of signs.** There are, however, times when this cannot be done or an extra effort is needed. Very short term work also often requires that signs be portable, light weight, and/or collapsible. Figure 13.18 illustrates a collection of less commonly used signs, variations on standard signs for particular applications, and non-standard signs which are occasionally used, but which are not currently detailed in Volumes 1 or 4. In some instances the variation from more common practice is due to the combination of signs displayed. In other instances it may be the use of different materials which is relevant. The use of such signs

**Detail 13.1.1 Control Regulatory Signs****Detail 13.1.2 Permanent Regulatory Signs****Detail 13.1.3 Commonly Used Temporary Regulatory Signs****KEY TO COLOUR CODE:****RED****BLACK****YELLOW****BLUE****NOTE:**

- (1) The signs in Detail 13.1.1 do not have a temporary form, number or colour code. When used temporarily they shall have their permanent colours and numbers.
- (2) A mixture of permanent and temporary signs, with the exception of the CONTROL signs in Detail 13.1.1, is not recommended at roadworks sites. The temporary sign colour code shall be used for all signs on the approach to, and within roadworks sites whether these occur for short, medium or long durations. The permanent SPEED LIMIT signs R201 illustrated in Detail 13.1.2 shall be displayed after the end of a roadworks site at which the relevant general or other speed limit has been reduced due to the roadworks. All other SPEED LIMIT signs used shall be temporary TR201 signs - see Detail 13.1.3.
- (3) The temporary regulatory signs indicated in Details 13.1.3 and 13.2.1 are commonly used at roadworks sites. Their use is covered by Sections 408(3), 409(5)(b), 409(5)(c), 410(2), 410(5)(a), 410(9)(b)(ii) and Schedule 3 of the Road Traffic Regulations to the Road Traffic Act, Act 29 of 1989. Other temporary regulatory signs are illustrated in Figures 13.2 and 13.3.

**Fig 13.1****Regulatory Signs for Use at Roadworks - 1**



TR103



TR104

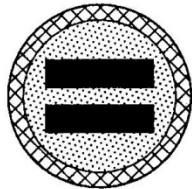
Ref: Vol1-2.3.4/2.3.6 Vol4-2.3.3 to 2.3.7



TR105

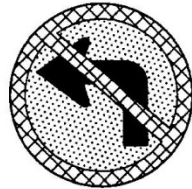


TR106



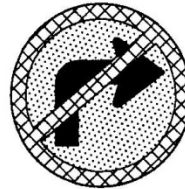
TR208

Ref: Vol1-2.4.11 Vol4-2.4.10



TR209

Ref: Vol1-2.4.12 Vol4-2.4.11/2.4.12

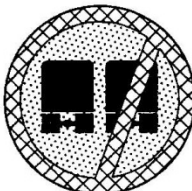


TR210



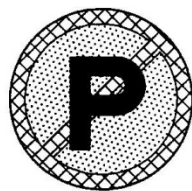
TR214

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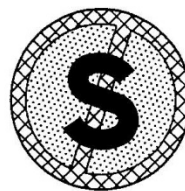
TR215

Ref: Vol1-2.4.16 Vol4-2.4.17



TR216

Ref: Vol1-2.4.18 Vol4-2.4.18



TR217

Ref: Vol1-2.4.21 Vol4-2.3.19



TR218

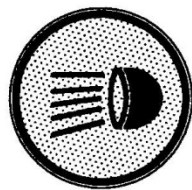
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#### Detail 13.2.1 Commonly Used Temporary Regulatory Signs



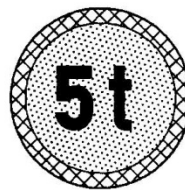
TR125

Ref: Vol1-2.3.19 Vol4-2.3.25



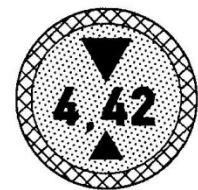
TR133

Ref: Vol1-2.3.25 Vol4-2.3.33



TR202-5

Ref: Vol1-2.4.3 Vol4-2.4.3/2.4.4



TR204

Ref: Vol1-2.4.6 Vol4-2.4.6



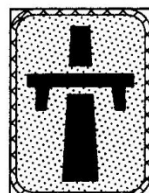
TR222

Ref: Vol1-2.4.28  
Vol4-2.4.24



TR239

Ref: Vol1-2.4.21  
Vol4-2.4.40



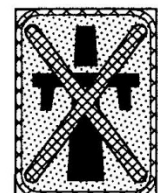
TR402

Ref: Vol1-2.6.4  
Vol4-2.6.2



TR401-600

Ref: Vol1-2.6.4  
Vol4-2.6.1/2.6.2



TR402-600

#### Detail 13.2.2 Other Temporary Regulatory Signs

##### NOTE:

- (1) The regulatory signs illustrated in Detail 13.2.2 are likely to be used only in special circumstances. A wide range of PROHIBITION signs applicable to specific classes of vehicle is also available. Temporary RESERVATION signs may also be appropriate particularly at urban roadworks sites. See Volume 1 and 4 for further signs.

Fig 13.2

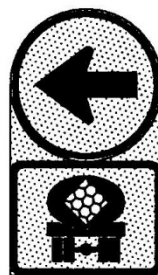
Regulatory Signs for Use at Roadworks - 2



TR102-570



TR103-562



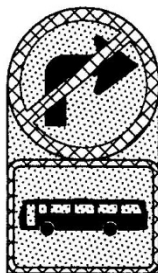
TR105-571



TR201-569



TR217-502



TR210-560



TR201-570



TR218-501

#### Detail 13.3.1 Typical Temporary Selective Restriction Regulatory Signs

(Ref: Vol1-Section2.7 Vol4-Section2.7)



TR217-TIN11.502



TR214-TIN11.2



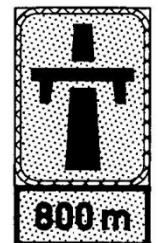
TR216-TIN11.4



TR217-502-TIN11.501



TR402-TIN11.2



TR402-TIN11.3

(Ref: Vol1-Section2.8 Vol4-Chapter9)

#### Detail 13.3.2 Typical Temporary Regulatory/Information Sign Combinations

##### NOTE:

- (1) Regulatory signs may be combined to create temporary SELECTIVE RESTRICTION Regulatory signs. See Detail 13.3.1. The function of such signs is that the lower secondary regulatory message modifies the applicability of the upper primary regulatory message. This modification may make the primary regulatory message applicable only for a certain period of time, to a particular action or by a particular class of vehicle. Temporary SELECTIVE RESTRICTION signs must not be confused with information combination signs - see Detail 13.3.2.
- (2) Information may be added below a temporary regulatory sign as shown in Detail 13.3.2 by means of a SUPPLEMENTARY PLATE Information sign to clarify when the regulation to which it refers starts or for how long it lasts, by means of a text or symbolic message. Regulatory / Information combination signs must not be confused with SELECTIVE RESTRICTION Regulatory signs - see Detail 13.3.1. The principle physical difference between the two types is that the SUPPLEMENTARY PLATE always has a black border and the SELECTIVE RESTRICTION secondary message sign has a border the same colour as that of the primary message sign.

Fig 13.3

Regulatory Signs for Use at Roadworks - 3





TW336

Ref: Vol1-3.4.30 Vol4-3.4.36



TW336-WA



TW336-WB

Ref: Vol1-3.6.4 Vol4-3.1.6 to 3.1.9



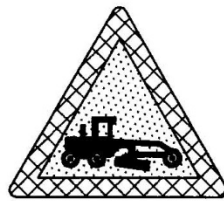
TW336-WA/TIN11.3

#### Detail 13.4.1 Roadworks Ahead



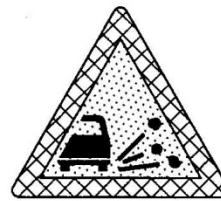
TW336

Ref: Vol1-3.4.30 Vol4-3.4.36



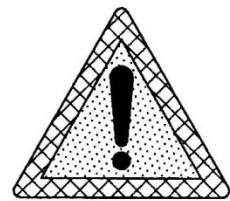
TW337

Ref: Vol1-3.4.31 Vol4-3.4.37



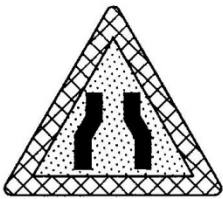
TW338

Ref: Vol1-3.4.32 Vol4-3.4.38

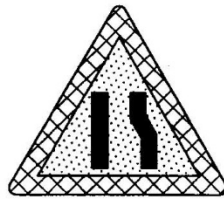


TW339

Ref: Vol1-3.4.33 Vol4-3.4.39

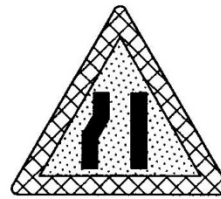


TW328

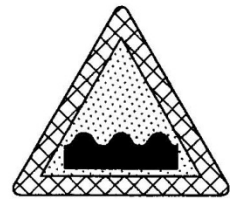


TW329

Ref: Vol1-3.4.24/3.4.25 Vol4-3.4.28 to 3.4.30



TW330



TW331

Ref: Vol1-3.4.26 Vol4-3.4.31

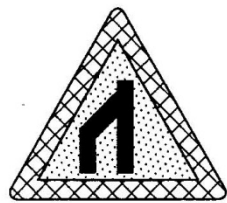
#### Detail 13.4.2 Commonly Used Temporary Advance Warning Signs

#### NOTE:

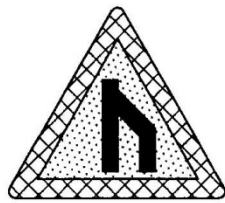
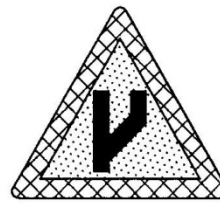
- (1) Warning of ROADWORKS AHEAD has traditionally been given using Information sign G36A at larger work sites and WORKMEN AHEAD warning sign W40 at minor work sites. The function of sign W40 has been changed to that of a general warning of ROADWORKS AHEAD. In terms of the revision to the signing system the sign is re-numbered TW336. For larger work sites the message "ROADWORKS AHEAD" should be given by incorporating sign TW336 into a high visibility background with or without supplementary distance plates - see Detail 13.4.1. **Such signs replace sign G36A which is no longer a road traffic sign.**
- (2) ONLY temporary versions of warning signs shall be used at roadworks sites and other temporary conditions requiring warning signs such as accident sites, traffic survey sites etc. The signs illustrated in Detail 13.4.2 relate principally to roadworks use and many do not have permanent versions. The signs are not listed exclusively in numerical order. Additional temporary warning signs are illustrated in Detail 13.5.1 and hazard marker signs in Detail 13.8.1.

Fig 13.4

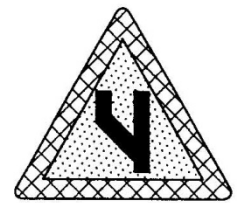
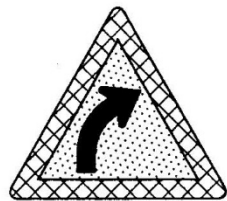
Warning Signs for Use at Roadworks - 1

**TW116**

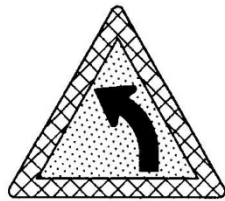
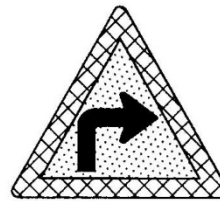
Ref: Vol1-3.2.7 Vol4-3.2.16/3.2.17

**TW117****TW118**

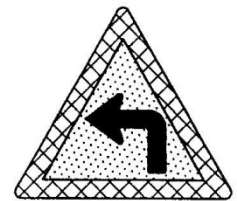
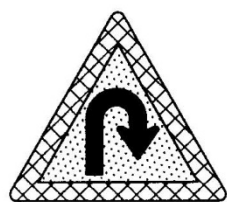
Ref: Vol1-3.2.8 Vol4-3.2.18/3.2.19

**TW119****TW202**

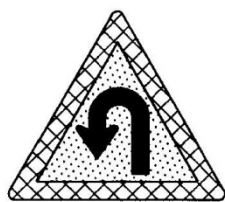
Ref: Vol1-3.3.2 Vol4-3.3.2/3.3.3

**TW203****TW204**

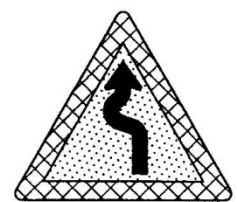
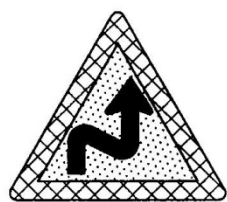
Ref: Vol1-3.3.3 Vol4-3.3.4/3.3.5

**TW205****TW206**

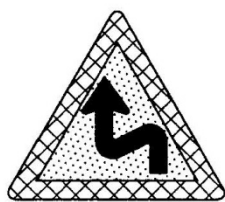
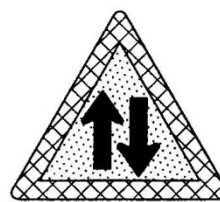
Ref: Vol1-3.3.4 Vol4-3.3.6/3.3.7

**TW207****TW208**

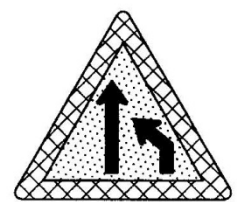
Ref: Vol1-3.3.5 Vol4-3.3.6/3.3.9

**TW209****TW210**

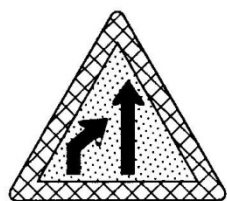
Ref: Vol1-3.3.6 Vol4-3.3.10/3.3.11

**TW211****TW212**

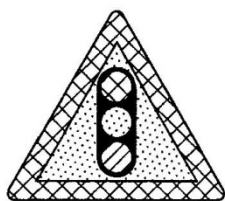
Ref: Vol1-3.3.7 Vol4-3.3.12

**TW214**

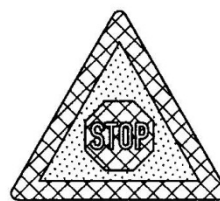
Ref: Vol1-3.3.9 Vol4-3.3.14

**TW215**

Ref: Vol1-3.3.9 Vol4-3.3.15

**TW301**

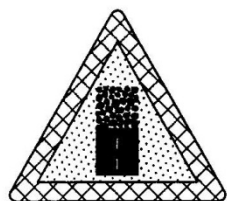
Ref: Vol1-3.4.1 Vol4-3.4.1

**TW302**

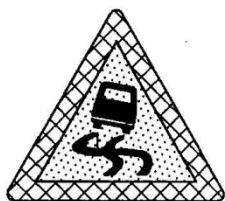
Ref: Vol1-3.4.2 Vol4-3.4.2

**TW304**

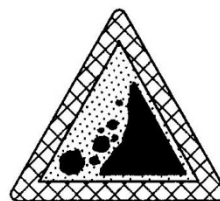
Ref: Vol1-3.4.4 Vol4-3.4.4

**TW325**

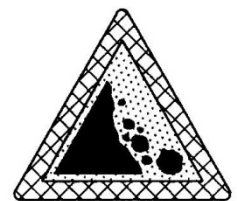
Ref: Vol1-3.4.21 Vol4-3.4.25

**TW333**

Ref: Vol1-3.4.28 Vol4-3.4.33

**TW334**

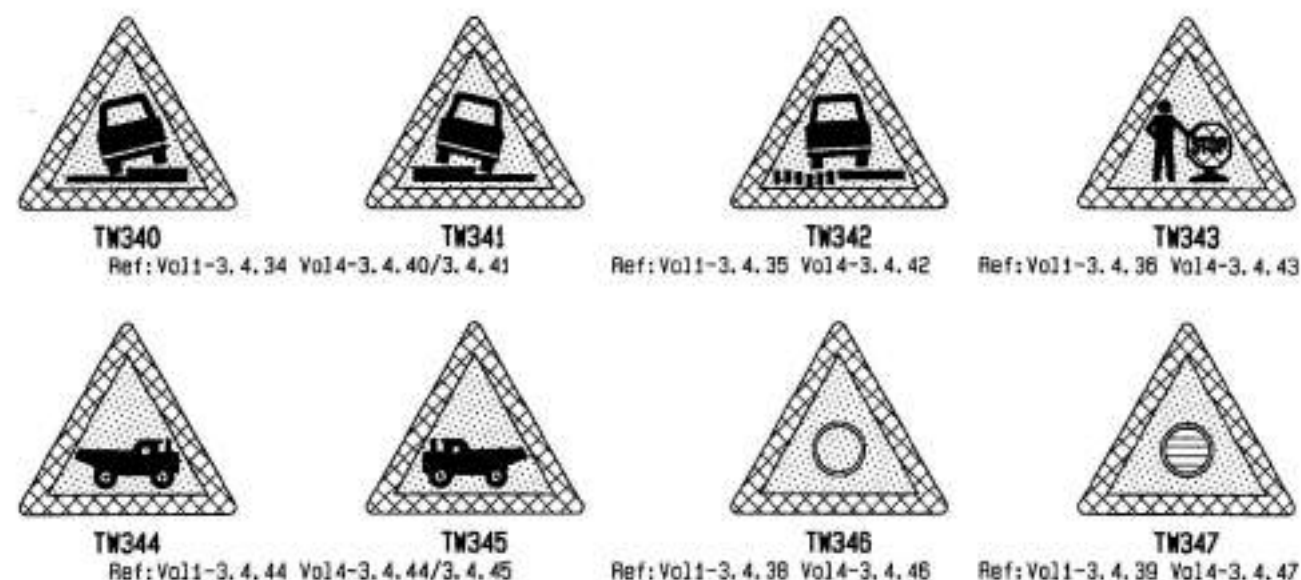
Ref: Vol1-3.4.29 Vol4-3.4.34/3.4.35

**TW335**

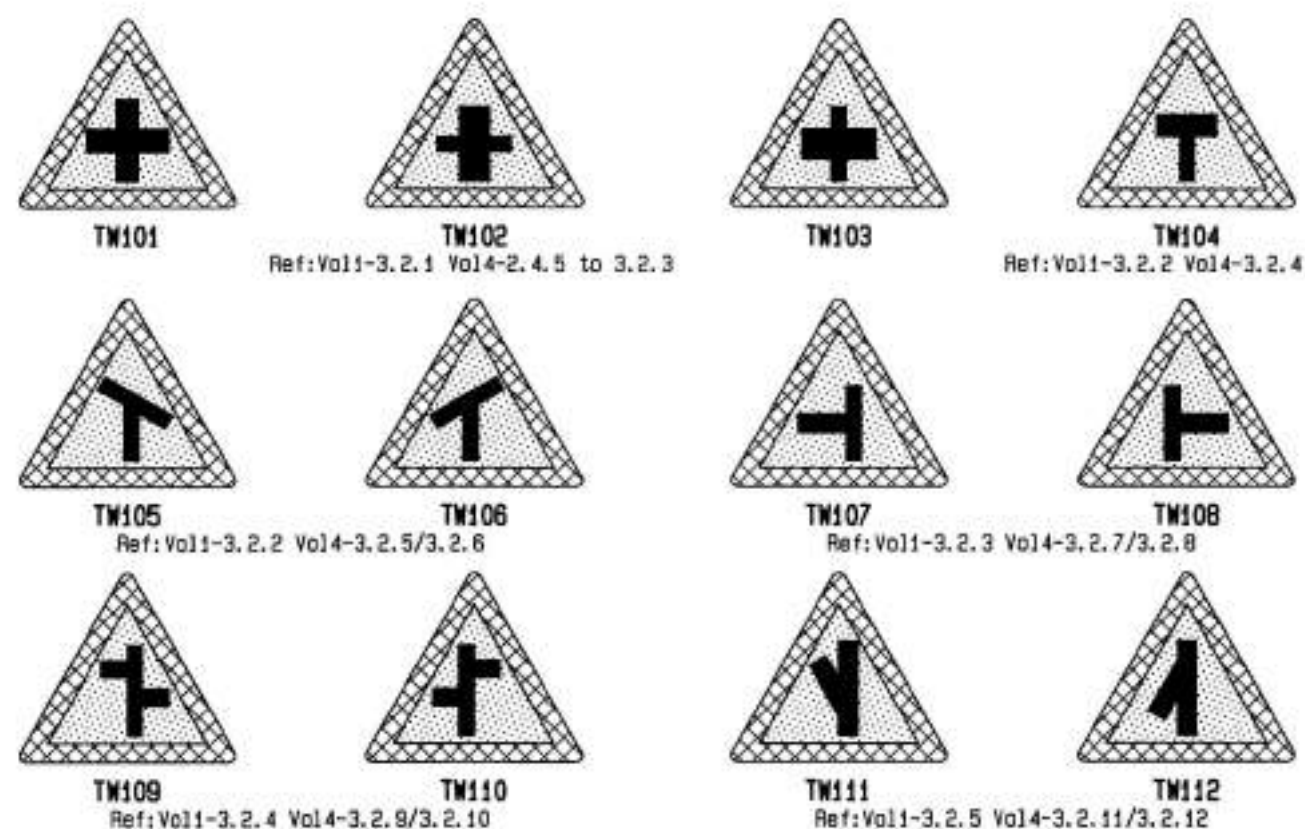
Detail 13.5.1 Commonly Used Temporary Advance Warning Signs

Fig 13.5

Warning Signs for Use at Roadworks - 2



Detail 13.6.1 Commonly Used Temporary Advance Warning Signs (Continued in Fig 13.5)



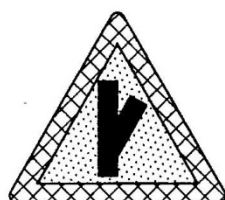
Detail 13.6.2 Other Temporary Advance Warning Signs (Continued in Fig 13.7)

NOTE:

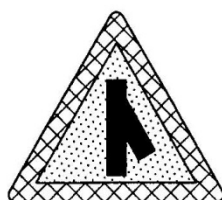
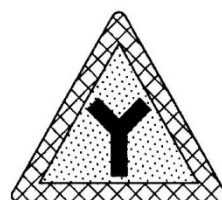
- (1) The warning signs in Detail 13.6.2 may be required at roadworks under certain circumstances but their use is not likely to be common. The signs are not listed exclusively in numerical order due to the previous listing in Details 13.4.2, 13.5.1 and 13.6.1 of the more commonly used warning signs. SCHOLAR PATROL sign and FARM ANIMALS signs TW310, TR311 and TW312 have not been illustrated as they are unlikely to be required at roadworks sites.

Fig 13.6

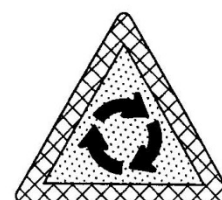
Warning Signs for Use at Roadworks - 3

**TW113**

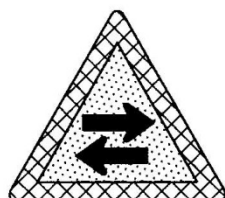
Ref: Vol1-3.2.5 Vol14-3.2.13/3.2.14

**TW114****TW115**

Ref: Vol1-3.2.6 Vol14-3.2.15

**TW201**

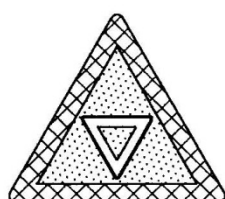
Ref: Vol1-3.3.1 Vol14-3.3.1

**TW213**

Ref: Vol1-3.3.8 Vol14-3.3.13

**TW216****TW217**

Ref: Vol1-3.3.10 Vol14-3.2.16 to 3.3.18

**TW218****TW303**

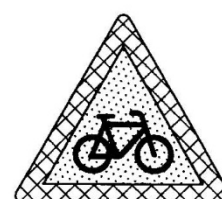
Ref: Vol1-3.4.3 Vol14-3.4.3

**TW306**

Ref: Vol1-3.4.6 Vol14-3.4.6

**TW307**

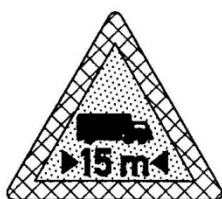
Ref: Vol1-3.4.7 Vol14-3.4.7

**TW309**

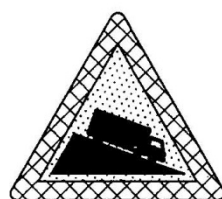
Ref: Vol1-3.4.8 Vol14-3.4.9

**TW318**

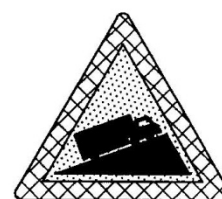
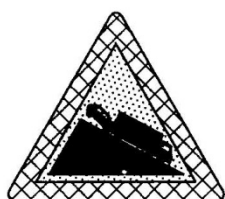
Ref: Vol1-3.4.14 Vol14-3.4.18

**TW321**

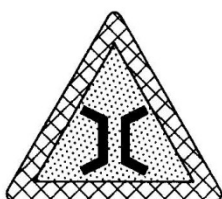
Ref: Vol1-3.4.17 Vol14-3.4.21

**TW322**

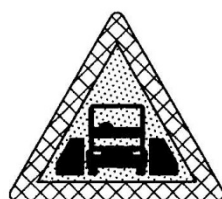
Ref: Vol1-3.4.18 Vol14-3.4.22/3.4.23

**TW323****TW324**

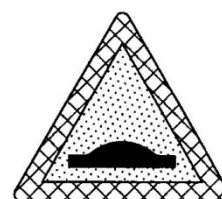
Ref: Vol1-3.4.20 Vol14-3.4.24

**TW326**

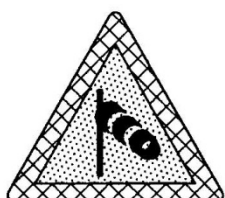
Ref: Vol1-3.4.22 Vol14-3.4.26

**TW327**

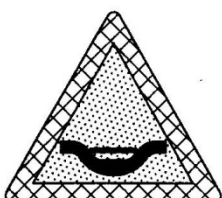
Ref: Vol1-3.4.23 Vol14-3.4.27

**TW332**

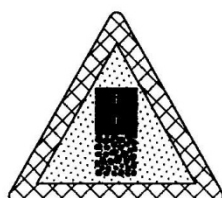
Ref: Vol1-3.4.27 Vol14-3.4.32

**TW349**

Ref: Vol1-3.4.41 Vol14-3.4.49

**TW350**

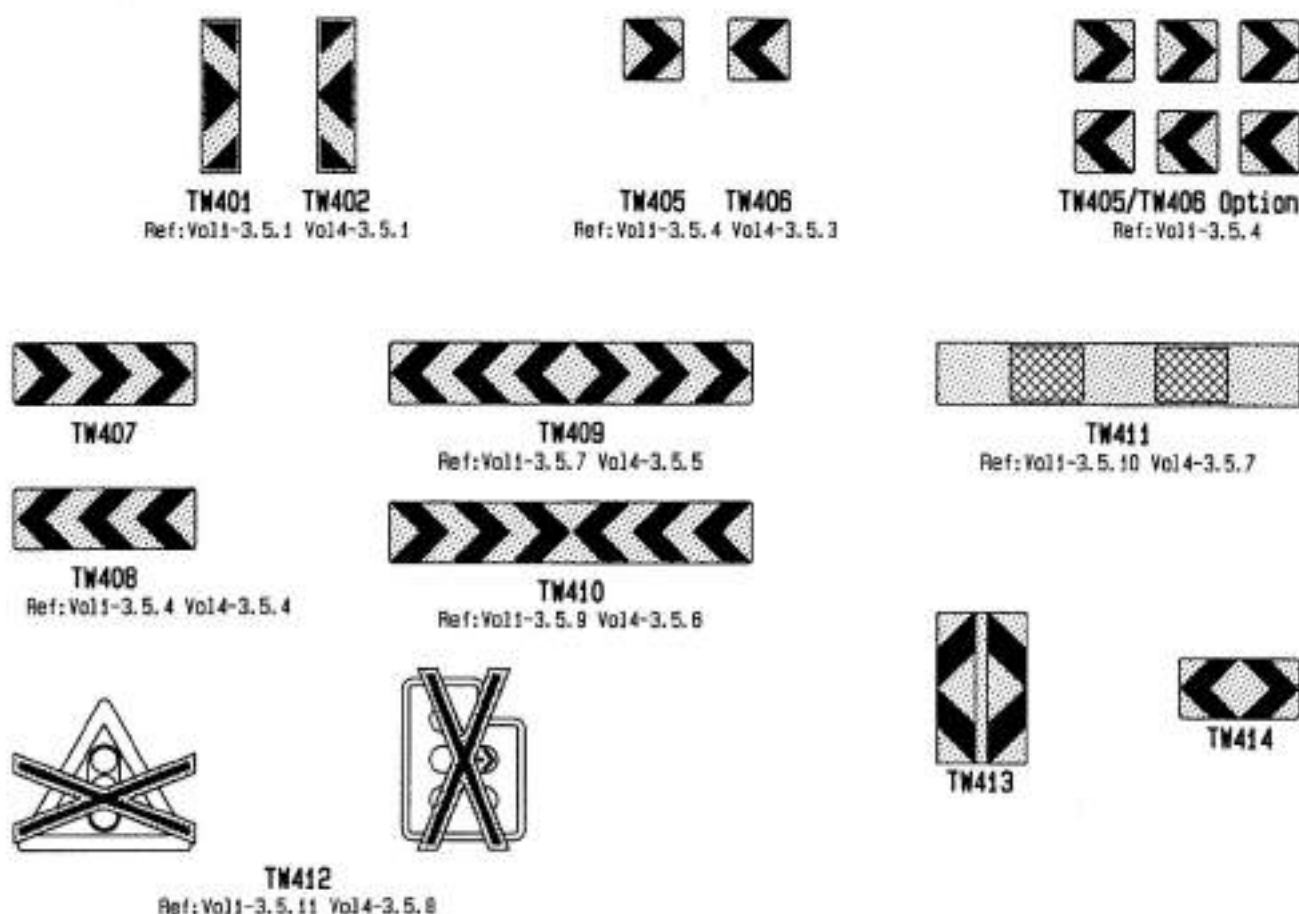
Ref: Vol1-3.4.42 Vol14-3.4.50

**TW363**

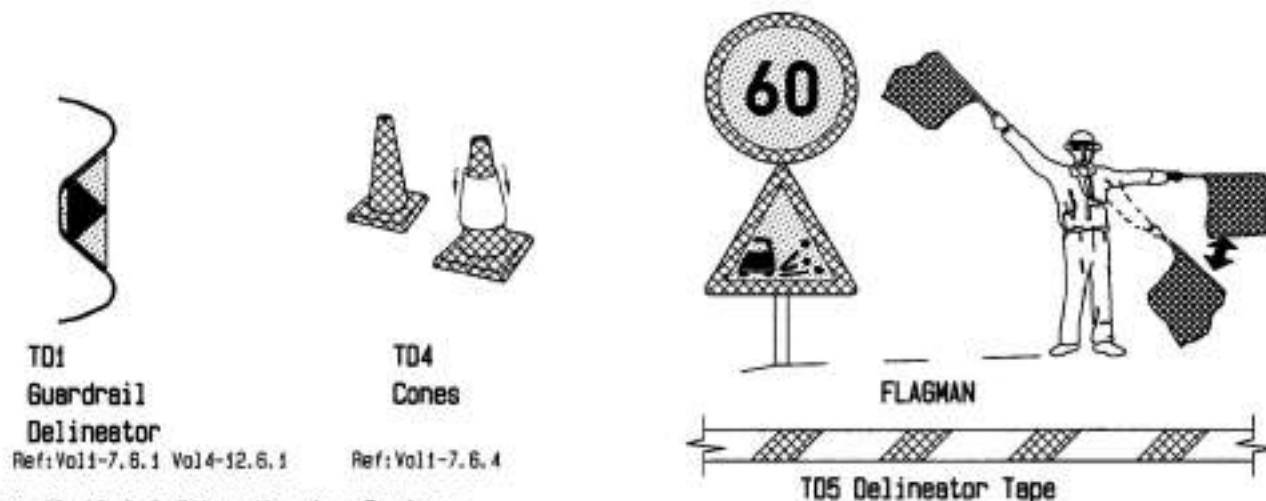
Ref: Vol1-3.4.28 Vol14-3.4.33

Detail 13.7.1 Other Temporary Advance Warning Signs (Continued from Fig13.6)

**Fig 13.7****Warning Signs for Use at Roadworks - 4**



Detail 13.8.1 Temporary Hazard Marker Warning Signs



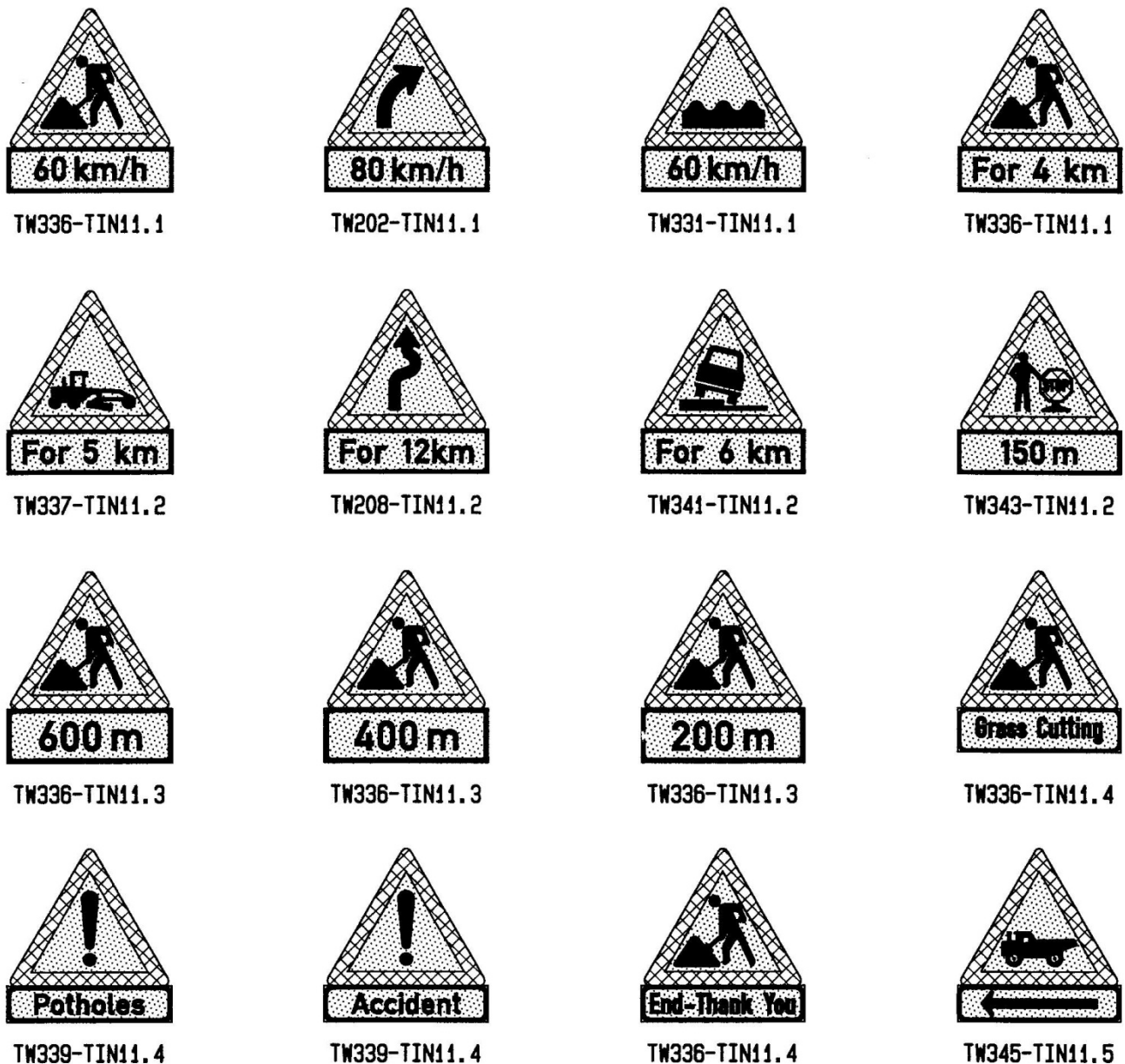
Detail 13.8.2 Other Warning Devices

**NOTE:**

- (1) The HAZARD MARKER warning signs indicated in Detail 13.8.1 are commonly used to identify specific hazards or obstructions at roadworks sites. Signs TW401 and TW402, and TW405 are also commonly used in multiples to delineate temporary roadway alignments. TW405 and TW406 should only be used in multiples of three (3) except in gore areas.
- (2) GUARDRAIL DELINEATORS and TRAFFIC CONES may be used temporarily to warn drivers of altered roadway alignment. Well trained FLAGMEN may also be used to good effect to direct traffic or to draw attention to specific hazard in the roadway.

Fig 13.8

Warning Signs for Use at Roadworks - 5



Detail 13.9.1 Typical Advance Warning / Information Sign Combination  
(Ref: Vol1-Section3.6 Vol4-Chapter9)

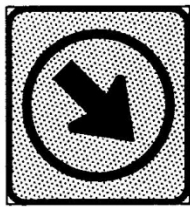
**NOTE:**

- (1) Information may be added below a temporary warning sign by means of a SUPPLEMENTARY PLATE Information sign to give further information in regard to the warning being given. The information given on a SUPPLEMENTARY PLATE will fall into one of the following categories - an advisory speed: TIN11.1; a distance "for": TIN11.2 (the distance for which the warning is appropriate); a distance "to": TIN11.3 (the distance to where the warning takes effect to allow speeds to be reduced); a text message: TIN11.4; or a symbol: TIN11.5.

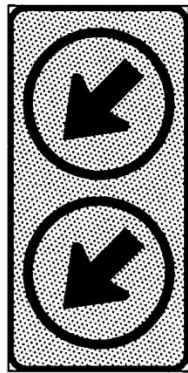
Fig 13.9

Warning Signs for Use at Roadworks - 6

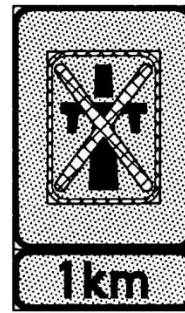




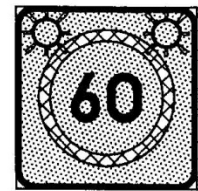
TR104-RC



TR103+TR103-RD



TR601-RA-B-  
TIN11.3



TR201-RC+TW208-  
NC-TIN11.2

Ref: Vol1-Section3.6 Vol4-2.1.16 to 2.1.21 and 3.1.6 to 3.1.9



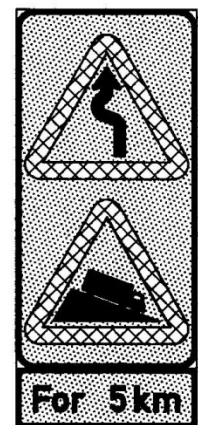
TW336-WB-  
TIN11.3



TW302-WA-  
TIN11.3



TW345-WB-  
TIN11.5



TW209-TW324  
-WD-TIN11.2

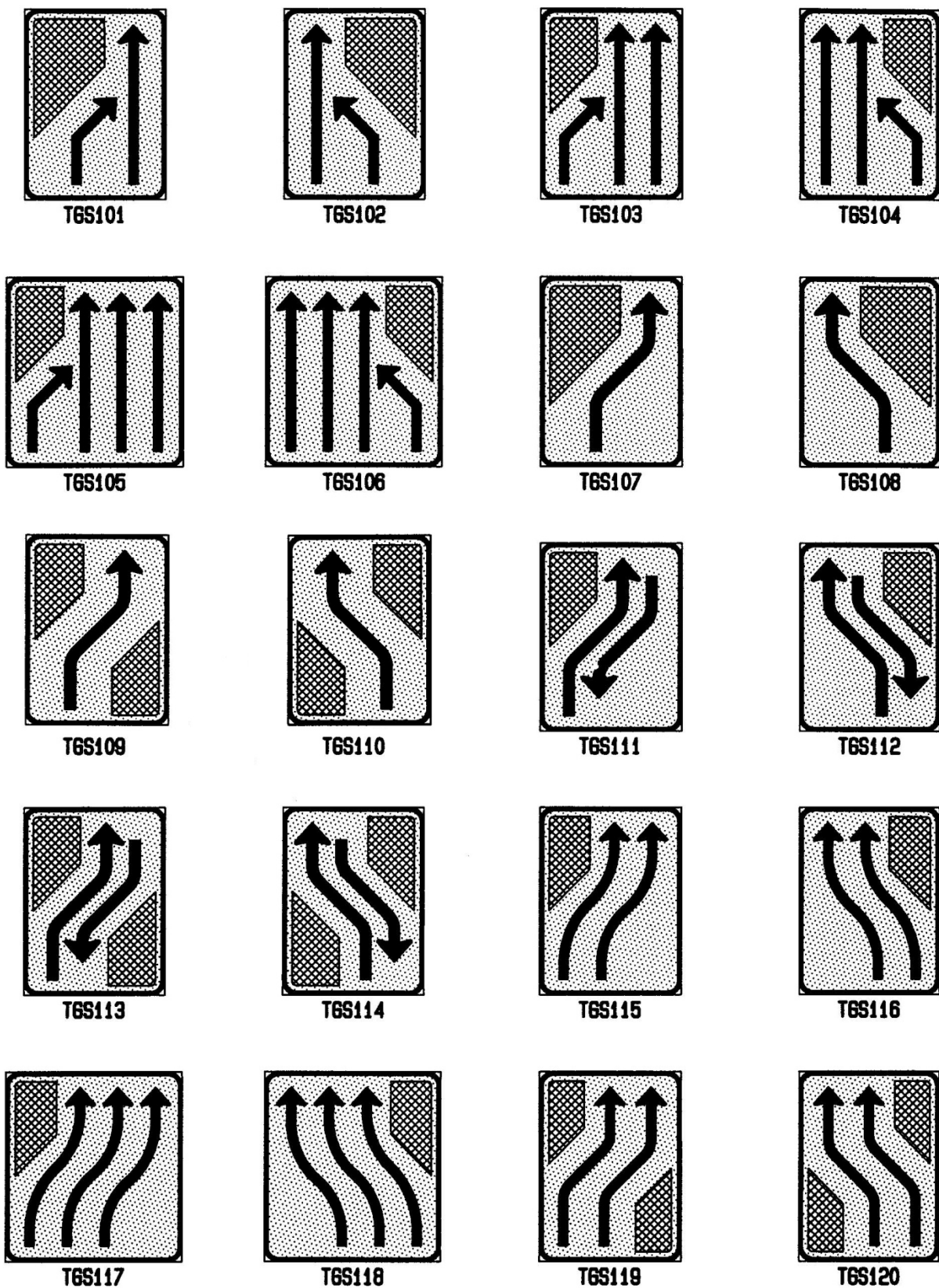
#### Detail 13.10.1 Examples of High Visibility Application of Regulatory and/or Warning Signs

##### NOTE:

- (1) Any regulatory or warning sign may be displayed on a HIGH VISIBILITY background sign to increase conspicuity. This practice is recommended at major roadworks sites where driver information processing is commonly under considerable pressure. Two regulatory OR two warning messages may be included on one HIGH VISIBILITY sign. If it is required to combine a regulatory and a warning sign message these must be included on separate background signs but may be mounted together with the regulatory message above the warning message. SUPPLEMENTARY PLATES are also recommended (see also examples in Figures 13.4).

Fig 13.10

High Visibility Signs for Use at Roadworks



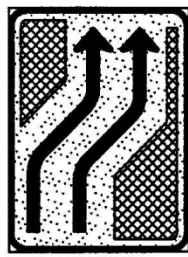
Ref: Vol1-4.10.15 to 4.10.17 Vol4-8.2.1 to 8.2.15

Detail 13.11.1 Traffic Movement Affected by an Obstruction (continued in Figure 13.12)

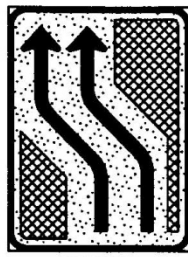
Fig 13.11

Diagrammatic Guidance Signs for Use at Roadworks - 1

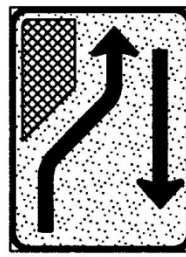




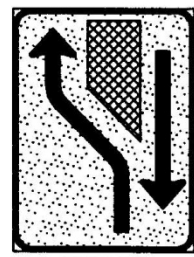
T6S121



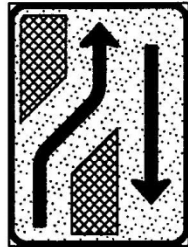
T6S122



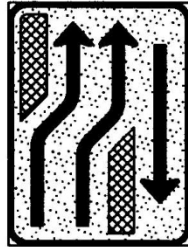
T6S123



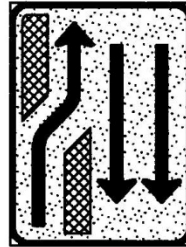
T6S124



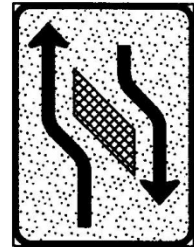
T6S125



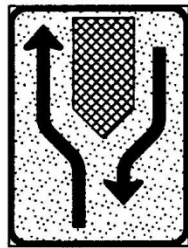
T6S126



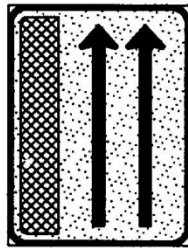
T6S127



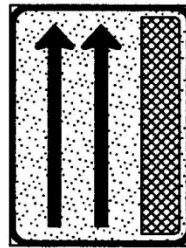
T6S128



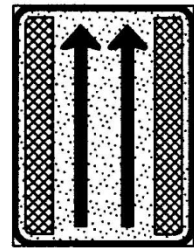
T6S129



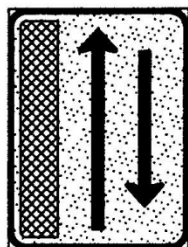
T6S130



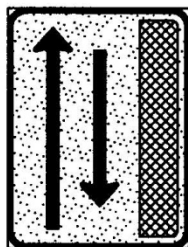
T6S131



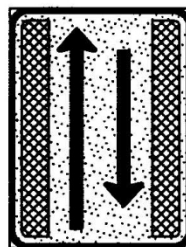
T6S132



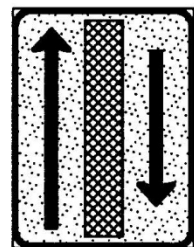
T6S133



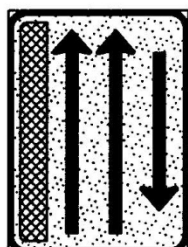
T6S134



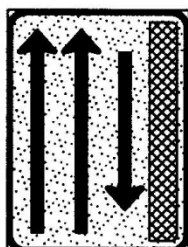
T6S135



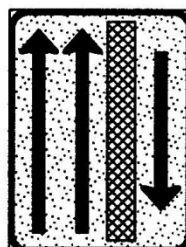
T6S136



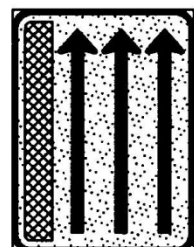
T6S137



T6S138



T6S139



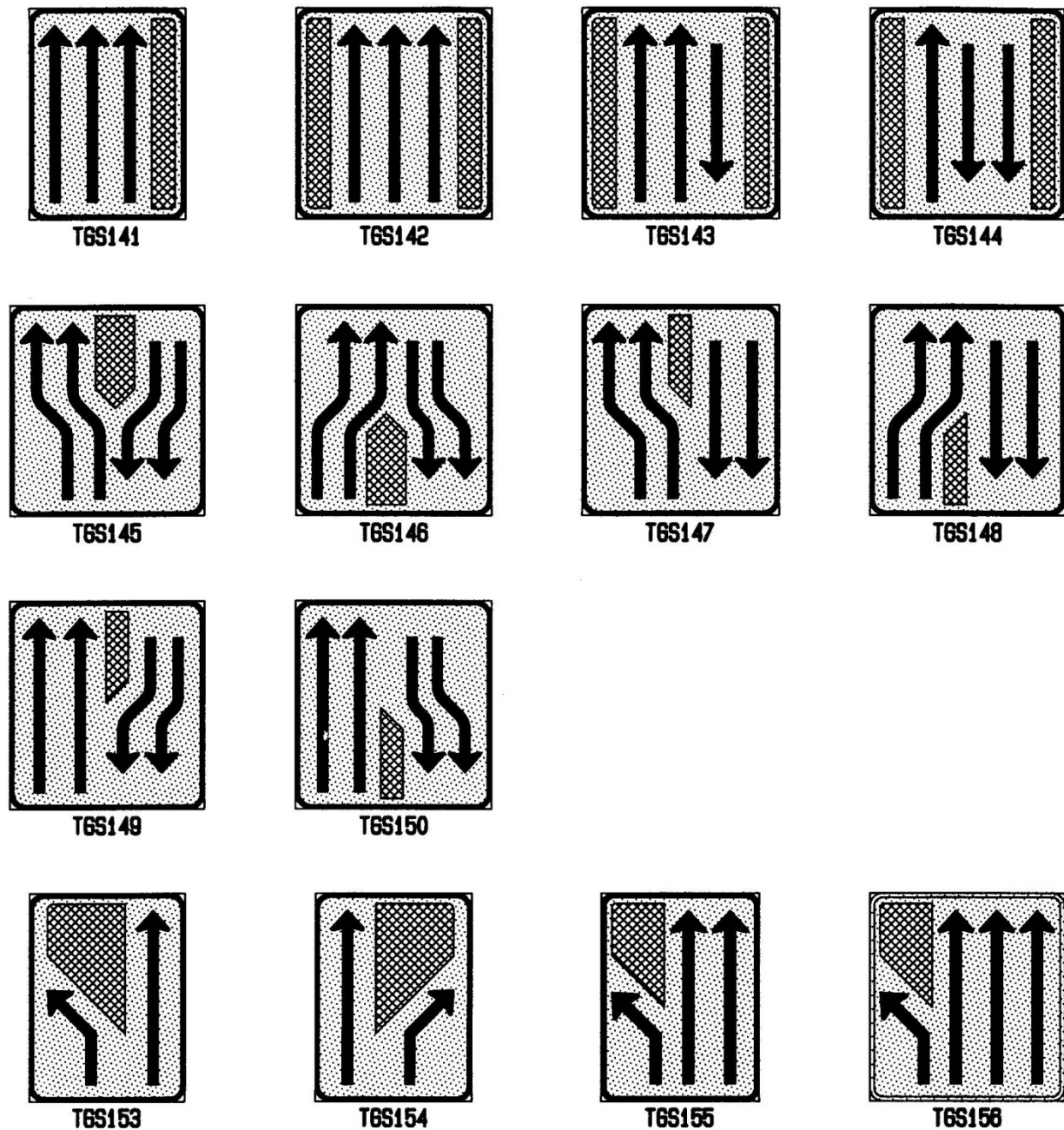
T6S140

Ref: Vol1-4.10.17 to 4.10.21 Vol4-8.2.15 to 8.2.37

Detail 13.12.1 Traffic Movement Affected by an Obstruction (continued in Figure 13.13)

Fig 13.12

Diagrammatic Guidance Signs for Use at Roadworks - 2

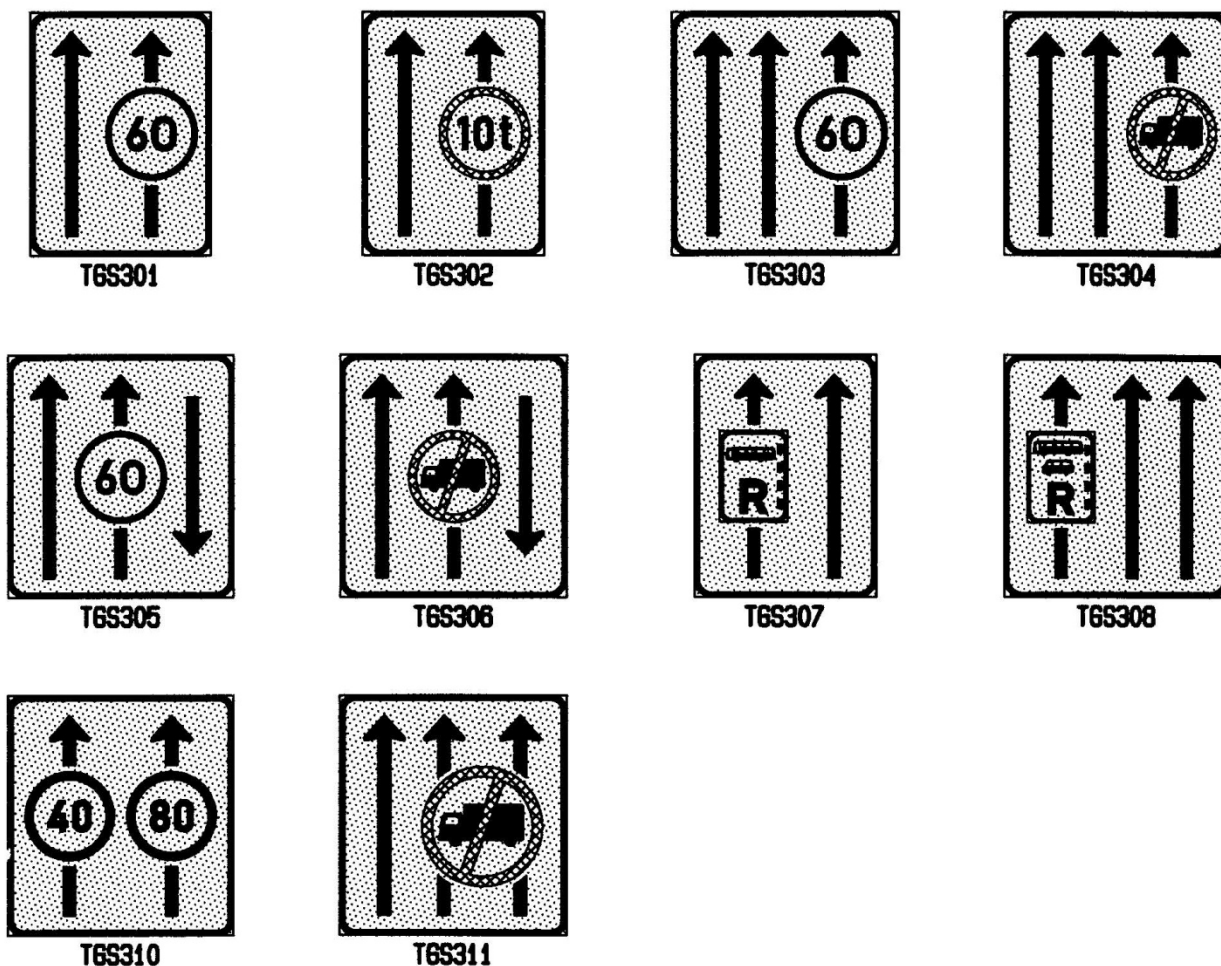


Ref: Vol1-4.10.21 to 4.10.23 Vol4-8.2.37 to 8.2.55

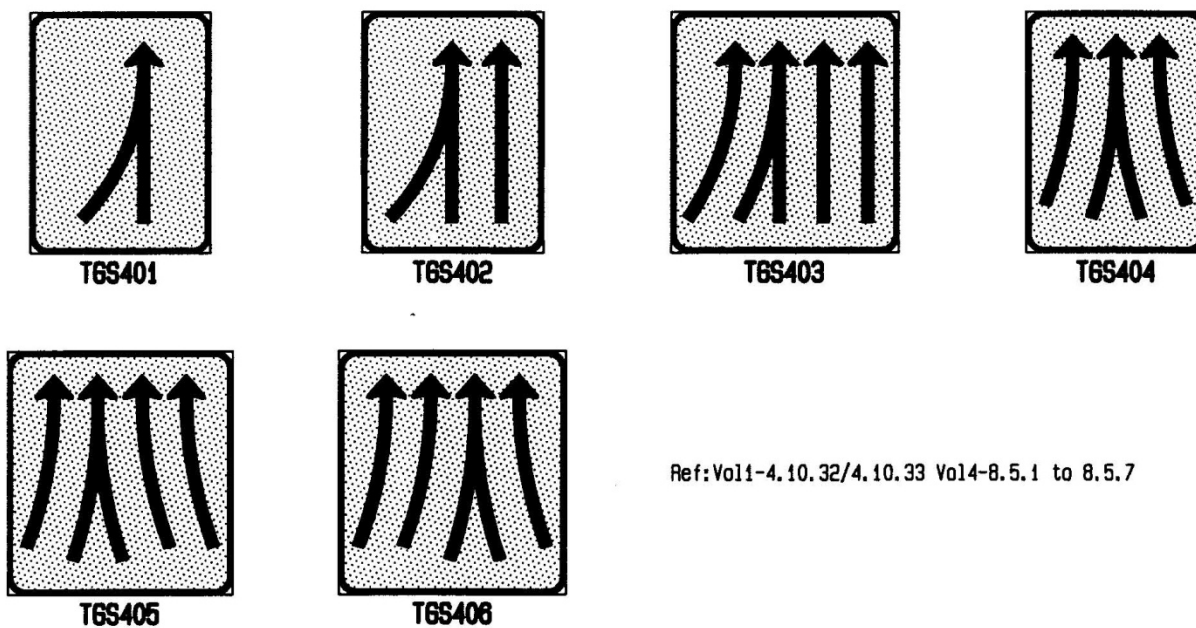
Detail 13.13.1 Traffic Movement Affected by an Obstruction (continued from Figure 13.12)

Fig 13.13

Diagrammatic Guidance Signs for Use at Roadworks - 3



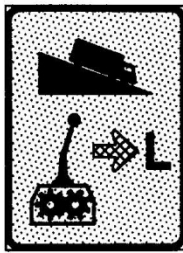
Detail 13.14.1 Lane Use Control by Regulation Ref: Vol1-4.10.29 Vol4-8.4.1 to 8.4.4



Ref: Vol1-4.10.32/4.10.33 Vol4-8.5.1 to 8.5.7

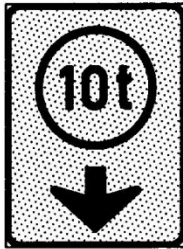
Detail 13.14.2 Lanes Merge

Fig 13.14 Diagrammatic Guidance Signs for Use at Roadworks - 4

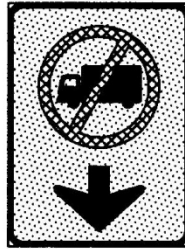


T6S505

**Detail 13.15.1 Heavy Vehicle Guidance and Control** (Ref: Vol1-4.10.39 Vol4-8.7.4 and 8.9.2)



T6S603



T6S604

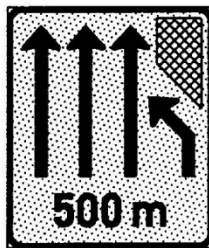


T6S605

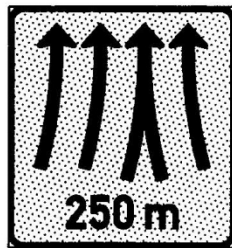


T6S606

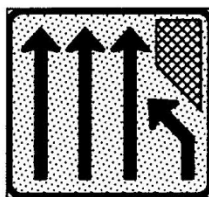
**Detail 13.15.2 Overhead Signs** (Ref: Vol1-4.10.41 Vol4-8.8.3/8.8.4)



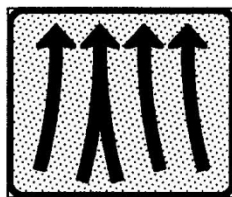
T6S6106D



T6S6406D



T6S6106



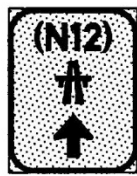
T6S6406

**Detail 13.15.3 Overhead Versions of Other Diagrammatic Sign Types** (Ref: Vol1-4.10.42 Vol4-8.8.5/8.8.10)

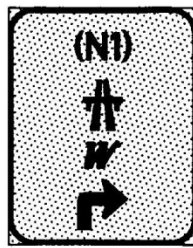
**NB.** See also Figures 13.18 and 13.19

Fig 13.15

Diagrammatic Guidance Signs for Use at Roadworks - 5



TGE1



TGE2



TGE3



TGE4



TGE12



TGE13



TGE14



TGE15



TGE12.1



TGE12.2



TGE12.3



TGE12.4

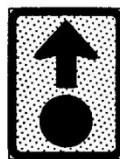


TGE12.5

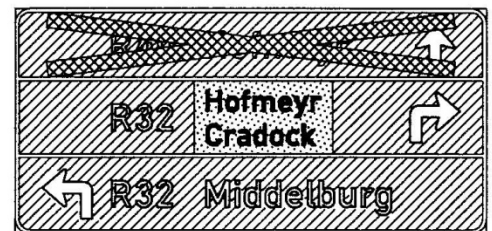
Detail 13.16.1 Temporary Route Marker Signs



TGD2-D



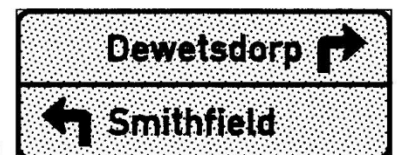
TGD3-D



Amended GD1/TGD1



TGD4



TGD1



TGP9+TGP1



TGP9+TGP3



TGP4+TGP9



TGD2

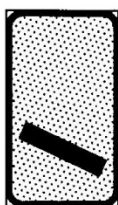
Detail 13.16.2 Temporary Direction Signs

NOTE:

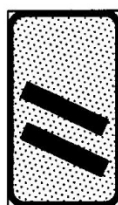
- (1) GUIDANCE signs comprise LOCATION, TRAILBLAZERS, ROUTE MARKER, DIRECTION, FREEWAY DIRECTION and DIAGRAMMATIC signs. All except LOCATION signs may be used in temporary form. Use is likely to be limited to longer duration work. An urgent detour may be established using standard format signs TGD2-D and TGD3 which are designed to be deployed quickly. These may then be replaced in time by larger temporary TRAILBLAZER, ROUTE MARKER or DIRECTION signs. Only a limited range of examples is illustrated.

Fig 13.16

Guidance Signs for Use at Roadworks



TIN1

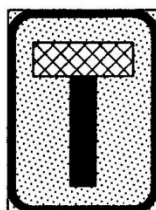


TIN2

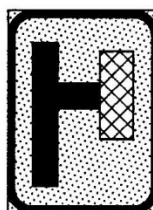


TIN3

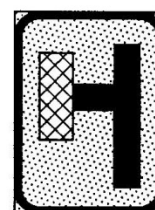
Detail 13.17.1 Countdown Signs



TIN4



TIN5



TIN6

Detail 13.17.2 Cul-de-sac Signs



TIN11.1



TIN11.2



TIN11.3



TIN11.4



TIN11.4



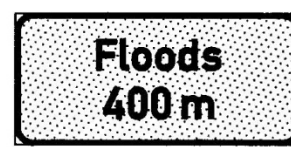
TIN11.4



TIN11.503



TIN11.501



Combination TIN11.3/11.4

Detail 13.17.3 Temporary Supplementary Plates

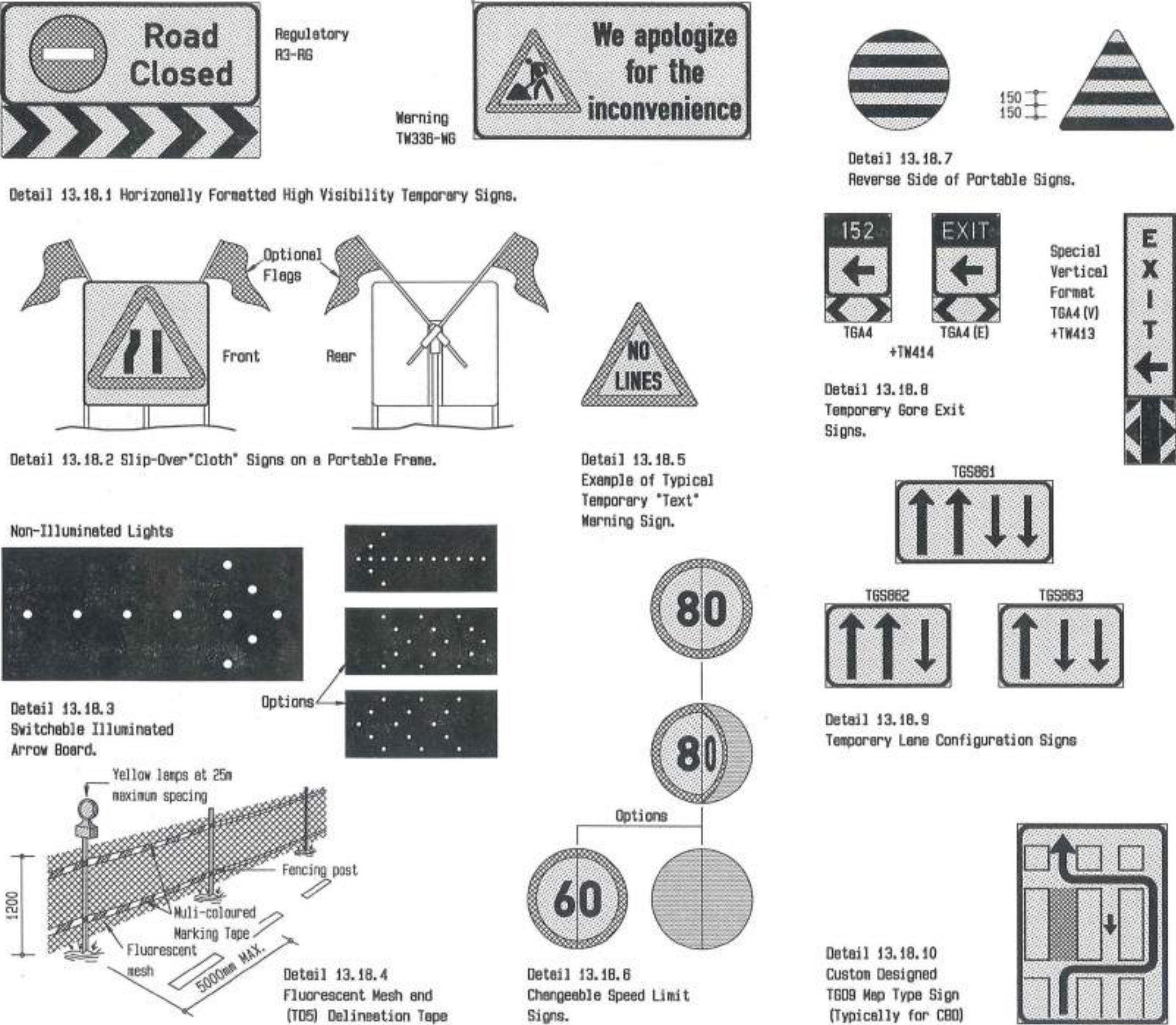
## NOTE:

- (1) The illustrated temporary INFORMATION signs will commonly be required at roadworks sites. At freeway roadworks sites temporary COUNTDOWN signs TIN1, TIN2 and TIN3 indicating relocated off-ramp exit points are often required. Temporary CUL-DE-SAC signs TIN4, TIN5 and TIN6 are effective and compact signs which may be used to inform drivers of the temporary closure of a normally through route. Such a temporary closure could result from such diverse situations as the replacement of a washed away culvert or bridge, which may require a closure for weeks or months, to a temporary closure for a few hours due to resurfacing, trenching, tree felling or other short duration works. Temporary SUPPLEMENTARY PLATES may be used with a wide range of regulatory or warning signs. Their use should not be confused with SELECTIVE RESTRICTION Regulatory signs - see Figure 13.3. Variations of signs TIN4, TIN5 and TIN6 to cover the temporary closure of one approach to a crossroad or other type of junction are permitted - see examples in Section 13.10.

Fig 13.17

Information Signs for Use at Roadworks





13.2.7 Notes on Figure 13.18

- (1) Figure 13.18 shows a selection of temporary signs which are used occasionally at roadworks, not all of which are specified in detail in the Manual.
- (2) Detail 13.18.1 illustrates two examples of a horizontally formatted type of HIGH VISIBILITY sign. The size of this sign type is not standardised because of the variety of text messages which can be displayed. Dimensional details are included in Volume 4, Chapters 2 and 3.
- (3) Detail 13.18.2 shows a lightweight form of collapsible sign which can be useful for short term operations, particularly on multi-lane roads. Typical operations for which such signs might be used include installing and servicing traffic measuring devices, and localised repairs to roadstuds or road markings.
- (4) Detail 13.18.3 gives an example of a typical arrow board made up of light sources mounted on a backing board. A variety of light positional patterns may be specified. The example shown may be switched to display a single shaft arrow to the left or right, or a set of three "chevron" arrows, also to left and right.
- (5) Detail 13.18.4 illustrates a typical lightweight barricade made of fencing posts, DELINEATION TAPE TD5, and a highly visible fencing mesh. A number of suitable bright fluorescent meshes are on the market.
- (6) When no suitable symbol is available for a warning message, the message may be given as text on a warning sign as shown in Detail 13.18.5.
- (7) Detail 13.18.6 shows the principle of a changeable temporary SPEED LIMIT sign TR201. The sign comprises an extra hinged plate which can be "flipped" over to change the value of the speed limit, or to remove the temporary speed limit by displaying a blank face.
- (8) It is recommended that portable regulatory and warning signs, particularly those which are on stands which place the signs only 200 mm above the road surface, be marked on the reverse side with alternating 150 mm wide black and yellow stripes as shown in Detail 13.18.7.
- (9) Detail 13.18.8 gives the range of temporary GORE EXIT signs TGA4, available for use at temporarily relocated freeway exits.
- (10) Detail 13.18.9 illustrates a range of arrow-based lane configuration signs which are occasionally seen at roadworks. These signs, which are appropriate during temporary contra-flow traffic operation, are compact in size.
- (11) It is sometimes necessary to close a section of road over a full city block for maintenance. When this occurs in a CBD environment with one-way roads a special type of MAP TYPE sign TGD9, as shown in Detail 13.18.10, may be warranted.

Fig 13.18  
 Other Temporary Signs Used At Roadworks



### 13.2.8 Notes on Figure 13.19

(1) Temporary signs of all classes may be provided at roadworks mounted in one of two ways:

- (a) pole-mounted and buried in the ground as for a permanent sign, and therefore not portable: or
- (b) frame and/or stand mounted, and therefore portable or movable.

(2) Detail 13.19.1 illustrates basic pole-mounted clearance criteria which should conform to the provisions of Volume 1, Chapter 1, Table 1.4. The basic minimum clearances should be:

- (a) lateral - A: 1200 mm;
- (b) vertical - B: 750 mm;
- (c) vertical - C: 800 mm (small signs up to 2 m<sup>2</sup>) to 1600 mm (larger signs).

The lateral clearances should be maintained if the signs are mounted behind barricades, but may be reduced to be flush with the rear of a barrier.

(3) Detail 13.19.2 shows two types of delineators. All sizes of delineator should be mounted with a minimum vertical clearance of 200 mm.

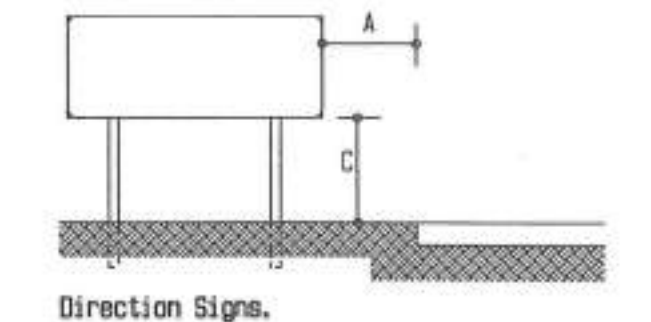
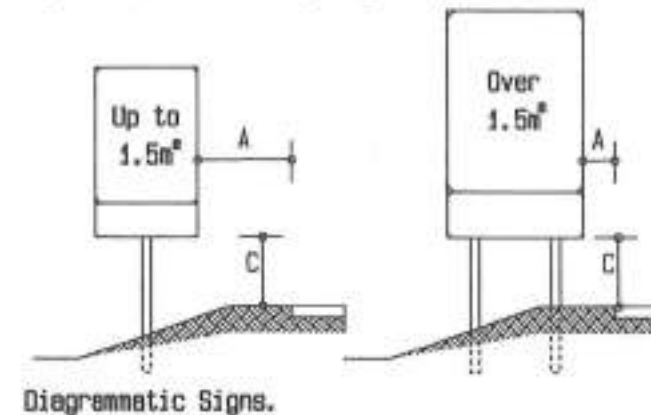
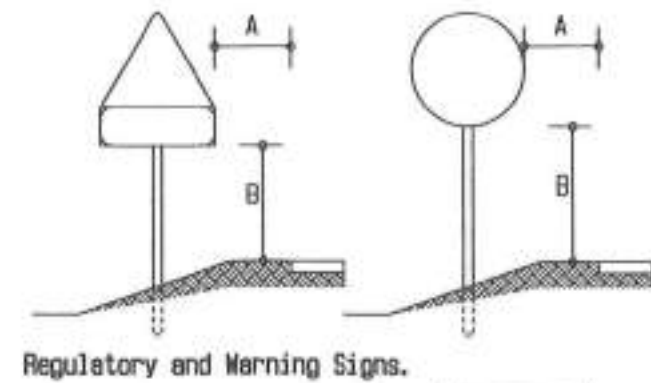
(4) Detail 13.19.3 shows typical portable sign frames for single signs and a single vertical cluster of signs. Such portable signs are used for all types of short term work. Whilst the mode of operation requires easy portability, operators must be aware that signs placed only 200 mm above the road or verge surface can very easily become ineffective. Care has to be exercised over longitudinal positioning to ensure that the signs are in fact visible to drivers. Failure to achieve adequate visibility of signs could result in legal action against the responsible road authority or contractor.

(5) Detail 13.19.4 illustrates two typical movable barricades which display road signs. Whilst general dimensions are given for information these are not obligatory, although size will be dictated to a certain extent by the signs to be displayed. The height of sign indicated should be considered as a minimum.

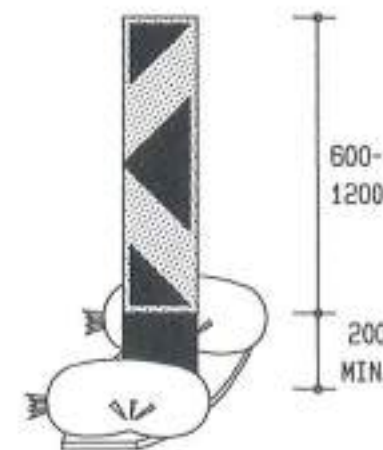
(6) Detail 13.19.5 also illustrates typical larger movable sign supports and frames. Again the dimensions given are representative and may be varied within the constraints of the sizes of the signs to be displayed and the stability of the overall frame.

(7) Ballast sandbags are shown in the examples. These sandbags should have a mass of around 30 kg each and must be maintained and replaced as necessary to ensure the stability of the signs and their supports.

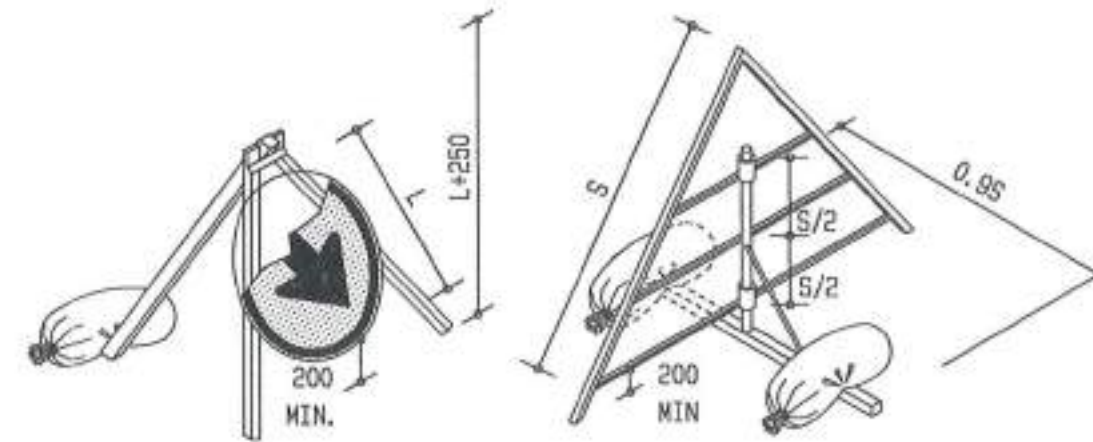
(8) Minimum vertical clearance requirements are recorded in Table 13.1 in Section 13.1.



Detail 13.19.1  
Clearances for Pole Mounted Signs.



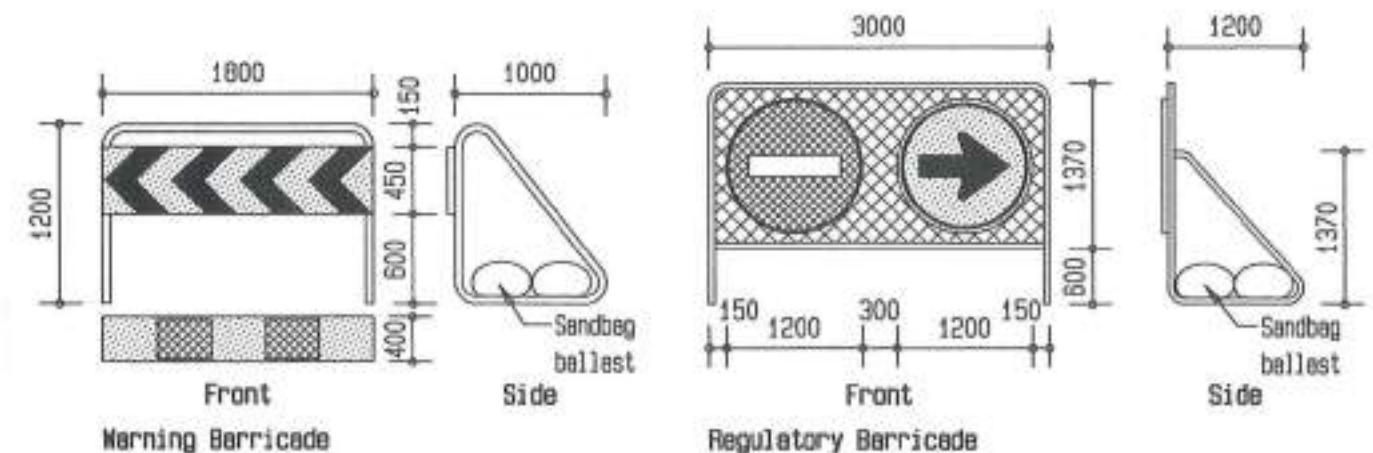
Detail 13.19.2  
Delineator Vertical Clearance.



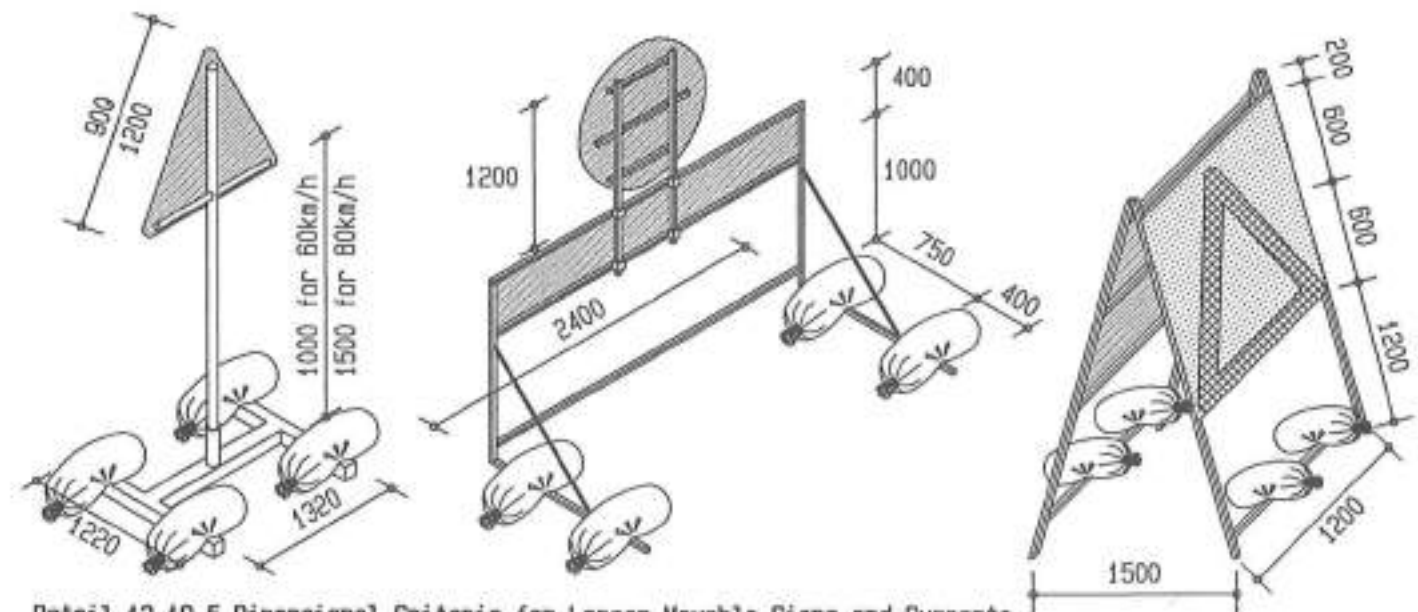
Pivot/Folding Frame

Fixed Frame

Detail 13.19.3 Dimensional Criteria for Portable/Movable Regulatory and Warning Signs.



Detail 13.19.4 Dimensional Criteria for Movable Barricade Mounted Signs.



Detail 13.19.5 Dimensional Criteria for Larger Movable Signs and Supports.

Fig 13.19  
Mounting of Temporary Signs –  
Options and Minimum Clearances



## 13.3 TRAFFIC MANAGEMENT

### 13.3.1 General

- 1 In order to adequately deal with the needs of manual or handbook users, it is necessary to go beyond the specification of sign face designs and sequences. It is necessary to develop a standardised approach to the traffic management of roadworks sites. This applies particularly to the more complex conditions. Ideally it should be possible for almost any site condition to be simplified to a number of standard treatments and, therefore, traffic should be accommodated within the range of signs detailed in this Chapter. According to this principle, the motorist should then have to deal only with familiar situations and preferably with only one at a time.
- 2 The layouts provided in later sections have therefore been prepared with these objectives in mind. Each condition has been subdivided into standard components or sections as shown in Figure 13.20. In some cases, one or more of the area or zone subdivisions may be repeated. **The primary reason for this approach is the ultimate safety of drivers and workers.** It is not an uncommon practice to complicate the situation presented to drivers by superimposing changing conditions such as road width reductions or carriageway crossovers upon each other and/or by locating them at interchanges. This results in drivers trying to negotiate these changes in condition and interpret their directional needs at the same time. Wherever possible this situation should be avoided. There will, however, always be circumstances where, for reasons of cost or physical conditions, such a superimposing of activities is unavoidable. In this event carefully prepared special signing techniques will have to be employed.
- 3 In the interests of safety these principles should be carried through to the preparation of less complex traffic management situations. A systematic breakdown of any site into standardised sub-components is likely to result in more efficient and safe site operation because it will allow the site supervisor to clearly understand the traffic operation of the site.
- 4 In certain instances it will be necessary to create, within sections of a roadworks site, conditions where traffic is reduced to one-way operation. In this event the passage of traffic will have to be controlled manually or automatically. Three methods of traffic control available are:
  - (a) flagmen;
  - (b) STOP/RY-GO signs;
  - (c) temporary traffic signals.

Details of these traffic control methods are given in Subsection 13.3.9.
- 5 As part of the general traffic management effort at a roadworks site, the resident engineer AND the contractors' representative dealing with temporary signing and delineation should institute a regular programme of checking the site for compliance with specifications, including sign cleanliness. This inspection programme should occur as frequently as necessary to keep the site correctly signed and delineated. This may need several inspections a day. The inspection programme should pay particular attention to the effectiveness of the signs and delineation under adverse weather conditions, at dusk, and at

night. In extreme cases, the illumination of critical signs may be justified by a combination of such conditions and high traffic volumes. Care should be exercised not to create running lanes which are too wide for one traffic stream but not quite wide enough for two traffic streams (see paragraph 13.4.3.2(c)).

### 13.3.2 The Advance Warning Area

- 1 This area is used to advise motorists that there are temporary conditions ahead of them which require particular care. Almost invariably, a stepped reduction in the speed will be required within this area. These speed reductions should be indicated at reasonable intervals (200 m minimum), and occur in 20 km/h steps until the speed for which the traffic control has been designed is indicated. It is good practice to repeat the final speed limit at least once. It should be noted that, depending on the nature of the change ahead, any of the DIAGRAMMATIC guidance sign layouts given in Figures 13.11 to 13.15 may be used, but the use of non-standardised sign layouts should be avoided.
- 2 The length of the Advance Warning Area should relate directly to measured approach speeds. A realistic distance must be allowed for speed reduction. High traffic volumes will be better handled if the standard length of this area is generous, since more time is needed to take in the sign messages and react to them under heavy traffic conditions. For approach speeds of around 120 km/h and moderately high to high volumes, a base length for the Advance Warning Area of 1000 m is required. If traffic volumes are low and/or approach speeds in the region of 80 km/h, this length may be reduced to 600 m. This reduction applies particularly when changes in road conditions, such as alignment or width, occur within the main site.
 

e.g. a section of 16 kilometres of rural road may be under repair or reconstruction - the effects of work on traffic will vary widely through the site - assuming a 120-100 km/h approach speed and high traffic volumes, a full Advance Warning Area sign sequence covering 1000 m should be used - speed within the site is likely to be controlled at 80-60 km/h - at these approach speeds the secondary Advance Warning Area sign sequence for local deviations can be reduced to 600 m in length, or, for simple cases, even to 400 m.
- 3 Urban sites will commonly have limited space for Advanced Warning Area signs. However, every attempt should be made to provide adequate advance signing. High speed arterials should normally have sufficiently long block lengths to allow Advance Warning Areas in the range of 600-300 m. On lesser roads or in busy business areas, shorter Advance Warning Areas in the range of 150-75 m should be used. In the latter cases, consideration should be given to taking lane closures and the relevant signing into the preceding block.

### 13.3.3 The Transition Area

- 1 This is the area in which drivers are required to **take an action**, such as:
  - (a) shift position on the roadway without reduction in the number of lanes;
  - (b) merge two lanes into one (lane drop);

- (c) cross the central median (crossover);
  - (d) enter a detour completely separate from the road under construction.
- 2 The transition area must be clearly defined using delineator plates and should conform to the layout depicted on the guidance signs preceding it. The more complex roadworks sites should be broken down into a number of standard transition situations. No signing for subsequent transition conditions should be included within a transition area.
  - 3 The transitional action required of traffic can be achieved in a limited number of ways, e.g.:
    - (a) a taper;
    - (b) a crossover;
    - (c) a deviation (normally reserved for complete re-routing).
  - 4 The length of a transition area will depend on the approach speed of traffic and the amount of shift in alignment involved by the transition. Details of the length of tapers and crossovers are given in Subsections 13.5.5. and 13.5.6.

### 13.3.4 The Stabilising Area

- 1 The purpose of this area is to allow traffic flow to stabilise after negotiating a transition area before reaching another change of condition. If more than one transition area is required to achieve the final traffic configuration, the signing for second or subsequent transitions should be located within the stabilising area(s). The stabilising area is normally defined by delineator plates.

### 13.3.5 The Buffer Zone

- 1 This is the limiting form of stabilising area. It is normally used between a transition area and the work area. In a situation involving more than one transition area the buffer zone will occur after the transition area closest to the work area. The principal function of the buffer zone in such situations is to separate the traffic from the workers at the site in the interests of worker safety. It can be a relatively short distance but never less than 50 m. Provision of a longitudinal buffer zone, and indeed a lateral buffer zone within the work area, must be considered as fundamental to effective worker safety.

### 13.3.6 The Work Area

- 1 This area must be adequately defined by delineators in the less complex conditions. Where there is a risk to traffic or workers of vehicles entering the work area, temporary barriers of a standard sufficient to prevent vehicle penetration are recommended (see Subsection 13.5.3).
- 2 When traffic is relocated well away from the work area, little action is required along the length of the work area other than to protect contractors' vehicles and employees. If such a relocation results in two-way traffic flow then special attention should be paid to the definition of the line separating the two traffic flows. Under normal conditions, the minimum treatment should involve the marking of a temporary DIVIDING or NO OVERTAKING line where appropriate. This line should be supplemented by temporary roadstuds.
- 3 If the section of detour running parallel to the work area uses asymmetrical lane configurations, drivers should be reminded

of this situation by using lane arrangement signs as shown in Figure 13.70. If the condition exists for considerable distances, it is recommended that these signs be repeated at regular intervals and that a distance plate indicating the remaining extent of the condition be added to the signs.

- 4 Where an asymmetrical lane configuration is varied to permit overtaking through a long site for instance, then the signing and marking of this treatment should follow the principles laid down for transition and stabilising areas. An example is given in Figure 13.70.
- 5 Experiences with major road rehabilitation contracts have shown a tendency towards increasingly long road sections under construction. There may be very valid economic reasons for such a practice. However, if a site is going to be long, extra care must be taken to ensure adequate overtaking opportunities. In addition, great care must be taken to control the manner in which work phases are completed and reopened to traffic. The random mixture of full construction, with and without road markings, and short incomplete sections of work should be avoided at all costs. The resultant confusion on the part of drivers is to be expected, and can be extremely hazardous.

### 13.3.7 The Termination Area

- 1 This area involves the return of traffic to normal flow conditions. In simple cases this can be achieved by a relatively rapid taper of delineator signs. In more complex conditions a reverse crossover may be required. This should follow the same principles given for such conditions at the start of a site and dealt with under Subsections 13.3.3 and 13.3.4.
- 2 Courtesy signs and permanent speed limit signs restoring the normal speed limit conditions should be erected adjacent to each other as soon as possible after the end of the Termination Area.

### 13.3.8 Traffic Management Planning

- 1 It is not possible to predetermine how all construction sites shall be managed because there are too many variables. As has been mentioned earlier, however, it is considered very important to plan, and work, in a systematic manner and in standardised steps. The objective of such an approach is to optimize site efficiency, traffic flow and all aspects of safety.
- 2 The temporary road signing system covered by the typical applications in this chapter have been documented and in use for several years. However well developed the system may be, there will always be scope for improvement and refinement. It is therefore important that practitioners develop their utilization of the system along disciplined lines and include feedback at all phases of the process. Detail 13.21.1, in Figure 13.21, illustrates a breakdown of a structured planning process.
- 3 At a more detailed level planners should identify the component parts of a site long before ordering signs or transporting them to site. Detail 13.21.2 shows an arrangement of typical site components. Almost every road construction or maintenance site, however small, can be broken down into the basic system components. At a major site each of these may be several hundred metres in length, whereas, for a small urban

(continued on page 13.3.6)

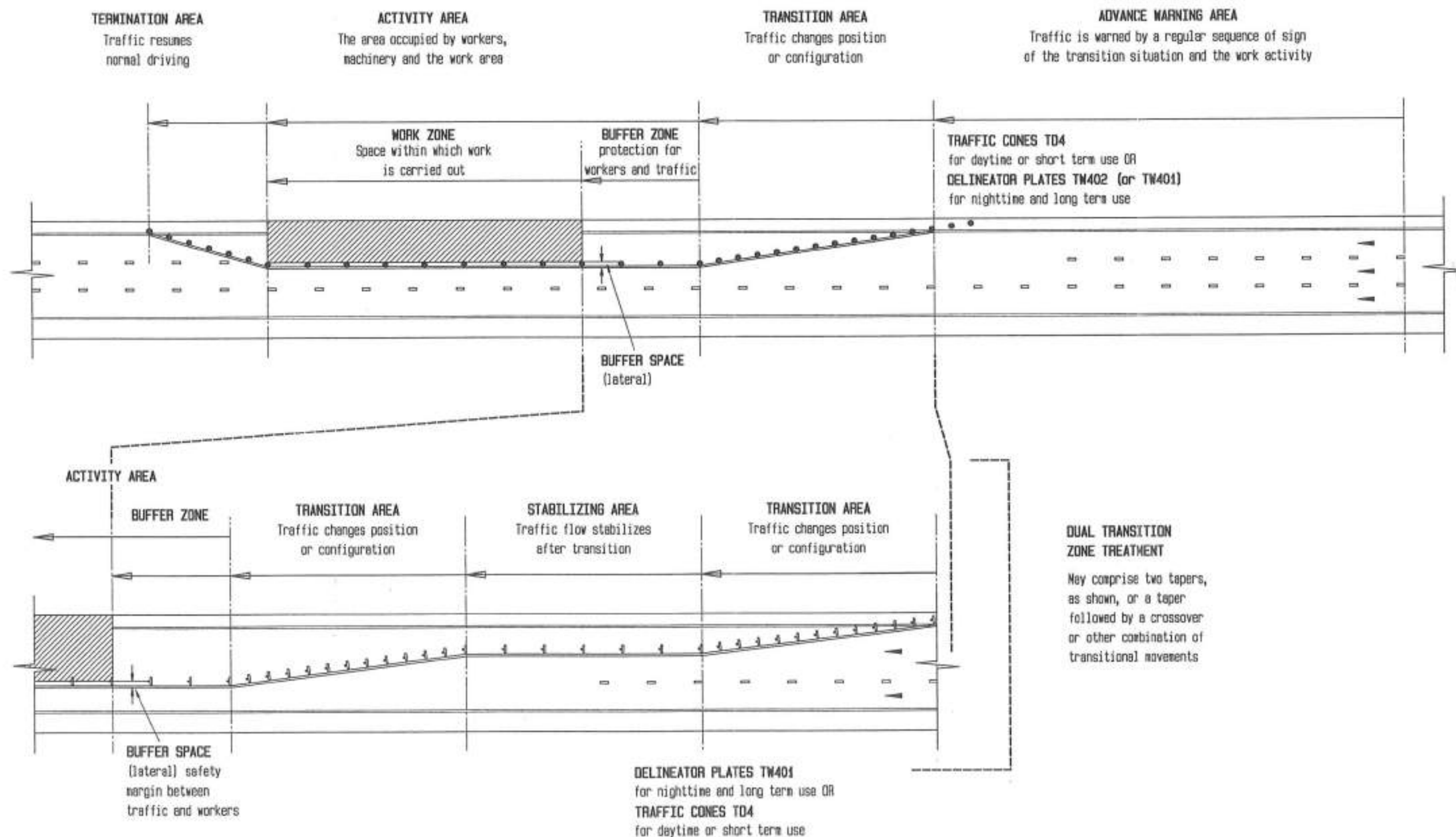
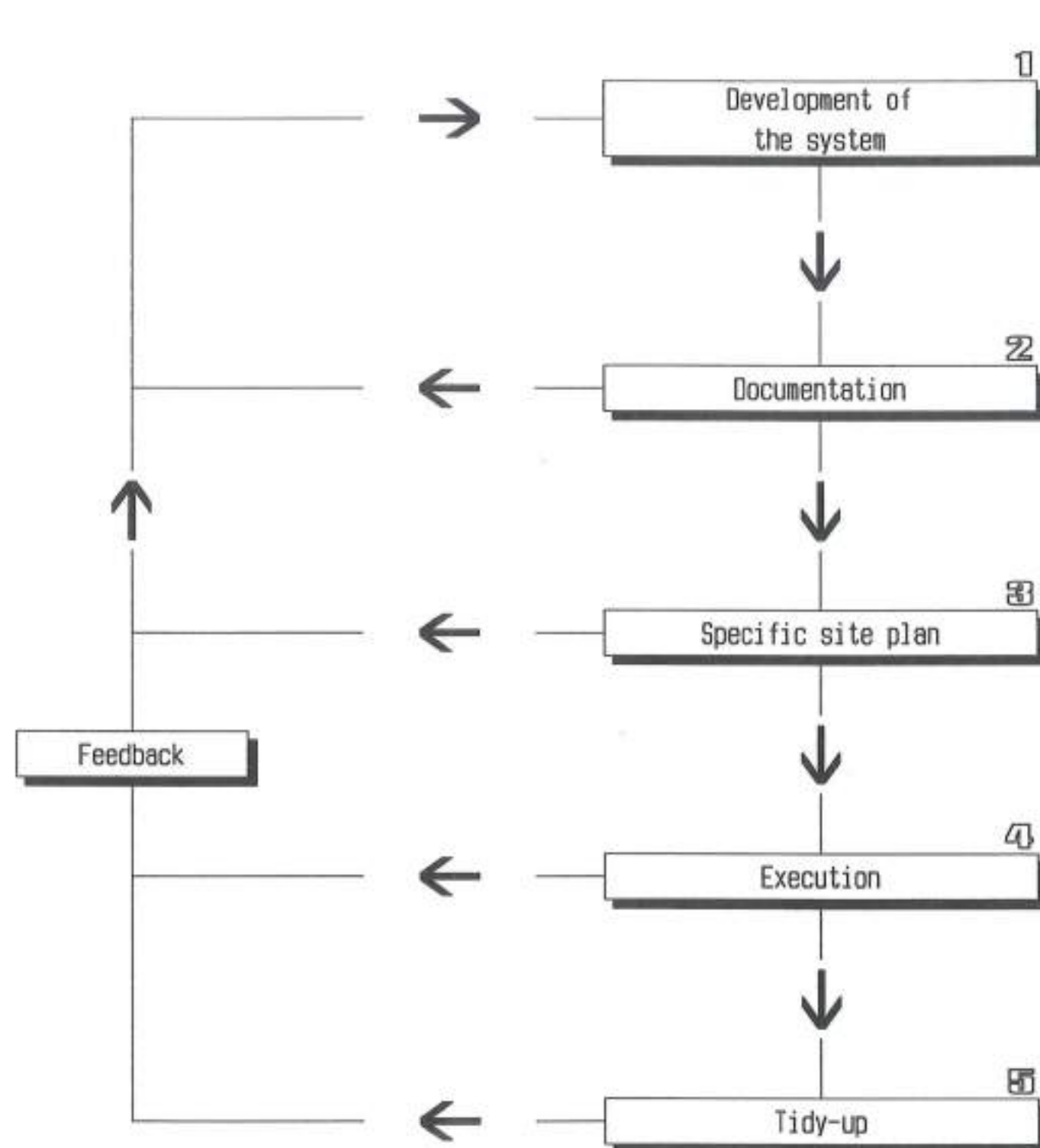
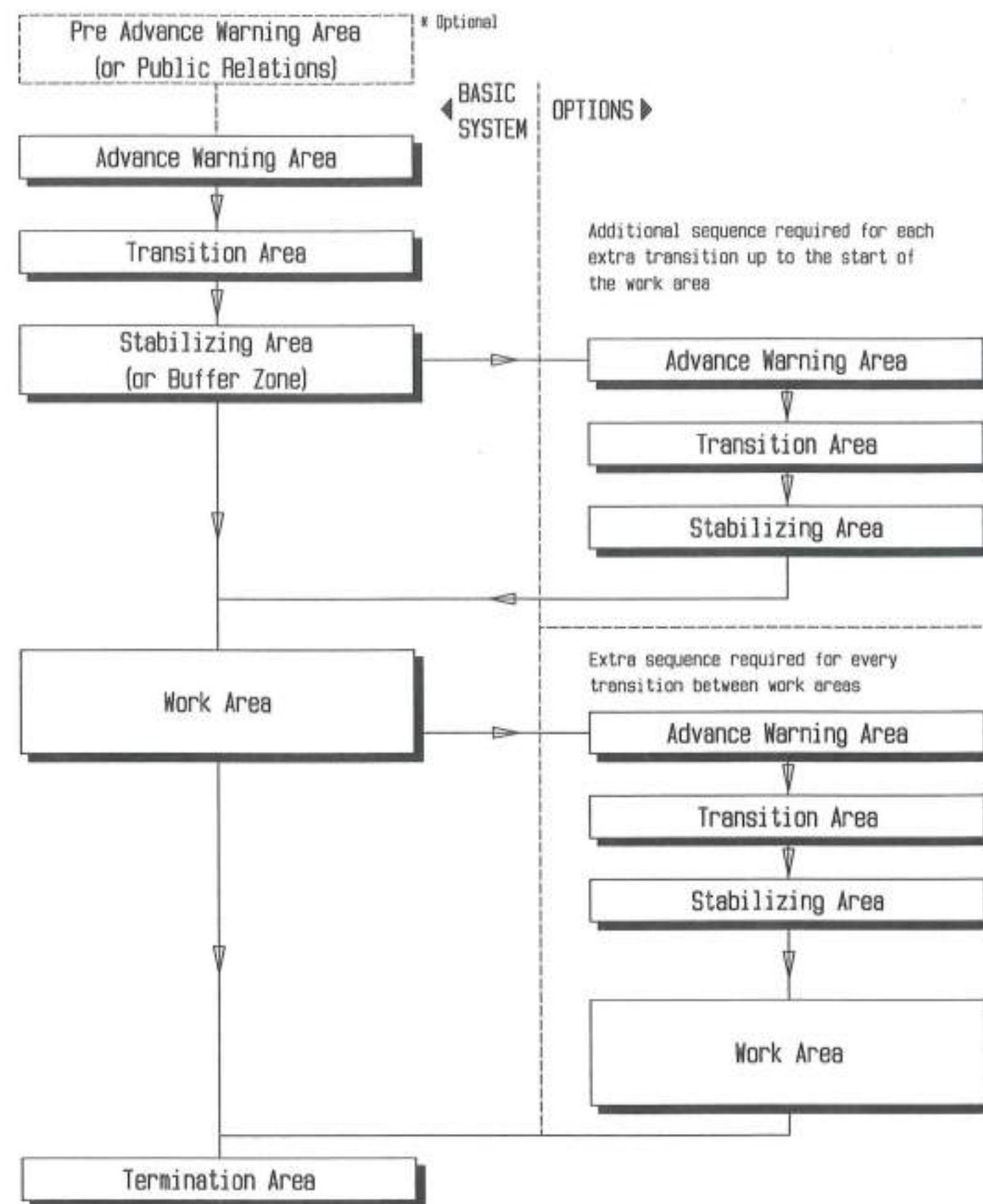


Fig 13.20  
Component Parts of a Temporary  
Traffic Control Zone



Detail 13.21.1 Planning System.

Fig 13.21  
Components of a Systematically  
Developed Site



Detail 13.21.2 Systematic Arrangement of Typical Site Components.

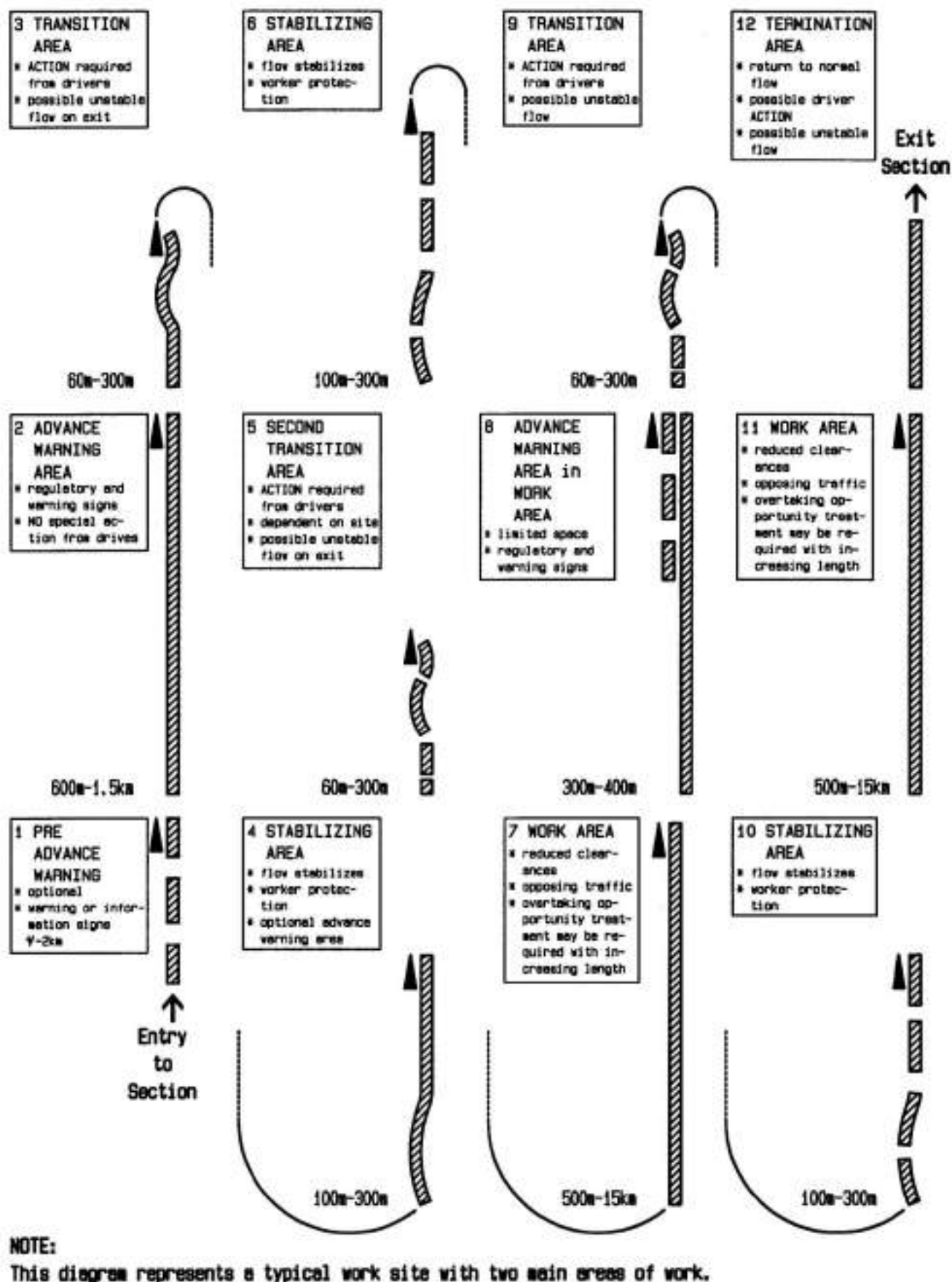


Fig 13.22

Schematic Arrangement of System Sections

(continued from page 13.3.2)

maintenance exercise they may each be only a few metres in length. At a training level it is important that maintenance crews "think" out all the components, even if all that is placed on the road is a set of delineators or traffic cones.

- 4 Figure 13.22 shows a similar arrangement to that given in Detail 13.21.2 but gives more detail on the function of each component of the site and illustrates how the different components form a cohesive and flowing site.

### 13.3.9 Traffic Control Methods - One Way Traffic

- 1 The choice of the traffic control method to be used will depend on the speed and volume of traffic, and on the length of, and visibility on, the section of roadway subject to control.
- 2 **Flagmen** are a simple and flexible method of traffic control suitable for use when traffic volumes are less than 200 vehicles per hour. The flagmen at each end of the one-way traffic section must be clearly visible to each other and the section should not exceed 100 m in length. If the obstruction is intermittent the need for flagmen may be occasional.
- 3 **Flags** should be at least 450 mmx450 mm and should be made of a durable fluorescent red-orange or red cloth fastened to a staff at least 1 metre long. The free edge of the flag should be weighted to ensure a vertical position during windy weather. A diagonal stiffener may also be used for the same purpose.
- 4 **Flagmen stations** should be located far enough from the roadworks to ensure that drivers have sufficient distance to slow down before entering the work-site but not so far away that the drivers will tend to increase speed before passing the work-site. The flagmen should stand either on the shoulder adjacent to the lane of traffic they are controlling or in the barricaded lane. Under no circumstances should they stand in the traffic lane. In rural areas flagmen should be clearly visible to the traffic they are controlling from a distance of at least 150 m. For this reason they should stand alone, never permitting a group of workmen to congregate around them.
- 5 **Distinctive clothing** should be worn by flagmen on duty so that the public will recognise them and respect indications given by them. They should be issued with fluorescent-coloured helmets and safety jackets as illustrated in Figure 13.30.
- 6 The **careful selection and training** of flagmen before making them responsible for the flow of traffic is essential. The efficiency of flagging control is often dependent on the intelligence of the flagmen. Flagmen should have good eyesight and hearing, and be mentally alert.
- 7 **Flagging procedures** are prescribed in the Road Traffic Act and must be standardised so that the travelling public throughout South Africa can expect to be given the same signals by flagmen controlling traffic. Details are illustrated in Figure 13.23. The purpose of flagging procedures and STOP/GO control is to regulate and control traffic flow, and to warn drivers of a potential danger ahead. Regulation and control of traffic by flagmen will normally be undertaken to allow access by construction vehicles or to operate one-way traffic flow. Such interruptions in an already restricted traffic flow should be kept to a minimum. Drivers will become irritated by delays in excess of two minutes. Irrate, impatient drivers

will be inclined to disobey traffic control measures and speed limits at roadworks, to the risk of site staff and themselves. Flagging procedures can be very effective in drawing attention to hazardous features of a roadworks site because of the flag movement involved. The basic flagging procedures are described briefly below and in full detail in Figure 13.23. Detail 13.23.3 illustrates some innovative flagging techniques.

**To stop traffic** flagmen shall face approaching traffic and extend the flag horizontally, at right-angles to the traffic lane, in a stationary position so that the full area of the flag is visible hanging below the staff. The free arm should be raised with the palm towards the approaching traffic (see Detail 13.23.1).

The **signal to proceed** may be given when it is safe for traffic to proceed. The flagmen shall stand parallel to the flow of traffic and, with flag and arm removed from the view of the driver, shall signal traffic with his free arm to proceed. **The red flag shall not be used to signal traffic to proceed.**

**To slow traffic down** flagmen shall stand in the position for stopping traffic as set out above and move the flag up and down at a steady pace. When the approaching vehicle has slowed down sufficiently, the flagman shall change his stance and give the signal for traffic to proceed.

- 8 **STOP/RV-GO R1.5A and R1.5B** portable sign should be used when traffic volumes exceed 200 vehicles per hour and one-way traffic operation is essential for safe passage through a work section greater than 100 m in length. The signs should be controlled by a responsible person who should have at least the qualities referred to in paragraph 13.3.9.6. The sign should be positioned so that it is readily visible to the approaching driver (see Detail 13.23.2). A typical advance sign sequence which should be set up ahead of the STOP and GO/RV signs R1.5A and R1.5B is shown in Figures 13.40 and 13.44. The workers controlling the signs should be visible to each other, or be in radio contact, and the most responsible employees should be detailed for the purpose of co-ordinating traffic flow.
- 9 **Temporary Traffic Signals** should be used if one lane one-way traffic is required to operate at night. Temporary traffic signals should also be used if flagmen/STOP-RV/GO/radio operation of a one-way section without inter-visibility is not satisfactory for whatever reason. As traffic volumes increase above 500 vehicles per hour, the use of temporary traffic signals to minimise delay to traffic is recommended at all one lane one-way sites (see also paragraph 13.3.9.3).

Temporary traffic signals should always be used with the appropriate warning signs. The temporary marking of a stop line is recommended.

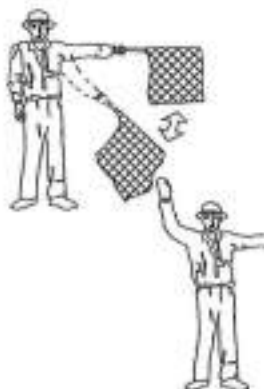
The cycle of a fixed time traffic control signal should be carefully adapted to the specific work area. The green signal face should be illuminated for a period which would be sufficient to permit a group of vehicles to pass through the area followed by an all-red period for both directions to allow complete clearance of the section by the vehicle group.

Depending on the anticipated traffic pattern, a vehicle actuated traffic control signal with temporary actuation loops is likely to be more efficient in the handling of traffic.



**Warning Traffic**

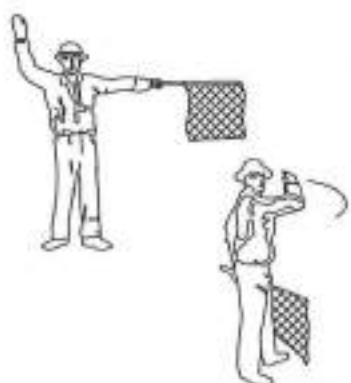
Stand facing traffic looking directly at the driver - Flag in left hand - move flag up and down from side of leg to shoulder height continuously  
- For added effect move right arm up and down as well.

**To Stop Traffic**

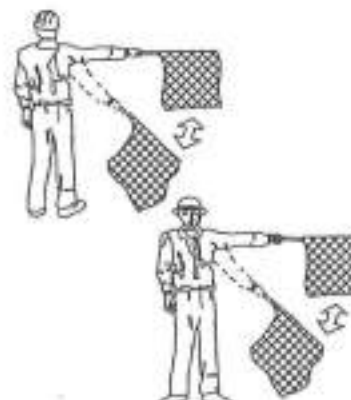
Stand facing traffic looking directly at the driver - Flag in left hand - move flag up and down from side of leg to shoulder until vehicle is 100 paces away - Looking at driver directly - hold flag at shoulder height with outstretched arm - Raise right hand with palm to face traffic  
- This procedure is for short-term use only.

**Vehicles To Proceed**

Turn right hand side of body towards oncoming traffic - lower flag behind left leg and indicate with horizontal swinging movement of the right arm that vehicles may proceed.

**To Slow Traffic Down**

Stand facing traffic looking directly at the driver - Keep flag at shoulder height with outstretched arm and raise right hand - palm facing traffic - As soon as traffic has slowed enough turn right hand side of body to oncoming traffic - Lower flag behind left leg and indicate with horizontal swinging movement of the arm that vehicles may proceed.

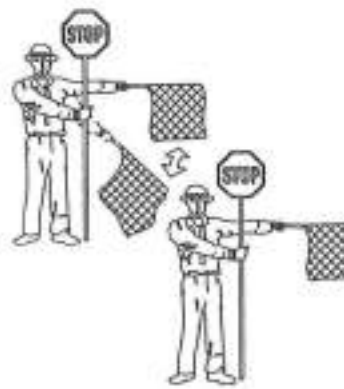
**Warning of Slow-Moving Vehicles**

Walk 300 paces in front of moving vehicle while raising and lowering flag continuously from side of leg to shoulder height - At sharp curves or when visibility of vehicles is reduced, stand still, facing and visible to oncoming traffic, and continue to raise and lower flag to warn traffic  
- use flag in arm nearest to road.

Detail 13.23.1 - General Flag Procedures

**Warning Traffic**

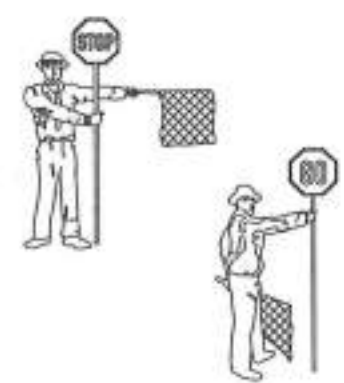
Stand with right hand side of body towards oncoming traffic - hold STOP/GO sign with GO turned to traffic with right hand - Move flag up and down continuously, behind sign, from side of left leg to shoulder height while vehicles are approaching.

**To Stop Traffic**

Stand with right hand side of body towards oncoming traffic - hold STOP/GO sign with the STOP side facing traffic - Move flag up and down continuously from side of left leg to shoulder height, behind sign, until traffic is 100 paces away then keep flag at shoulder height pointing towards road centre.

**Vehicles To Proceed**

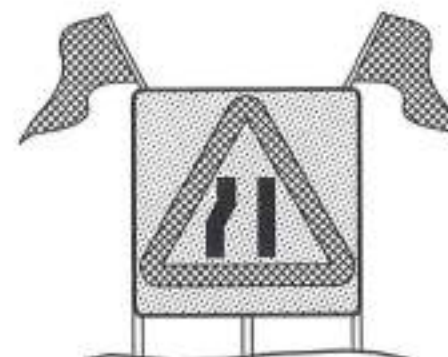
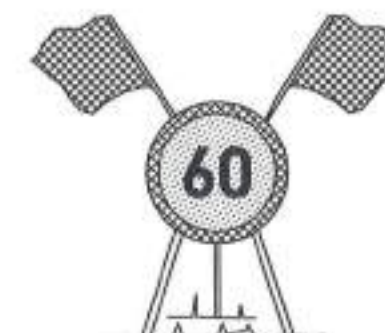
Make sure that all vehicles from the other side have passed through and that the flagman at the opposite end has closed the road - Turn STOP/GO sign to GO and lower flag behind left leg behind the sign.

**To Slow Traffic Down**

Stand with right hand side of body towards oncoming traffic - hold STOP/GO sign with right hand with STOP facing traffic - Hold flag at shoulder height with left hand pointing towards road centre - When oncoming vehicle has slowed, turn sign to GO and lower flag behind left leg behind sign.

Detail 13.23.2

STOP/GO Procedures



Flags may be attached to sign frames so that the flag movement and visual impact draws attention to the sign.



To enhance the "Warning Traffic" message a flagman may use two flags and draw attention to signs.

Detail 13.23.3  
Innovative ProceduresFig 13.23  
Flag Procedures

The installation of temporary traffic control signals together with the proposed timings sequence should receive the prior approval of the road authority concerned.

A typical traffic management layout for temporary traffic control signals is shown in Figure 13.57.

- 10 One-way operation of long sites is not generally recommended. If no other alternative exists, then such a site must be provided with adequate passing places. The passing places must be located so that they are inter-visible. This will allow approaching drivers to exercise a yield procedure. One direction of traffic should be given priority over the other through the full length of the site unless some specific condition of the site makes such a control arrangement unsatisfactory. The direction of travel which must yield right of way shall be indicated by appropriate signs. Each passing place layby shall be signed to indicate the right of way priority. It is recommended that on sites over 1 km in length, reassurance signs be located to advise drivers of the extent of the site remaining.

13.3.10 Traffic Control Methods - Slow-moving Work

- 1 Many general maintenance operations on roadways normally require some form of lane closure. Typical of such tasks are the following:
- (a) road marking;
  - (b) road surface condition surveys;
  - (c) alignment surveys;
  - (d) deflectograph surveys;
  - (e) grass cutting;
  - (f) street lighting maintenance;
  - (g) gardening/weed spraying;
  - (h) roadstud application;
  - (i) service installation.

These operations all require a slow-moving, or stop-start operation on the roadway, and due to the nature of the task this will normally extend over many kilometres. This has traditionally involved dropping one lane over such a distance, much to the disadvantage of traffic. The number of traffic cones required and the time needed to place them can be saved by carrying out such operations from, or in front of, a vehicle or vehicles equipped with high visibility rear treatment or towing trailers with such equipment.

- 2 Vehicles used for slow-moving maintenance operations or survey work should be painted in conspicuous colours and be equipped with one or more yellow flashing lights. If the vehicle (or tractor) is used in a contra-flow operation, such as grass cutting on a central median, it must be equipped with a flashing light on each side of the vehicle.
- 3 In addition, it is recommended that slow-moving vehicles used for mobile or stop-start work be provided with high visibility rear treatment. This treatment may include a road traffic sign appropriate to the operation, similar to the example illustrated in Figure 13.31. If the vehicle itself is not suitable for such treatment, it should tow a trailer suitably provided with a high visibility rear treatment. The use of a trailer is particularly relevant

to operations which can be carried out from a conventional motor car, such as road surface condition surveys. Such a vehicle cannot be easily differentiated from normal traffic and it may be travelling at 10 km/h instead of 100 km/h, an extremely hazardous operation. In this event a trailer with high visibility treatment will offer a simple safety device together with a convenient way of carrying test equipment.



## 13.4 SETTING OF SPEED LIMITS AT ROADWORKS

### 13.4.1 General

- 1 Excessive vehicle speed is a major contributor to accidents at roadwork sites. **The purpose of speed limits is therefore to reduce the number and severity of accidents to minimum levels consistent with the provision of smooth and efficient traffic flow.** At roadworks sites the normal, or anticipated, road environment is changed. The driver, on his first encounter with the roadworks, has difficulty in determining a safe speed through the changed road environment. In addition, detail changes may be made to long term sites so that even the regular user may find his judgement of circumstances inadequate.
- 2 **It is essential that speed limits are realistic and that the public can learn to respect and rely on them.** In deciding on speed limits for a site the following factors should be taken into consideration:
  - (a) the design speed of the geometric components of the site;
  - (b) the applicability of advisory speeds;
  - (c) the proximity of works and machinery;
  - (d) traffic volumes and the effects of loss of road capacity;
  - (e) the likelihood of adequate enforcement of speed limits;
  - (f) the length of the site.
- 3 It is important that designs of traffic accommodation measures take these factors into account. **In planning the traffic management and work phases the need for unrealistically low speed limits, over excessive distances, must be avoided.** If a site is long and there is a localised need for a low speed, the speed limit for the whole site should not be dictated by such localised conditions. Speed limits should rather be reduced locally where necessary, with a recommended minimum length of operation within long sites of 300 m to 500 m. Alternatively the use of localised advisory maximum speeds should be considered.

### 13.4.2 Design Speeds

- 1 The basic safety principles governing the design speed of permanent roadways should also govern the design speed(s) at roadworks sites. Geometric standards and traffic control should be kept at the highest levels possible. The traffic control plan should be designed on the assumption that drivers will reduce their speed only if they clearly perceive a need to do so.
- 2 The following factors should be taken into account when deciding on design speeds and these speeds applied to Table 13.3 as potential speed limits:

#### (a) Geometry of Travelled Way

A most important factor in relation to temporary alignment is the horizontal curvature. Figure 13.24 gives details of reverse curve treatment and Table 13.2 covers a range of minimum radii in relation to design speed, superelevation and side friction factor. Since road surface conditions vary widely at changes of direction and at detours, and correct levels of superelevation are rarely provided (reverse cambers or superelevations may even occur), the design

engineer should relate his temporary road geometry to the anticipated road conditions, bearing in mind the need for realistic speed limits. Likely values for "e", "i" and "R" for a site can be applied to Table 13.2 to determine an appropriate design speed/speed limit.

In the context of roadworks situations the treatment of tapers in roadway width is also an important aspect of the horizontal alignment presented to drivers. Design criteria for tapers are covered in Section 13.5.

The vertical profile of a road is also a critical geometric element particularly when low standards are applied to temporary elements such as deviations or detours. In the past, poor attention to the combination of temporary vertical and horizontal alignment has often created hazardous conditions within roadworks sites. The effects of low standard vertical alignment must be analysed as part of the traffic accommodation planning process including adjustments to standard positions for signs relating to a subsequent hazard.

#### (b) Stopping Sight Distance

The stopping sight distance is the distance a driver must be able to see ahead in order to stop in safety as illustrated in Figure 13.25. This is normally based on the vertical or horizontal sight line between a driver's eye located 1,05 m above ground level to an object on the roadway ahead which is 0,15 m in height. If altered road markings are a particular feature of the site, consideration should be given to reducing the object height to zero so that the driver can observe the road markings at an adequate distance. Once stopping sight distances have been determined relevant design speeds can be obtained from graphs in Figure 13.25.

#### (c) Width of Roadway

The travelled way is commonly reduced in width at roadworks sites. Particular attention should be paid to conditions when parallel reduced width lanes pass through reverse curves so that sufficient space is available for large vehicles. The following recommended speeds may be related to Table 13.3:

- |            |                  |                          |
|------------|------------------|--------------------------|
| (i) Rural  | 3,6 m-3,1 m      | -100 km/h                |
|            | 3,1 m and lower  | - 80 km/h                |
| (ii) Urban | 3,6 m and higher | - prevailing speed limit |
|            | 3,6 m-3,1        | - prevailing speed limit |
|            | 3,1 m and lower  | - 60 km/h.               |

If more than one lane width of roadway is available, but insufficient width for two, even narrow, marked lanes, it is recommended that the lane be delineated at a standard width. This will discourage attempts to overtake when insufficient lane width is available.

(continued on page 13.4.4)

TABLE 13.2

MINIMUM RADII OF HORIZONTAL CURVATURE

TABLE 13.2

| Anticipated 85% ile Speed (km/h) | R <sub>1</sub> (1)<br>(m) | R <sub>2</sub> (1)<br>(m) | R <sub>3</sub> (1)<br>(m) | R <sub>4</sub> (1)<br>(m) |
|----------------------------------|---------------------------|---------------------------|---------------------------|---------------------------|
| 50                               | 80                        | 124                       | 189                       | 248                       |
| 60                               | 110                       | 186                       | 280                       | 372                       |
| 70                               | 160                       | 264                       | 393                       | 528                       |
| 80                               | 210                       | 360                       | 531                       | 720                       |
| 90                               | 270                       | 477                       | 694                       | 954                       |
| 100                              | 350                       | 618                       | 887                       | 1236                      |
| 110                              | 430                       | 786                       | 1113                      | 1572                      |
| 120                              | 530                       | 986                       | 1375                      | 1972                      |

**NOTES:**

- (1) The figures in Table 13.2 are derived using the formulae:

$$e + f = \frac{v^2}{127R} \quad \text{and} \quad R = \frac{v^2}{127(e + f)}$$

where e is the superelevation rate (m/m)  
 f is the side friction factor  
 v is vehicle speed (km/h)  
 R is the curve radius (m)

and where

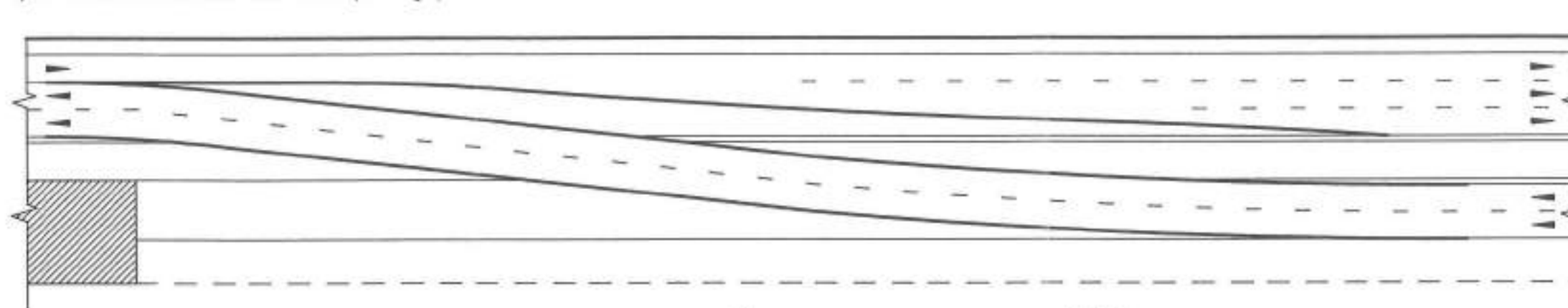
|                      |                     |                              |
|----------------------|---------------------|------------------------------|
| - for R <sub>1</sub> | e = 0,1 (1 in 10)   | and f = f <sub>max</sub>     |
| - for R <sub>2</sub> | e = 0               | and f = f <sub>max</sub>     |
| - for R <sub>3</sub> | e = 0,025 (1 in 40) | and f = 0,5 f <sub>max</sub> |
| - for R <sub>4</sub> | e = 0               | and f = 0,5 f <sub>max</sub> |

and f<sub>max</sub> = 0,19 —  $\frac{v}{1600}$  (ie 0,16 at 50 km/h to 0,10 at 100 km/h for GOOD road surface)

- (2) For practical purposes a minimum 85% ile/design speed of 50 km/h is considered realistic. (If significant delays are acceptable this minimum may be reduced 30 km/h in urban areas.)
- (3) Values of "e" and "f" have been chosen to cover a normal design range with respect to roadworks deviations. It should be borne in mind that "f" values could be very much lower than 0,5 f<sub>max</sub> due to poor road surface conditions (mud, bleeding surface or loose gravel or chippings).
- (4) Table 13.2 is not a design table. It is intended as a guideline to demonstrate the effects of sub-standard superelevation and/or side friction factor, to assist designers in their choice of curve radius and/or speed according to anticipated conditions. If values of "e" and "f" can reasonably be assumed, radii can be interpolated, from the table. Since there is a wide daily variation in site conditions this method of selection is likely to be adequate provided the designer assumes the worst likely conditions.

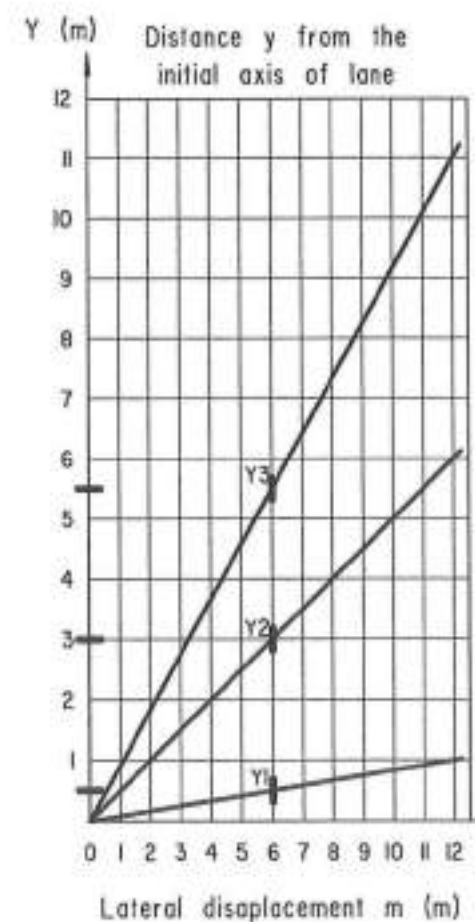
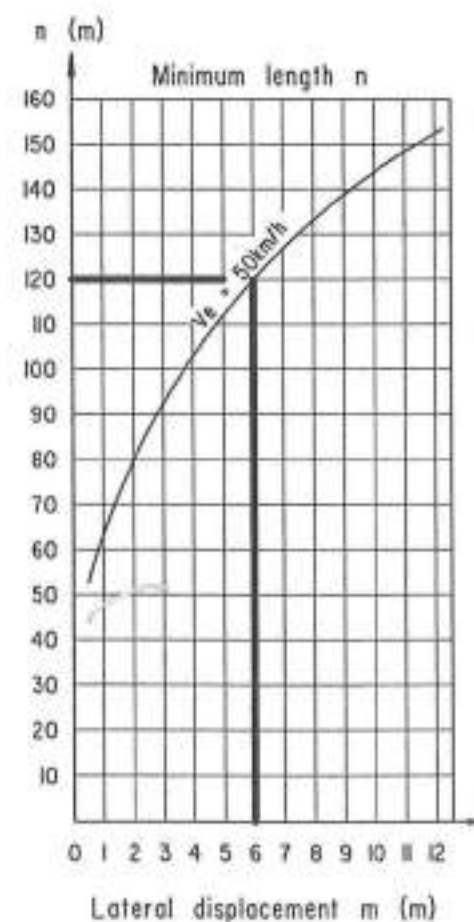
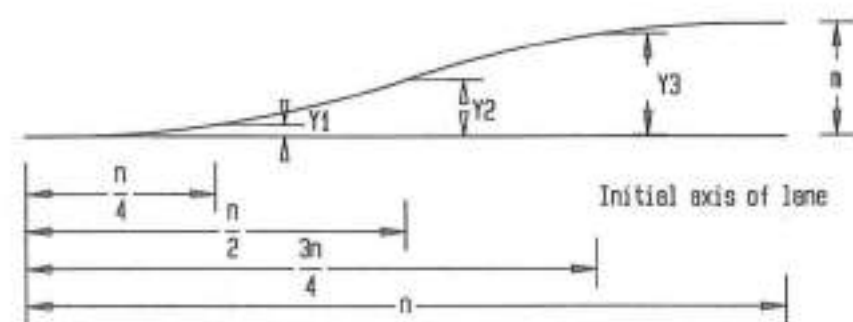
**Detail 13.24.1****REVERSE CURVE DESIGN-METHOD 1 - HIGH STANDARD**

In this method reverse circular curves are designed according to normal geometric standards with a design speed no less than 15% lower than normal operating speed.

**Detail 13.24.2****REVERSE CURVE DESIGN-METHOD 2 - QUICK DESIGN**

This method allows rapid site calculation and setting out of reverse curves based on a design speed of 50 km/h.

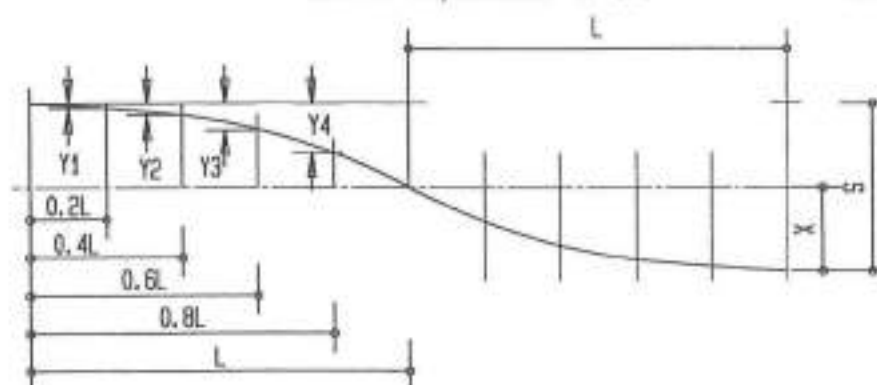
EXAMPLE : Shift = 6 m    Offset  $Y_1 = 0.5$  m  
                    $L = 120$  m     $Y_2 = 3.0$  m  
                                    $Y_3 = 5.5$  m

**Detail 13.24.3****REVERSE CURVE DESIGN-METHOD 3 - PARABOLIC CURVES**

This method allows flexibility for quick curve design and is adequate for smaller work areas particularly in urban streets.

$$Y_1 = X \cdot \frac{L^2}{2}$$

Where  $S = \text{total shift}$   
 $X = \frac{S}{2}$



**Fig 13.24**  
**Geometry of Travelled Way at**  
**Roadworks**

(continued from page 13.4.1)

(d) **Workmen Near or Crossing Travelled Way**

Pedestrians and workers are very vulnerable when involved in an accident with a motor vehicle. Special efforts must therefore be made to ensure their safety. As a guide the following speed limits are appropriate when workers are on site (refer to Table 13.3):

- (i) 3 m or less from the travelled way - 50 km/h
- (ii) more than 3 m from travelled way - 60 km/h(urban)  
and no need to cross travelled way - 80 km/h(rural).

(e) **Construction Vehicles Near, Entering or Leaving Roadway**

Large slow-moving construction vehicles are a hazard. When such vehicles are present and active, temporary speed limits as given below should be considered, and referred to Table 13.3:

- (i) stationary within 2 m - 60 km/h(urban)  
- 80 km/h(rural)
- (ii) stationary + 2 m -prevailing speed limit(urban)  
- 100 km/h(rural)
- (iii) entering or leaving the travelled - 50 km/h(urban)  
- 60 km/h(rural)

(provided construction vehicle access is not otherwise controlled i.e. by STOP-GO control, flagman or temporary traffic signals).

(f) **Proximity of Fixed Objects or Excavation**

Fixed objects or excavation close to the roadway have an influence on the severity of accidents. As a guide the following speed limits should be considered, and referred to Table 13.3:

- (i) urban area with more than 20 fixed objects per km
  - less than 1 m from edge or road - 60 km/h
  - between 1 m and 2 m - 70 km/h
  - between 2 m and 3 m - 80 km/h
- (ii) rural area with more than 10 fixed objects per km
  - less than 1 m from edge of road - 70km/h
  - between 1 m and 3 m - 80 km/h
  - more than 3 m - 100 km/h
  - more than 5 m - 120 km/h
- (iii) excavation greater than 300 mm - 60 km/h  
- 70 km/h.

3 **In the case of high traffic volumes, it is essential that the design speed of the roadworks site be kept as close to the normal design speed of the roadway as possible to reduce congestion, delay and accident potential to a minimum.**

4 If drivers have to travel for long distances at slow speeds, they are likely to become frustrated and make errors of judgement. The length of a section of roadworks should not be used as an argument for increasing the design speed of the whole section above that applicable to localised areas. Rather the length of the site should be limited to avoid widely ranging design speeds within one section.

**13.4.3 Summary - Temporary Speed Limits**

- 1 Once the various factors have been considered, and the design speed/limits appropriate to those factors which are relevant have been selected according to the prevailing circumstances, the minimum speed limit can be selected with the help of Table 13.3. If this speed limit is considered unrealistically low, the factor which determined it should be re-examined with a view to upgrading the relevant standards to the requirements for at least a speed limit equal to that determined by the next lowest factor, or the use of a localised advisory maximum speed should be considered.

**13.4.4 Speed Limit Enforcement**

- 1 The traditional methods of speed measurement and enforcement can all be used at roadworks sites. However, stopping motorists is rarely safe and causes considerable congestion. There is also rarely adequate space to pull offenders out of the traffic stream. The use of speed enforcement by camera, or other similar means, is therefore considered to be the most effective way of apprehending offenders. The objective, nevertheless, is to get all motorists to reduce speed. It is important, therefore, to make motorists aware that such enforcement is in progress by the use of very visible and repeated signs.
- 2 If the need for speed limit enforcement has been identified in the planning stage, traffic control plans and contract documents should be flexible enough to be easily modified to include provision for the use of speed control methods such as extra flagmen, traffic officers and enforcement equipment. A unit item approach for the relevant traffic safety items would allow for all contingencies. State, provincial and local authorities are encouraged to make special contractual provisions for the inclusion of the employment of traffic officers in the traffic control plan.

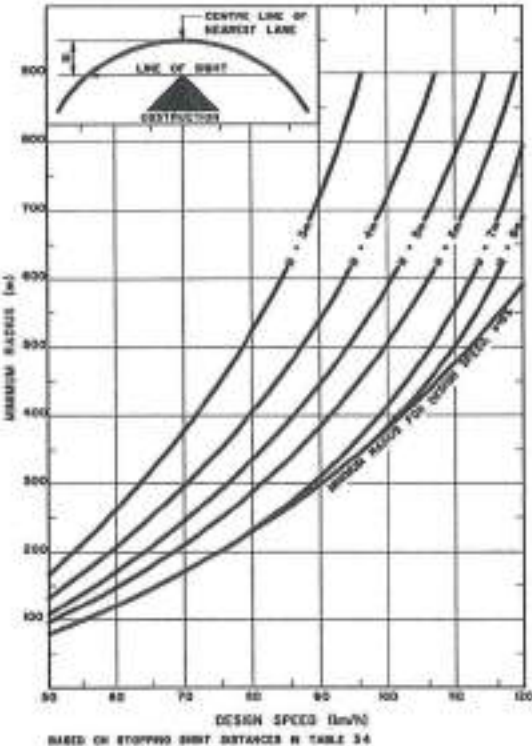
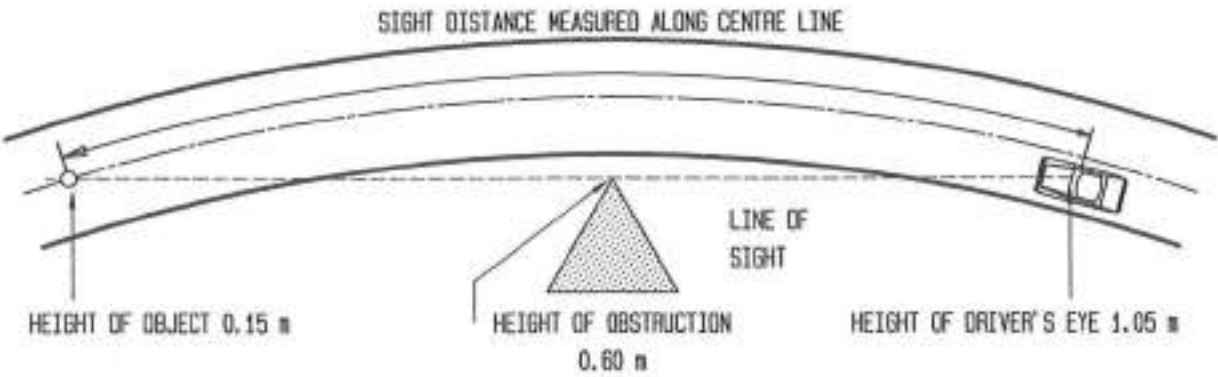
**13.4.5 Speed Reductions**

- 1 The need for speed reduction can be effectively indicated by one of two methods:
- (a) warning of an advisory maximum speed; or
  - (b) reducing the regulatory speed limit.
- 2 An advisory speed supplementary plate may be used in conjunction with an appropriate warning sign to recommend the maximum speed at which a local potentially hazardous section of roadway should be negotiated. The advisory speed should be determined by the resident engineer and the site safety officer after field trials.
- 3 The specification of a reduced regulatory speed limit is appropriate to long-term and longer distance sites. It is important that the selected speed be not significantly lower than that which drivers would reasonably expect, or that they will tolerate. In determining the speed limit various design speed factors should be taken into account.
- 4 Motorists may well be reluctant to reduce speed sufficiently. The presence of law enforcement officers, or the use of flagmen in selected locations, are two positive steps which can be taken to achieve more effective speed control.

Detail 13.25.1

HORIZONTAL STOPPING SIGHT DISTANCE

This sight distance factor is determined by physical obstructions, particularly on road curves.

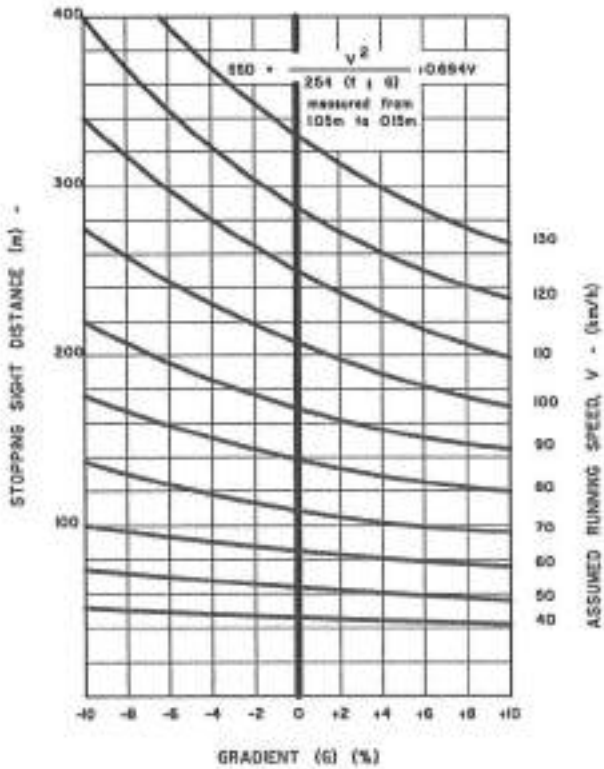
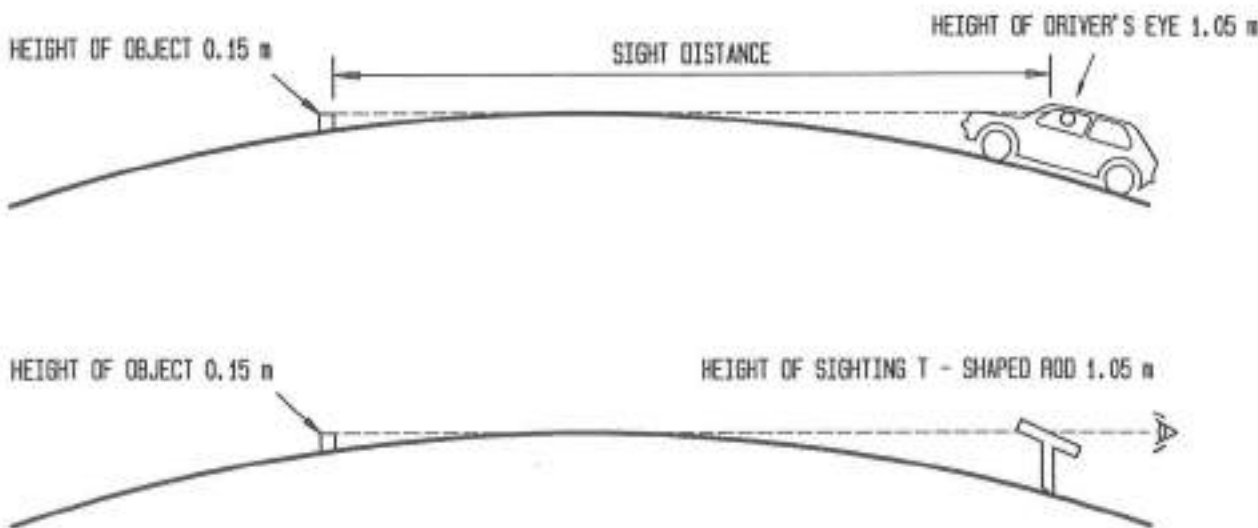


Detail 13.25.3  
HORIZONTAL RADIUS FOR STOPPING SIGHT DISTANCE

Detail 13.25.2

VERTICAL STOPPING SIGHT DISTANCE

This sight distance factor is determined based on assumptions of driver's eye height above ground and a minimum object height.



Detail 13.25.4  
STOPPING SIGHT DISTANCE ON GRADE

Source : TRB

NOTES ON SIGHT DISTANCE

Stopping Sight Distance is used in this section as a factor in deciding on speed limits. Sight distance has an impact on many other aspects of road design including temporary alignments such as deviations. The following types of sight distance are relevant:

- (a) Stopping Sight Distance - SSD
- (b) Barrier Sight Distance - BSD
- (c) Decision Sight Distance - DSD
- (d) Passing Sight Distance - PSD

SSD is expressed as  $S = 0.694V + V^2/254f$

where  $S$  = total distance travelled (m)  
 $V$  = speed (km/h)  
 $f$  = brake force coefficient

Barrier Sight Distance (BSD) is the limit below which overtaking should be legally prohibited by NO OVERTAKING LINE marking RM1 (approx. 2 x SSD).

Decision Sight Distance (DSD) should be considered in complex decision situations when the information given to a driver may require a resultant series of actions eg. a lane change before turning or exit (freeway). DSD assumes an object height of 0m.

Passing Sight Distance (PSD) is relevant for long deviations but may be difficult to design for. High degrees of driver frustration are likely to occur in long deviations without PSD when heavy and slow moving traffic occurs.

SSD & BSD ON LEVEL ROADS

| Design Speed (km/h) | SSD (m) | BSD (m) |
|---------------------|---------|---------|
| 40                  | 50      | 115     |
| 50                  | 65      | 150     |
| 60                  | 80      | 180     |
| 80                  | 115     | 250     |
| 100                 | 155     | 300     |
| 120                 | 210     | 400     |

DSD & PSD ON LEVEL ROADS

| Design Speed (km/h) | DSD (m) | PSD (m) |
|---------------------|---------|---------|
| 40                  | 130     | 290     |
| 50                  | 160     | 335     |
| 60                  | 190     | 420     |
| 80                  | 240     | 560     |
| 100                 | 300     | 680     |
| 120                 | 350     | 800     |

Fig 13.25  
Stopping Sight Distance –  
Vertical and Horizontal Curves



- 5
- A flagman may be used to bring greater emphasis to bear on the posted advisory or regulatory speed. The flagman can use his flag to indicate to the traffic to slow down whilst pointing to the speed sign or warning sign with his other hand (see Figure 13.23). Flagmen should be alert and well trained in flagging techniques. They should be clearly visible from at least 60 m to 100 m and should wear high visibility clothing. They should stand so that they contrast well with their background.

Law enforcement officers may be employed effectively in either, or both, of two ways:

(a)

a highly visible patrol car can be parked adjacent to the roadway;

(b)

the traffic officer, alternatively, may perform a similar function to the flagman, by actively directing traffic to slow down.

- 6
- Figure 13.26 shows a selection of typical roadworks environments in which speed reduction is achieved by a progressive reduction. **A reduction in a posted speed limit should preferably not exceed 15% of the approach speed if it is to be successful in actually reducing operating speeds.** For practical purposes it may be necessary to reduce speed limits by more than one such increment due to site limitations. In the majority of figures detailed in Sections 13.8 to 13.12 this latter approach is illustrated because it represents the greater space and signing requirement. **This should not be interpreted as over-riding the preferred 15% maximum reduction in the speed limit.** For further details refer to the notes with Figure 13.26.

TABLE 13.3

SELECTION OF SPEED LIMIT

TABLE 13.3

| Factor |                            | Selected Speed Limit |    |    |    |    |     |     |  |
|--------|----------------------------|----------------------|----|----|----|----|-----|-----|--|
| (i)    | Geometry                   | 50                   | 60 | 70 | 80 | 90 | 100 | 120 |  |
| (ii)   | Stopping sight distance    | 50                   | 60 | 70 | 80 | 90 | 100 | 120 |  |
| (iii)  | Width of roadway           |                      | 60 | 70 | 80 |    | 100 |     |  |
| (iv)   | Workmen near               | 50                   | 60 |    | 80 |    | 100 |     |  |
| (v)    | Construction vehicles      | 50                   | 60 | 70 | 80 |    | 100 |     |  |
| (vi)   | Proximity of fixed objects |                      | 60 | 70 | 80 |    | 100 | 120 |  |

NOTES:

- (1)

It is presumed that the road surface of a detour or deviation is maintained in a condition which is safe at a speed limit selected from Table 13.3.
- (2)

In deciding on the speed limit for the "geometry" factor other secondary factors may be used to "weight" the speed limit chosen (either up or down).

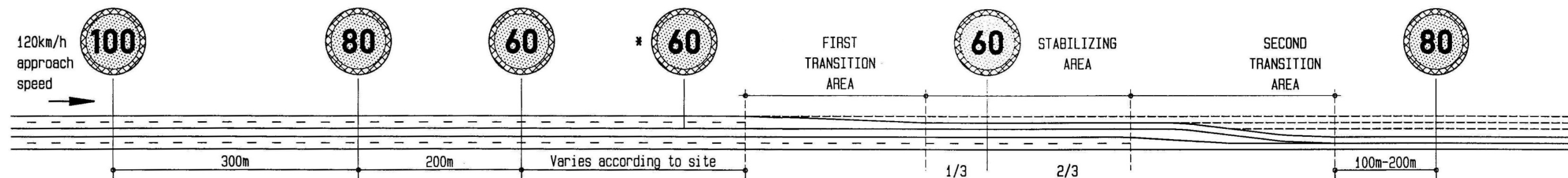
Such factors are:-

  - quality of delineation;
  - traffic volumes;
  - class/standard of roadway (single/dual carriageway).
- (3)

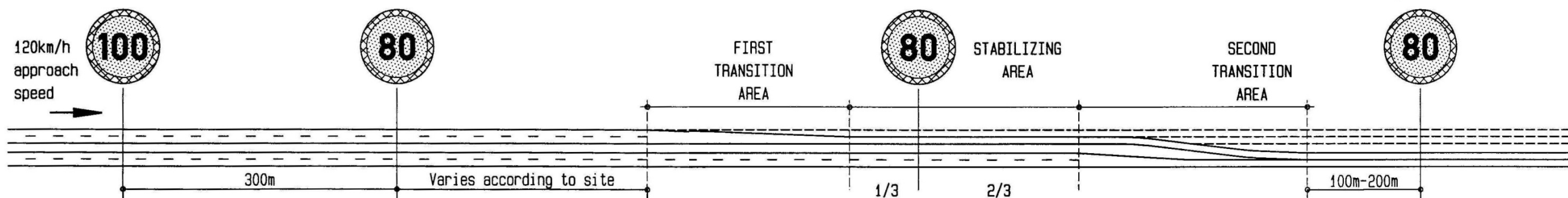
The "width of roadway" factor may be adjusted according to the following secondary factors:-

  - number of lanes per direction;
  - availability of shoulders;
  - passing opportunity.
- (4)
- (5)

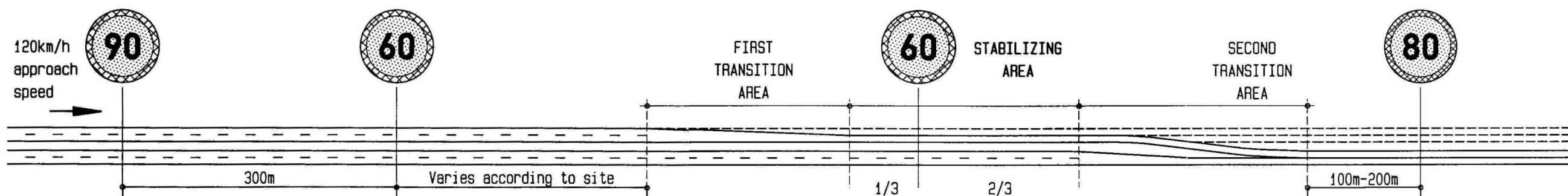
Every effort should be made to keep the length of a long construction site to a minimum consistent with the design speed of the roadworks deviation and the acceptability of a similar speed limit to motorists.



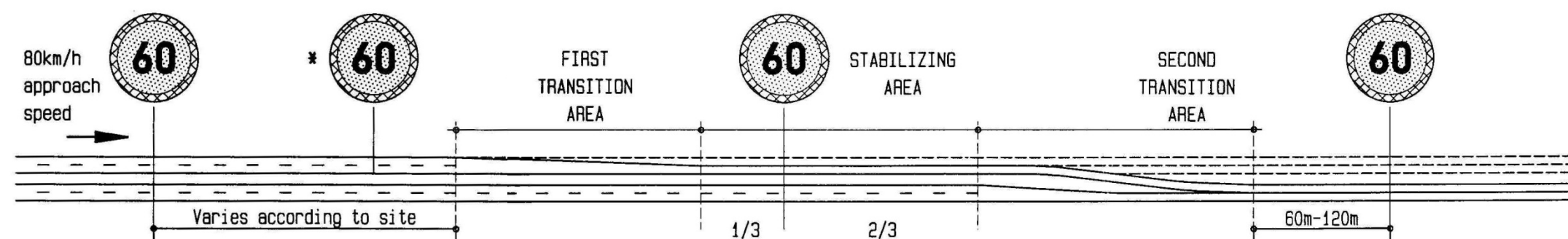
Detail 13.26.1 Speed Reduction - Maximum Reduction Recommended - FREEWAY



Detail 13.26.2 Speed Reduction - Recommended Reduction - FREEWAY



Detail 13.26.3 Speed Reduction - Optional with Space Limitation - FREEWAY



Detail 13.26.4 Speed Reduction - Recommended Treatment - URBAN ARTERIAL

\* = Optional Signs

NOTES:

- 1 The above details show temporary SPEED LIMIT signs TR201 only. For details of all other signs see figures in Sections 13.8 to 13.12.
- 2 In each detail there is a section marked "varies according to site". The length of this section should be in the range of 100 m to 200 m for a free-flowing site. If a site is subject to regular congestion this length should be increased accordingly so that traffic approaching in the previous speed reduction section can either:
  - (a) see and recognise the end of a stationary queue;

- or
- (b) judge that traffic is flowing at a speed lower than the posted 60 km/h.
- 3 Notwithstanding the fact that the figure shows reductions from 120 km/h to 60 km/h it is strongly recommended that roadworks site geometry, for intended free-flowing situations, be designed so that the speed through any transition area can be set at a maximum of 15% below the operating approach speed (see Detail 13.26.2).
- 4 When it is not possible to design the site geometry to

- 5 a free-flow standard, speed reduction should be signed in steps so that each is approximately a 15% reduction on the speed previously posted (see Details 13.26.1 and 13.26.4).
- 5 In situations where recommended speed reduction distances given in Details 13.26.1 and 13.26.3 cannot be accommodated, larger speed reduction steps of up to 25% may be considered. However, such a treatment should be considered when congestion is not likely to occur and it must be realised that such reductions in speed may require actual vehicle braking rather than a more comfortable rate of

deceleration.

**Fig 13.26**  
Recommended Speed Limit Signing for Speed Reduction Within an Advance Warning Area





## 13.5 TEMPORARY DELINEATION

### 13.5.1 General

- 1 A change of alignment at roadworks generally occurs within transition areas (see Subsection 13.3.3), or on detours completely separated from the road under construction. The details given in this section refer mainly to conditions where such changes of alignment require particular attention and action on the part of the driver. They do not cover normal, and sometimes sub-standard, changes of alignment required by the topography of the countryside through which a detour has been built. Such situations should be signed in the normal way using warning signs conforming to the temporary road traffic sign colour code.
- 2 The channelisation required at change of alignment is achieved using techniques and delineation devices as detailed in the following sub-sections.

### 13.5.2 Delineation

- 1 The traditional device used to provide delineation in South African has been the 200 litre drum. **The use of drums should be phased out and they should no longer be specified in contracts or used by road authorities.** Drums should be replaced by DELINEATOR PLATES which should be manufactured to the requirements given in Volume 4 from the safest possible materials. **Plastic delineators and bases are available and are recommended. The specification of plastic delineators may have cost implications from time to time but additional initial purchase costs may well be offset due to re-usability and reduced claims for damages from the public.**
- 2 **DELINEATOR PLATE signs TW401 and TW402** have been developed to provide a safer, more visible (by day and night) device with which to indicate to drivers changes in alignment or areas of work. The plate may be used in combination with other delineation devices such as temporary barricades, barriers, roadstuds and road markings.

Four sizes of plate are available and their use is recommended as follows:

- (a) 150 mm x 600 mm
  - intermediate use on long rural sites with straight sections of roadway;
  - minor urban works;
- (b) 200 mm x 800 mm
  - short rural sites and localised sections of above average hazard potential at rural sites;
  - urban class "B" (arterial) streets and other complex sites;
- (c) 250 mm x 1000 mm
  - higher speed rural and urban sites, in particular freeway sites.
- (d) 300 mm x 1200 mm
  - special applications where extra emphasis is required.

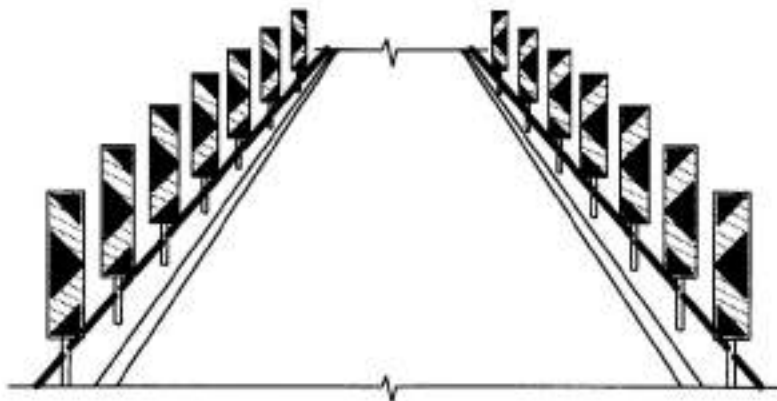
Examples of the plates are given in Figure 13.27 and dimensional details in Volume 4. The delineator stands should be designed not to overturn when subjected to wind gusts of 60 km/h and to collapse under impact in the safest possible

manner. Specific examples of how and where delineators should be used are given in the Sections 13.8 to 13.12.

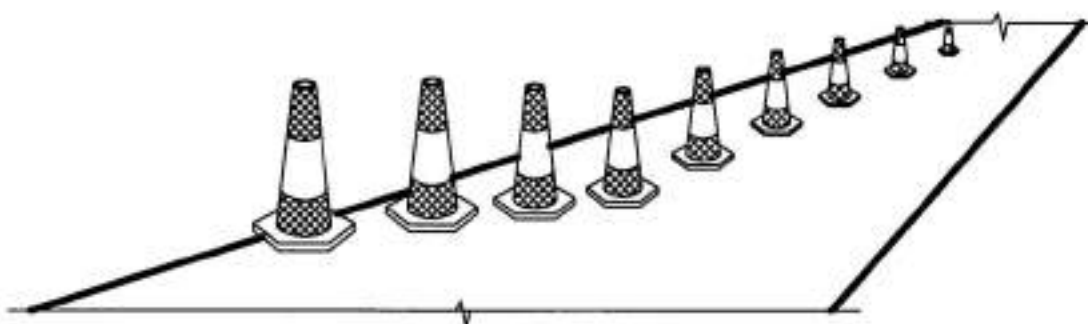
- 3 **TRAFFIC CONES TD4** manufactured in a fluorescent red-orange or fluorescent red plastic material should be used only at minor short-term roadworks sites during daylight. They may also be used in connection with mobile maintenance operations such as grass cutting, sign cleaning, road marking, street light repair, etc. Cones used in urban areas with low speed traffic should be a minimum of 450 mm high. For higher speed applications a minimum height cone of 750 mm should be used. If work at sites where traffic cones are in use is forced to continue into dusk and/or night time, all cones must be fitted with white retroreflective sleeves or they must be replaced with DELINEATOR PLATE signs TW401 or TW402. The sleeves may be removable.
- 4 **GUARDRAIL DELINEATORS TDI**, or similar delineation devices, should be used to demarcate the line of any temporary barrier provided at a roadworks site in terms of Subsection 13.5.4. Device TDI is designed for use with a W-Section Guardrail. If a similar device is required to demarcate some other form of barrier, such as a portable shaped concrete barrier, the shape and mounting may have to be adapted.
- 5 **Temporary ROADSTUDS** are recommended at changes of alignment on all Class A and B roads and other hazardous locations. They may be used to supplement DELINEATOR PLATES and/or temporary NO OVERTAKING line. Temporary roadstuds should only be used strictly in accordance with the standard roadstud colour code given in Volume 1, Chapter 7.
- 6 **Temporary ROADMARKINGS** should be retroreflective and are essential at any position where the temporary roadway is diverted from the normal roadway, such as at tapers, crossovers and detours. It is equally important that in these situations the existing standard road markings be erased or covered by temporary black tape or by painting out with a matt (non-reflective) paint. The painting of temporary road markings should be carefully planned and co-ordinated on major roadworks sites to minimise the need to change or erase these temporary markings. Constant erasing and variation in longitudinal road markings can produce a situation which, under adverse light conditions, makes it impossible for drivers to tell which lines are correct. Temporary retroreflective road marking tape is best suited to temporary markings which are going to be in position unchanged, for a long period of time, or for a very short period of time. On high class roads, the erasure of markings by wet (or dry if traffic permits) grit blasting or high pressure water jet is recommended.
- 7 **Plastic DELINEATOR TAPE TD5**, is widely used for delineation purposes. However, the capability of the tape to provide effective delineation, as opposed to hazard identification, should not be over-estimated. It is recommended that the use of TD5 tape be reserved for low speed urban environments, or the identification of specific hazards, obstacles or excavations at the roadside, or within the work area, **in addition to the other necessary delineation devices.**

(continued on page 13.5.4)

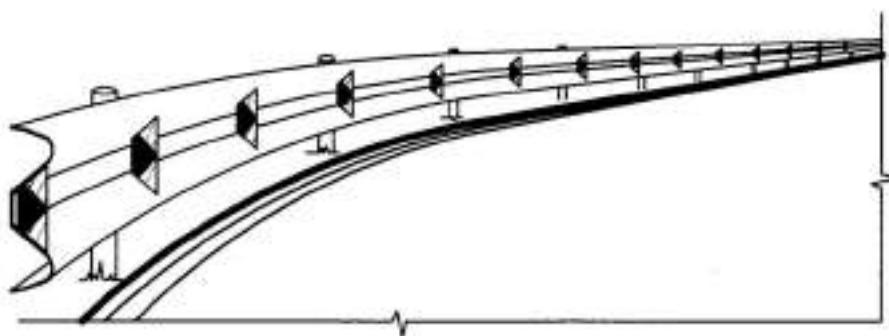
Detail 13.27.1 - DELINEATOR PLATES TW401/TW402



Detail 13.27.2 - TRAFFIC CONES TD4



Detail 13.27.3 - GUARD RAIL DELINEATORS TD1



Detail 13.27.4 - BARRICADE TW411/KEEP RIGHT TR104 COMBINATION ( Typical Example )

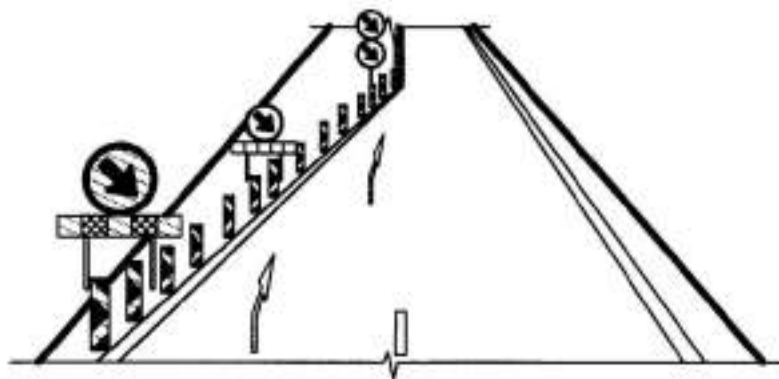


Fig 13.27

Typical Delineation Devices

TABLE 13.4

DELINEATOR, CONE AND ROADSTUD SPACING AT ROADWORKS

TABLE 13.4

| Temporary Condition  |                     | Delineator or Cone Spacing (m) | Roadstud Spacing (m) |
|--|---------------------|--------------------------------|----------------------|
| Transition taper   | - 1 in 10           | 3                              | 1-2 (4)              |
|  | - 1 in 20           | 5                              | 5 or 6 (1)           |
|  | - 1 in 30           | 7                              | 5 or 6 (1)           |
|  | - 1 in 40           | 10                             | 5 or 6 (1)           |
| Transition crossover                                       | - curve (2)         | 5 to 10                        | 1-2 (4)              |
|  | - straight (3)      | 10                             | 12                   |
| Stabilising of work area<br>(according to site conditions) |                     | 10 to 15                       | 12                   |
|  |                     | 20 to 50                       | 24                   |
| Termination taper  | - 1 in 5            | 5                              | 12 or 24             |
|  | - 1 in 10           | 7                              | 12 or 24             |
| Straights  | - short             | 10                             | 12                   |
|  | - long rural (5)    | 200 max                        | (6)                  |
|  | - freeway or        | 50 max                         | (6)                  |
|  | high speed road (7) |                                |                      |

**NOTES:**

- (1) Choose spacing to best fit with adjacent sections. Different spacing should be used on adjacent sections, according to the table, **to achieve the necessary visual impact on the sections of greatest hazard.**
- (2) The figures given apply to outer curves at crossovers; the spacing may be increased to 10m to 20 m on inner curves or the delineators omitted altogether.
- (3) This spacing refers for straights between reverse curves, if used.
- (4) In urban areas or where the curve radius is 60 m or less a 1 m spacing is recommended.
- (5) On long rural straights the delineator size may be reduced to 600 mm x 150 mm as well.
- (6) Temporary roadstuds need only be used on straights if conditions required by the warrants given in Volume 1, Chapter 7 are applicable i.e. standing water, construction dirt, fog etc.
- (7) Experience has shown that spacings greater than 50 m on freeways may encourage drivers to move onto the work area.

(continued from page 13.5.1)

- 8 Delineator spacing depends on the speed and volume of traffic, and the vertical and horizontal alignment at the change of direction. Table 13.4 gives guidance on spacings. Site engineers should be prepared to adjust their delineator plates to best advantage by visual inspection on site. For rural sites it is recommended that the standard spacings given in the table be adhered to at all changes of alignment and areas of concentrated work activity. It is characteristic of such sites, however, that long sections of often straight road will stand for periods of time between phases of construction. In this event the spacing and size of delineators may be increased and reduced respectively. It should be noted, however, that any spacing greater than 50 m makes it relatively easy for vehicles to pass between the delineators, to the wrong side, and at speed.

### 13.5.3 Barricades

- 1 Barricades can take many forms, but **should always be visible and portable**. The objective of a barricade is to demarcate the work area or an area restricted to site vehicles only. If delineators have been used then it will rarely be necessary except at the beginning of a site or in transition areas to use barricades. For small amounts of shift in alignment one barricade sign combination should be used. If the shift in alignment is one lane width or more, two or more barricade sign combinations should be used. Details of a typical barricade sign combination are given in Figure 13.27.
- 2 Barricades may commonly be used on their own in urban areas to redirect pedestrians or to indicate trenching, particularly by service agencies which have to carry out excavations in the roadway or footpath. Where these are used with vehicular traffic, they shall have a night time visibility capability.

### 13.5.4 Barriers

- 1 Barriers must be sufficiently fixed to give physical protection to traffic and workers alike. Typical barriers are W-section steel or portable shaped concrete (New Jersey) section mounted in accordance with prevailing South African Bureau of Standards requirements. The alignment of barriers shall be defined for night time visibility by GUARDRAIL DELINEATORS or similar devices. Special effort should be taken to make the face of concrete section barriers visible, particularly at night and under conditions of bad visibility.
- 2 When portable concrete barriers are used, particular attention should be paid to the end treatment of the barrier. On low speed approaches a minimum of three sections should be tapered away from the line of traffic flow and a loose sand bag or open graded stone heap should be placed at the end facing on-coming traffic. (Note: the specification for open-graded stone should be as for use in arrestor beds). This treatment should always be used on high speed approaches unless a full standard taper or curve of portable barriers is used to offset the end from the path of approaching traffic (see Figure 13.28).
- 3 Barriers should be installed in the following cases:
  - (a) where the fill is more than 4 m with no recovery area;
  - (b) where water next to the road formation is deeper than 1,5 m;
  - (c) at all bridges;

- (d) where obstructions appear to be more dangerous than a guardrail would be;
  - (e) in restricted areas between opposing flows of high volumes of traffic.
- 4 Brief details relating to barriers and their use are given in Figures 13.28.

### 13.5.5 Tapers

- 1 Tapers are used in transition areas on the approach to a work area to achieve a reduction in road width or to drop a lane altogether, and in termination areas at the end of the work area or deviation, to restore the normal roadway width to traffic. It is extremely difficult to predict actual traffic running speeds in roadworks sites. Even with clear signing and regular enforcement, speeds are likely to vary widely. It is therefore recommended that taper lengths (or rates) be specified which are appropriate to the top of the likely speed range. Table 13.5 and Figures 13.20 and 13.29 give details of different types of taper.
- 2 Tapers are used in a number of different ways even within, for example, a transition area. The function of the taper has an effect on its recommended length. The following types of taper may be specified as illustrated in Figure 13.20, and their relative lengths, as a "rule of thumb," are indicated as a function of L (as given in Table 13.5):
  - (a) merging taper - L m;
  - (b) shift taper - 0,5L m;
  - (c) shoulder taper - 0,3L m;
  - (d) termination taper - 0,3L m.

### 13.5.6 Crossovers

- 1 When a crossover is provided, it should allow traffic to transfer smoothly from its normal roadway position to a temporary position. The treatment of such a crossover must take into account the likely conventional reverse curve standards for the anticipated speed and, if lane widths have been reduced on the approaches, extra widening should be provided through the reverse curve to allow for the swept path of heavy vehicles and their trailers. This refers to side by side lane layouts in either opposing directions or the same direction. An example of this treatment is given in Figure 13.24.
- 2 For shorter term installations, the use of parabolic reverse curves set out using offsets is recommended. The design of these should take into account speed and shift. An example is given in Figure 13.24. On wide carriageways of three lanes or more, when a shift of more than one lane is required, the use of reverse curves in preference to a taper is recommended.

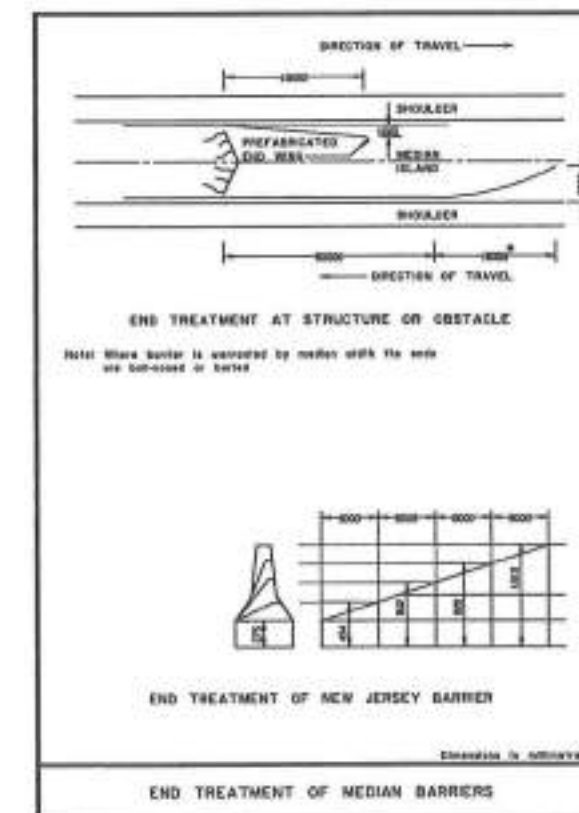
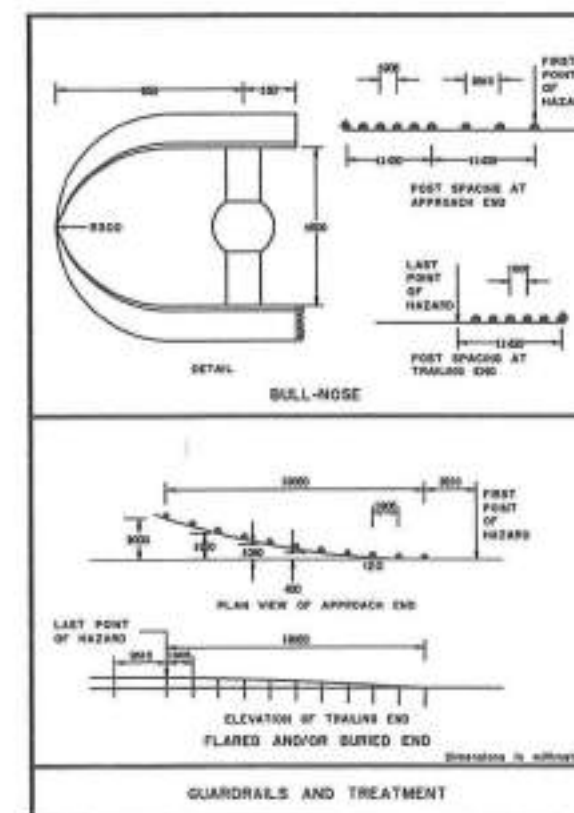
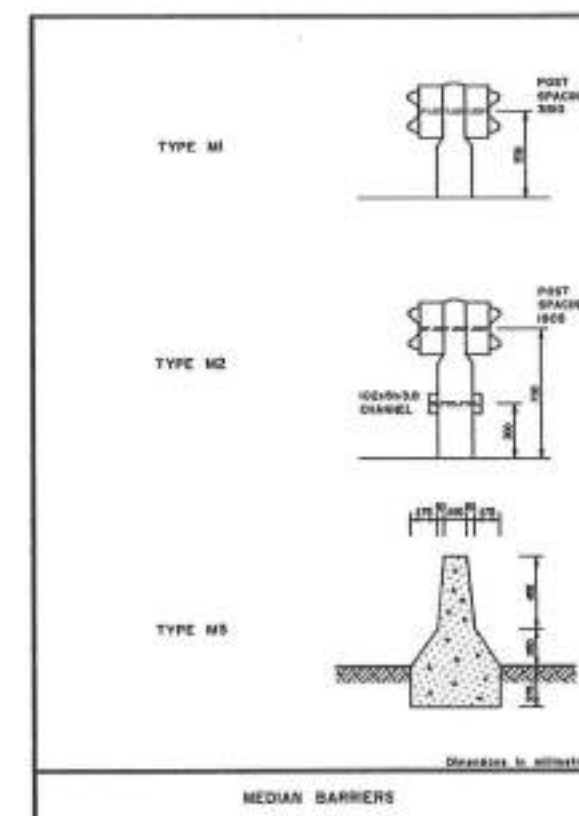
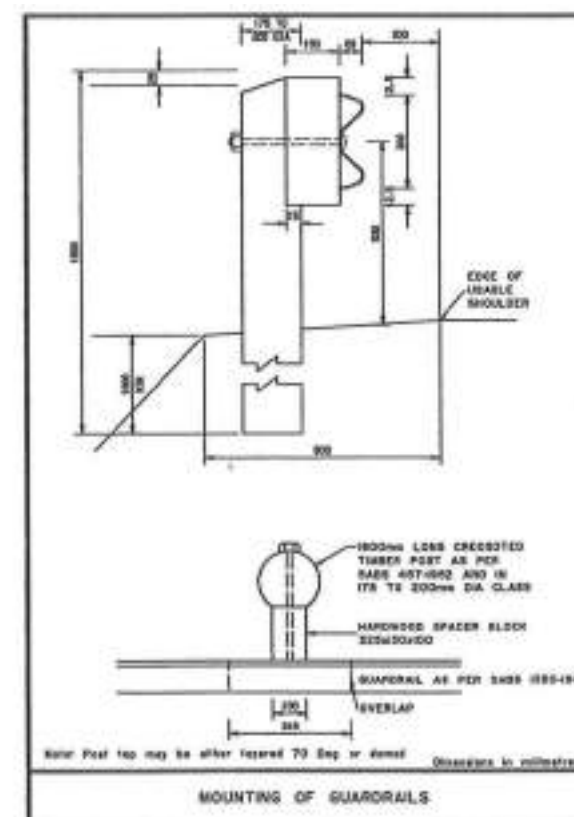
### 13.5.7 Flashing Lights

- 1 Yellow flashing lights may be used to give added emphasis to the signing or delineation of a potentially hazardous location. Their application could be appropriate either singly, in pairs or in sets, to the following temporary conditions:

(continued on page 13.5.7)

### 13.5.5

1. An offset of 6m of the first barrier from the edge of the roadway and a taper rate in the range 1:6 (36m) to 1:10 (60m) has been found to be a cost effective use of portable concrete barriers (USA research - source: TRB-TRR1035).



### Fig 13.28 Barrier Details

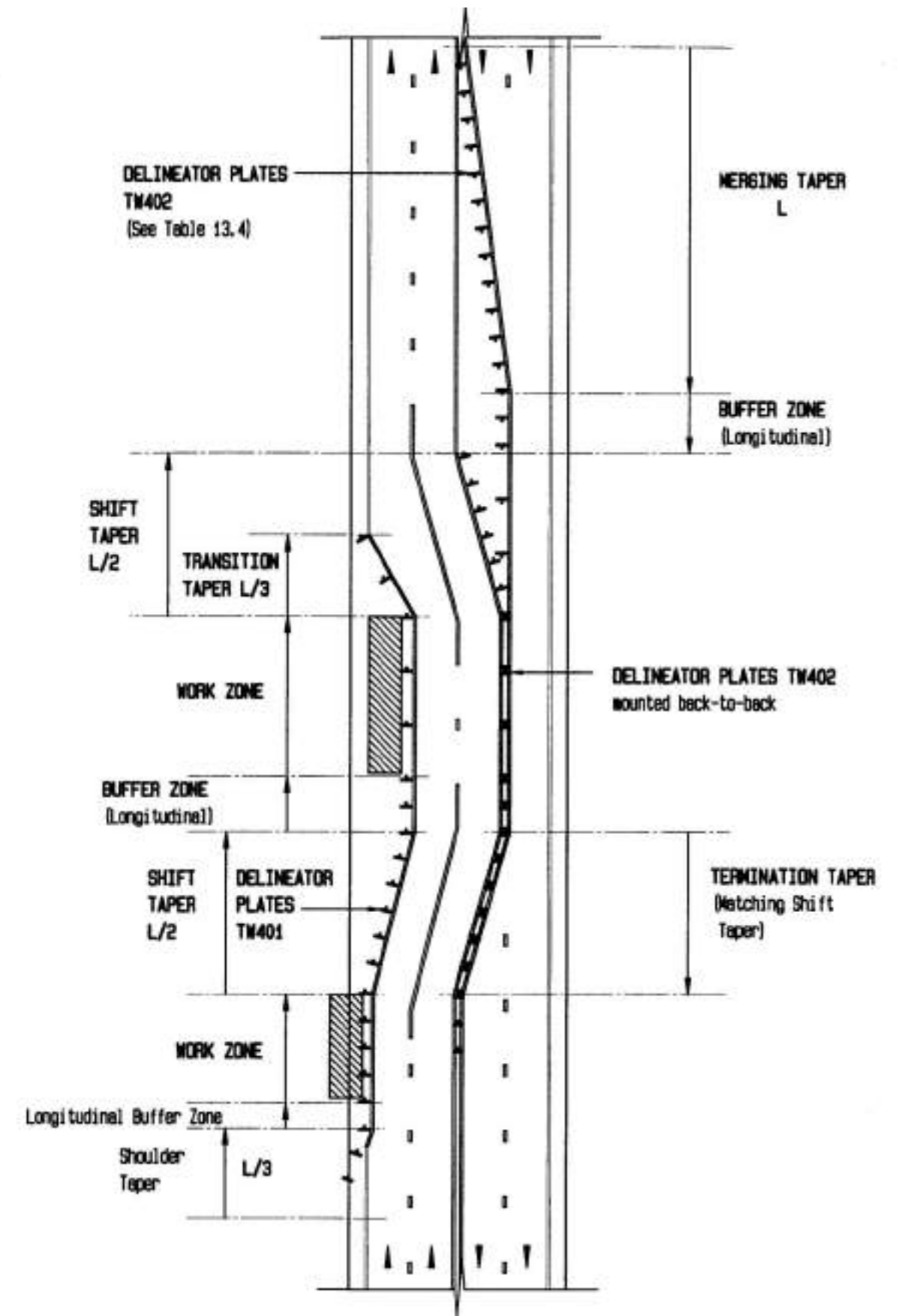


Fig 13.29

Taper Details



- (a) lane drop tapers and crossovers with restricted visibility or potentially high approach speeds;
  - (b) at barricades or barriers particularly at road closures;
  - (c) at deep excavations in front of or to the side of the travelled way;
  - (d) to warn in advance of limited vertical clearance at a structure (the use of red flashing lights, representing a STOP condition, should be considered at the structure; these should be capable of being triggered by an advance height sensing device);
  - (e) urban service trenching with a limited lateral buffer space to the travelled way;
  - (f) with individual warning signs.
- 2 When flashing lights are to be installed, the following factors should be considered:
    - (a) mounting height;
    - (b) frequency of flash;
    - (c) brightness(light intensity)-with different day and night settings;
    - (d) maintenance.

There are no South African specifications for flashing lights as used at roadworks. For details refer to British Standards or Australian Standard 1165-1982 - "Traffic Hazard Warning Lamps".

TABLE 13.5

TAPER TREATMENT AT ROADWORKS

TABLE 13.5

| Condition                            | Taper Rate (2)        | Rounded Length (L) for 4 m shift<br>(nominal lane width 3,7 m) (3) |
|--------------------------------------|-----------------------|--|
| <b>A. Transition Tapers (1)</b>      |                       |  |
| 120 km/h - 80 km/h<br>approach speed | 1 in 50<br>to 1 in 40 | 200 m to 150 m   |
| 80 km/h - 60 km/h<br>approach speed  | 1 in 30<br>to 1 in 20 | 120 m to 60 m (3)  |
| 60 km/h - 40 km/h<br>approach speed  | 1 in 20<br>to 1 in 10 | 80 m to 30 m (3)   |
| under 40 km/h<br>approach speed      | 1 in 10<br>to 1 in 5  | 40 m to 20 m (3)   |
| <b>B. Termination Tapers</b>         |                       |  |
| All (4)                              | 1 in 10<br>to 1 in 5  | 40 m to 20 m (4)   |

**NOTES:**

- (1) Refer to Volume 1, Glossary of Terms. Other tapers may be used to close off shoulders on high class roadways. These may be much shorter than transition and termination tapers. (1 in 5).
- (2) When writing specifications for tapers on plans or in documents it is preferable to give pre-determined overall lengths rather than taper rates.
- (3) Urban lane widths will normally be less than 3,7 m. The shorter lengths given equate to a 3,0 m lane width.
- (4) Depending on the side on which a lane may be re-developed, the added lane side should develop at 1 in 10 and the shoulder side at 1 in 5 (Termination tapers).
- (5) The lengths given may be increased or reduced proportionally for tapers over more or less than a lane width subject to an overall minimum taper length of 10 m (and three delineation devices).
- (6) A taper should never be extended continuously over two lanes. If it is required that two lanes be dropped this should be achieved by dropping each lane one at a time separated by a stabilizing area.





## **13.6 CONTRACT SPECIFICATION**

### **13.6.1 General**

- 1 It is important that the specification and control of roadworks sites be significantly improved. In order to improve safety and efficiency new traffic management and signing techniques are available. These "tools" must be used well to simplify the tasks of the engineer in charge, and of the contractor, and to make site conditions more predictable and credible to drivers.
- 2 A traditional method of contract payment for traffic accommodation, namely that of "lump sum" payment, results in an inability of an engineer in charge to adequately ensure that the contractor pays attention to the necessary detail. The complexity of major sites requires a flexible approach to signing and management. This has to be carried through into contract specifications to enable fair payment to the contractor and effective control by road authorities and their agents. Traffic management techniques recommended in this chapter encourage a systematic approach to signing and management which should make tender pricing more simple for contractors, and installation and reaction to change on site, easier once the job is underway.
- 3 It is recommended that contract specifications call for tenders based on itemised pricing. This approach may be used in combination with "provisional sums" to cover unplanned changes in traffic accommodation which will always occur. However, the "provisional sums" should be used more as contingency items instead of being paid out on a proportional basis through the contract period.
- 4 Temporary items which should be covered by individual rates are:
  - (a) temporary signs (rate per sign area including direction signs);
  - (b) delineator plates and stands;
  - (c) traffic cones;
  - (d) barricades;
  - (e) barriers (guardrail, portable concrete etc);
  - (f) flashing lights;
  - (g) road marking (rate per width, colour, type of temporary marking);
  - (h) roadstuds;
  - (i) sandbags;
  - (j) cleaning of road traffic signs.
- 5 Care must be taken in specifying how the temporary signs should be provided on the site. This can be done in a number of ways:
  - (a) supply only - with separate rates for erection and relocation;
  - (b) supply, erect and maintain for contract period;
  - (c) supply and erect with a daily or weekly maintenance extra rate (to be ordered by the engineer in charge - maintenance rates may include for cleaning, inspection, relocation or put into storage).
- 6 Major contracts have, in the past, included severe penalties in an effort to keep tight control of the temporary signing and to get the support needed for the contractor to achieve this objective. These penalties can be specified by the hour, for failure to supply listed signs within a specified time period (a number of hours), or a non-listed sign within a reasonable number of days (5 days has been used and should be adequate close to major centres). These same contracts have also included an ultimate penalty of closing down all work if the contractor has failed to take necessary precautions for the safety and convenience of public traffic.
- 7 Such drastic measures should never need to be implemented. It is, therefore, recommended that contract specifications require that a member of the contractors staff be nominated as the "Site Safety Officer" with specific responsibilities to keep the temporary traffic accommodation requirements up to specification.
- 8 The correct application and enforcement of speed limits may have an effect on the way in which a contract is specified (see Section 13.4).



## 13.7 OTHER SITE FACTORS

### 13.7.1 General

- 1 Whilst the main objective of this Chapter is to provide for a standardised approach to the analysis of the traffic management and temporary signing of roadworks situations as is practical, it is also necessary to draw the attention of practitioners to aspects which can easily be forgotten or taken for granted. In fact they may require additional thought and attention. The following factors should therefore be considered during the planning stage of a project, or even once a project has started, if certain hazardous areas have been identified.
  - (a) are retroreflective materials according to specifications?
  - (b) would replacement of an existing sign with one with a higher grade of material help solve an identified problem?
  - (c) should additional high visibility techniques be used?
  - (d) are signs and markings being properly maintained?
- 2 No site should therefore be considered to be, in fact, "standard". Site staff responsible for traffic management should develop an awareness for whatever unique or peculiar factors a site may have, and should be prepared to compensate for these in their traffic management design and signing solutions.
- 3 The most insignificant maintenance operation could result in the death of a worker if a high level of awareness of prevailing conditions is not maintained by all on site. The factors covered in the following subsections are all important in ensuring that all roadworks sites operate safely and efficiently.

### 13.7.2 Materials for Temporary Signs

- 1 When ordering signs for temporary roadworks use, the rough handling which these signs are commonly subjected to should be borne in mind. It is not generally cost-effective to specify long-life materials for temporary signs. Since many signs need to be erected and removed several times during the time-span of a job, the use of light-weight materials should be considered.
- 2 The retroreflective and other materials recommended for use on temporary roadworks signs are as follows:
  - (a) black - semi-matt finish;
  - (b) yellow background - Class I;
  - (c) red - Class I.
- 3 Those responsible for accepting signs onto a site, or for ensuring their effectiveness, must make certain that the retroreflective materials conform to specifications. **Materials of a grade lower than Class 1 may well not perform acceptably even from new, and should not be used.** It must also be remembered that although covered with a retroreflective material all signs also have to perform effectively during daytime. The daytime luminance of certain retroreflective materials, or worn or dirty signs, may be inadequate particularly when displayed against a wintry bush veld background.
- 4 If it is required to draw special attention to a particular part of a roadworks site the use of special grade or even development of grade yellow retroreflective sheeting, available from some suppliers, is recommended. **This material has very high quality retroreflective properties and excellent daytime luminance.**

- 5 Although not recommended, as an absolute economy, signs which will **only** be used during daylight hours may have a paint finish, **unless otherwise required in terms of the Road Traffic Act** (generally regulatory signs). However, care must be taken to avoid their use under adverse visibility conditions, at dusk or at night. All signface materials used should conform to the requirements of SANS 1519-1:2006 and 1519-2:2004.

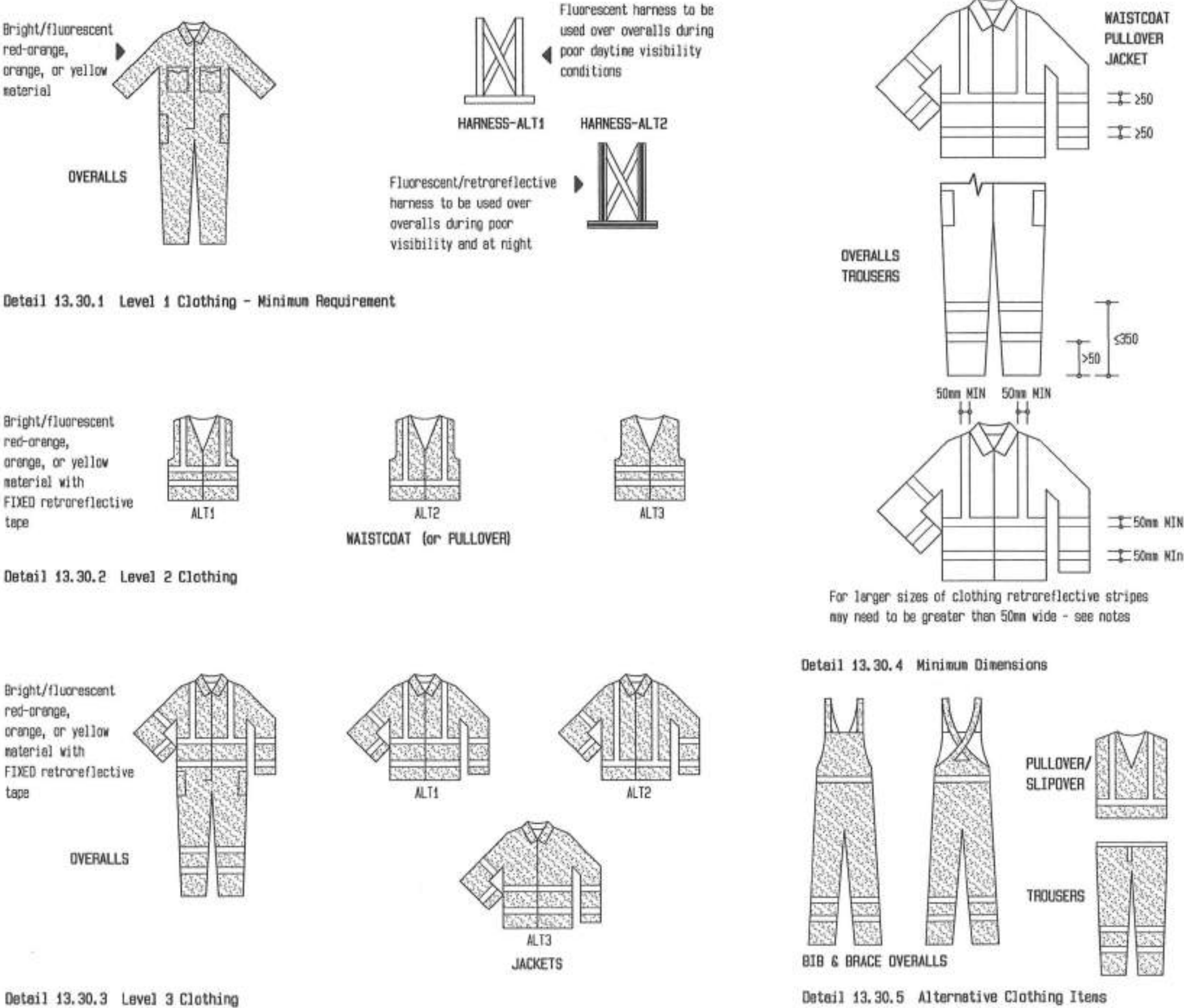
### 13.7.3 High Visibility Treatment

- 1 The signs comprising the temporary roadworks signing system have been developed around a specification for high conspicuity. There are times, however, when an even greater effort is needed to improve the conspicuity of parts of the roadworks scene. Such an effort is particularly appropriate when the object concerned is small (a worker), or on its own (a single vehicle), in amongst the confused backdrop of a typical construction area.
- 2 Special high visibility treatment is therefore recommended for:
  - (a) workers clothing;
  - (b) construction vehicles, plant and machinery;
  - (c) slow-moving maintenance and survey vehicles;
  - (d) any vehicle used to travel in the opposite direction to on-coming traffic e.g. median grass cutting on a freeway.
- 3 All workers at roadworks sites should wear conspicuously coloured clothing. Overalls and "hard" hats should be red-orange, orange or yellow in colour.
- 4 Any worker, or official, involved in traffic control operations or in work which requires him to regularly operate close to the travelled way, or to cross the travelled way, should wear a high visibility waistcoat or vest of the sort illustrated in Figure 13.30. This clothing should include fluorescent materials for best performance during dusk or in mist, and retroreflective materials for night time visibility.
- 5 All site vehicles should be equipped with one or more yellow flashing lights which shall be maintained in working order. Flashing lights fitted must be in use at any time when a site vehicle or any vehicle delivering materials is parked or operated close to traffic.
- 6 All vehicles should be regularly cleaned and should be painted in light, and preferably bright, colours. The use of additional boards or rear panels, covered in highly visible fluorescent and/or retroreflective materials, is very effective in improving the conspicuity of construction vehicles, plant and machinery.
- 7 If certain vehicles are regularly used for specific tasks in close proximity to traffic it is recommended that the rear of the vehicles be specially treated to make them highly visible. Such high visibility treatment may include an appropriate temporary road traffic sign (see Figure 13.31).

### 13.7.4 Maintenance of Temporary Signs

- 1 The nature of roadworks sites is such that dust or mud is deposited on the retroreflective surface of signs, delineators and barriers. This will lead to a very rapid reduction in the daytime

conspicuity of the signs. DELINEATOR PLATES, which are mounted very close to the road surface, will be particularly subject to this problem. Dirty retroreflective signs will also rapidly lose a significant proportion of their night-time effectiveness. A regular cleaning programme must therefore be undertaken. Signs must be replaced once they are no longer effective. Site safety personnel must agree on an inspection procedure to identify signs that should be replaced.



13.7.5 Notes on Figure 13.30

- (1) Standard specifications are not fully developed for high visibility workers clothing for use at roadworks sites. The details given in Figure 13.30 represent guidelines for good practice. The specific style or type of article of clothing is not prescribed to permit flexibility of choice. The following categories of work require that all workers involved in them be dressed in the most visible possible clothing:
- (a) any function involving direction or control of traffic, including functions related to accidents;
  - (b) any function involving the placing of signs, traffic cones or road markings;
  - (c) all work carried out under reduced visibility conditions such as in mist or fog, at dawn or dusk, during any type of fire, and at night.
- (2) Whilst emphasis is always on night-time visibility the difficulty in achieving high visibility during daytime must be recognised. The use of fluorescent and retroreflective materials is therefore recommended.
- (3) Three levels of clothing are illustrated:
- (a) **Level 1** clothing is appropriate for daytime use only - the possible need to supplement the above articles of clothing with fluorescent harnesses or vests must be considered - if a work function is likely to carry over into darkness then the work unit must carry adequate supplies of removable retroreflective vests or harnesses;
  - (b) **Level 2** clothing is appropriate for use at night (or at other times of reduced visibility) at roadworks sites where vehicle speeds are under 50 km/h - Level 2 clothing should incorporate a visible minimum of 0,50 m<sup>2</sup> of background material and 0,13 m<sup>2</sup> of Class 3 retroreflective material - the retroreflective materials should be in bands of not less than 50 mm width - for larger sizes of clothing to conform to these requirements the retroreflective material bands will need to exceed 50 mm (i.e. for a 107 mm chest the bands will need to be 62 mm wide);
  - (c) **Level 3** clothing is appropriate for use at night (or at other times of reduced visibility) at roadworks sites where vehicle speeds are over 50 km/h - Level 3 clothing should incorporate a visible minimum of 0,80 m<sup>2</sup> of background material and 0,20 m<sup>2</sup> of retroreflective material - the retroreflective materials should be in bands of not less than 50 mm width - for larger sizes of clothing to conform to these requirements the retroreflective material bands will need to exceed 50 mm (i.e. for a 107 mm chest the bands will need to be 62 mm wide).

Fig 13.30  
High Visibility Treatment Techniques

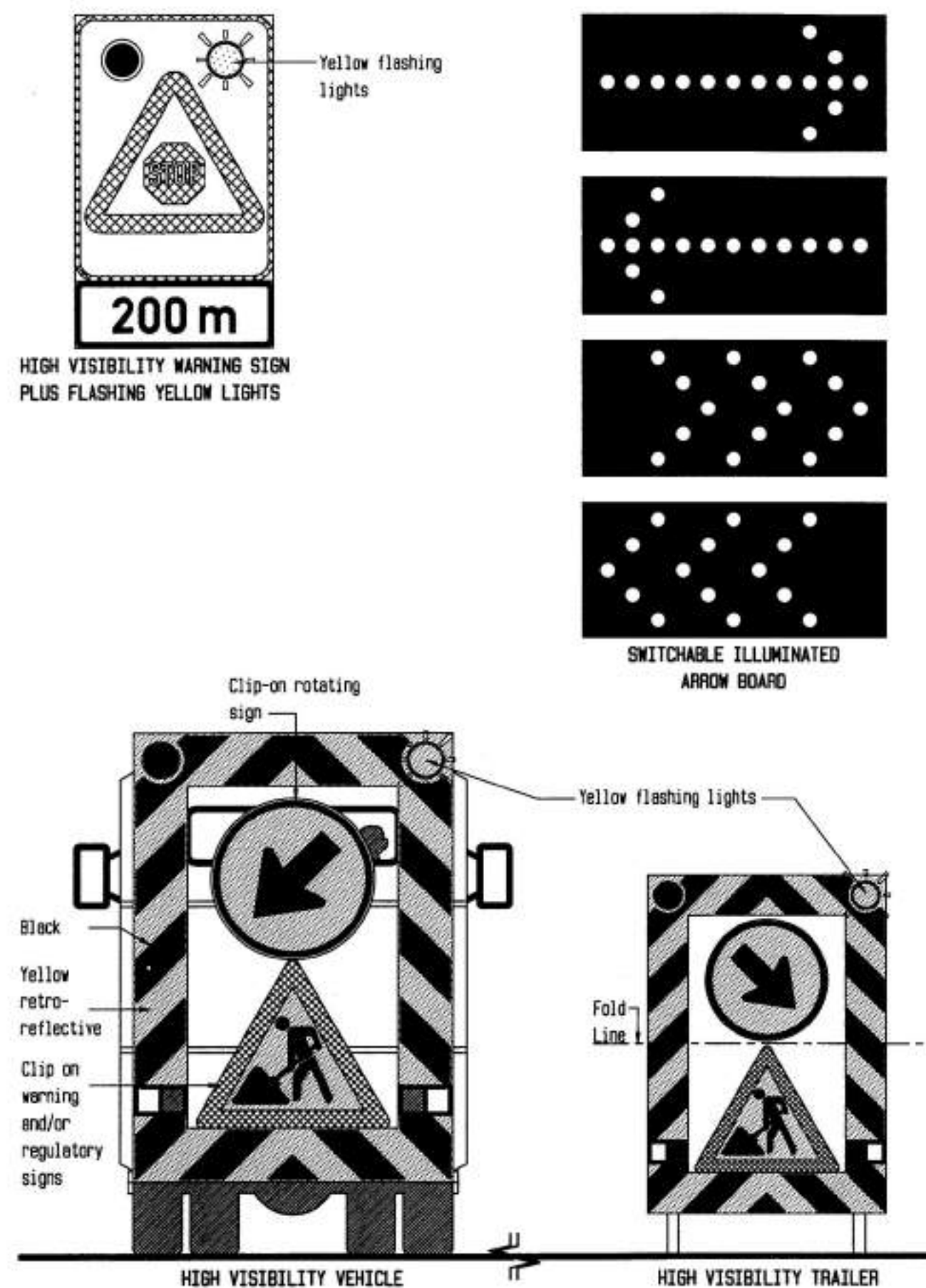


Fig 13.31

Other High Visibility Treatment Techniques



## 13.8 SIGNING APPLICATIONS FOR SHORT TERM WORKS

### 13.8.1 General

1 The applications of temporary signing for roadworks covered in Sections 13.8 to 13.12 have been subdivided into categories for ease of reference. These categories are:


- (a) short term works (Section 13.8);
- (b) rural roads (Section 13.9);
- (c) urban roads (Section 13.10);
- (d) freeways and dual carriageway roads (Section 13.11).

Section 13.12 provides enlarged details of elements covered in other sections and may be appropriate to any or all of the categories listed above.

2 The categorisation of applications used should only be considered to be general in nature. Many applications may be appropriate in several or all categories. Such applications are only detailed once to avoid duplication. Practitioners who do not find the application they are seeking in their first choice of category should therefore check other categories. If their required application is not covered, it will be necessary to determine a similar situation and to adapt it, with care, to their needs.

3 Sections 13.9 and 13.10 deal with rural and urban situations respectively. These terms also should be considered as general and if a "rural" application is appropriate within an urban area the application details should be used with appropriate adjustments to sign spacing and sizes. The signing of roadworks in peri-urban areas will most likely be catered for by rural category applications.

4 In the various figures the following rules or conventions apply:

- (a) all signs are correctly oriented for the direction of travel to which they apply;
- (b) to avoid confusion with any arrows on road signs or markings, the direction of travel of traffic is, where relevant, indicated thus ;
- (c) all details are given in metres **but all may be directly used as "paces" in practice.**

5 Signs should be sized as recommended in Volume 1. As a rule of thumb the following sizes are appropriate for regulatory, warning and diagrammatic signs:

- (a) Gravel roads:
  - (i) circular signs - 1200 mm diameter;
  - (ii) triangular signs - 200 mm side length;
  - (iii) diagrammatic signs - 1200 mm x 1600 mm;
- (b) Bituminous concrete or brick surfaced roads:
  - (i) circular signs - 1200 mm diameter;
  - (ii) triangular signs - 1500 mm side length;
  - (iii) diagrammatic signs - 1200 mm x 1600 mm.
- (c) Urban streets:
  - (i) circular signs - 900 mm / 1200 mm diameter;
  - (ii) triangular signs - 900 mm / 1200 mm side length;
  - (iii) diagrammatic signs - 1200 mm x 1600 mm.

### 13.8.2 Short Term Works

1 "Short term work" is generally defined for the purposes of this chapter as work during which the "site" is affected by the work being undertaken for a duration of up to 24-hours.




2 Most light to medium maintenance work is therefore included by "short term work". Maintenance operations which are:

- (a) mobile (or move along the road at a steady rate); or
- (b) such that at the end of the days work the roadway is returned to full use by traffic until maintenance recommences the next day (or after a weekend);

are therefore classified as short term work. Conversely, any maintenance work during which road traffic signs are kept in place for periods longer than 24-hours should be treated in terms of application details given in Sections 13.9 to 13.11.

### 13.8.3 Maintenance in Road Reserve

- 1 This application represents the lowest signing level covered in this Chapter. This signing level is appropriate ONLY when the work concerned does not encroach nearer to the edge of the roadway than the shoulder break point. Typical activities which might warrant this low level of signing are:
  - (a) verge grass-cutting;
  - (b) cleaning of side drains or cross drain inlets and outlets;
  - (c) fence repairs;
  - (d) kilometre post repair/maintenance/replacement.
- 2 As soon as workers are required to move closer to the travelled way, additional signing consistent with Figures 13.35, 13.36 or 13.41 to 13.43 should be used.
- 3 If the maintenance work gradually progresses along the road reserve, the TW336 signs should be moved forward with the work so that they are never more than 600 m from the work.
- 4 All workers should still be provided with the recommended bright clothing, even when working off the road edge (see Figure 13.30).
- 5 The sign inventory indicated is a minimum for the type of work concerned. Any work unit undertaking this type of work is likely to be a general maintenance unit and will probably have a minimum sign inventory consistent with most tasks in this section.

| MAINTENANCE UNIT INVENTORY  |          |              |          |
|---|----------|--------------|----------|
| Sign  | No       | Size (mm)    | Quantity |
|  | TW336    | 1200         | 2        |
|  | TIN 11.3 | 1200         | 4        |
|  | FLAGS    | 450 X<br>450 | 2        |

#### Checklist

- ☐ is the site set up with adequately safe Buffer Zones (see Figure 13.20)?
- ☐ are workers likely to get within 3 m of passing vehicles?
- ☐ is the maintenance unit vehicle and equipment well off the road?
- ☐ can signs be clearly seen by approaching drivers - if not move them further out?
- ☐ is a higher level of signing appropriate to ensure worker and public safety?

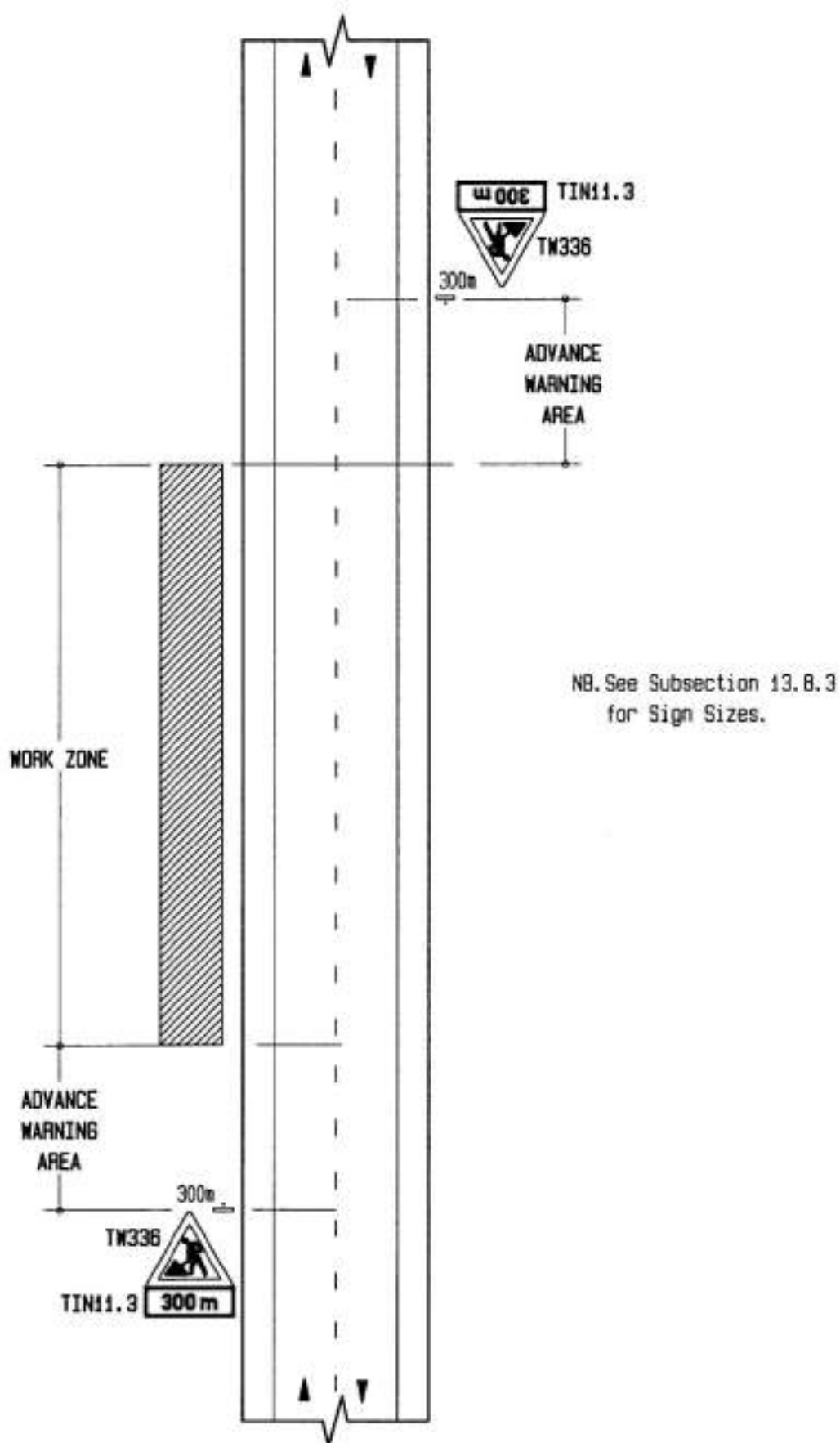








Fig 13.32

Maintenance in Road Reserve (off the roadway)

### 13.8.4 Firebreak Maintenance

- 1 Detail 13.33.1 shows a minimum level of signing treatment which may be used if smoke is not likely to represent a hazard. Activities which may be dealt with in this manner are grass cutting of a firebreak, including work within the public road reserve, and controlled burning of grass within the verge or close to the roadway, with a low risk of smoke being carried over the roadway due to the prevailing wind direction.
- 2 Detail 13.33.2 is appropriate when smoke, or the fire itself, represents a hazard or risk to traffic. The most significant difference between the two details is that when the smoke is a hazard, the flagmen must be prepared to exercise discretion and stop traffic. Under extreme circumstances **all traffic** may have to be halted. On other occasions one-way operation may offer adequate levels of safety. As with any STOP-GO operation queues of waiting traffic will form. Advance warning signs TW343 - TIN11.3 and TW339 - TIN11.4 should be moved away from the standard position so that they are located appropriately for the likely end of the traffic queue. **The signing requirement of Detail 13.33.2 is recommended for all accidental fires.**
- 3 **Flagmen operations as required for Details 13.33.1 and 13.33.2 shall be in accordance with the provisions of Figure 13.23.** Any unit which is working according to Detail 13.33.1 must be trained and equipped to be in a state of readiness to upgrade its operation to that shown in Detail 13.33.2.
- 4 Equipment for operation to Detail 13.33.2 shall include two-way radios for the STOP/GO flagmen, who, by virtue of the warrant for their operation, will not be able to see each other to co-ordinate traffic control. If all traffic has been stopped, and if a decision is taken to implement alternating one-way traffic it is recommended that each "entry" flagman counts all vehicles passing his control point and relays this information to the "exit" flagman, who should then count the vehicles out of the section.
- 5 If the fire or firebreak is on a dual carriageway roadway, advance warning signs must be placed on both the left and right sides of the carriageway.

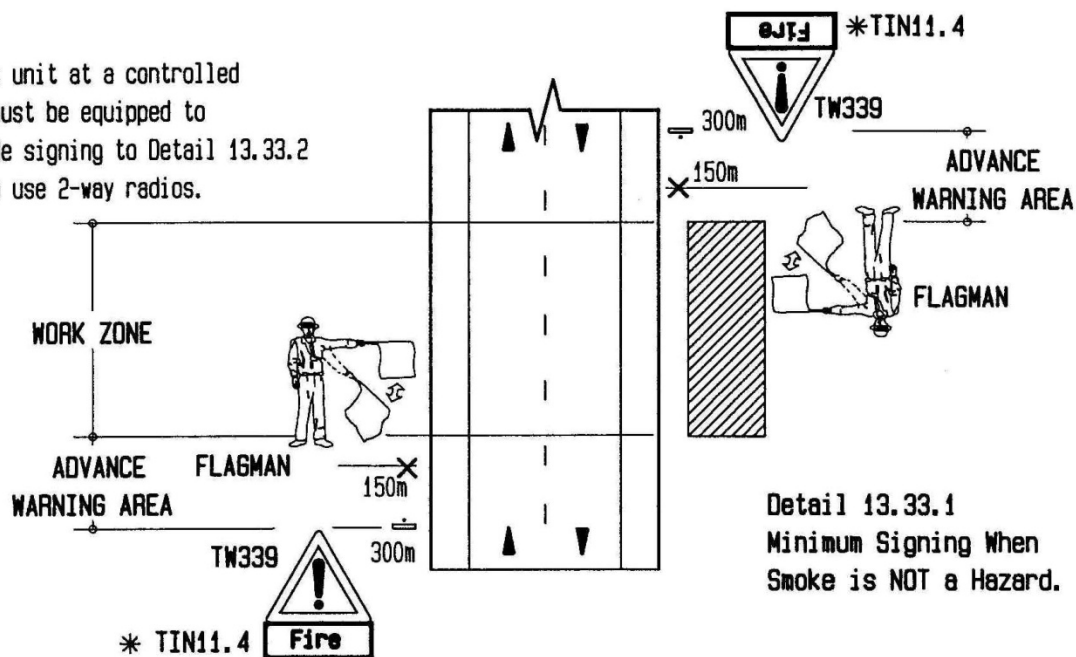
| MAINTENANCE UNIT INVENTORY  |                 |              |               |
|---|-----------------|--------------|---------------|
| Sign  | No              | Size (mm)    | Quantity      |
|    | TW339           | 1200         | 2             |
|    | TW343           | 1200         | 2             |
|    | R1.5A/<br>R1.5B | 750          | 2             |
|    | FLAGS           | 450 X<br>450 | 2             |
|    | TIN 11.3        | 1200         | 2             |
|  | TIN 11.4        | 1200         | 2<br>Optional |

#### Checklist

- ☐ do workers have effective high visibility clothing?
- ☐ are the flagmen correctly trained for their task?
- ☐ are radios in working order?
- ☐ can signs be clearly seen by approaching drivers?
- ☐ is the unit ready to upgrade to STOP/GO control?
- ☐ should consideration be given to a traffic detour?

**NOTE:**

1. A work unit at a controlled fire must be equipped to upgrade signing to Detail 13.33.2 and to use 2-way radios.



\* = Optional signs.

NB. See Subsection 13.8.4  
for Sign Sizes.

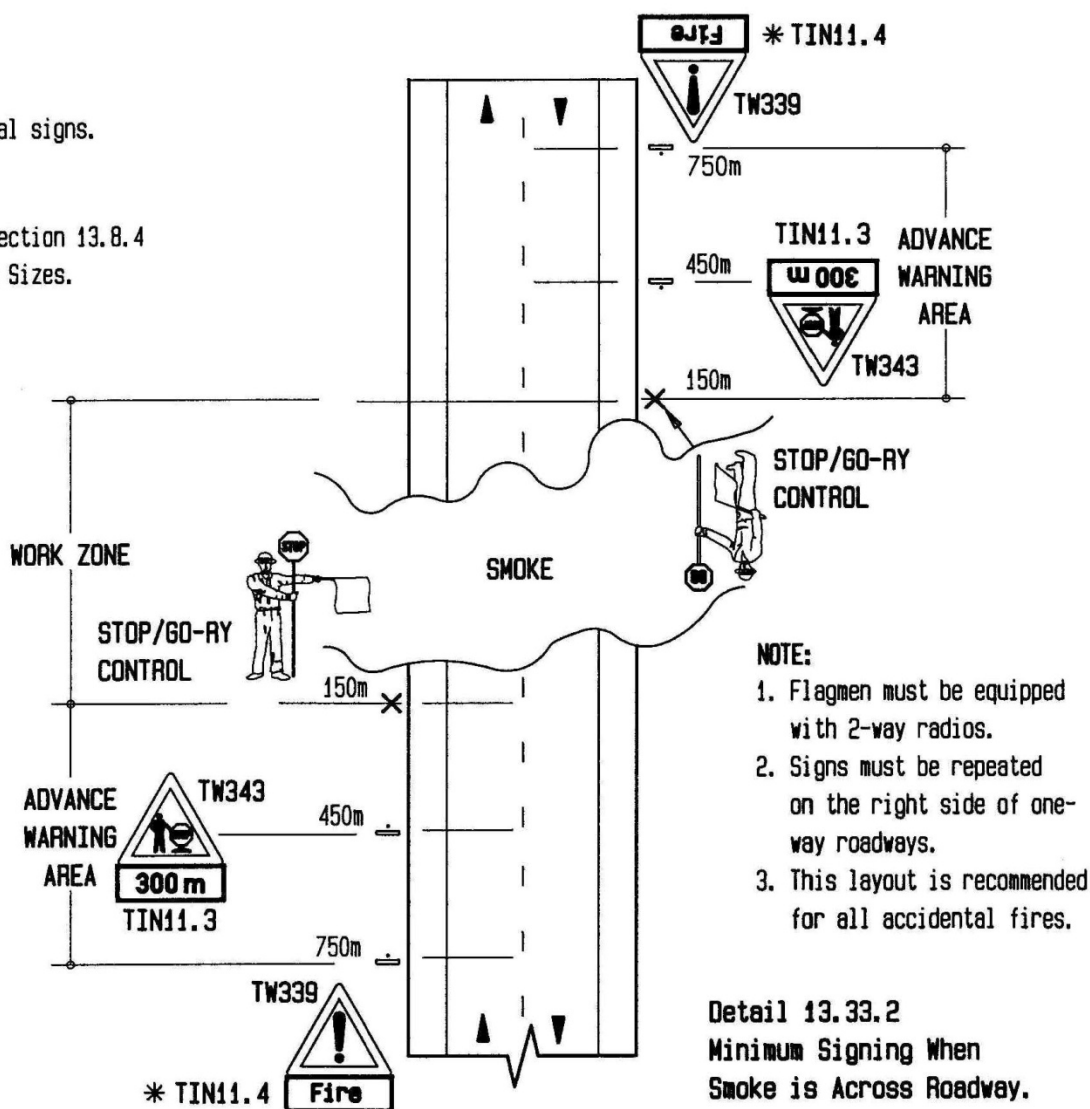


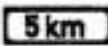




Fig 13.33

Firebreak Maintenance

### 13.8.5 Weedspray Maintenance

- 1 Weedspraying may be a mechanised operation or it may be a manual operation with a team of workers, working on the ground, either with or without a support vehicle present. The signing requirements for such maintenance are given in Figure 13.34.
- 2 Figure 13.34 includes two signing details. Detail 13.34.1 is appropriate for maintenance operations on one side of a two-way roadway, whereas Detail 13.34.2 applies for maintenance on a multi-lane one-way roadway (normally part of a dual carriageway road). The main differences between the two requirements is that a two-way road requires the placing of a ROADWORKS sign TW336 facing the opposing stream of traffic, and the one-way operation requires advance signs on both the left and right sides of the carriageway. This latter requirement is applicable whether the work is being undertaken on the left side or on the right side.
- 3 When weedspraying is supported by a vehicle, the work can be considered as "mobile". Subject to the proximity of the work to the roadway and the rate of movement of the work, the requirements of Subsection 13.8.12 and Figure 13.41 may be relevant.
- 4 The vehicle carrying out the spraying or supporting the manual team should occupy the far left side of the roadway or shoulder (or the far right side in the case of a median spraying operation). The vehicle shall be provided with a HIGH VISIBILITY REAR PANEL of the type illustrated in Figure 13.31.
- 5 The vehicle shall also have two FLASHING YELLOW WARNING LIGHTS, SS3, of which, at least one shall be visible from the front, and one shall be visible from the rear. In practical terms, if a vehicle is likely to work on the right side of a roadway, the two flashing lights should also define the vehicle width to approaching drivers so that, wherever it is working, the near side is identified by at least one flashing light. The contractor or road supervisor shall be responsible for ensuring that the flashing light requirement is functioning during day and night, at all times whilst the vehicle is working or within 2 metres of the roadway.

| MAINTENANCE UNIT INVENTORY  |                                    |                 |               |
|---|------------------------------------|-----------------|---------------|
| Sign  | No                                 | Size (mm)       | Quantity      |
|    | TW336                              | 1200            | 2             |
|    | TW330                              | 1200            | 2             |
|    | TIN 11.3                           | 1200            | 2             |
|    | Vehicle High Visibility Rear Panel | To suit Vehicle | 1             |
|   | TR103/TR104                        | 900             | 1             |
|   | plus TW336                         | 1200            | 1             |
|  | Yellow Flash Light                 |                 | 2 Per Vehicle |

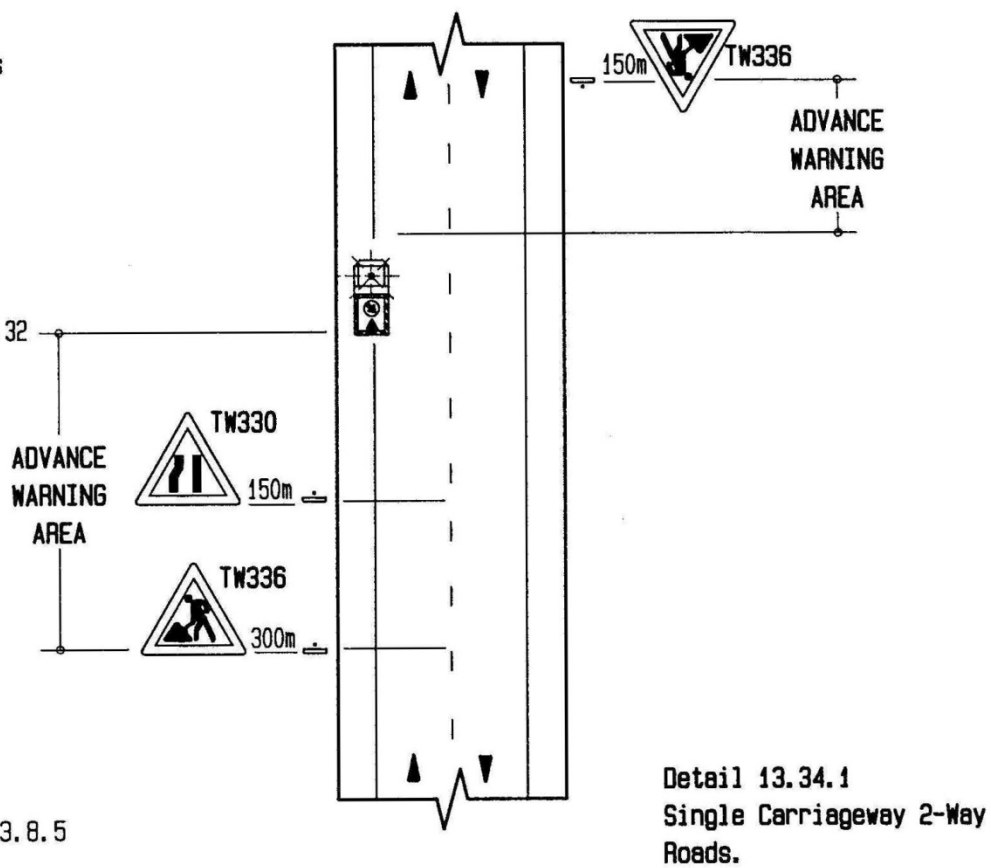
#### Checklist

- ☐ do workers have adequate high visibility clothing?
- ☐ is there a support vehicle?
- ☐ does the support vehicle have a high visibility rear panel?
- ☐ are the signs on the rear panel correctly set?
- ☐ will the advance warning signs need to be moved to follow the work (see Subsection 13.8.12)?
- ☐ will work encroach into the roadway significantly (see Subsections 13.8.11 and 13.9.8)?



## NOTES:

1. Yellow flashing lights must be visible to front and rear in all situations.
2. Maintenance vehicle equipped with HIGH VISIBILITY REAR PANEL (See Figures 13.32 and 13.41).



NB. See Subsection 13.8.5  
for Sign Sizes.

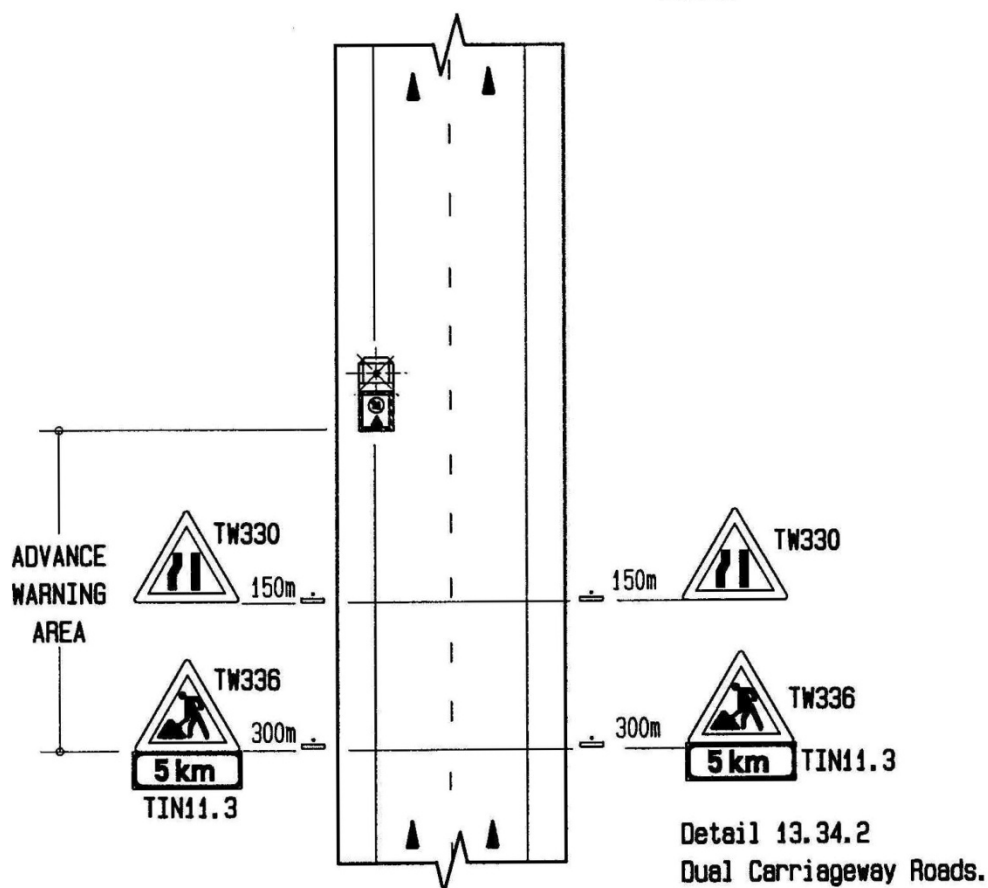







Fig 13.34

## Weedspray Maintenance

### 13.8.6 Fixed Site - Work on Shoulder

- 1 The temporary signing treatment illustrated in Figure 13.35 is intended for short term work located on the shoulder of a public road, either in the sense that the work is actually on the shoulder, or is immediately adjacent but outside the shoulder, but requires occupation of the shoulder by the work unit. In situations such as this, if the work unit's support vehicle is equipped with flashing yellow warning lights, it may benefit the safety of the workers for the vehicle to be parked on the shoulder, at the end of the Buffer Zone, between the workers and approaching traffic.
- 2 If the work is carried over into darkness, the TRAFFIC CONE delineation devices TD4 shall be provided with retroreflective sleeves or they shall be replaced by DELINEATOR PLATE hazard marker signs TW401/TW402. Cones used on high speed roads shall have a height of at least 700 mm. For details of delineator and cone spacings refers to table 13.4.
- 3 Tapers used for this type of work site treatment should be in accordance with Table 13.5.
- 4 Advance warning signs should be located up to 600 m in advance of the start of the taper for sites with operating speeds in excess of 80 km/h. In addition, because the signing levels are minimised, extreme care must be taken to note any features of each specific work site which may reduce the effectiveness of the signs. In particular, vertical curvature and overhanging vegetation should be assessed. If there are adverse conditions and operating speeds are in excess of 80 km/h, or even 60 km/h signs, should be displayed in accordance with Figure 13.26. The requirements of Table 13.1 should be adhered to with regard to the minimum mounting height of temporary signs.

| MAINTENANCE UNIT INVENTORY   |                      |            |  |
|--|----------------------|------------|--|
| Sign   | No                   | Size (mm)  | Quantity                                   |
|   | TW336                | 1200       | 2  |
|   | TW330                | 1200       | 1  |
|   | TR104                | 1200       | 1  |
|   | TD4                  | 450<br>750 | 15 Min. plus<br>10 per 100m<br>site length |
|  | TR201-80<br>TR201-60 | 1200       | 2<br>2                                     |

#### Checklist

- ☐ are operating speeds in excess of 80 km/h?
- ☐ does the unit have enough cones/delineators for correct spacings?
- ☐ does the unit have delineators or retroreflective sleeves for cones for night time use?
- ☐ is the site set up with adequately safe Buffer Zones (see Figure 13.20)?
- ☐ is there adverse vertical or horizontal curvature on the approach to the site?
- ☐ can signs be mounted higher to improve early warning of the site if required?

NB. See Subsection 13.8.6  
for Sign Sizes.

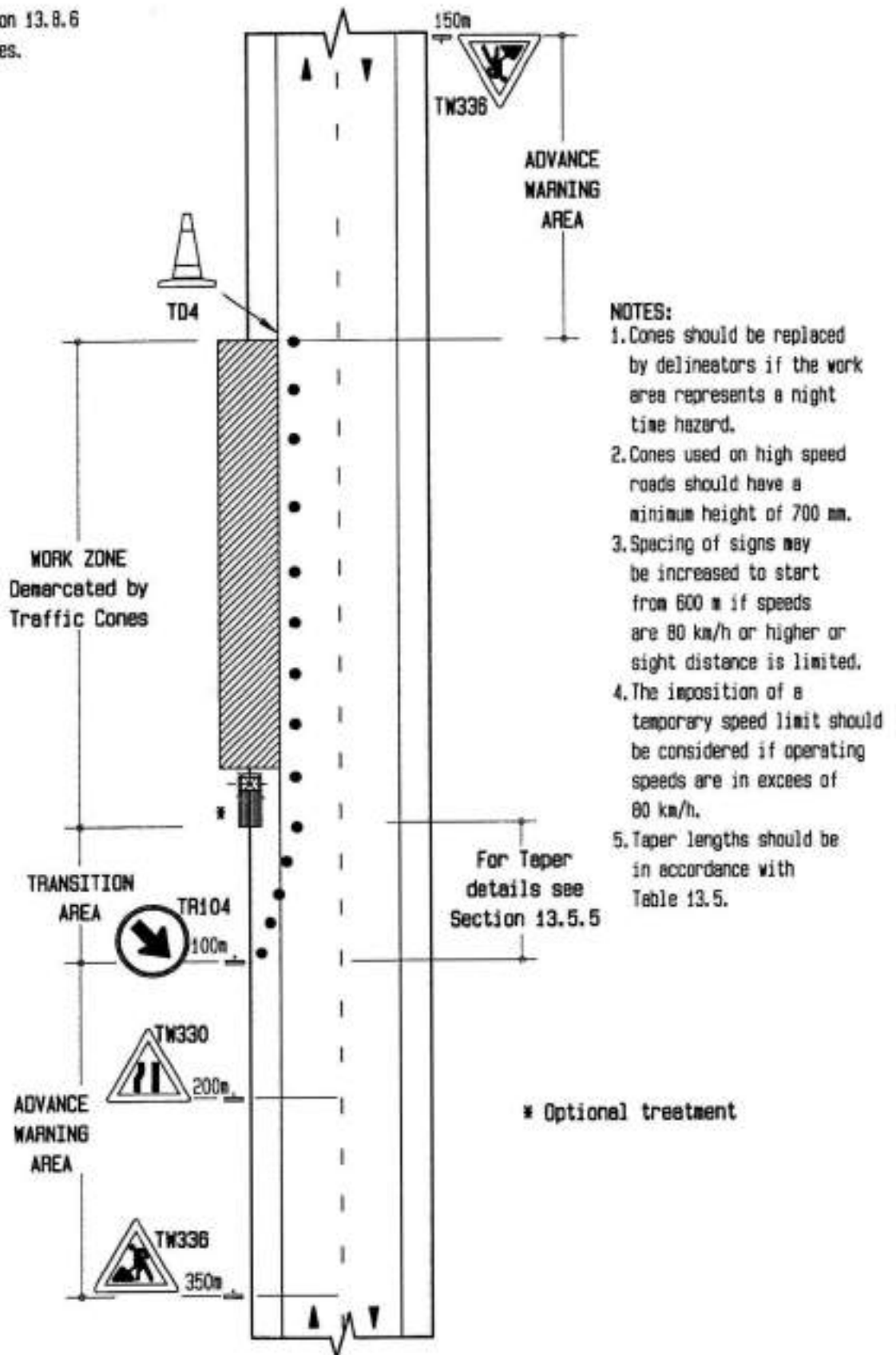








Fig 13.35

Fixed Site – Work on Shoulder

### 13.8.7 Localised Small Site

- 1 This application is similar to that illustrated in Figure 13.36 but is for an even shorter, more localised work area, which may encroach into the roadway but still permit two-way traffic flow. The criterion for two-way traffic operation under moderate traffic volumes is an available running width of 6 metres, provided speeds can be reduced so that such operation is safe. This width may include localised use of the opposite side shoulder.
- 2 The sign spacings given are for low traffic approach speeds appropriate to low speed urban environments. For higher speeds the sign spacings as illustrated in Figure 13.35 should be used, and the reduction of the operating speed in 20 km/h increments (see Figure 13.26), by means of temporary speed limit signs TR201, should be considered.
- 3 If traffic volumes are such that two-way operation will present unacceptable risk levels to workers and/or vehicles then STOP/GO or temporary traffic signal control should be considered (see Subsections 13.8.11, 13.9.3 and 13.10.3). Safety "Buffer Zone" spacing must be provided in accordance with Figure 13.20.
- 4 TRAFFIC CONE delineation devices TD4 and DELINEATOR PLATE hazard marker signs TW401/TW402 shall be spaced in accordance with Table 13.4 and all tapers shall conform to the provisions of Table 13.5. When cones are to be used during adverse light conditions, they shall be fitted with retroreflective sleeves. The mounting height of all signs shall be at least that given in Table 13.1 or higher. If the work unit's support vehicle is equipped with flashing yellow warning lights, it may benefit the safety of workers for the vehicle to be parked on the shoulder, at the work end of the approach Buffer Zone, between the workers and approaching traffic.

| MAINTENANCE UNIT INVENTORY  |                      |               |  |
|---|----------------------|---------------|--|
| Sign  | No                   | Size (mm)     | Quantity                                   |
|    | TW336                | 1200          | 2  |
|    | TW329<br>TW330       | 1200          | 1<br>1                                     |
|    | TR104                | 1200          | 2  |
|    | TW411                | 300 X<br>1800 | 1  |
|    | TD4                  | 450<br>750    | 20 Min. plus<br>10 per 100m<br>site length |
|  | TR201-80<br>TR201-60 | 1200          | 2<br>2                                     |

#### Checklist

- ☐ are operating speeds in excess of 80 km/h?
- ☐ does the unit have enough cones/delineators for correct spacings?
- ☐ does unit have delineators, or retroreflective sleeves for cones?
- ☐ is the site set up with adequately safe Buffer Zones (see Figure 13.20)?
- ☐ is there adverse vertical or horizontal curvature on the approach to the site?
- ☐ is there safe operating width for two-way traffic operation?
- ☐ should the use of STOP/GO control or temporary traffic signals be considered?

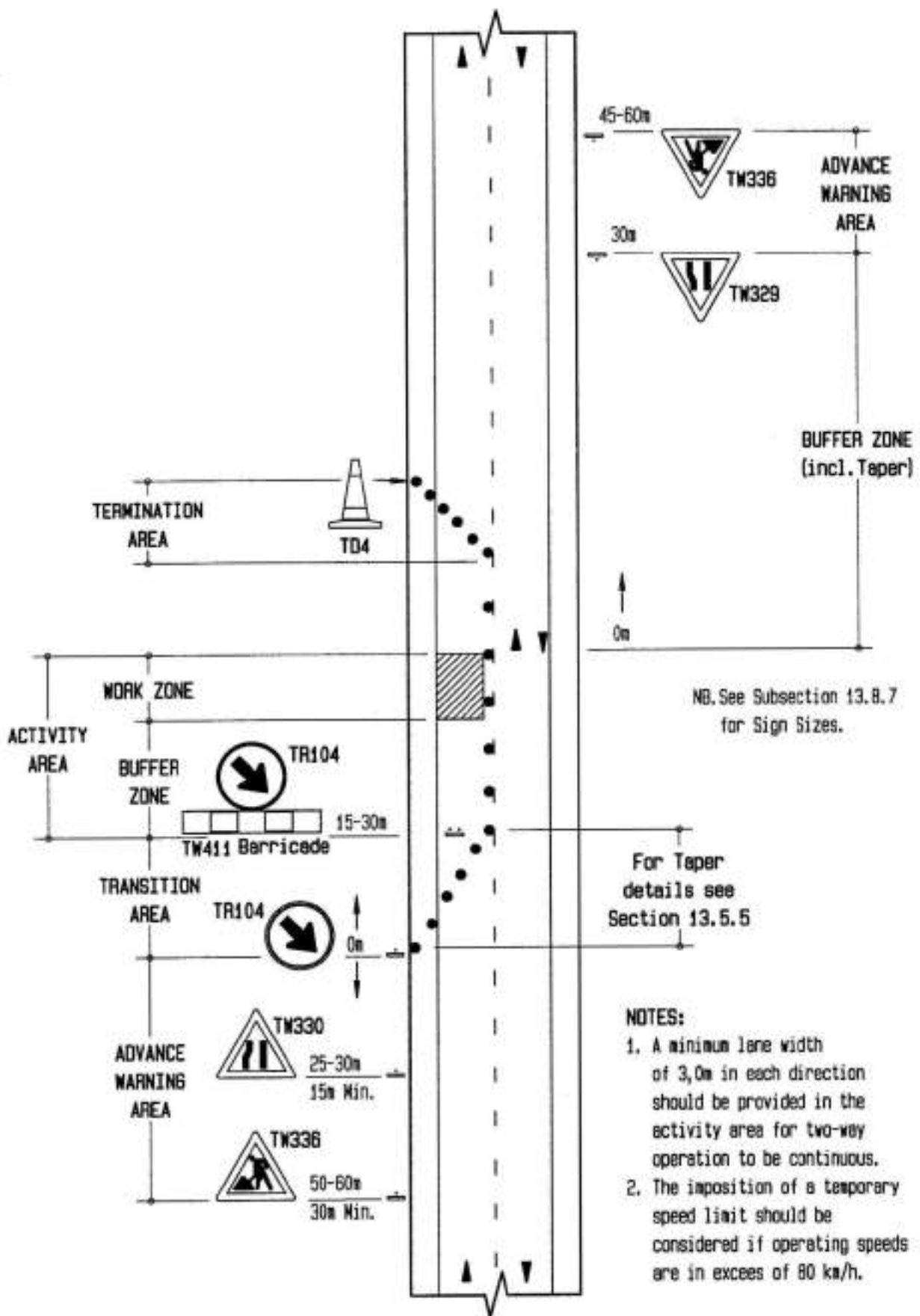












Fig 13.36

Localised Small Work Site

### 13.8.8 Short Term Lane Closure

- Figure 13.37 illustrates two **short term** conditions which can commonly occur on any rural or urban two-lane/two-way roadway. Refer to Subsection 13.8.2 for a description of "short term". Longer term applications are covered in Sections 13.9 and 13.10. (Multi-lane situations are generally covered in Section 13.11). Both applications of temporary signing require roughly the same signing but are quite different operationally. Any general maintenance unit should carry a sign inventory capable of sustaining either type of operation.
- Detail 13.37.1 shows a typical situation where the work needs to encroach into one lane but not fully occupy it. Two-way traffic operation through restricted width lanes is still possible. Due to the reduced lane width, it is desirable that vehicle speeds be reduced to a legal but cautious level i.e. reduced speed limit is not considered necessary. Under these circumstances the use of a flagman to slow traffic is recommended. TRAFFIC CONES TD4 may be used for short term work but if this situation occurs on a high speed road or freeway, the cones must be 700 mm or more in height.
- Detail 13.37.2 deals with a similar situation where a full lane is needed to undertake the work and two-way traffic is no longer possible. STOP/RV-GO operation signs R1.5A/R1.5B must be added to those required for Detail 13.37.1. This mode of operation should not be used into dusk or darkness. If it is necessary to work outside daylight hours, the site must either be adjusted to allow it to operate as shown in Detail 13.37.1, or temporary traffic signals should be used (see Figure 13.57).
- If operating speeds are in excess of 80 km/h additional speed limit signs TR201 should be displayed to reduce speed by a maximum of 20 km/h, or in 20 km/h increments to 80 km/h or 60 km/h as appropriate (see Section 13.4).
- Flagmen must be well trained and shall operate in accordance with Figure 13.23.
- If the site has to be maintained in operation into dusk or night-time, or for more than 24 hours, all traffic cones should be replaced by delineators. If work is of an emergency or response nature (rather than planned), the site supervisor must assess the likely duration of the work within the first two to three hours and, if necessary, call for additional signing if these are not being carried.
- In all cases suitable longitudinal and lateral Buffer Zones must be created to ensure worker and public safety (see Figures 13.20 and 13.29). If approaches are subject to high vehicle speeds or visibility limitations, sign spacings may be increased out to 600 m.

| MAINTENANCE UNIT INVENTORY   |                      |              |  |
|--|----------------------|--------------|--|
| Sign   | No                   | Size (mm)    | Quantity                                   |
|   | TW336                | 1200         | 2  |
|   | TW329<br>TW330       | 1200         | 1<br>1                                     |
|   | TW343                | 1200         | 2  |
|   | TR103<br>TR104       | 1200         | 2  |
|   | R1.5A/<br>R1.5B      | 750          | 2  |
|   | TD4                  | 450          | 50 Min. plus<br>20 per 100m<br>site length |
|   | FLAGS                | 450 X<br>450 | 6  |
| <br> | TIN 11.3<br>TIN 11.3 | 1200         | 2<br>2                                     |
|   | TR201-80<br>TR201-60 | 1200         | 2<br>2                                     |

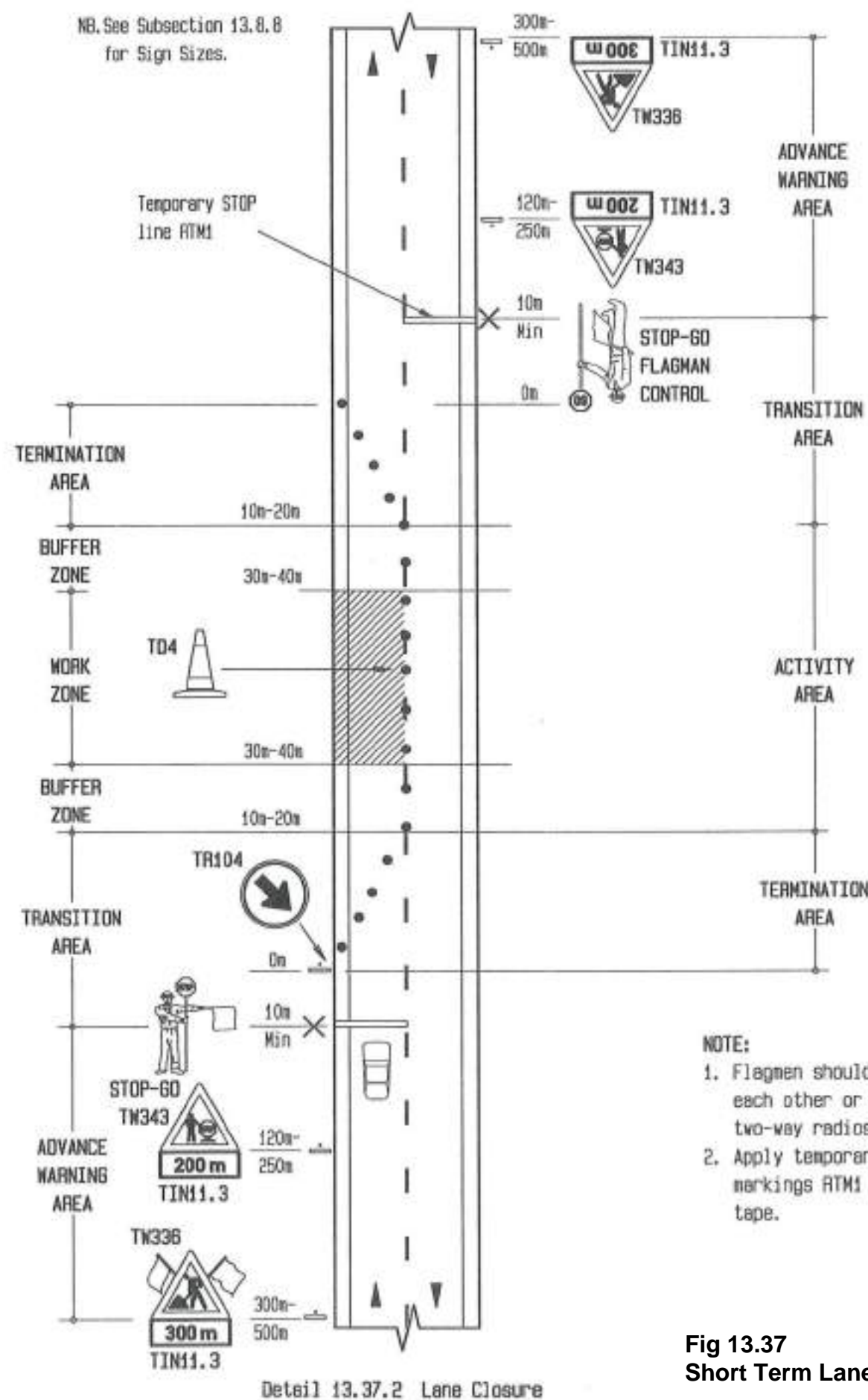
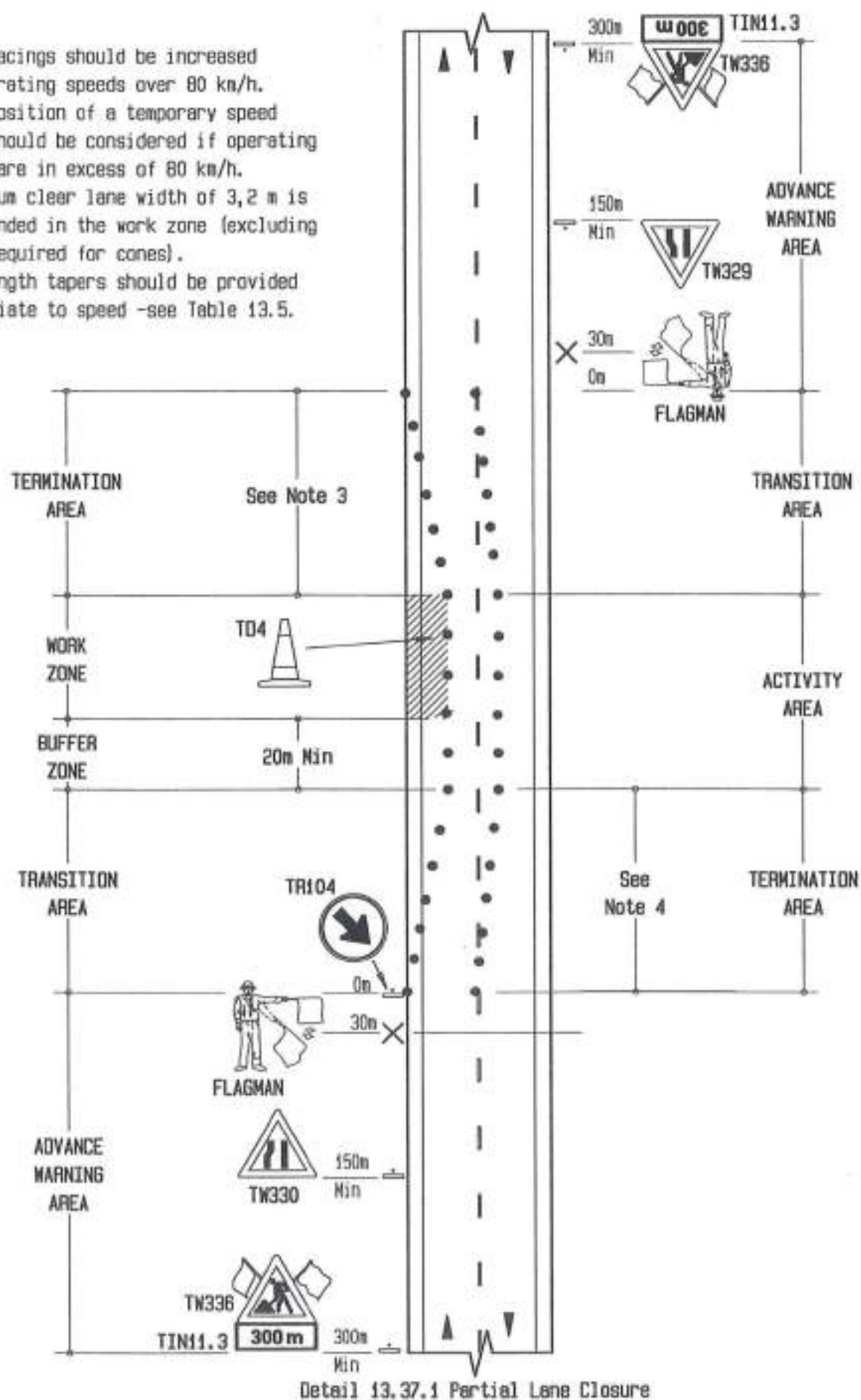
#### Checklist

- ☐ are operating speeds in excess of 80 km/h?
- ☐ are enough cones available for the length of site?
- ☐ is the site set up with adequately safe Buffer Zones (see Figure 13.20)?
- ☐ will the work extend beyond the balance of the working day?
- ☐ is visibility to the work area or the first sign in any way limited?
- ☐ does the control of the site need to be upgraded to a higher order?



## NOTES:

1. Sign spacings should be increased for operating speeds over 80 km/h.
2. The imposition of a temporary speed limit should be considered if operating speeds are in excess of 80 km/h.
3. A minimum clear lane width of 3,2 m is recommended in the work zone (excluding space required for cones).
4. Full length tapers should be provided appropriate to speed -see Table 13.5.



## NOTE:

1. Flagmen should be able to see each other or be issued with two-way radios.
2. Apply temporary STOP line markings RTM1 using removable tape.


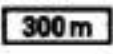



Fig 13.37  
Short Term Lane Closure

13.8.9 Short Term Lane Drop within Deviations

- 1
- Figure 13.38 shows two details for short term work within a multi-lane deviation which involves the temporary closure of one of the lanes. The treatments shown are only appropriate on deviations on one of the carriageways of a dual carriageway roadway (commonly a freeway) where traffic is operating within a three lane cross-section. Since these applications represent "roadworks-within-roadworks" situations, their use should be reserved for very short term needs and should only be considered during off-peak traffic times.
- 2
- Detail 13.38.1 depicts a work zone within the single lane in one direction. To accommodate traffic one of the two lanes operating in the opposite direction has to be dropped. The signs shown represent minimum requirements for maximum portability. LANE DROP sign TW214 may be replaced by diagrammatic sign TGS102 if time, space and convenience permit. The advance signs may be located further from the site if deemed necessary due to visibility requirements or traffic speeds.
- 3
- Detail 13.38.2 shows a similar arrangement when it is one of the two lanes in one direction which needs to be closed. In this case also sign TW215 may be replaced by diagrammatic sign TGS101.
- 4
- If operating speeds are in excess of 80 km/h additional speed limit signs TR201 should be displayed to reduce speed by a maximum of 20 km/h, or in 20 km/h increments to 80 km/h or 60 km/h as appropriate (see Section 13.4).
- 5
- Flagmen must be well trained and shall operate in accordance with Figure 13.23.
- 6
- TRAFFIC CONE delineation devices TD4 and DELINEATOR PLATE hazard marker signs TW401/TW402 shall be spaced in accordance with Table 13.4 and all tapers shall conform to the provisions of Table 13.5. When cones are to be used during adverse light conditions, they shall be fitted with retroreflective sleeves. The mounting height of all signs shall be at least that given in Table 13.1 or higher. If the work unit's support vehicle is equipped with flashing yellow warning lights, it may benefit the safety of workers for the vehicle to be parked on the shoulder, at the work end of the approach Buffer Zone, between the workers and approaching traffic.

Checklist

- ☐ are operating speeds in excess of 80 km/h?
- ☐ can traffic speeds be reduced effectively to allow these applications to work safely?
- ☐ is the site set up with adequately safe Buffer Zones (see Figure 13.20)?
- ☐ can signs be displayed at a greater than minimum mounting height?
- ☐ are flagmen alert and well-motivated?
- ☐ would flags on the first sign in each direction assist driver awareness?

| MAINTENANCE UNIT INVENTORY  |                      |              |  |
|---|----------------------|--------------|--|
| Sign  | No                   | Size (mm)    | Quantity                                   |
|    | TW336                | 1500         | 2  |
|    | TW330                | 1500         | 1  |
|    | TR103<br>TR104       | 1200         | 1<br>1                                     |
|    | TIN 11.3             | 1500         | 2  |
|    | FLAGS                | 450 X<br>450 | 6  |
|   | TD4                  | 750          | 60 Min. plus<br>20 per 100m<br>site length |
|  | TW214<br>TW215       | 1500<br>1500 | 1<br>1                                     |
|  | TR201-80<br>TR201-60 | 1200         | 2<br>2                                     |

## NOTES:

1. Extreme care must be taken when the work area is in the environs of an interchange. The use of flags with advance warning signs TW336 is recommended for short term installations of this nature.
2. Full length tapers should be provided appropriate to speed – See Fig.13.29 and Table 13.5.
3. For cone spacing refer to Table 13.4 and table on page 13.8.14.
4. The imposition of a temporary speed limit should be considered if operating speeds are in excess of 80 km/h.

NB. See Subsection 13.8.9 for Sign Sizes.

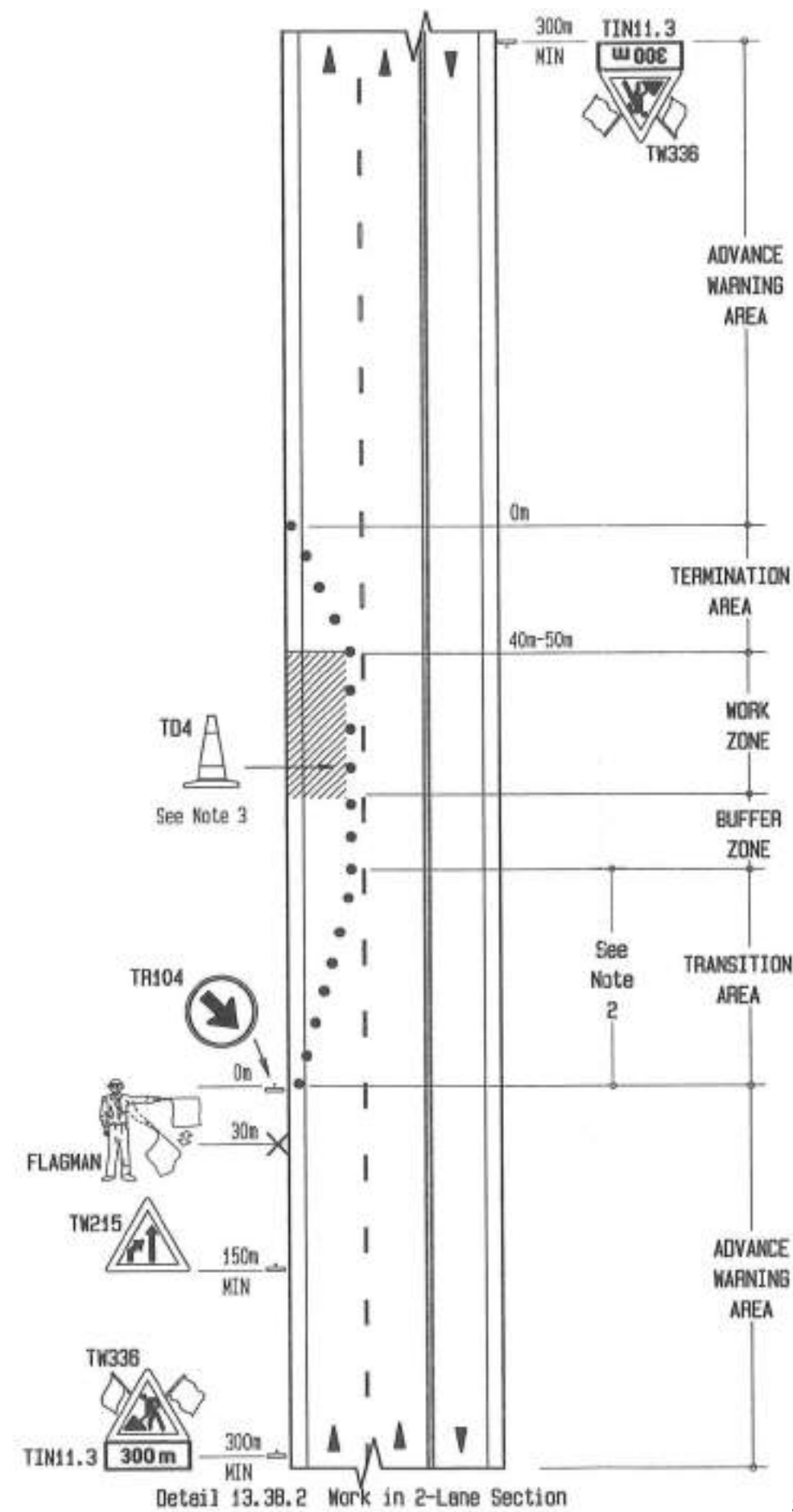
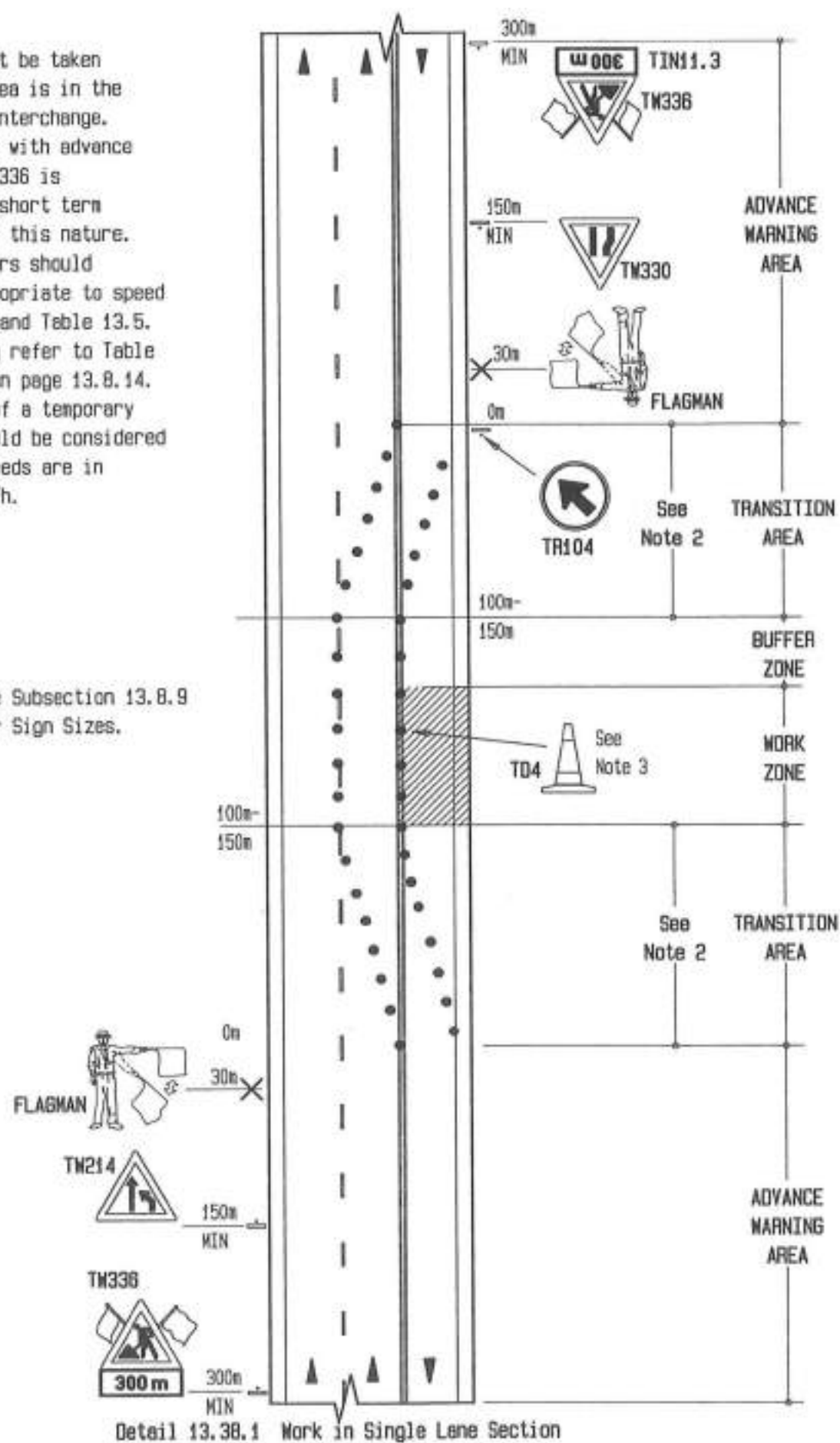






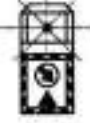

Fig 13.38  
Short Term Lane Drop  
Within Deviation

13.8.10 Installation/Removal of Traffic Data Logger

- 1
- Figure 13.39 illustrates recommended signing for the installation, servicing or removal of traffic data logging loops on the road surface of a multi-lane, one-way roadway. The signs shown are lightweight portable/collapsible signs made from a durable flexible and foldable material for ease of quick placing and removal. Conventional signs may alternatively be used. Since the "work" being undertaken has very little visual impact in itself, it is very important that special attention be paid to high visibility treatment of the area. The use of a HIGH VISIBILITY REAR TREATMENT on the work unit support vehicle, and/or the use of a HIGH VISIBILITY TRAILER, and the highest visibility clothing for workers is recommended (see Figures 13.30 and 13.31).
- 2
- If it is required to install, service or remove data logging loops on a two-way roadway, STOP/GO control should be used (see Figure 13.40).
- 3
- If flagmen are used, they must be well trained and shall operate in accordance with Figure 13.23.
- 4
- TRAFFIC CONE delineation devices TD4 and DELINEATOR PLATE hazard marker signs TW401/TW402 shall be spaced in accordance with Table 13.4 and all tapers shall conform to the provisions of Table 13.5. When cones are to be used during adverse light conditions, they shall be fitted with retroreflective sleeves. The mounting height of all signs shall be at least that given in Table 13.1 or higher. If the work unit's support vehicle is equipped with flashing yellow warning lights, it may benefit the safety of workers for the vehicle to be parked on the shoulder, at the work end of the approach Buffer Zone, between the workers and approaching traffic.
- 5
- Since an operation of this type is only likely to be undertaken during daylight the use of appropriate high luminance fluorescent colours on the road signs should be considered.

Checklist

- ☐ is the roadway one-way or two-way?
- ☐ is a STOP/GO sign inventory carried by the unit?
- ☐ does the unit have trained flagmen?
- ☐ is a high visibility vehicle or trailer available?

| MAINTENANCE UNIT INVENTORY  |  |                    |                                    |
|---|--|--------------------|------------------------------------|
| Sign  | No                                       | Size (mm)          | Quantity                           |
|    | TW336                                    | 1200               | 2                                  |
|    | TW214<br>TW215                           | 1200               | 2                                  |
|    | TR104                                    | 1200               | 1                                  |
|    | TD4                                      | 750                | 30 Min<br>plus<br>5-10 per<br>100m |
|   | Vehicle High<br>Visibility<br>Rear Panel | To suit<br>Vehicle | 1                                  |
|   | TR103/TR104                              | 900                | 1                                  |
|   | plus<br>TW336                            | 1200               | 1                                  |
|  | Yellow<br>Flash<br>Light                 |                    | 2<br>Per<br>Vehicle                |

C

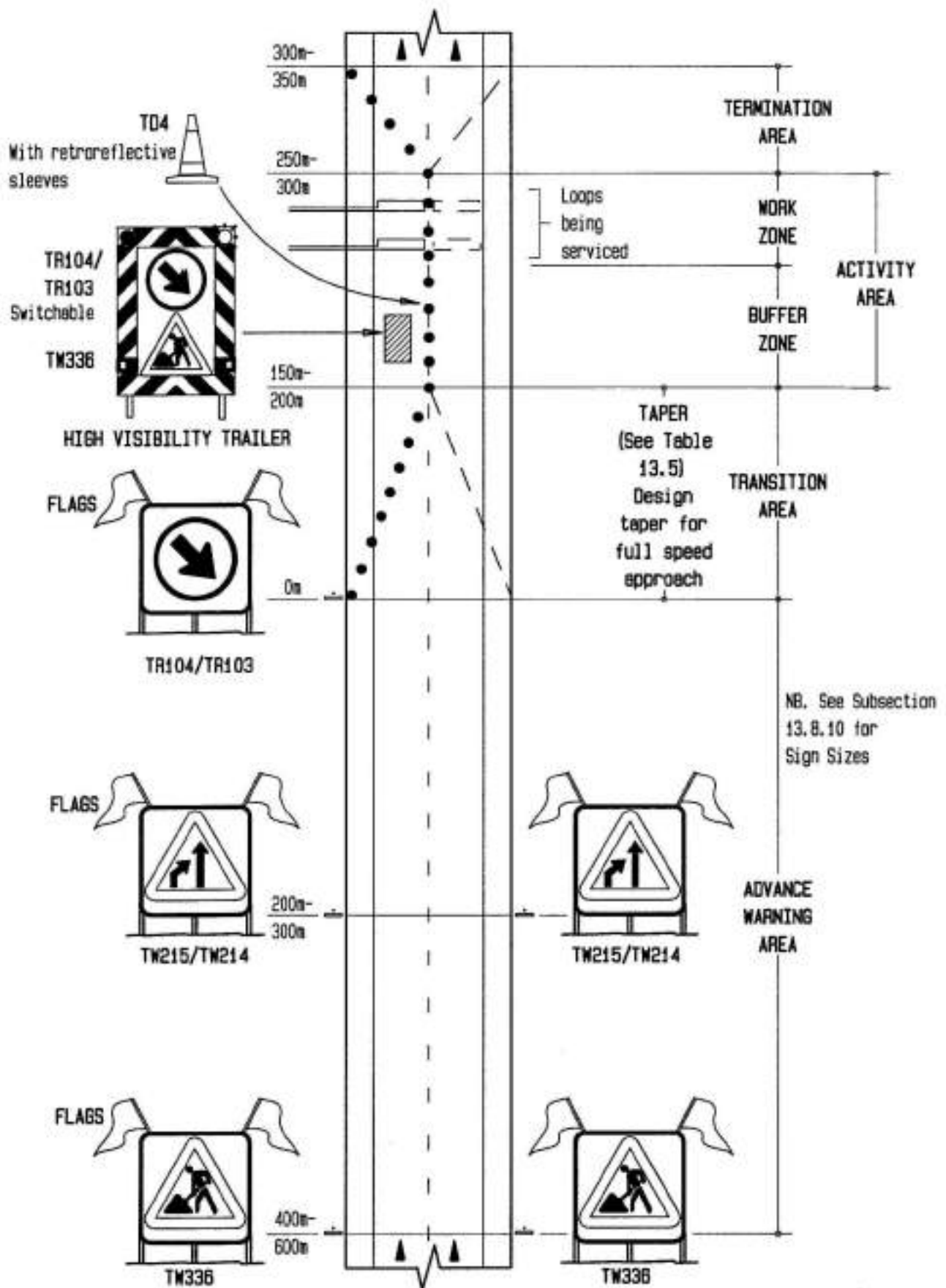


Fig 13.39





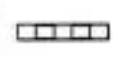




Installation/Removal of Traffic Data Logger

### 13.8.11 STOP/RV-GO Traffic Control-Minor Works

- 1 STOP/RV-GO operation may be required to control traffic at a variety of short term roadworks sites where the remaining roadway is reduced to less than two lanes in width, for whatever reason. As such, STOP/RV-GO traffic control is effectively a temporary signing sub-system. It may be used on its own or it may be used locally, in more than one place, for short periods within a long roadworks site. The detail in Figure 13.40 may therefore be incorporated with other short term applications and is particularly appropriate for urban areas.
- 2 The signing given in this detail is a minimised treatment for a very short term application lasting only one or two hours. For longer applications the signing should be upgraded to that covered by Subsection 13.9.3 and Figure 13.44. It should be considered as a daytime operation unless the site is very well illuminated at night. NO OVERTAKING signs TR214 should be carried by the maintenance unit and added to the illustrated sign sequence if required.
- 3 If operating speeds are in excess of 80 km/h additional speed limit signs TR201 should be displayed to reduce speed by a maximum of 20 km/h, or in 20 km/h increments to 80 km/h or 60 km/h as appropriate (see Section 13.4).
- 4 Flagmen must be well trained and shall operate in accordance with Figure 13.23. Whilst short term sites are likely to be short in length, if inter-visibility between flagmen cannot be guaranteed the flagmen should be equipped with two-way radios.
- 5 TRAFFIC CONE delineation devices TD4 and DELINEATOR PLATE hazard marker signs TW401/TW402 shall be spaced in accordance with Table 13.4 and all tapers shall conform to the provisions of Table 13.5. When cones are to be used during adverse light conditions, they shall be fitted with retroreflective sleeves. The mounting height of all signs shall be at least that given in Table 13.1 or higher. If the work unit's support vehicle is equipped with flashing yellow warning lights, it may benefit the safety of workers for the vehicle to be parked on the shoulder, at the work end of the approach Buffer Zone, between the workers and approaching traffic.

#### Checklist

- ☐ are operating speeds in excess of 80 km/h?
- ☐ do advance signs for the STOP/RV-GO control clash with other roadworks signs within the site?
- ☐ are the flagmen alert and well trained for their task?
- ☐ are the flagmen fully visible to oncoming traffic?
- ☐ are the flagmen standing in a safe position?
- ☐ can the restriction be eliminated to permit two-way traffic by dusk?

| MAINTENANCE UNIT INVENTORY  |                             |               |  |
|---|-----------------------------|---------------|--|
| Sign  | No                          | Size (mm)     | Quantity                                   |
|    | TW336                       | 1200          | 2  |
|    | TW343                       | 1200          | 2  |
|    | R1.5A/<br>R1.5B             | 750           | 2  |
|    | TR103<br>TR104              | 1200          | 1<br>2                                     |
|    | TW411                       | 300 X<br>1800 | 2  |
|  | FLAGS                       | 450 X<br>450  | 2  |
|  | TD4                         | 450<br>Min    | 20 Min. plus<br>10 per 100m<br>site length |
|  | TR214                       | 1200          | 2  |
|  | TR201-80<br>AND<br>TR201-60 | 1200          | 2<br>2                                     |



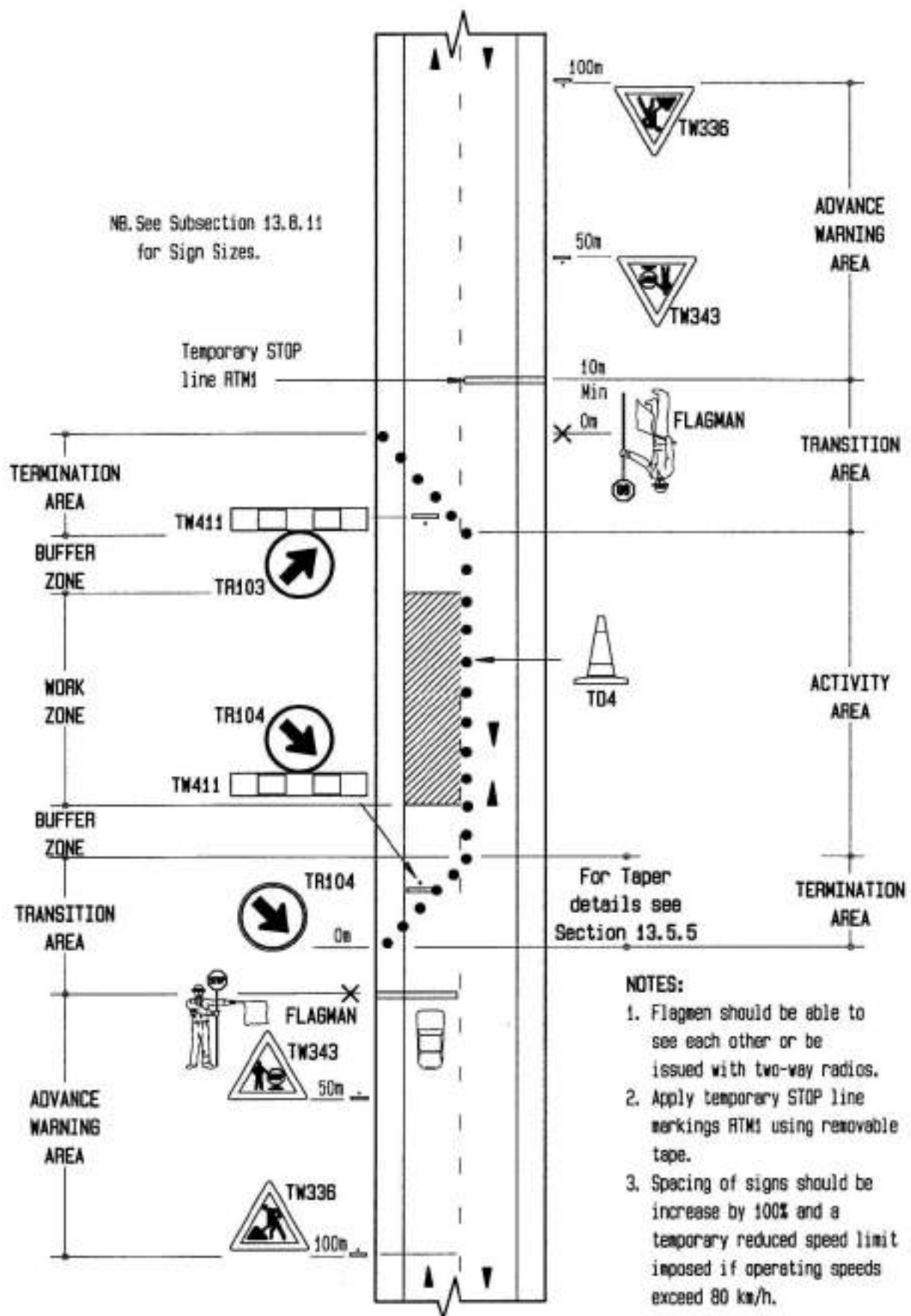





Fig 13.40

STOP/RV-GO Traffic Control – Minor Works

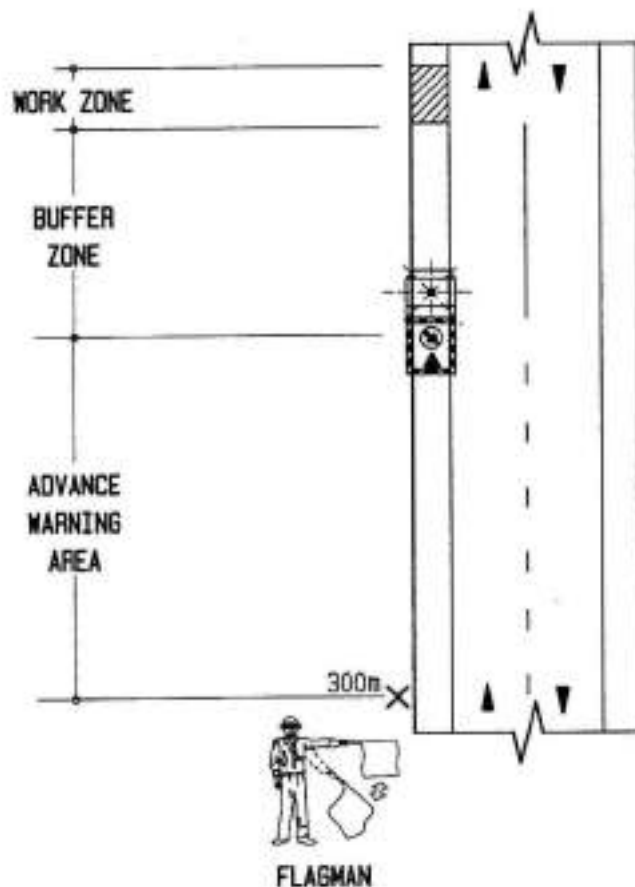
### 13.8.12 Mobile Maintenance of Road Shoulder

- Figure 13.41 includes two details of typical short term or mobile work involving slow-moving vehicles occupying the shoulder of the public road. Detail 13.41.1 shows mobile work occurring ahead of a support vehicle which should maintain a close following distance behind the workers (of the order of 20 m to 50 m). In Detail 13.41.2 a single vehicle is performing a mechanised maintenance function.
- In each case the vehicles should be supported by an alert, well trained flagman, who shall operate in accordance with Figure 13.23.
- Detail 13.41.1 shows a support vehicle equipped with a HIGH VISIBILITY REAR PANEL and two FLASHING YELLOW WARNING LIGHTS, SS3, whereas the tractor used for grass-cutting operations in Detail 13.41.2 only carries the two FLASHING YELLOW WARNING LIGHTS. For the safety of workers and road users, it is essential that these visibility requirements are adhered to and are functional at all times. The contractor or road supervisor, as appropriate, shall be responsible for ensuring the functionality of all flashing lights.
- It is recommended that the tractor, which may operate on the left or the right side of a one-way roadway, always works in the direction of traffic flow so that its flashing lights, which are likely to be on the rear, are as effective as possible. Every effort should be made to enhance the visibility of tractors used for road maintenance purposes. The tractors should be kept clean and freshly painted in a bright colour which will contrast with the grass background within which it is working.

| MAINTENANCE UNIT INVENTORY  |                                    |                 |               |
|---|------------------------------------|-----------------|---------------|
| Sign  | No                                 | Size (mm)       | Quantity      |
|  | FLAGS                              | 450 X 450       | 1             |
|  | Vehicle High Visibility Rear Panel | To suit Vehicle | 1             |
|   | TR103/TR104                        | 900             | 1             |
|   | plus<br>TM336                      | 1200            | 1             |
|  | Yellow Flash Light                 |                 | 2 Per Vehicle |

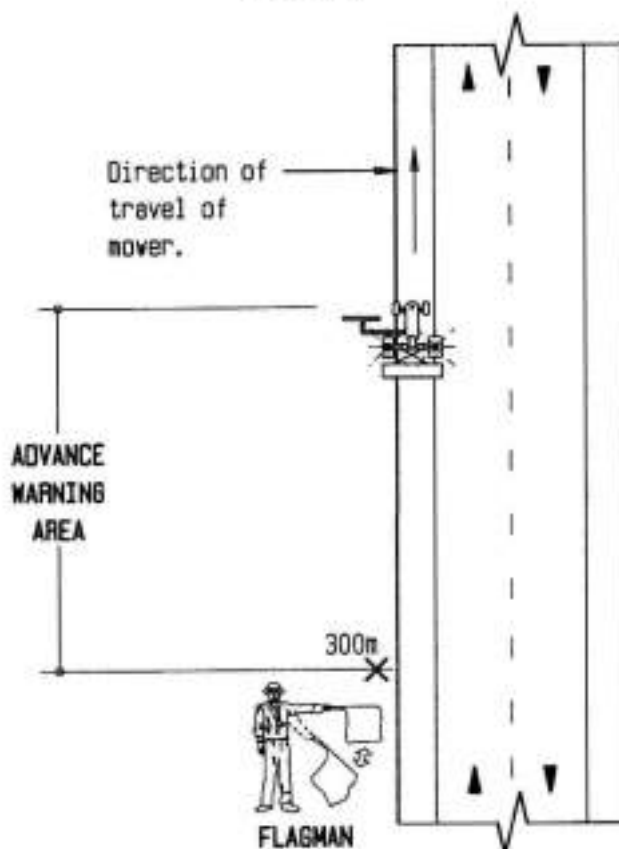
#### Checklist

- ☐ are workers equipped with high visibility clothing?
- ☐ are flagmen alert and well trained?
- ☐ are all flags clean and bright?
- ☐ are the signs on the HIGH VISIBILITY REAR PANEL correctly set?
- ☐ are all flashing lights working?
- ☐ is the tractor clean and brightly painted?

**NOTE:**

1. Maintenance support vehicle shall be equipped with a HIGH VISIBILITY REAR PANEL including two flashing yellow lights (See Fig.13.31).
2. See Subsection 13.8.12 for Sign Sizes.

Detail 13.41.1  
Mobile Work on the Shoulder.

**NOTES:**

1. Mower to travel ONLY in the direction of travel of the adjacent lane.
2. Mower shall be equipped with two operational flashing yellow lights -one on the left and one on the right.





Detail 13.41.2  
Tractor Mowing from Shoulder.

Fig 13.41

Mobile Maintenance on Road Shoulder

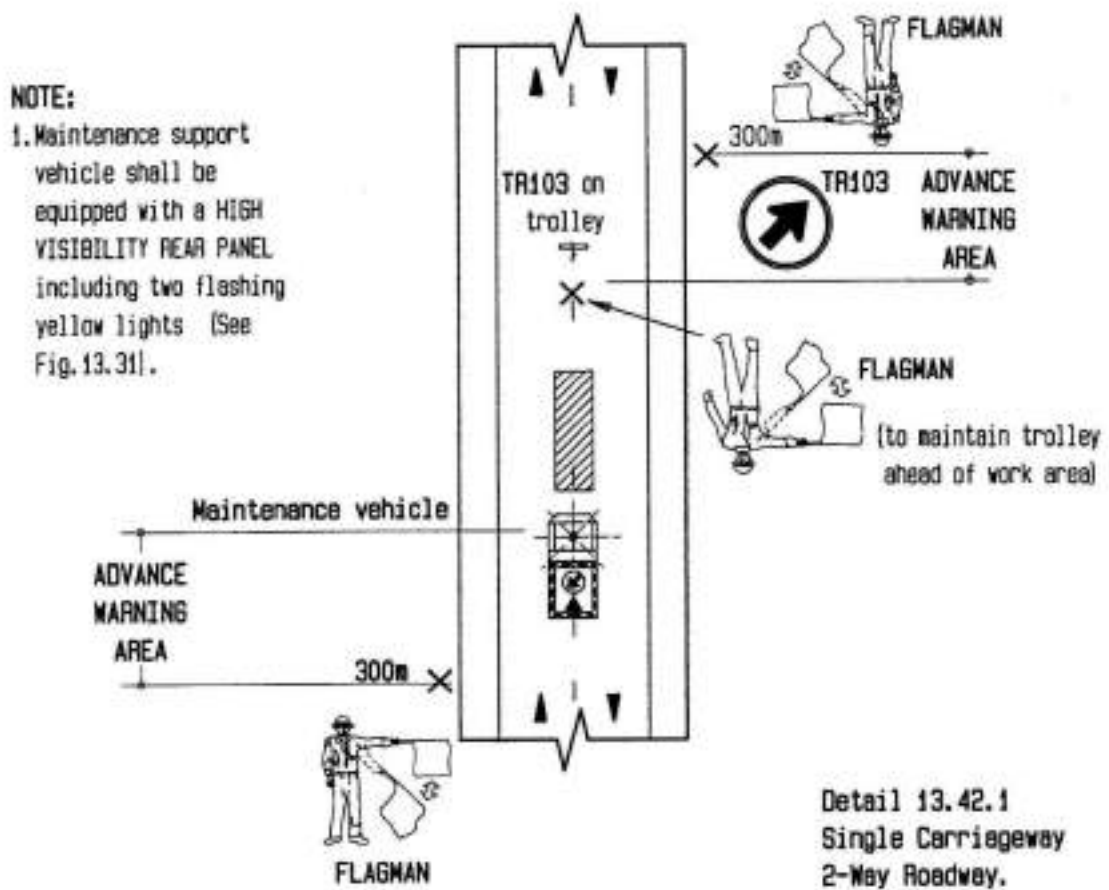
### 13.8.13 Mobile Maintenance in Centre of Carriageway

- 1 Mobile maintenance in the centre of the roadway or carriageway is always likely to be a hazardous operation, particularly on high speed rural roads. Detail 13.42.1 shows such an operation on a two-lane two-way roadway and Detail 13.42.2 a similar operation on a two-lane one-way carriageway.
- 2 The operation on a two-way roadway is particularly hazardous and requires the services of three flagmen as illustrated. The vehicle carrying out the work, or in direct support of it, shall be provided with a HIGH VISIBILITY REAR PANEL and at least two FLASHING YELLOW WARNING LIGHTS, SS3. The two flashing lights shall be positioned so that they define the front and rear of the vehicle, and , if practical for this type of work, the width of the vehicle as well, since it will be passed by traffic on both sides.
- 3 In Detail 13.42.2 two high visibility treated vehicles are specified and traffic is controlled to pass only to one side of the two vehicles. The rear most vehicle effectively closes one lane (it could be the left lane or the right lane subject to the nature of the work and local traffic conditions). The second vehicle travels some 150 m in front, either undertaking the work, or in support of it if the work is being done manually.
- 4 In each case the vehicles should be supported by alert, well trained flagmen, who shall operate in accordance with Figure 13.23.
- 5 When traffic speeds are high, it is recommended that at least one advance sign be placed to warn drivers of the activity ahead. A "public relations" type of message and/or flashing lights should be considered for such signs (see Figure 13.18).

| MAINTENANCE UNIT INVENTORY  |                                    |                 |               |
|---|------------------------------------|-----------------|---------------|
| Sign  | No                                 | Size (mm)       | Quantity      |
|  | FLAGS                              | 450 X 450       | 3             |
|  | TR103                              | 1200            | 1             |
|  | Vehicle High Visibility Rear Panel | To suit Vehicle | 2             |
|   | TR103/TR104                        | 900             | 2             |
|   | plus TW336                         | 1200            | 2             |
|  | Yellow Flash Light                 |                 | 2 Per Vehicle |

#### Checklist

- ☐ are workers equipped with high visibility clothing?
- ☐ are flagmen alert and well trained?
- ☐ are all flags clean and bright?
- ☐ are the signs on the HIGH VISIBILITY REAR PANEL correctly set?
- ☐ are all flashing lights working?



NB. See Subsection 13.8.13  
for Sign Sizes.

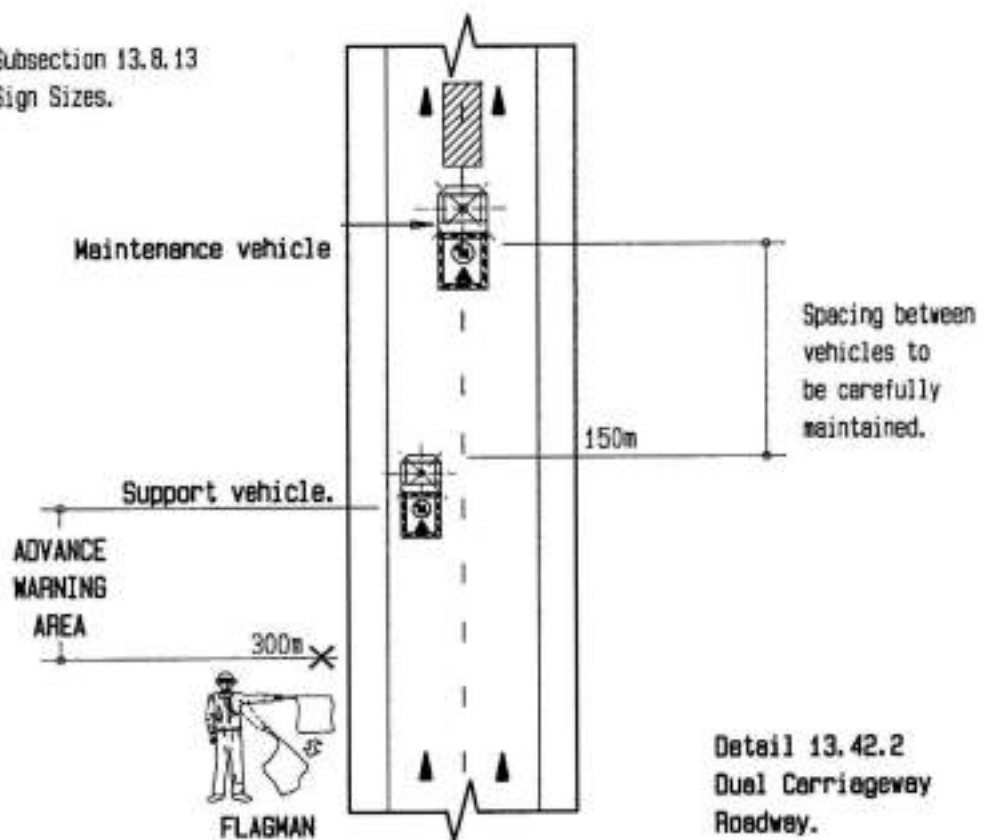


Fig 13.42






Mobile Maintenance in Centre of Roadway)

### 13.8.14 Mobile Maintenance of Dual Carriageway Roads

- Figure 13.43 shows similar treatments to those in Details 13.41.1 and 13.42.2, but refers to shoulder area work, or work within the left lane up to, but excluding the lane line. For shoulder work, the support vehicle at the rear shall be equipped with a HIGH VISIBILITY REAR PANEL and two FLASHING YELLOW WARNING LIGHTS SS3, whereas the lead vehicle need only be provided with two flashing lights, unless it may also be used for the role depicted in Detail 14.42.2.
- The advance signing used in support of the vehicles is kept to a minimum because these should be moved forward periodically as work progresses. To maximise their effectiveness, it is recommended that they be displayed with one or more flags.
- The detail given is applicable to one-way roadways, normally forming part of a dual carriageway. It is not applicable to two-way traffic operation (see Figure 13.42).

#### Checklist

- ☐ are flags clean and visible?
- ☐ are the signs on the HIGH VISIBILITY REAR PANELS correctly set?
- ☐ are all flashing lights working?

| MAINTENANCE UNIT INVENTORY  |  |                    |                     |
|---|--|--------------------|---------------------|
| Sign  | No                                       | Size (mm)          | Quantity            |
|    | TW336                                    | 1200               | 2                   |
|    | FLAGS                                    | 450 X<br>450       | 4                   |
|    | TIN 11.2                                 | 1200               | 1                   |
|    | Vehicle High<br>Visibility<br>Rear Panel | To suit<br>Vehicle | 1                   |
|   | TR103/TR104                              | 900                | 1                   |
|   | plus<br>TW336                            | 1200               | 1                   |
|  | Yellow<br>Flash<br>Light                 |                    | 2<br>Per<br>Vehicle |



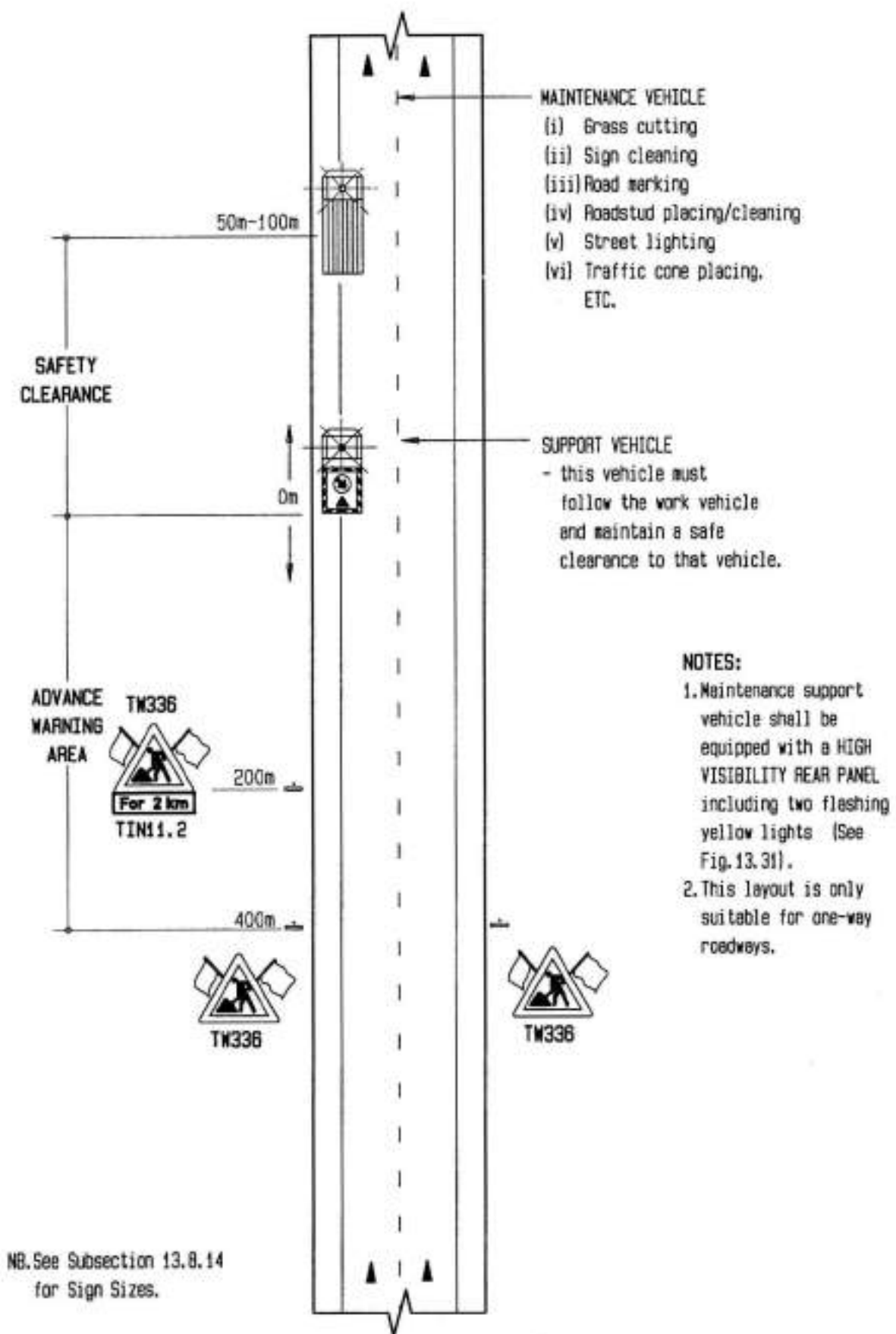


Fig 13.43

Mobile Maintenance of Dual Carriageway Roads



## 13.9 SIGNING APPLICATIONS FOR RURAL ROADS

### 13.9.1 General

1 The applications of temporary signing for roadworks covered in Sections 13.8 to 13.12 have been subdivided into categories for ease of reference. These categories are:


- (a) short term works (Section 13.8);
- (b) rural roads (Section 13.9);
- (c) urban roads (Section 13.10);
- (d) freeways and dual carriageway roads (Section 13.11).

Section 13.12 provides enlarged details of elements covered in other sections, and may be appropriate to any or all of the categories listed above.

2 The categorisation of applications used should only be considered to be general in nature. Many applications may be appropriate in several or all categories. Such applications are only detailed once to avoid duplication. Practitioners who do not find the application they are seeking in their first choice of category should therefore check other categories. If their required application is not covered, it will be necessary to determine a similar situation and to adapt it, with care, to their needs.

3 This section and Section 13.10 deal with rural and urban situations respectively. These terms also should be considered as general and if a "rural" application is appropriate within an urban area the application details should be used with appropriate adjustments to sign spacing and sizes. The signing of roadworks in peri-urban areas will most likely be catered for by rural category applications.

4 In the various figures the following rules or conventions apply:

- (a) all signs are correctly oriented for the direction of travel to which they apply;
- (b) to avoid confusion with any arrows on road signs or markings, the direction of travel of traffic is, where relevant, indicated thus  ;
- (c) all details are given in metres **but all may be directly used as "paces" in practice.**

5 Signs should be sized as recommended in Volume 1. As a rule of thumb the following sizes are appropriate for regulatory, warning and diagrammatic signs:

(a) Gravel roads:

- (i) circular signs - 1200 mm diameter;
- (ii) triangular signs - 1200 mm side length;
- (iii) diagrammatic signs - 1200 mm x 1600 mm;

(b) Bituminous or concrete surfaced roads:

- (i) circular signs - 1200 mm diameter;
- (ii) triangular signs - 1500 mm side length;
- (iii) diagrammatic signs - 1200 mm x 1600 mm.

- (a) gravel road construction including re-gravelling;
- (b) reseal/chip-and-spray type surfacing operations;
- (c) partial road closure/reduced width operations;
- (d) separately constructed deviations around the work site.

2 Although common to rural roads, the conditions listed in (a), (b) and (c) above may also occur in urban areas where similar signing principles to those illustrated should be used. These principles are not repeated in Section 13.10.

3 Temporary signing applications appropriate to multi-lane and dual carriageway roads are covered in Section 13.11.

### 13.9.2 Rural Roadworks











1 The examples of temporary signing given in this section deal with applications which are most typical of rural roads such as:

### 13.9.3 STOP/RY-GO Operation

- 1 STOP/RY-GO operation may be required to control traffic at a wide variety of roadworks sites where the remaining roadway is reduced to less than two lanes in width, for whatever reason. As such, STOP/RY-GO traffic control is effectively a temporary signing sub-system. It may be used on its own or it may be used locally, in more than one place, within a long roadworks site. The detail in Figure 13.44 may therefore be incorporated into other layouts in this Chapter.
- 2 If a daytime STOP/RY-GO operation cannot be opened to traffic by dusk, temporary traffic signals must be provided for night time operation. A portable power source may be required in order to operate the signals, and such an installation will need to be well secured.
- 3 All obstructions close to a one-way site of this nature must be marked adequately by DELINEATOR PLATE signs TW401 and/or TW402 and/or flashing yellow lights. This includes any working or parked construction vehicles.
- 4 The STOP/RY-GO operators must also be equipped with flags and must be well trained/experienced flagmen (see Subsection 13.3.9 and Figure 13.23).

#### Checklist

- ☐ do the advance signs for the STOP/RY-GO control clash with other roadworks signing within the site?
- ☐ is the flagman fully visible to oncoming traffic?
- ☐ are all signs fully visible to oncoming traffic?
- ☐ is the flagman standing in a safe position?
- ☐ is the lateral Buffer Zone within the site adequate for worker and public safety?
- ☐ can the restriction be eliminated to permit two-way traffic by dusk?

| MAINTENANCE UNIT INVENTORY   |                      |                |                       |
|--|----------------------|----------------|-----------------------|
| Sign   | No                   | Size (mm)      | Quantity              |
|   | TR201-60<br>TR201-80 | 1200           | 2<br>2                |
|   | R201-100             | 1200           | 2                     |
|   | TW336-WA             | 1200 X<br>1600 | 2 or 0 <sup>(1)</sup> |
|   | TW336                | 1200           | 2 or 4 <sup>(1)</sup> |
|   | TW343                | 1200           | 2                     |
|   | TW344                | 1200           | 2 <sup>(2)</sup>      |
|   | TW337                | 1200           | 2 <sup>(2)</sup>      |
|   | TW331                | 1200           | 2 <sup>(2)</sup>      |
|   | TW339                | 1200           | 2 <sup>(2)</sup>      |
|   | TIN 11.3             | 1200           | 4                     |
| <p>(1) TW336 may be specified for TW336-WA on low volume roads.</p> <p>(2) Only one pair of these signs may be needed. A large unit may need one pair of each.</p> |                      |                |                       |

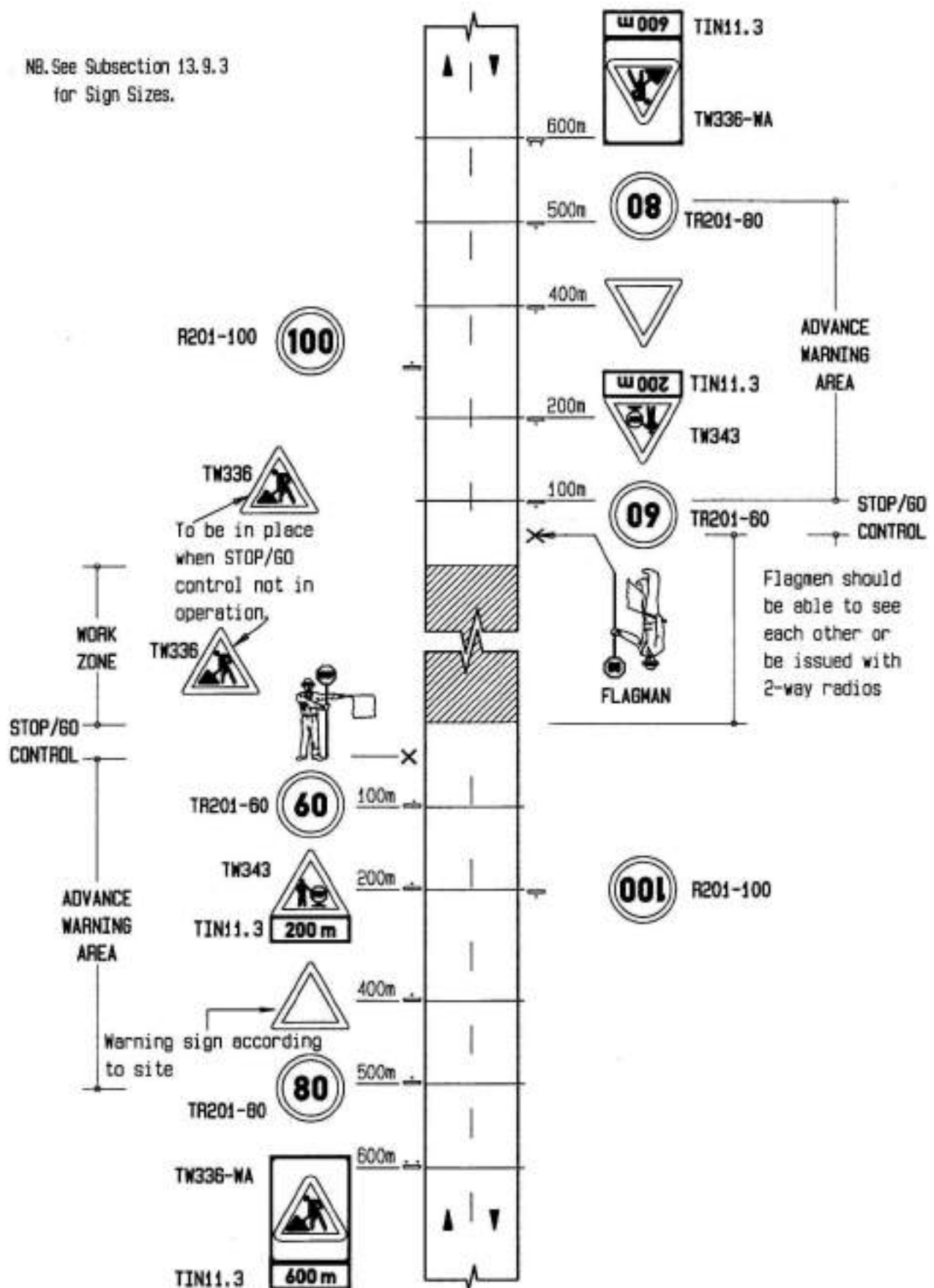

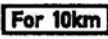





Fig 13.44

STOP/RY-GO Operation

### 13.9.4 Gravel Road Blading/Re-Shaping

- 1 Figure 13.45 illustrates the signing for grader operations involving the blading and reshaping of gravel roads in rural areas. It is recommended that the signs required to cover a section of road of about 10 km in length, or approximating a days work, be set out at the beginning of the day. On this basis TW337 signs should be placed at 2 km to 3 km intervals through the section on both sides of the road. Typically a grader will run four or five blade widths over such a 10 km section in a day. This signing application is also appropriate when a grader is being used for cleaning and reshaping of side drains.
- 2 The grader shall be fitted with at least one FLASHING YELLOW WARNING LIGHT SS3 to assist visibility of the vehicle. This light shall be switched on at all times whilst the grader is working or stopped in the roadway, or it is within 3 metres of the edge of roadway. In hilly terrain the use of a high mounted flag (located on a 3 metre aerial or similar device mounted above the cab) is recommended to further enhance the warning given to approaching drivers.
- 3 The grader inventory may include two or more flags which the grader operator's assistants can use to mark problem areas in the road surface exposed by the blading operation.
- 4 It is possible that labourers may be working within a typical 10 km section undergoing blading and reshaping. When this occurs, the labour gang should be provided with at least a pair of TW336 signs. It is likely that such gangs of workers will move from place to place, in which case any of the short term sign applications given in Section 13.8 (Figures 13.32 to 13.37) may be appropriate within the overall section.
- 5 If sight conditions are particularly poor, or a section of road is has fairly high traffic volumes, flagmen may be used to slow oncoming vehicles. The flagmen shall be familiar with the standard flagging procedures given in Figure 13.23.

| MAINTENANCE UNIT INVENTORY   |                |                          |                                   |
|--|----------------|--------------------------|-----------------------------------|
| Sign   | No             | Size (mm)                | Quantity                          |
|   | TW337          | 1200                     | <sup>(1)</sup><br>6               |
|   | TIN 11.2       | 1200                     | 2                                 |
|   | FLAGS          | 450 X<br>450             | <sup>(2)</sup><br>2               |
|   | MARKER<br>FLAG | 500 On<br>3000<br>Aerial | <sup>(3)</sup><br>1 Per<br>Grader |
|    | TW336          | 1200                     | 4                                 |
| <p>(1) Add TW337 at 3km intervals if a 10km section is bladed.</p> <p>(2) Flags to mark problem spots in the road surface exposed by blading.</p> <p>(3) Marker flag to indicate presence of grader in undulating or rolling topography.</p> |                |                          |                                   |

#### Checklist

- ☐ is the grader's flashing light operational?
- ☐ is the grader working in hilly terrain and/or on winding roads?
- ☐ are labourers also present in the section?
- ☐ are flagmen required?

NB. See Subsection 13.9.4  
for Sign Sizes.

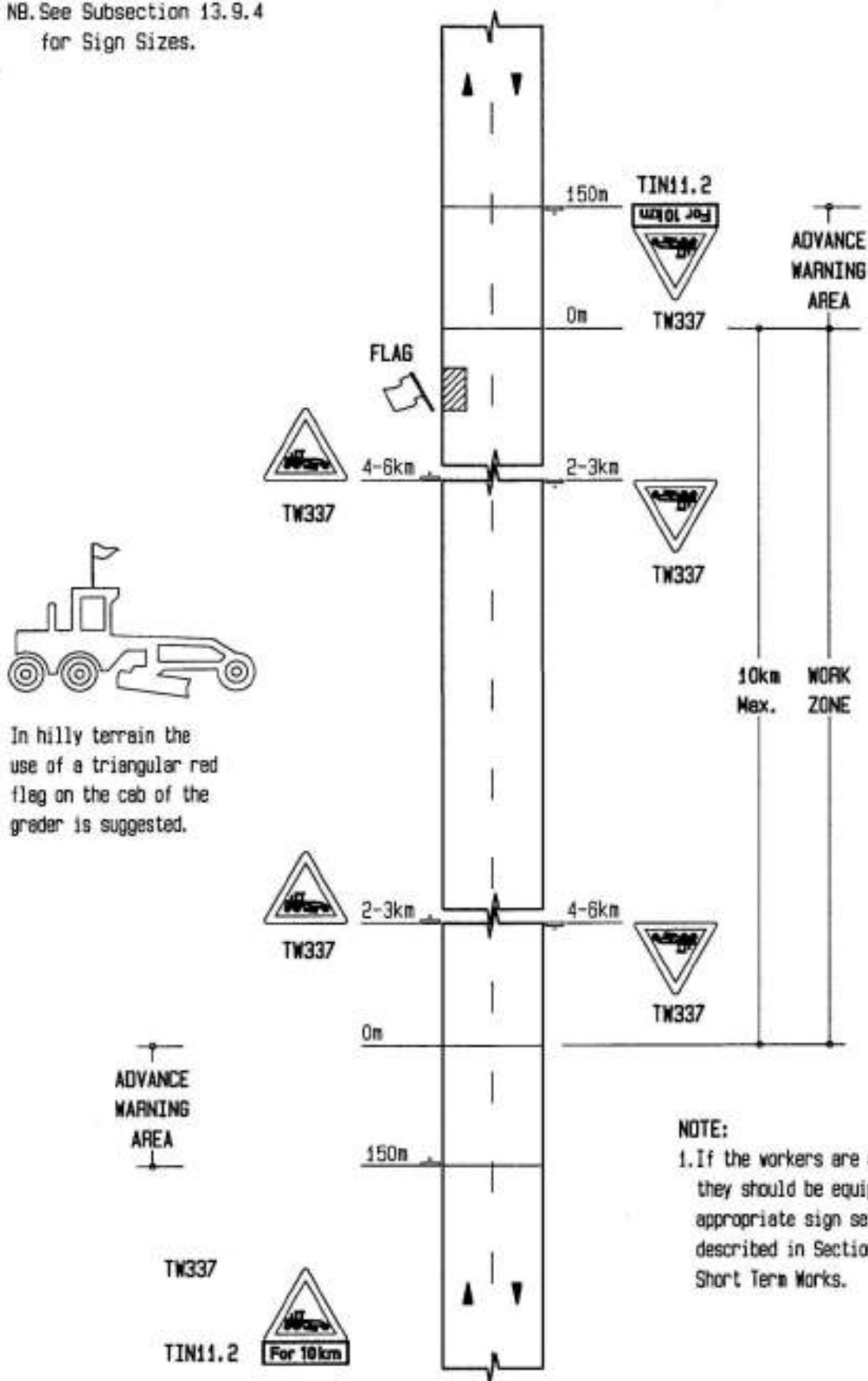


Fig 13.45

Gravel Road Blading/Re-Shaping








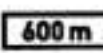



### 13.9.5 Gravel Roads - Gravel Heaps

- 1 In constructing gravel roads it is normal practice to stockpile gravel heaps on the section of roadway being worked, as shown in Figure 13.46. Whenever possible, gravel heaps must be spread before the end of the day's activities and should not be left in place overnight. If it is not possible to achieve this, there must be sufficient width for two-way traffic and adequate signing must be in place for drivers to determine that:
  - (a) there is an obstruction in the roadway; and
  - (b) there is limited space for two-way traffic.
- 2 Figure 13.46 shows signing appropriate to a working period and to a situation when gravel heaps may have to be left in place overnight. Double sided DELINEATOR hazard marker signs TW401/TW402 should be provided at 50 metre centres along the full length of any heaps which will remain in place overnight. At least three delineators shall be visible in each direction to establish the horizontal and vertical alignment of the road. Where possible, a reduction in speed limit should not exceed 15% of the operating speed (or 20 km/h).
- 3 This type of roadwork activity is traditionally very hard on road signs. Given the possible nature of the hazard, particularly at night, it is essential that the signs be maintained in good condition and that they are regularly inspected for the quality of their retroreflectivity.
- 4 Subject to the size of the maintenance unit, the length of a section of road being gravelled should be kept within the limits of good management and control. A maximum length of 2 km is recommended whilst work is in progress, but this should be significantly reduced, if at all possible, if gravel heaps are to be left in place overnight.

#### Checklist

- ☐ are gravel heaps to be left in place overnight?
- ☐ do all signs have good retroreflective properties?
- ☐ what is a safe manageable length of site for the size of work unit and likely traffic?

| MAINTENANCE UNIT INVENTORY  |                      |             |                                |
|---|----------------------|-------------|--------------------------------|
| Sign  | No                   | Size (mm)   | Quantity                       |
|    | TW336-WA             | 1200 X 1600 | 2                              |
|    | TR201-80<br>TR201-80 | 1200        | 2<br>2                         |
|    | TW329<br>TW330       | 1200        | 1<br>1                         |
|    | TR103<br>TR104       | 1200        | 1<br>1                         |
|   | TW212                | 1200        | 2                              |
|  | TW401<br>TW402       | 150 X 600   | 10m per<br>100m site<br>length |
|  | R201-100             | 1200        | 2                              |
|  | TIN 11.3             | 1200        | 2                              |
|  | TIN 11.4             | 1200        | 2                              |

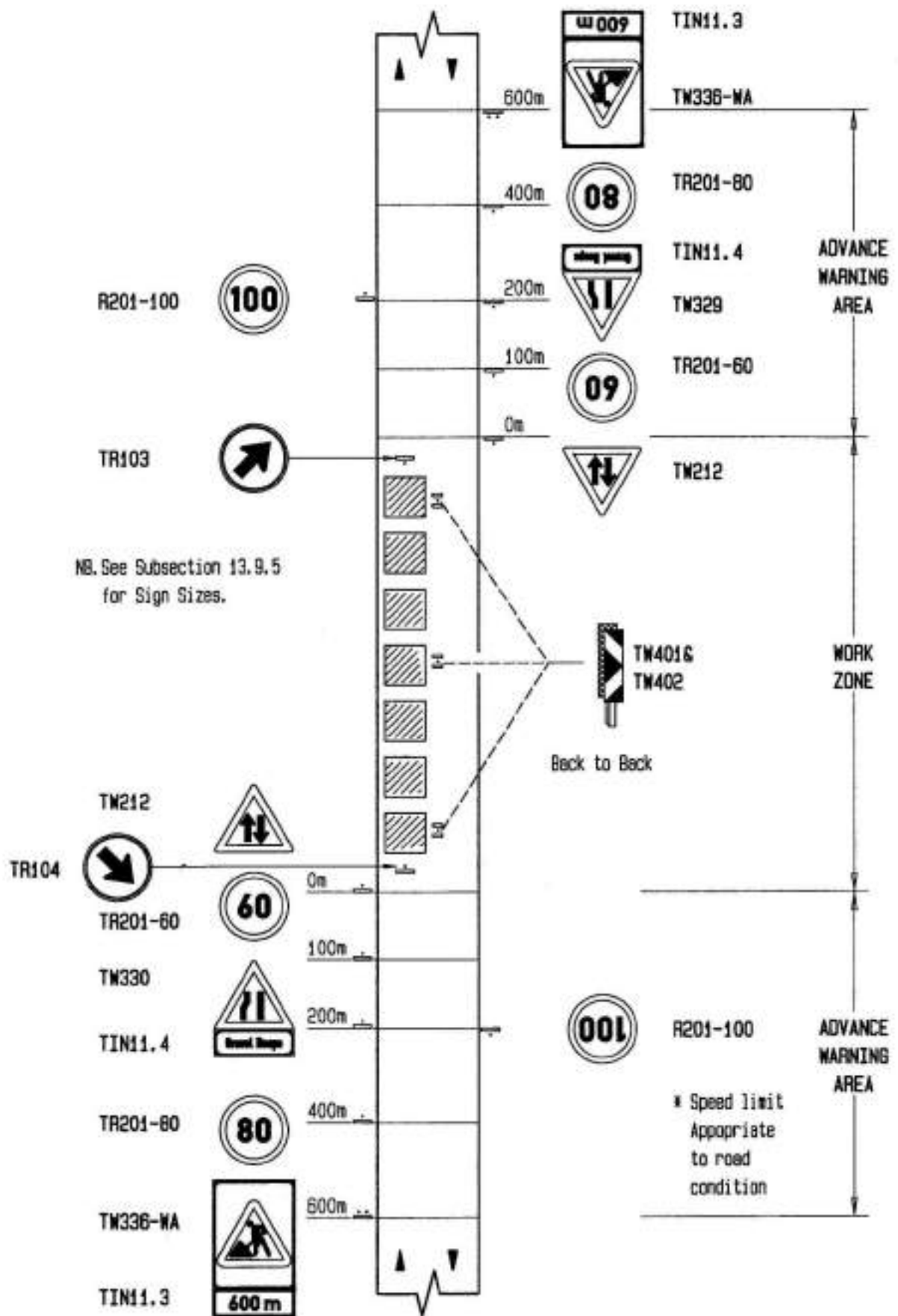


Fig 13.46

Gravel Roads – Gravel Heaps

### 13.9.6 Gravel Road Reconstruction

1 Figure 13.47 includes two typical details which may occur during gravel road construction. These details are similar to those in Figures 13.44 and 13.46 but are shown together here to illustrate the likely need to cater for both types of activity at one site. Detail 13.47.1 shows a typical STOP/RV-GO traffic control situation (for further details see Subsections 13.3.9, 13.9.3, and Figure 13.23). STOP/RV-GO control is likely to be required regularly as follows:

- (a) whilst material is being delivered to the site;
- (b) whilst gravel is being spread and worked;
- (c) whilst heavy of plant or equipment is being moved.

2 Detail 13.47.2 shows the signing arrangement once traffic is able to pass the working area. Subject to the expected nature of the work, advance signing may be arranged according to either detail. However, if STOP/RV-GO control is expected, the greater distances shown in Detail 13.47.1 should be used throughout the working period. The size and position of the first sign in the sequence may be varied according to known local conditions. If speeds are known to be low, sign TW336-WA may be replaced by a TW336 sign or omitted all together. However, if approach speeds are likely to be high, it may be appropriate to move the TW336-WA sign further out to 800 m or 1000 m and adjust the spacing of the other advance signs accordingly.

3 If the pattern of work is such that a relatively short section of road is being actively worked on at a time, but that the effects of work are evident over some greater distance, this should be indicated at the beginning of the site by means of a SUPPLEMENTARY PLATE sign TIN11.2 displayed with sign TW336.

4 If the extent of work and traffic is such that the occurrence of unacceptable delays to traffic and disruption to the smooth progress of the work are likely, a deviation or detour of the types illustrated in Figures 13.53 to 13.56 may need to be considered.

#### Checklist

- ☐ are gravel heaps to be left in place overnight?
- ☐ do all signs have good retroreflective properties?
- ☐ is a deviation or detour likely to be required?
- ☐ what is a safe manageable length of site for the size of work unit and likely traffic?
- ☐ is the unit equipped for STOP/RV-GO operation?

| MAINTENANCE UNIT INVENTORY                     |                      |             |                                |
|--|----------------------|-------------|--------------------------------|
| Sign   | No                   | Size (mm)   | Quantity                       |
|  | TW336-WA             | 1200 X 1600 | 2                              |
|  | TR201-60<br>TR201-80 | 1200        | 2<br>2                         |
|  | TW329<br>TW330       | 1200        | 1<br>1                         |
|  | R1.5A/<br>R1.5B      | 750         | 2                              |
|  | TR103<br>TR104       | 1200        | 1<br>1                         |
|  | TW212<br>Optional    | 1200        | 2                              |
|  | TW401<br>TW402       | 150 X 600   | 10m per<br>100m site<br>length |
|  | R201-100             | 1200        | 2                              |
|  | TIN 11.3<br>TIN 11.3 | 1200        | 2<br>2                         |
|  | TW344                | 1200        | <sup>(1)</sup><br>2            |
|  | TW343                | 1200        | 2                              |
| (1) Signs TW337 may be used as an alternative. |                      |             |                                |

NB See Subsection 13.9.6  
for Sign Sizes.

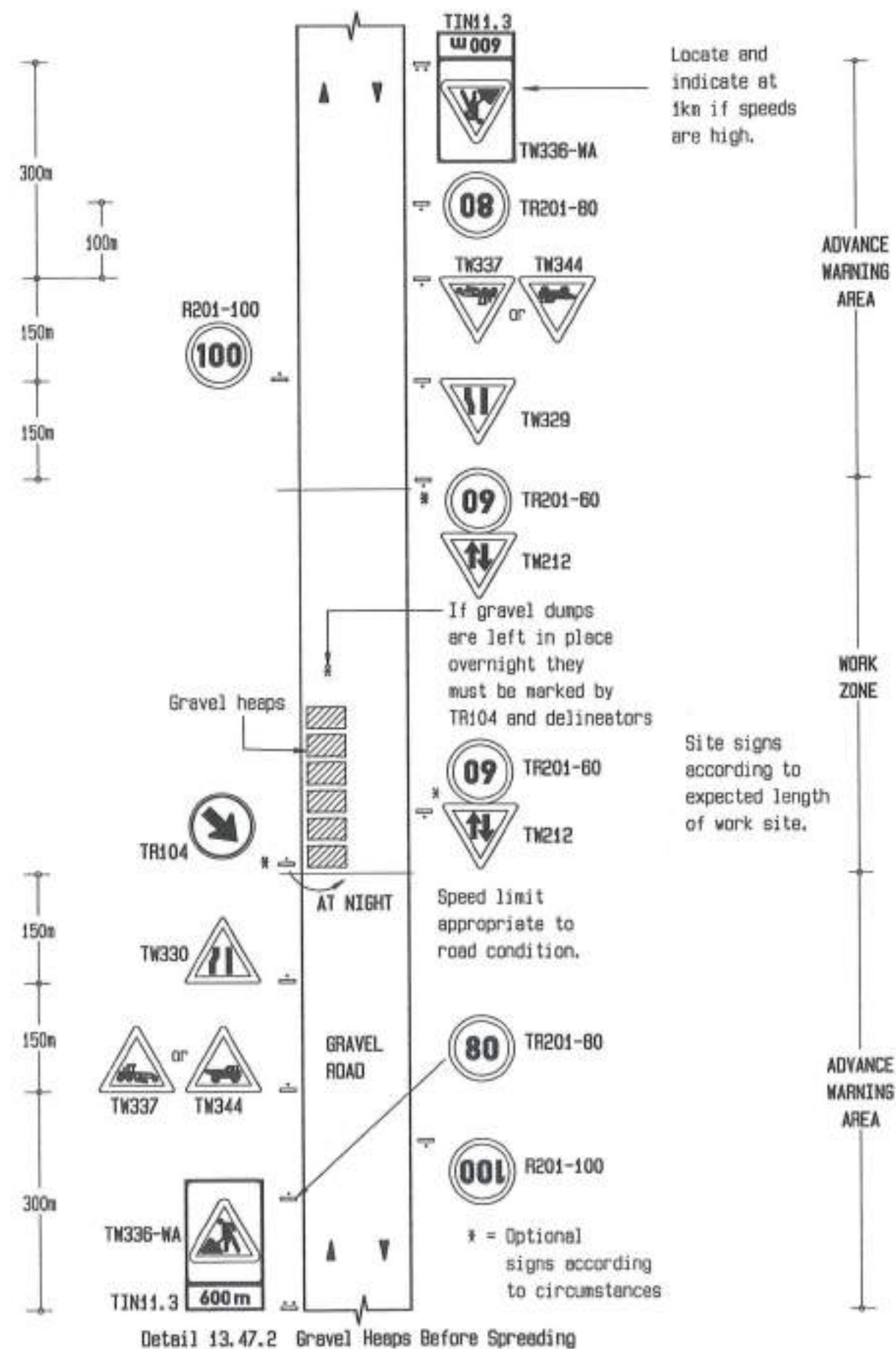
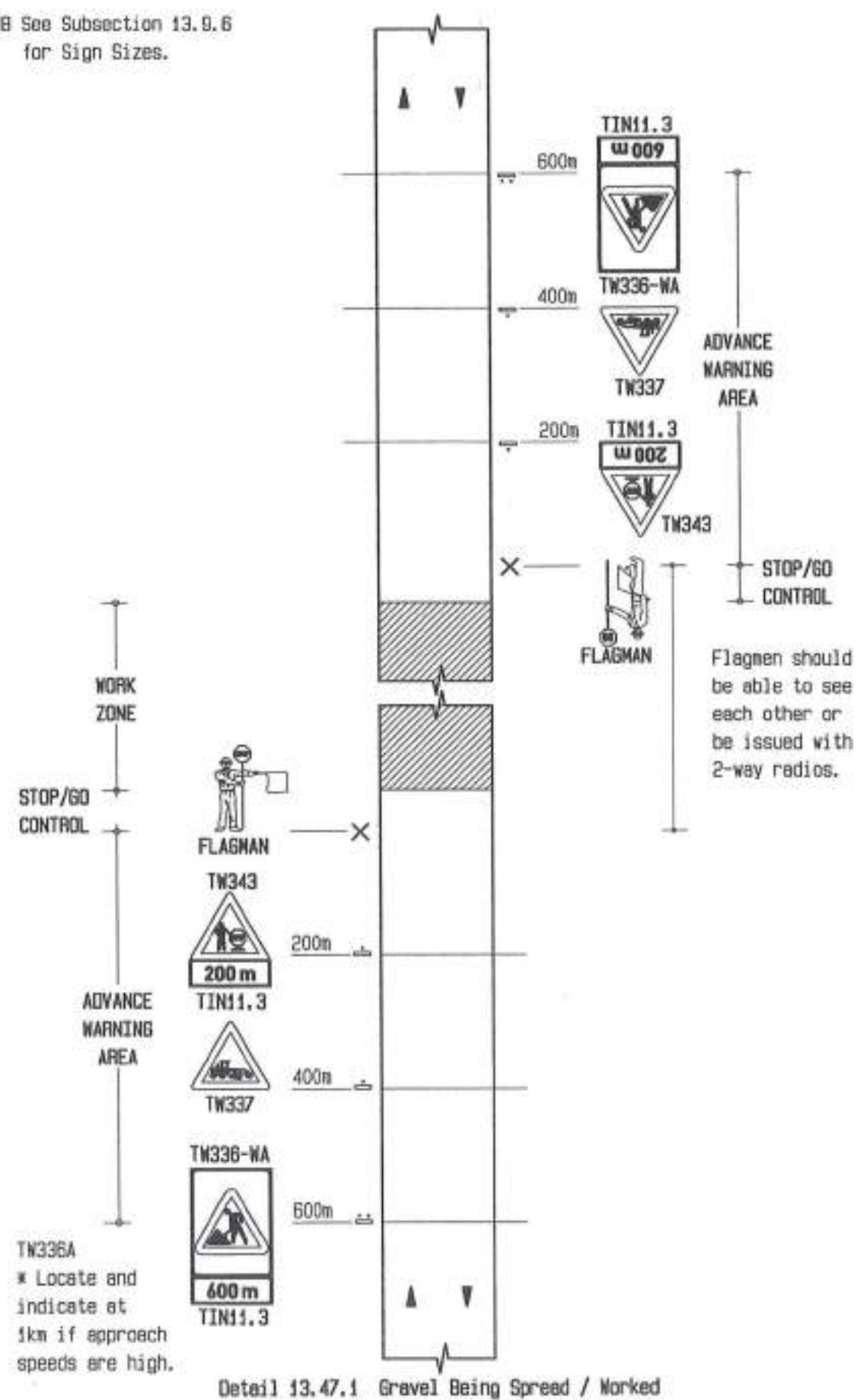








Fig 13.47  
Gravel Road Construction

13.9.7 Reseal/Resurfacing Work – Just Completed

- 1
- Figure 13.48 illustrates recommended signing levels where work on resealing of a section of roadway has just been completed. This work activity may occur on sections of roadway within a larger site and may occur in more than one place at a time within such a site. When this is the case, the signing should be adjusted to suit the overall signing requirements of the site. Any temporary speed limit should relate to that operating within the rest of the site and should be as high as is practical and safe (see Section 13.4).
- 2
- Sign TW333 and sign TW338 should be considered when there is significant horizontal road curvature and/or the road crossfall or superelevation is also significant, as in hilly country, since the combination of loose stone chippings or dust on the road surface together with this type of road profile can lead to slippery conditions. Alternatively, sign TW333 may be used instead of sign TW338 if the condition of the road surface is considered to be a greater hazard than the risk of stone chippings being thrown up.
- 3
- The sign sequence shown should be repeated at approximately three kilometre intervals and, if the road is one carriageway of a dual carriageway road, the signs shall be repeated on the right, on the median island.
- 4
- A similar level of signing is appropriate if an asphalt overlay or concrete surface has just been laid and traffic is using it for the first time. With this type of surfacing the use of SURFACE STEP advance warning signs TW340 and TW341 may also be appropriate.
- 5
- If road markings are not likely to be re-marked shortly after re-opening the road to traffic, NO LINES advance warning signs should also be provided (see Volume 4, Chapter 3, Section 3.1).

Checklist

- ☐ is a 3 km spacing of sign sets adequate?
- ☐ is the road surface slippery?
- ☐ is there a temporary step in the road surface?
- ☐ will road markings be re-marked shortly after re-opening the road?

| MAINTENANCE UNIT INVENTORY  |                |           |                                 |
|---|----------------|-----------|---------------------------------|
| Sign  | No             | Size (mm) | Quantity                        |
|    | TR201-60       | 1200      | 2<br>Plus 2<br>Every<br>3km     |
|    | TW338          | 1200      | 2<br>Plus 2<br>Every<br>3km     |
|    | R201-100       | 1200      | 2                               |
|    | TW333          | 1200      | 2<br>Plus 2<br>Every<br>3km (1) |
|    | TW340<br>TW341 | 1200      | 2<br>Plus 2<br>Every<br>3km (2) |
|    |                | 1200      | 2<br>Plus 2<br>Every<br>3km (3) |
| (1) Add signs TW333 at 3km intervals if many sharp curves exist especially in mountain passes where loose gravel and crusher dust are located on the road surface.<br>(2) Use signs TW340 / TW341 as appropriate in place of TW333 or TW338 when re-surfacing with asphalt overlay or concrete if a surface step is present.<br>(3) Use text warning sign if repainting is not immediate. |                |           |                                 |

NB See Subsection 13.9.7  
for Sign Sizes.

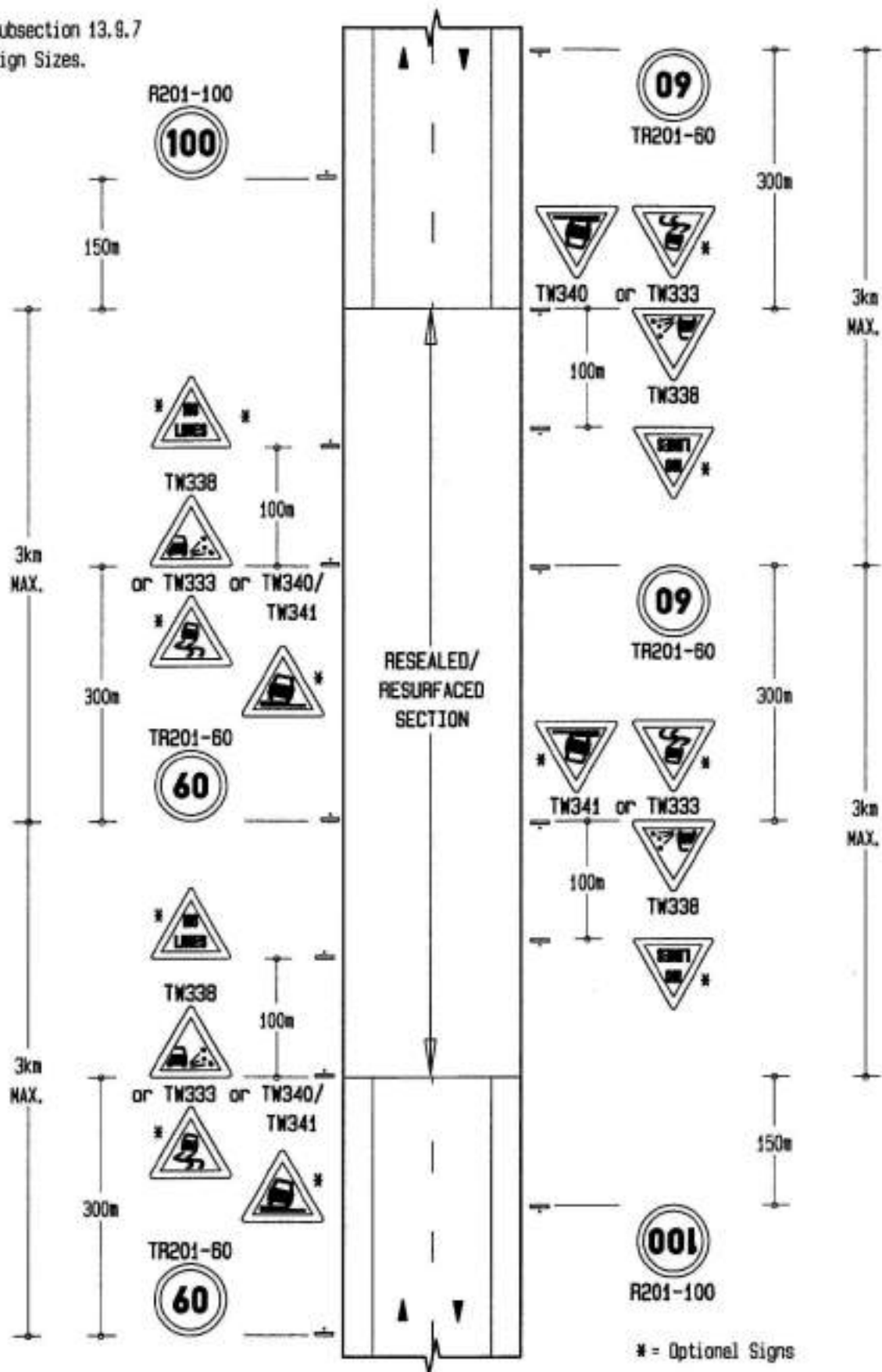


Fig 13.48












Reseal/Resurfacing Work – Just Completed

### 13.9.8 Reduced Width Operation - 2-Way Traffic

- Figure 13.49 should be read with Figures 13.78 and 13.79.
- The detail given in Figure 13.49 is suitable for general use when a rural 2-lane 2-way road is being resurfaced or reconstructed. The layout is based on a road cross-section which is wide enough to permit approximately half of the road to be resurfaced or reconstructed whilst traffic is diverted to run on the other half of the road. Such operation will require that the cross-section of the road includes useable shoulders, or that temporary shoulders are created for the duration of the deviation. Any temporary speed limit should preferably be within 15% (or 20 km/h) of that existing prior to the work starting. Cross section design standards should take this into account (see Section 13.4).
- Figure 13.49 represents the main signing requirements **for the ADVANCE WARNING AREAS to the deviation**. The signs indicated in the "Maintenance Unit Inventory" opposite are for this purpose. **To determine a full signing inventory, further signs will have to be added** for the TRANSITION AREAS, the WORK AREA, and the TERMINATION AREAS. The majority of signs in these areas will be DELINEATOR PLATE signs TW401/TW402. For details of the signs inventories for these areas, refer to Section 13.12 - Enlarged Standard Details and particularly to Figures 13.78 and 13.79.
- Particular attention should be paid to the transition area treatment. Tapers should be sized and delineated in accordance with Section 13.5, and in particular with Tables 13.4 and 13.5 and Figures 13.20 and 13.29. Retroreflective temporary road markings should be applied in the transition areas and should be kept in good condition for the duration of work.
- If flagmen should be deemed necessary due to specific hazards at the approaches to the transitions, or as a result of a poor accident history in these positions, they shall operate in accordance with the provisions of Subsection 13.3.9 and Figure 13.23.

#### Checklist

- ☐ does the maintenance unit have sufficient DELINEATOR PLATES for its task?
- ☐ are there vertical and/or horizontal curves on the approaches which should be taken into account when positioning signs?
- ☐ are flagmen required?
- ☐ if flagmen are required are they well trained and alert?

| MAINTENANCE UNIT INVENTORY  |                      |                |               |
|---|----------------------|----------------|---------------|
| Sign  | No                   | Size (mm)      | Quantity      |
|    | TW336                | 1200           | 2             |
|    | TR201-100            | 1200           | 2<br>Optional |
|    | TR201-60<br>TR201-80 | 1200           | 4<br>2        |
|    | T6S111<br>T6S112     | 1200 X<br>1600 | 1<br>1        |
| <br> | TIN 11.3<br>TIN 11.3 | 1200           | 2<br>2        |
|    | TR104                | 1200           | 1             |
|    | FLAGS                | 450 X<br>450   | 2             |
|    | TR214                | 1200           | 2             |
|    | T6S107<br>T6S108     | 1200 X<br>1600 | 1<br>1        |
|    | R201-120             | 1200           | 2             |



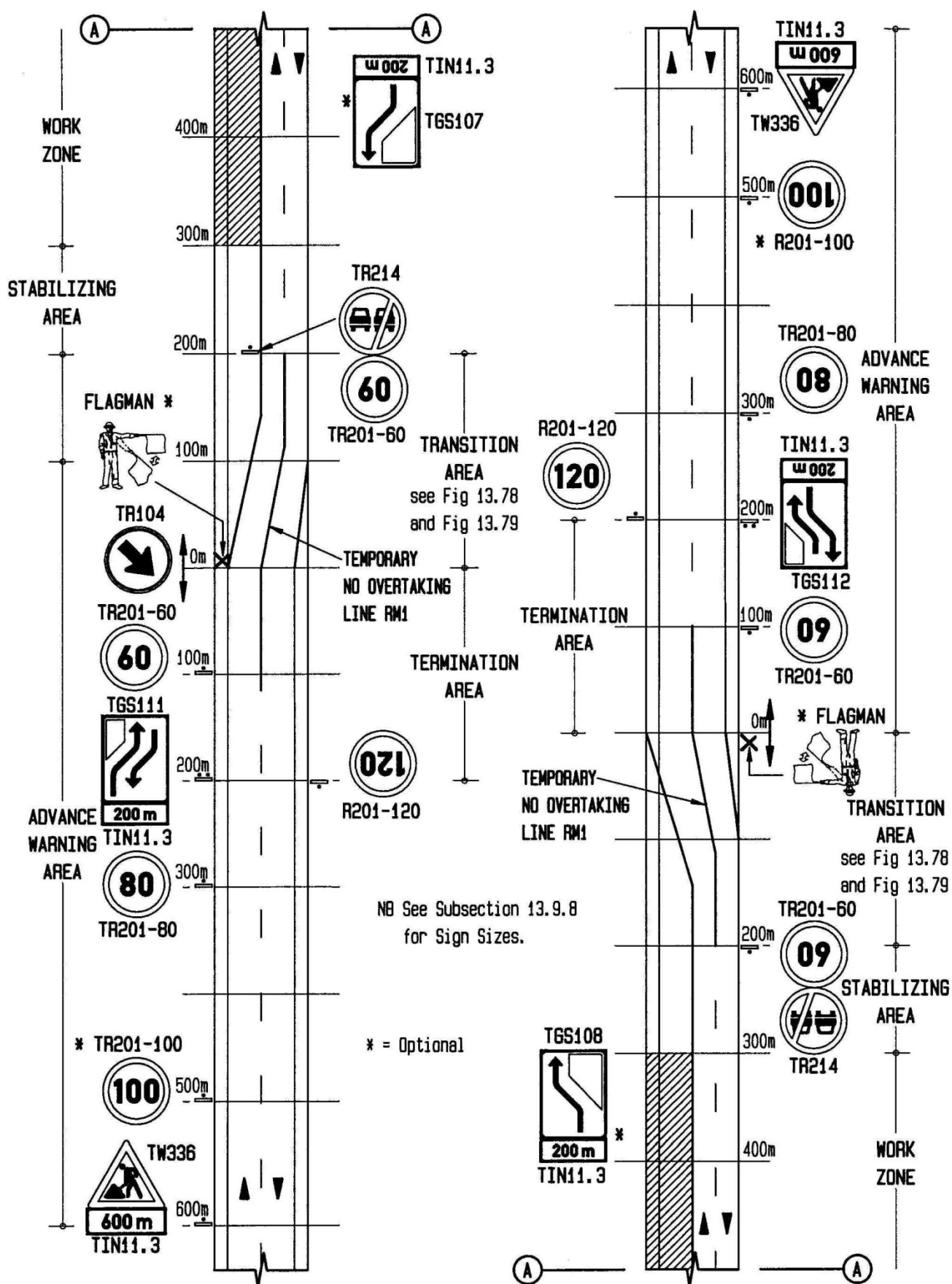


Fig 13.49









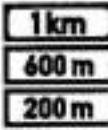
Reduced Width Operation – 2-Way Traffic

### 13.9.9 Total Road Closure Ahead

- Figure 13.50 shows the approach signing to a total STOP condition such as might be required at a bridge wash-away or other flooding, or at the site of a road collapse. A situation such as this should be preceded by one of the types of signing arrangements given in the details of Figure 13.52. The purpose of the signing given in Figure 13.52 is to reduce the number of drivers who might end up approaching the site of the road closure and to provide them with a detour round the site.
- When an event requiring this type of signing occurs the likelihood is that signing will be placed in a number of "steps". The first will be an "immediate action" signing provision put in place by the incident response team. This could well take the form of the signing given in Detail 13.52.1 together with a minimum level road closure at the site. This latter may well have to be attended by workers or a flagman in the first instance. If the incident is going to be a long term one the next step will be to implement the signing given in Figure 13.50 together with a ROAD CLOSURE BARRIER (see Figure 13.87), in order to make the site safe. This should be closely followed by more informative detour signing as illustrated in Details 13.52.2 and 13.52.3. Once work commences at the site to carry out repairs a work site will be required. This can be created by providing another barrier an appropriate distance in advance of the road closure barrier, which can be considered to be a NO UNAUTHORISED TRAFFIC BARRIER (see Figure 13.87), through which only contractors and road authority vehicles should be permitted.
- Remote from the actual road closure site it will commonly be necessary to provide NO THROUGH ROAD BARRICADES, as detailed in Figure 13.88, at one or more junctions.
- Subject to the time that the road is going to be closed to traffic a "public relations" message high visibility sign of the type illustrated in Figures 13.18 and 13.50 may be specified.

#### Checklist

- ☐ are the optional signs shown, warranted due to high traffic approach speeds?
- ☐ has an effective detour been put in place?
- ☐ will the site require major reconstruction when the effects of the incident are over?

| MAINTENANCE UNIT INVENTORY  |   |              |                   |
|---|---|--------------|-------------------|
| Sign  | No                                      | Size (mm)    | Quantity          |
|                      | TW302-WA                                | 1200 X 1600  | 2                 |
|                      | TR201-100                               | 1200         | 2<br>Optional     |
|                      | TR201-60<br>TR201-80                    | 1200         | 2<br>2            |
|                      | FIG. 13.87                              | Size to Suit | 2 for major roads |
|                      |   | 1200         | 2 for minor roads |
|                    | TW302-WA<br>Flashing lights<br>Optional | 1200 X 1600  | 2 for major roads |
|                    | TW302<br>Flash light<br>Optional        | 1500         | 2 for minor roads |
|                    | R1                                      | 1200         | 2                 |
|                    | TIN 11.3<br>TIN 11.3<br>TIN 11.3        | 1200         | 2<br>2<br>2       |
| (1) Refer to Figures 13.87 and 13.88 for traffic barriers for unauthorised vehicles or road closures. |   |              |                   |

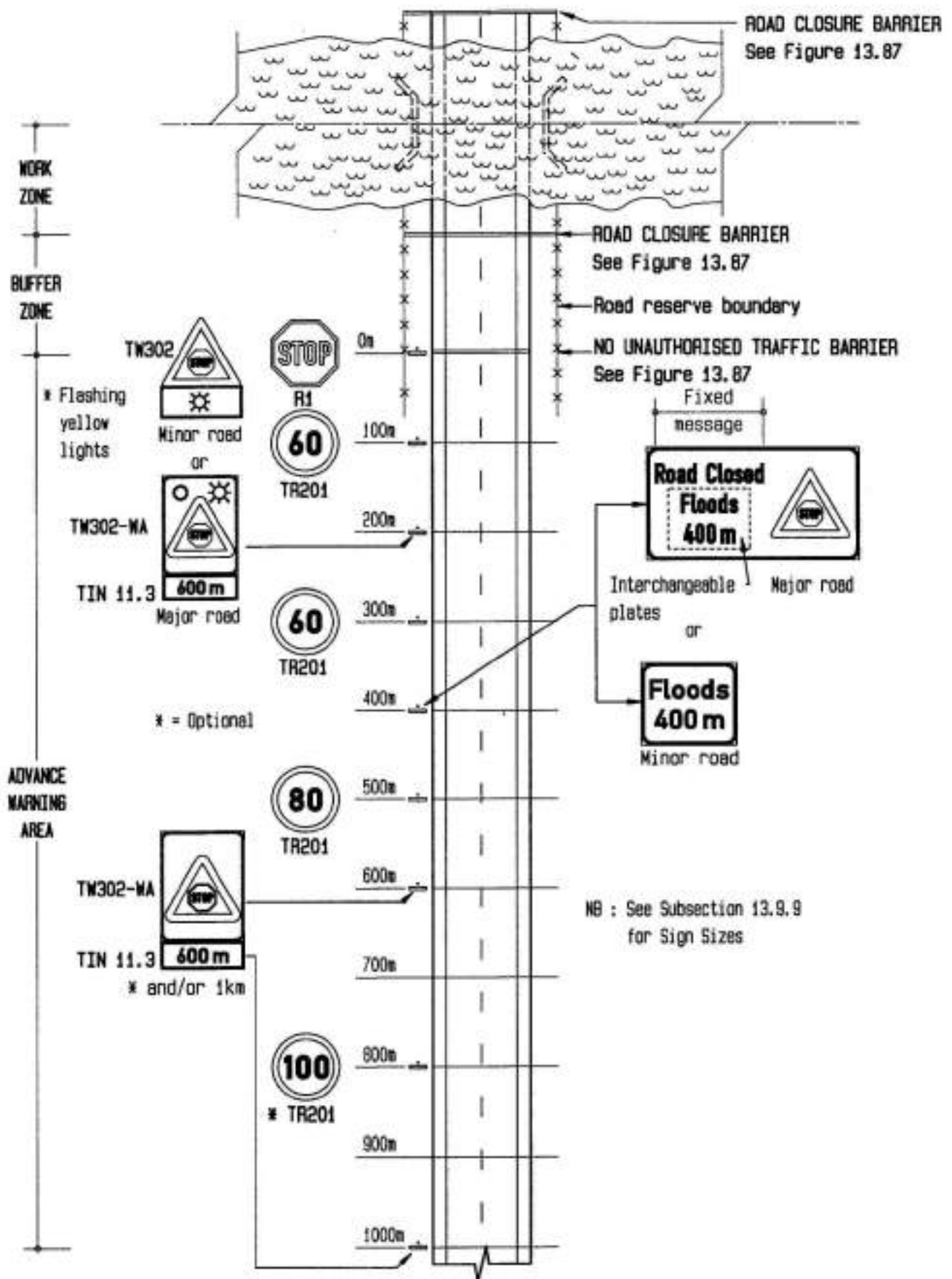


Fig 13.50

Total Road Closure Ahead

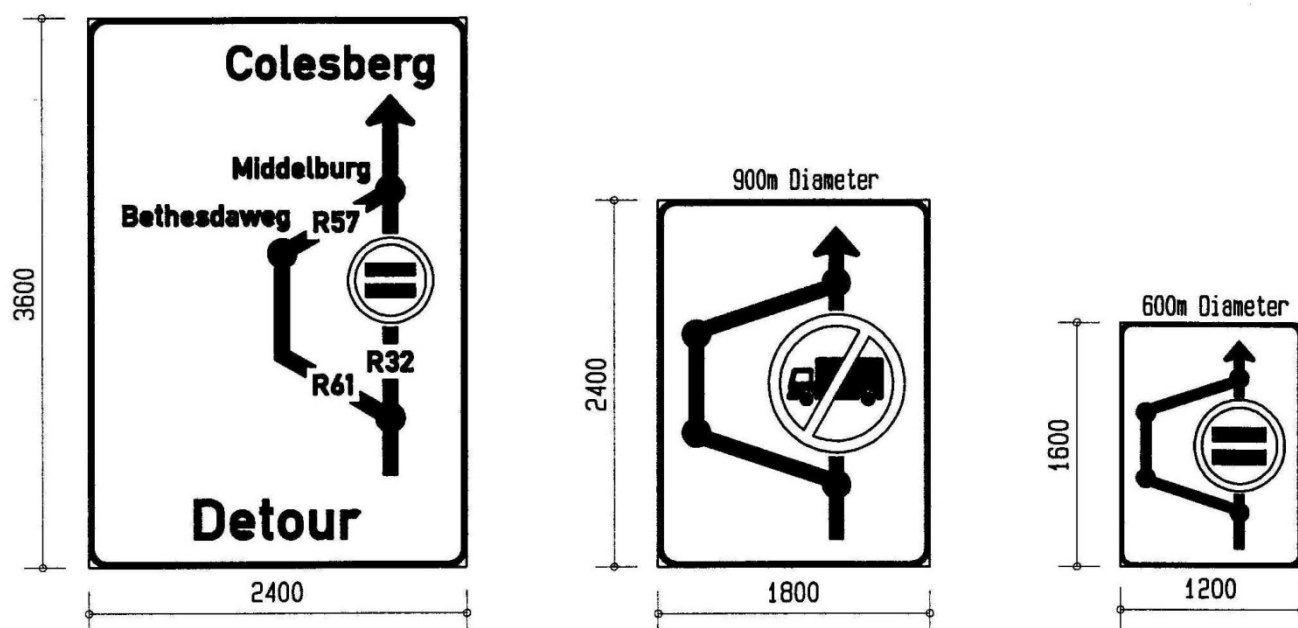
### 13.9.10 Detour Signing

- 1 For the purposes of categorising temporary road traffic signing at roadworks, the following descriptions of terms commonly used in this chapter are relevant:

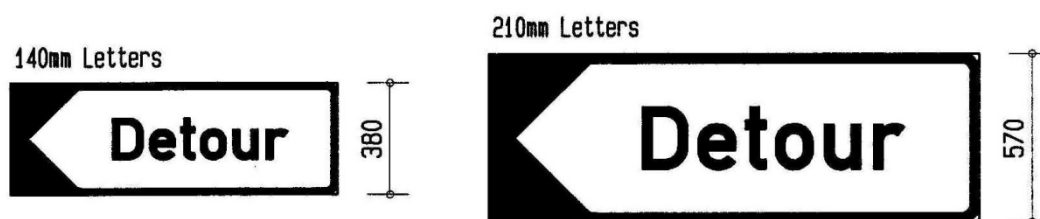
"**deviation**: involves the local redirection of traffic onto a roadway normally used only by traffic travelling in the opposite direction, **or** onto a specially constructed more-or-less parallel temporary roadway; existing direction signs can commonly be re-located to suit the temporary road alignment"; **and**

"**detour**: involves the redirection of traffic **to other parts of the road network** and will normally require the use of temporary direction signs to assist road users to reach their intended destination by alternative routes".

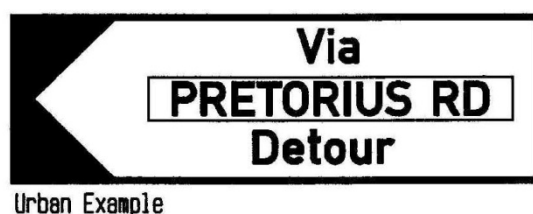
- 2 Figure 13.51 shows a selection of signs suitable for use at detours required either as a result of major road rehabilitation, or as a result of some incident such as a hazchem spill, a major accident or flooding. These signs are additional to the many temporary regulatory, warning and guidance signs illustrated in Section 13.2 which may also be required in such circumstances.
- 3 The signs shown in Figure 13.51 are appropriate at the types of situations given in Figures 13.50 and 13.52. The temporary DETOUR DIRECTION signs TGD2-D shown in Detail 13.51.3 are intended to be a rapid response tool to be put in place immediately the need for a detour arises. The TGD2-D sign is a universal sign in that it can be held in stock in some quantity and can be used to point in any direction to indicate the course of the detour. When these signs are put in place initially, it is recommended that they be placed on, or adjacent to, the relevant panel of an appropriate ADVANCE DIRECTION sign GD1 or DIRECTION sign GD2 on which the affected/closed direction panel has been temporarily been covered, pending a more effective modification of the signs (see Figure 13.16).
- 4 Once it becomes possible to upgrade the temporary signing of an "immediate action" detour, temporary FINGERBOARD DIRECTION signs TGD4 in Detail 13.51.2, which again can be standard items (with "left" and "right" examples), may be used to replace some or all of the TGD2-D signs. Although they are still small signs, the TGD4 signs have a significantly bigger target value.
- 5 Ultimately, once the length of time is known for which the detour may have to be operational, larger more informative signs such as those shown in Detail 13.51.1 may be warranted due to the number of drivers who are effectively strangers to the area.



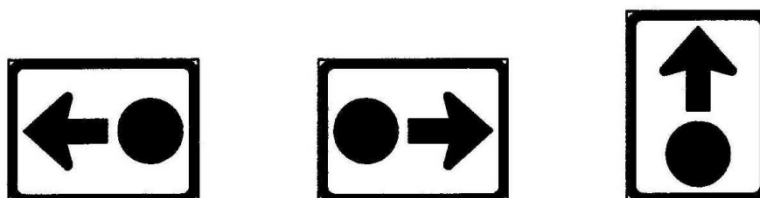
Detail 13.51.1 EXAMPLES OF TEMPORARY MAP-TYPE DIRECTION SIGNS



Typical Sizing for 140mm and 210mm Lettering



Detail 13.51.2 TEMPORARY FINGERBOARD SIGNS - T604



Detail 13.51.3 TEMPORARY DETOUR DIRECTION SIGN - T602-D

Fig 13.51

Detour Signing

### 13.9.11 Detour at a Road Junction

- 1 The situations illustrated in Figure 13.52 are relevant to major detours, either urban or rural, necessitated by the closure of a road link due to same event, such as a hazchem spill, a major accident, a flood or subsidence. The actual site of the incident may be remote from the junction concerned, but on a network basis the junction is the best one from which to provide a detour to the cut-off destination.
- 2 The first action, in such circumstances, will normally be the provision of a barricade on the entry to the closed section, and the effective conversion of the junction to a 4-way STOP control. Details of barricade treatment are given in Figures 13.87 and 13.88.
- 3 Figure 13.51 shows a range of specialised detour signs, some of which may be useful in situations similar to those illustrated. The need to provide for the sort of detour illustrated is likely to be an unplanned event. It will therefore commonly be necessary to react quickly to establish a detour. TEMPORARY DIRECTION sign TGD2-D can be utilised for this purpose. Sign TGD2-D is a compact sign which can be pre-manufactured because this one sign may be pointed left, right or straight on. Detail 13.52.1 shows a typical example of the use of TGD2-D signs. Standard left and right TEMPORARY FINGER BOARD signs TGD4 may also be pre-manufactured and quickly deployed to identify a detour.
- 4 Apart from the regulatory and warning signs associated with the modified junction control, alterations will be needed to existing direction signs if the detour is to be in place for some time. Details 13.52.2 and 13.52.3 give examples of such alterations for a minor, but priority road and similarly for a major road, respectively. In Detail 13.52.2 the junction is provided only with DIRECTION signs GD2. These have been altered to display the new direction to destination "A". The major junction in Detail 13.52.3 has, in addition, ADVANCE DIRECTION signs GD1. The GD1 and GD2 signs for two approaches are shown suitably modified to cater for the new routing to destination "A".
- 5 Drivers faced with an unexpected detour may be reluctant to follow temporary directions without confirmation that the new routing will lead to their intended destination. A version of temporary MAPTYPE ADVANCE DIRECTION sign TGD9 may be considered if such circumstances become evident.
- 6 No checklist or sign inventory is given for this example of temporary signing applications because each site is likely to be unique.

| MAINTENANCE UNIT INVENTORY   |                      |  |                |
|--|----------------------|--|----------------|
| Sign   | No                   | Size (mm)                              | Quantity       |
|  | TW104-WB             | 1200 X 1600                            | 1              |
|  | TW302                | 1500                                   | 1              |
|  | TW104                | 1200                                   | 1              |
|  | R1                   | 1200                                   | 1              |
|  | TIN 20<br>TIN 21     | 450 X 600 (urban)<br>675 X 900 (rural) | 2<br>2         |
|  | TGD2-D               | 384 X 288 (urban)<br>600 X 450 (rural) | 10-20 in Store |
|  | TIN 11.3<br>TIN 11.3 | 1500<br>1200                           | 2<br>2         |
| (1) Add temporary panels and 'crosses' to existing direction signs where necessary and when required.<br>(2) For the placement of 'No Through Road' Barriers refer to Figure 13.88 . |                      |  |                |


















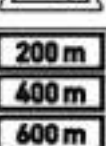


### 13.9.12 Deviation at a Bridge Site

- Figure 13.53 shows a typical signing arrangement for a short localised deviation round a bridge construction site. Such deviations are generally kept as short as possible and commonly have a steep and tortuous descent and ascent down to, and away from, a low level river crossing. The road geometry of the deviation will often be designed to minimum standards and it is, therefore, particularly important that the quality of the temporary sign installation is of the highest. **The quality control involved should include the maintenance of the signs in a clean and effective condition.**
- If approach speeds are known to be high and/or if the site is in any way hidden from direct view, consideration should be given to positioning the ADVANCE WARNING AREA signs over 800 m to 1000 m. Any temporary speed limit should preferably be within 15% (or 20 km/h) of that existing prior to the work starting, consistent with what is safe and practical. Design standards should take this into account (see Section 13.4).
- At the road closure barricades, the use of the strongly directional TW407 and TW408 CHEVRON signs is recommended in place of TEMPORARY BARRICADE sign TW411 when the alignment of the deviation is of minimum standards. If construction vehicles need to have access beyond these barricades, on one or both side of the bridge, then NO ENTRY sign R3 should be replaced by NO UNAUTHORISED VEHICLES sign TR208.

#### Checklist

- ☐ is the deviation alignment to minimum standards?
- ☐ are the signs clean and is the retroreflective material to specification and in good condition?
- ☐ do construction vehicles need to have access from the deviation to the closed portion of the site?

| MAINTENANCE UNIT INVENTORY  |                                   |             |                     |
|---|-----------------------------------|-------------|---------------------|
| Sign  | No                                | Size (mm)   | Quantity            |
|    | TW336-WA                          | 1200 X 1600 | 2                   |
|    | R201-100<br>or<br>R201-120        | 1200        | 2                   |
|    | TGS 111<br>TGS 112                | 1200 X 1600 | 2<br>2              |
|    | TR201-60<br>TR201-80<br>TR201-100 | 1200        | 2<br>2<br>2         |
|    | TW401<br>TW402                    | 150 X 600   | At 10-20m intervals |
|    | TR214                             | 1200        | 2                   |
|   | TR103<br>TR104                    | 1200        | 3<br>3              |
|  | TW407<br>TW408                    | 2400 X 400  | 2<br>2              |
|  | R3                                | 1200        | 2                   |
|  | TW202<br>TW203                    | 1500        | 1<br>1              |
|  | TW326                             | 1500        | 2                   |
|  | TIN 11.4                          | 1500        | 2                   |
|  | TW336                             | 1500        | 2                   |
|  | TIN 11.3                          | 1200        | 2<br>2<br>2         |

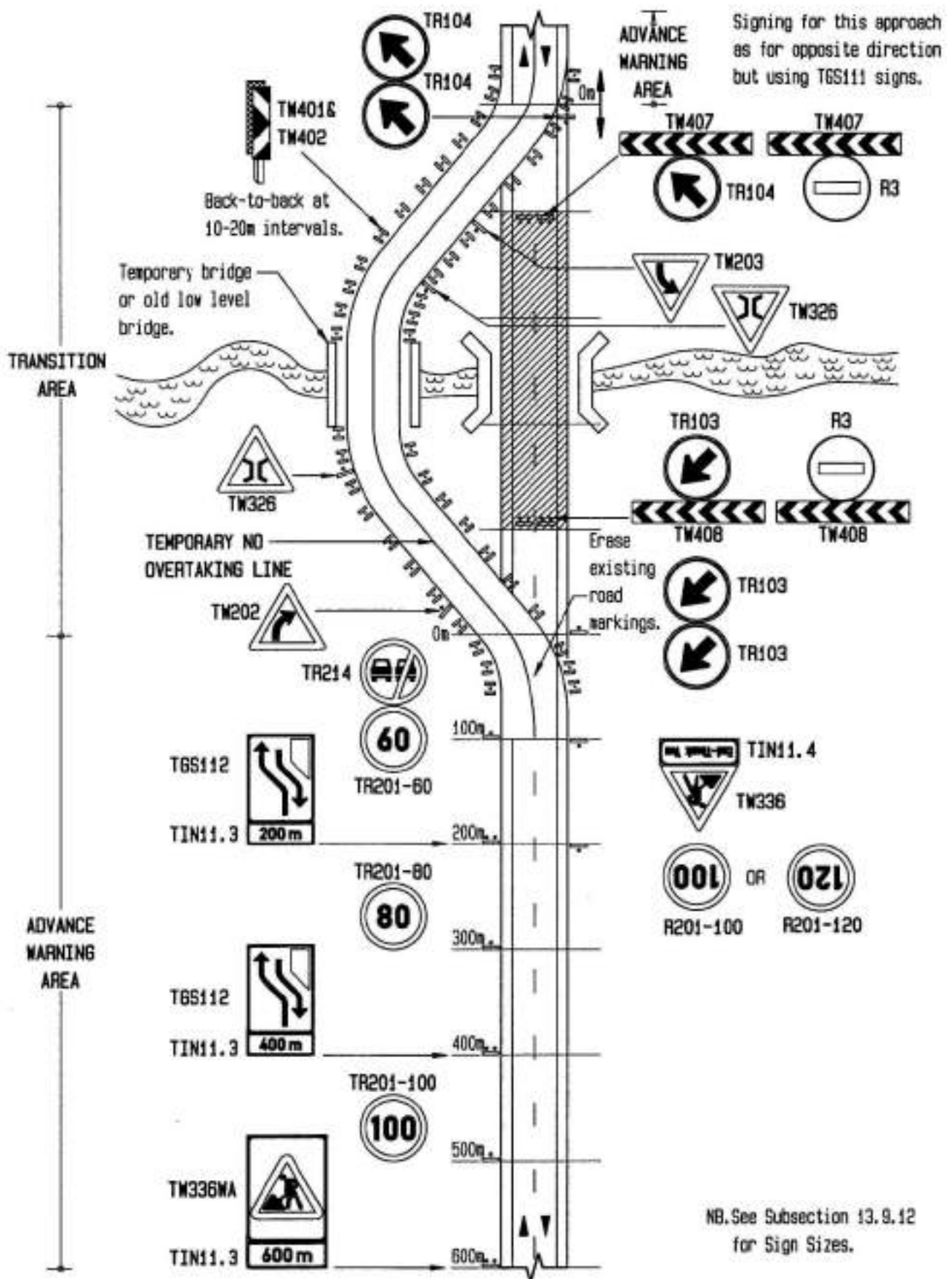


Fig 13.53

Deviation at a Bridge Site

### 13.9.13 Deviation - Low Traffic Volumes

- 1 For the purposes of categorising temporary road traffic signing at roadworks the following descriptions of terms commonly used in this chapter are relevant:





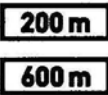





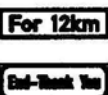
**"deviation":** involves the local redirection of traffic onto a roadway normally used only by traffic travelling in the opposite direction, **or** onto a specially constructed more-or-less parallel temporary roadway; existing direction signs can commonly be re-located to suit the temporary road alignment"; **and**

**"detour":** involves the redirection of traffic **to other parts of the road network** and will normally require the use of temporary direction signs to assist road users to reach their intended destination by alternative routes".

- 2 Figure 13.54 shows the signing requirements for the ADVANCE WARNING AREAS on the approaches to the start (and end - in the opposite direction) of a deviation at lengthy road construction or rehabilitation site. The concept of such signing is very similar to that depicted in Figure 13.53 but in this example is designed for low traffic volumes (see Figure 13.55 for appropriate details for a deviation for higher traffic volumes). Any temporary speed limit through the change of alignment should preferably be within 15% (or 20 km/h) of that existing on the approaches. Design standards should take this into account (see Section 13.4).
- 3 Once the deviation alignment is established it may closely parallel the road under construction or it may change its position according to the terrain and available space, but it will remain in relatively close proximity to the main road alignment. According to the space available the deviation may cross the road construction in one or several places. details of the signing for such situations are given in Figure 13.55.
- 4 Signing of the TRANSITION AREA depicted in Figure 13.54, and any others required within the deviation, should be in accordance with figures in Section 13.12: "Enlarged Standard Details" (see Figures 13.81 to 13.84 in particular).

#### Checklist

- ☐ are traffic volumes sufficiently low for this level of signing?
- ☐ is the geometry and road condition of the entry to the deviation suitable for the indicated speed limit?
- ☐ is there sufficient width through the curves of the entry to the deviation to accommodate large vehicles in both directions at the same time?

| MAINTENANCE UNIT INVENTORY  |                      |               |                   |
|---|----------------------|---------------|-------------------|
| Sign  | No                   | Size (mm)     | Quantity          |
|    | TW336                | 1500          | 3                 |
|    | TR214                | 1200          | 2                 |
|    | TR201-60<br>TR201-80 | 1200          | 2<br>2            |
|    | TW208                | 1500          | 2                 |
|    | TIN 11.3<br>TIN 11.3 | 1500          | 2<br>1            |
|  | TR104                | 1200          | 4                 |
|  | TW411                | 2400 X<br>400 | 2                 |
|  | TW401<br>TW402       | 150 X<br>600  | 5m-10m<br>Centres |
|  | TW333                | 1500          | 1                 |
|  | R201-100             | 1200          | 1                 |
|  | TIN11.2<br>TIN11.4   | 1500          | 2<br>1            |

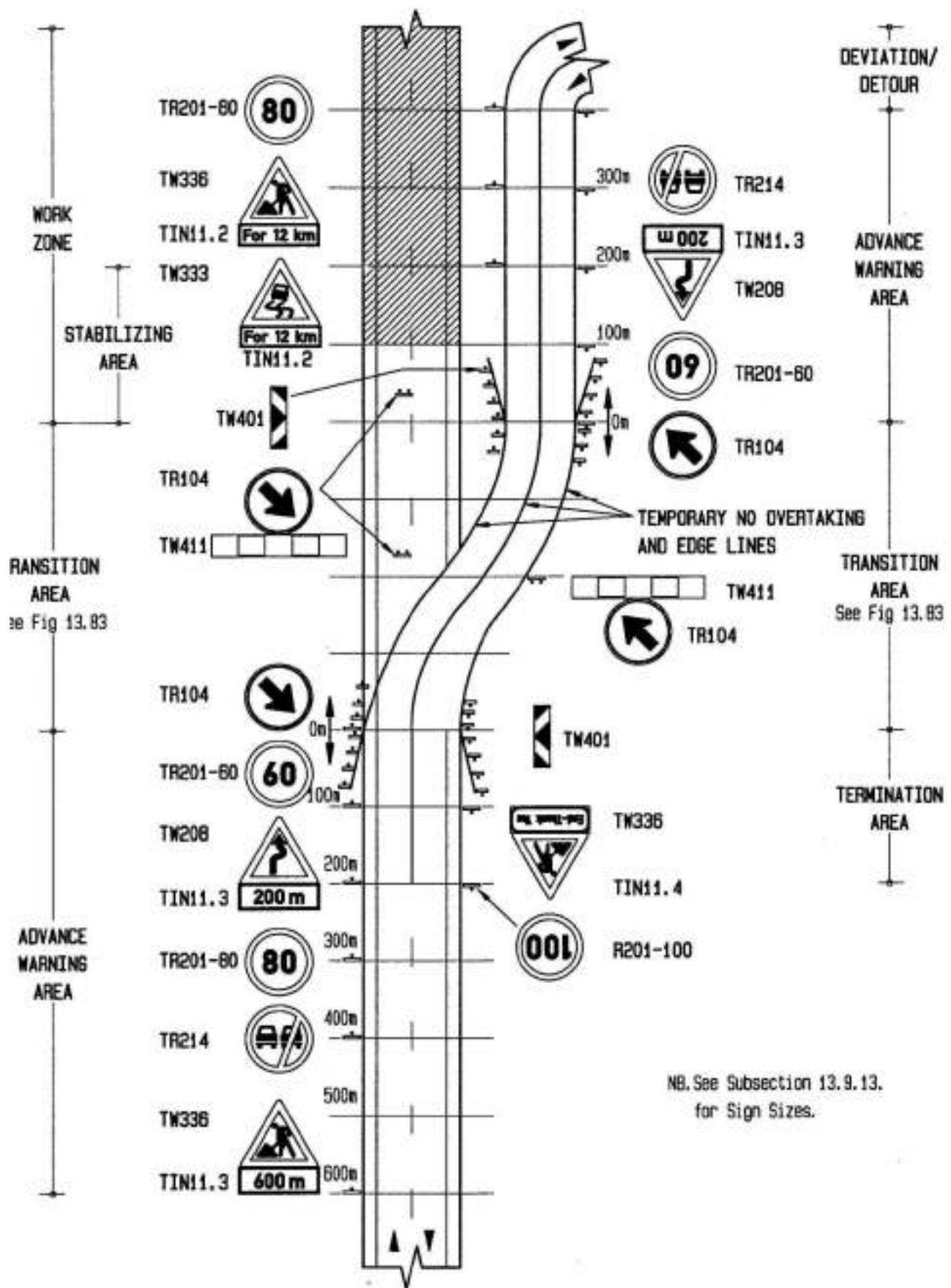


Fig 13.54

Deviation – Low Traffic Volumes

### 13.9.14 Deviation - High Traffic Volumes

- 1 For the purposes of categorising temporary road traffic signing at roadworks the following descriptions of terms commonly used in this chapter are relevant:












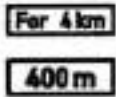
**"deviation":** involves the local redirection of traffic onto a roadway normally used only by traffic travelling in the opposite direction, **or** onto a specially constructed more-or-less parallel temporary roadway; existing direction signs can commonly be re-located to suit the temporary road alignment"; **and**

**"detour":** involves the redirection of traffic **to other parts of the road network** and will normally require the use of temporary direction signs to assist road users to reach their intended destination by alternative routes".

- 2 Detail 13.55.1 in Figure 13.55 is appropriate for the start (and end - in the opposite direction) of a deviation to be used by medium to high traffic volumes. The detail shows a similar signing to that given in Figure 13.54 but with DIAGRAMMATIC signs in the ADVANCE WARNING AREA instead of the advance warning signs depicted in Figure 13.54.
- 3 Once the deviation alignment is established, it may closely parallel the road under construction or it may change its position according to the terrain and available space, but it will remain in relatively close proximity to the main road alignment. According to the space available, the deviation may cross the road construction in one or several places as shown in a typical example in Detail 13.55.2. Detail 13.55.3 shows the sort of situation detail which may require specific signing attention within a deviation, and Detail 13.55.4 illustrates how a deviation may be connected to a section of existing road network to save on deviation construction.
- 4 Signing of the TRANSITION AREAS depicted in Figure 13.55, and any others required within the deviation, should be in accordance with figures in Section 13.12: "Enlarged Standard Details" (see Figures 13.81 to 13.84 in particular).
- 5 Formal "Road Closed" barricades should be established at the limits of each Work Area (see Figures 13.18 and 13.87).

#### Checklist

- ☐ is the geometry and road condition of the entry to the deviation suitable for the indicated speed limit?
- ☐ is there sufficient width through the curves at changes in direction in the deviation to accommodate large vehicles in both directions at the same time?
- ☐ can the deviation be satisfactorily connected to adjacent roads to limit construction costs?

| MAINTENANCE UNIT INVENTORY  |  |                |                    |
|---|--|----------------|--------------------|
| Sign  | No   | Size (mm)      | Quantity           |
|    | TW336-WB                                   | 1200 X<br>1600 | 2                  |
|    | TR201-60<br>TR201-80<br>TR201-100          | 1200           | 2<br>2<br>2        |
|    | R201-120                                   | 1200           | 1                  |
|    | TR214                                      | 1200           | 2                  |
|    | TW336                                      | 1500           | 2                  |
|  | TW411                                      | 2400 X<br>400  | 5                  |
|  | TR104                                      | 1200           | 7                  |
|  | TW202<br>TW203                             | 1500           | 2<br>2             |
|  | TGS 113<br>TGS 114                         | 1200 X<br>1600 | 4<br>4             |
|  | TGS 111<br>TGS 112                         | 1200 X<br>1600 | 2<br>2             |
|  | TW401<br>TW402                             | 150 X<br>600   | 10m-20m<br>centres |
|  | TIN 11.2<br>various<br>TIN 11.3<br>various | 1500<br>1200   | 4<br>10            |



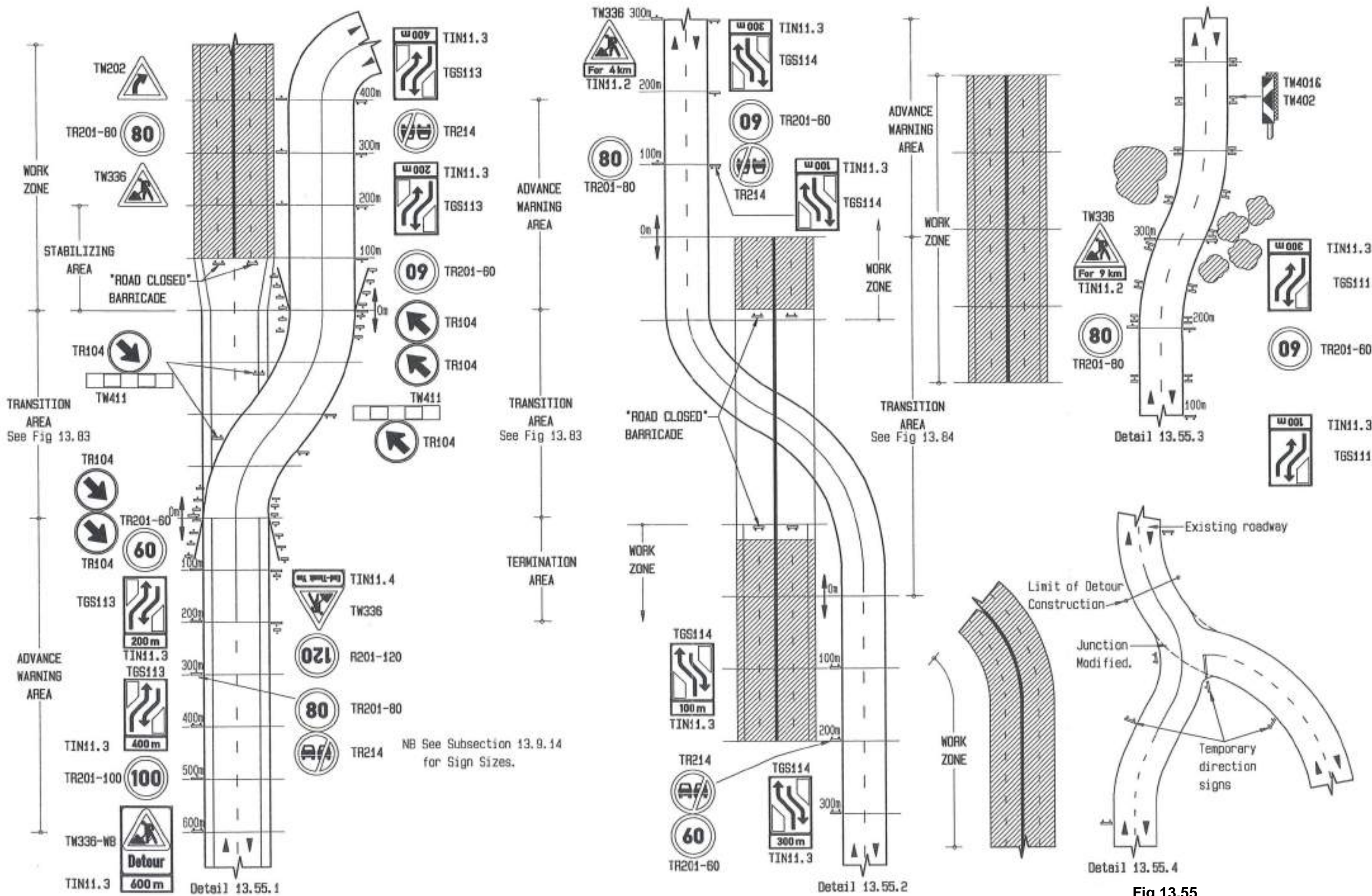


Fig 13.55  
Deviation – High Traffic Volumes

13.9.15 Deviation - 4 Lane Undivided Road

- 1
- Figure 13.56 shows the reduction in width of a 4 lane undivided road into a 2 lane deviation. The detail conforms to the description of a deviation given in Subsection 13.9.14, and will warrant the level of signing appropriate to high traffic volumes likely to be using its 4 lane cross-section.
- 2
- Because of the two lanes approaching the deviation, it will normally be desirable, on a cost and operational basis, to configure the entry to the deviation as a two-lane two-way section of roadway. This configuration requires the dropping of one of the approach lanes, and it is recommended that the lane nearest the centre of the road be dropped, particularly if the road carries even moderate volumes of slow moving vehicles. This arrangement also improves the ability to provide a smoother, longer curve through the entry to the deviation within the limits of the existing roadway width. Should there be circumstances which make the dropping of the lane nearest the edge of the roadway necessary, this may be achieved using DIAGRAMMATIC sign TGS101in place of sign TGS102. Any temporary speed limit through the change of alignment should preferably be within15% (or 20 km/h) of that existing on the approaches. Design standards should take this into account (see Section 13.4).
- 3
- Once the deviation alignment is established, it may closely parallel the road under construction, or it may change its position according to the terrain and available space, but it will remain in relatively close proximity to the main road alignment. Figure 13.55 shows the sort of situations which may require specific signing attention within a deviation.
- 4
- Signing of the TRANSITION AREA depicted in Figure 13.56, and any others required within the deviation, should be in accordance with figures in Section 13.12: "Enlarged Standard Details" (see Figures 13.77 to 13.84 in particular).

Checklist

- ☐ is it appropriate to drop the "fast" lane under the conditions prevailing on the approaches?
- ☐ is the geometry and road condition of the entry to the deviation suitable for the indicated speed limit?
- ☐ is there sufficient width through the curves at changes in direction in the deviation to accommodate large vehicles in both directions at the same time?

| MAINTENANCE UNIT INVENTORY |           |             |          |
|----------------------------|-----------|-------------|----------|
| Sign                       | No        | Size (mm)   | Quantity |
|                            | TW336-WA  | 1200 X 1600 | 2        |
|                            |           |             | 2        |
|                            |           |             | 2        |
|                            | TR201-60  | 1200        | 2        |
|                            | TR201-80  |             | 2        |
|                            | TR201-100 |             | 2        |
|                            | TW336     | 1500        | 2        |
|                            | TR214     | 1200        | 1        |
|                            | TGS101    | 1200 X 1600 | 2        |
|                            | TGS102    |             | 2        |
|                            | TGS125    | 1200 X 1600 | 2        |
|                            | TIN 11.3  | 1500        | 2        |
|                            | TIN 11.3  | 1200        | 2        |
|                            | TIN 11.3  |             | 2        |
|                            | TIN 11.3  |             | 2        |
|                            | TIN 11.3  | 1500        | 2        |
|                            | TIN 11.3  |             | 2        |



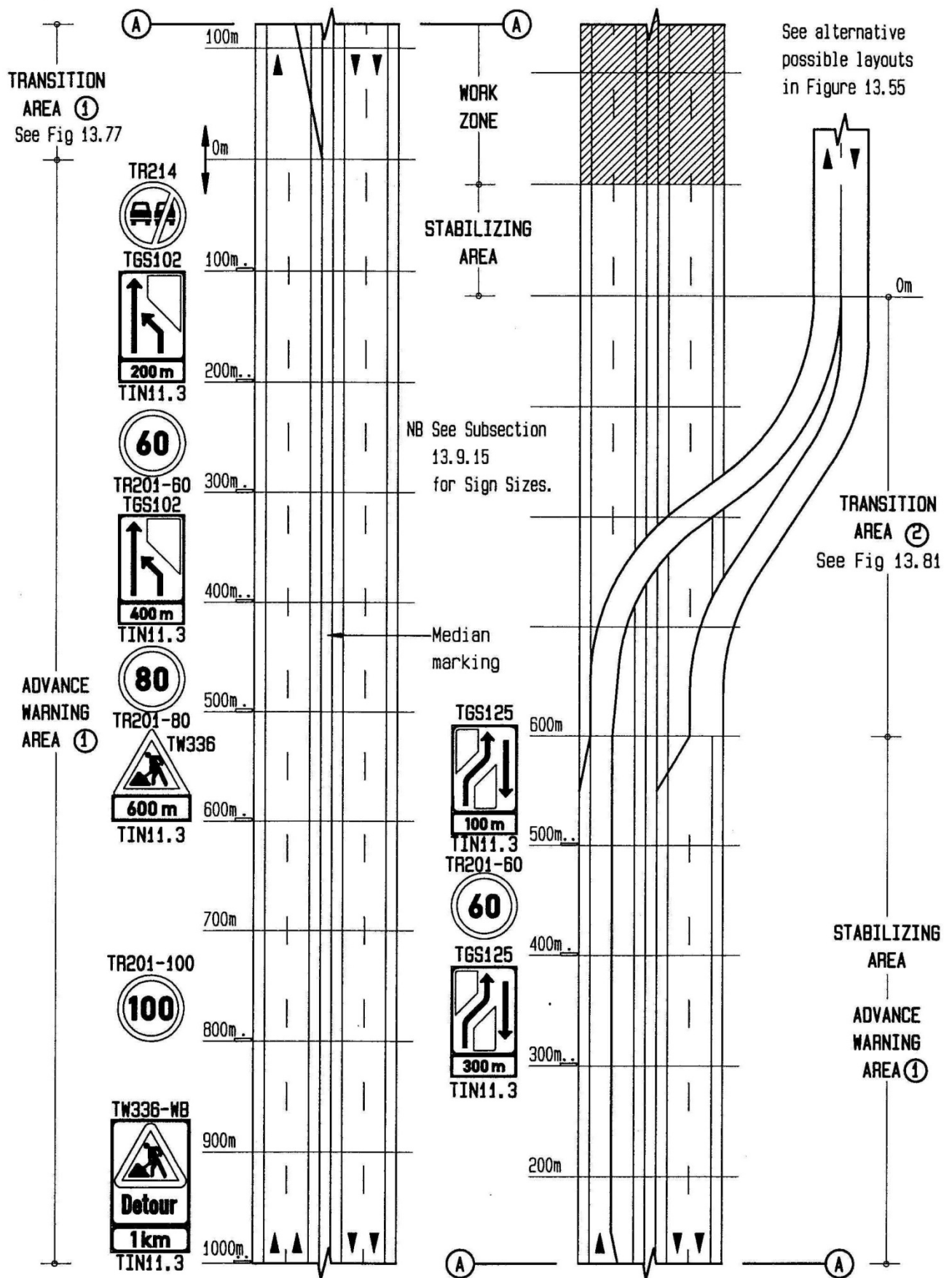


Fig 13.56


Deviation – 4 Lane Undivided Road



## 13.10 SIGNING APPLICATIONS FOR URBAN STREETS

### 13.10.1 General

- 1 The applications of temporary signing for roadworks covered in Sections 13.8 to 13.12 have been subdivided into categories for ease of reference. These categories are:
  - (a) short term works (Section 13.8);
  - (b) rural roads (Section 13.9);
  - (c) urban roads (Section 13.10);
  - (d) freeways and dual carriageway roads (Section 13.11).






Section 13.12 provides enlarged details of elements covered in other sections, and may be appropriate to any or all of the categories listed above.
- 2 The categorisation of applications used should only be considered to be general in nature. Many applications may be appropriate in several or all categories. Such applications are only detailed once to avoid duplication. Practitioners who do not find the application they are seeking in their first choice of category should therefore check other categories. If their required application is not covered, it will be necessary to determine a similar situation and to adapt it, with care, to their needs.
- 3 Section 13.9 and this section deal with rural and urban situations respectively. These terms also should be considered as general and if a "rural" application is appropriate within an urban area, the application details should be used with appropriate adjustments to sign spacing and sizes. The signing of roadworks in peri-urban areas will most likely be catered for by rural category applications.
- 4 In the various figures the following rules or conventions apply:
  - (a) all signs are correctly oriented for the direction of travel to which they apply;
  - (b) to avoid confusion with any arrows on road signs or markings, the direction of travel of traffic is, where relevant, indicated thus  ;
  - (c) all details are given in metres **but all may be directly used as "paces" in practice.**
- 5 Signs should be sized as recommended in Volume 1. As a rule of thumb the following sizes are appropriate for regulatory, warning and diagrammatic signs:
  - (a) Gravel roads:
    - (i) circular signs - 1200 mm diameter;
    - (ii) triangular signs - 1200 mm side length;
    - (iii) diagrammatic signs - 1200 mm x 1600 mm;
  - (b) Bituminous, concrete or brick surfaced roads:
    - (i) circular signs - 1200 mm diameter;
    - (ii) triangular signs - 1500 mm side length;
    - (iii) diagrammatic signs - 1200 mm x 1600mm.
  - (c) Urban streets:
    - (i) circular signs - 900 mm/1200 mm diameter;
    - (ii) triangular signs - 900 mm/1200 mm side length;
    - (iii) diagrammatic signs - 1200 mm x 1600 mm.

### 13.10.2 Urban Roadworks

- 1 The temporary signing of urban roadworks situations is commonly influenced by the following factors, either separately, or in combination:
  - (a) limited space to accommodate signs and traffic;
  - (b) high traffic volumes (even moderate urban traffic flows are high by rural standards);
  - (c) the presence of pedestrians;
  - (d) the need to maintain access to many properties.
- 2 Roadworks situations in urban areas vary widely in their signing requirements and operational characteristics including, as they do, such environments as:
  - (a) quiet residential streets;
  - (b) high capacity arterial streets;
  - (c) congested central business districts
- 3 Factors which commonly mitigate against the effectiveness of temporary road signs in urban areas, and which must be recognised and taken into account, include:
  - (a) street lighting - which may not, as might be expected, improve signing at night, due to stray reflections and reduced luminance contrast so that signs need to be positioned with care;
  - (b) obscuration of signs by trees, street furniture and by large vehicles;
  - (c) limited sight distances.
- 4 The examples covered in this section illustrate individual situations. In practice a large urban roadworks site may include several such situations within the one site. The signing treatment must therefore take into account the individual situations and the collective effect of all situations from a driver's perspective.
- 5 Many roadworks tasks in urban areas will be of short term duration, commonly undertaken between morning and evening peak traffic. Those examples within an obviously urban environment are included in this section, but many of the examples given in Section 13.8 are also relevant to urban areas.

### 13.10.3 Temporary Traffic Signals

- 1 Temporary traffic signals are an alternative form of temporary traffic control for use on two-way roads which are reduced to one-way operation during roadworks. The use of temporary traffic signals is appropriate at any time, subject to cost effectiveness, as an alternative to the manual STOP/RV-GO operation. However, their use is recommended when such restricted conditions have to be maintained during the hours of darkness.
- 2 The arrangement of light aspects of temporary traffic signals shall conform to the prescribed arrangements for permanent signals as illustrated in Volume 1. All component dimensions and installation dimensional criteria for temporary traffic signals shall conform to details given in Volumes 3 and 4.
- 3 The operation of temporary traffic signals may utilize any appropriate, proven, electrical/electronic control system, either linked by cable or not, **provided adequate fail-safe back-up systems are included.**
- 4 Ideally, the timing of temporary traffic signals should be closely related to actual vehicle arrivals (vehicle actuation) rather than by means of fixed time cycles. Where necessary, detection devices should include the ability to detect the presence of vehicles at the STOP LINE and give an indication of queue length. Due to the dual direction, alternating one-way operation associated with traffic signals in a roadworks installation, it is necessary that a long, specifically calculated, clearance all-red period be provided. This will allow the last vehicle to enter the section sufficient time to leave it, before opposing traffic is released.
- 5 In a similar manner to STOP/RV-GO operation, temporary traffic signals may be operated in isolation at a localised site or as part of the overall traffic control signing of a major roadworks site.
- 6 Figure 13.57 shows a typical urban traffic signal application with short advance warning distances. Provided a power source is available, temporary traffic signals may be used in rural situations. When used on a road with high vehicle approach speeds, all advance warning signs should be located at distances consistent with rural roadworks sign sequences (see Section 13.9).

| TYPICAL SIGN REQUIREMENTS  |                |                    |                                 |
|--|----------------|--------------------|---------------------------------|
| Sign   | No             | Size (mm)          | Quantity                        |
|     | TR103<br>TR104 | 900                | 1<br>1                          |
|     | TW301          | 900 <sup>(1)</sup> | 2                               |
|     | TW329<br>TW330 | 900 <sup>(1)</sup> | 1 of each                       |
|     | TD4            | 450                | Taper 24<br>plus 10<br>per 100m |
|     | TIN 11.3       | 900 <sup>(1)</sup> | 2                               |
| (1) Sizes indicated for 60km/h. Increase to 1200mm for over 60km/h or for rural use. |                |                    |                                 |

#### Checklist

- ☐ will the need for one-way operation extend into dusk and night time?
- ☐ is a power supply available?
- ☐ are traffic volumes known in order to set up cycle limit criteria under vehicle actuated operation?
- ☐ what are the fail-safe characteristics of the equipment?
- ☐ are the advance warning signs correctly located for appropriate vehicle approach speeds?
- ☐ will the end of a queue always be visible to approaching vehicles within stopping sight distance requirements?

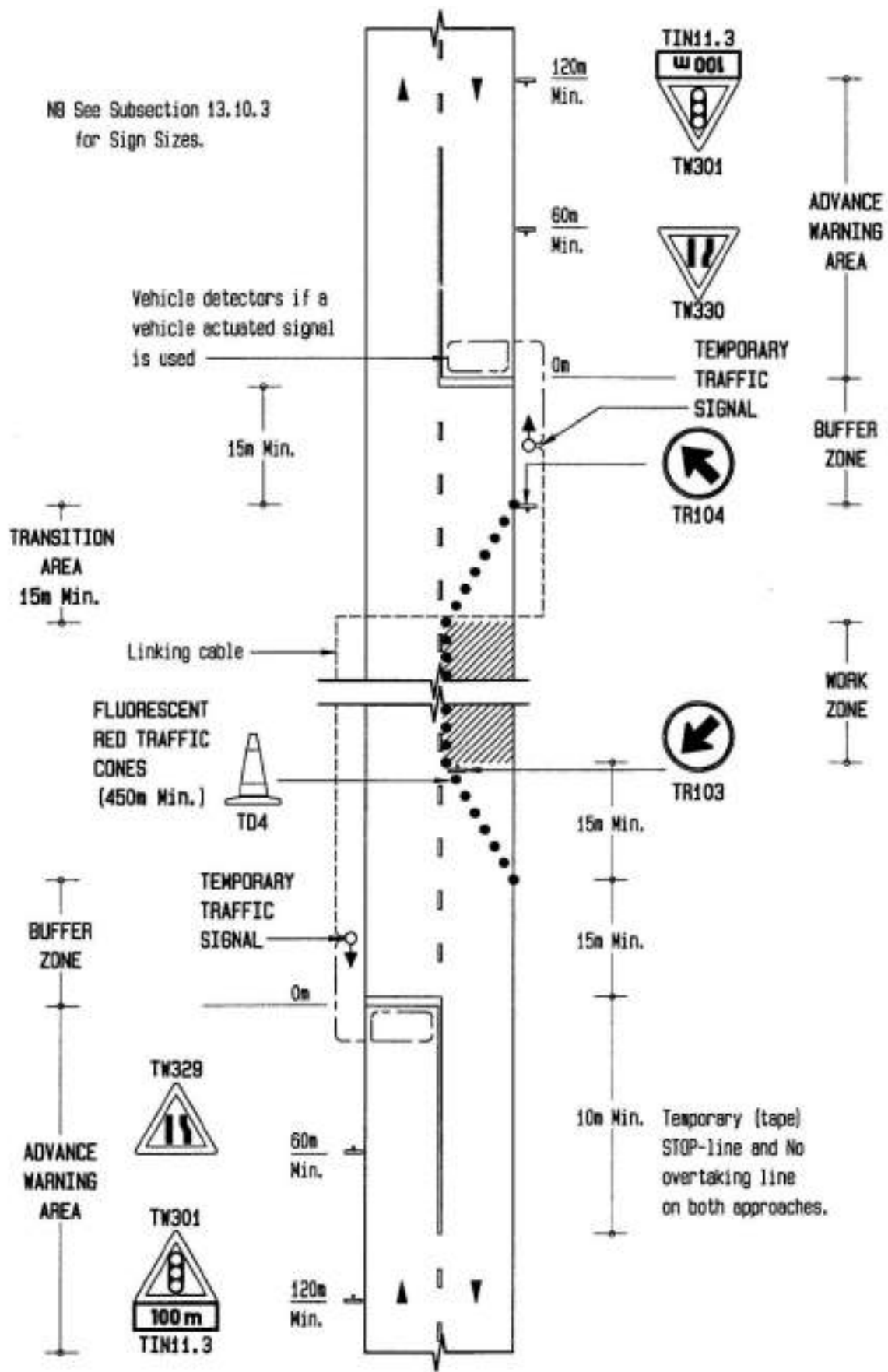











Fig 13.57

Temporary Traffic Signals

### 13.10.4 Sidewalk Deviation

- 1 It is an important aspect of the safety arrangements of urban (and other) roadworks sites that specific accommodation shall be made for pedestrians. It is too common an occurrence that pedestrians are left to their own devices and expected to just disappear, or to walk within reduced spaces provided for vehicles, totally without protection. Given the numbers of pedestrians on our roads at all times of day and night, it is quite unreasonable that, if the exclusion of pedestrians should be required, or advisable, adequate provisions are not made to redirect the pedestrians to an alternative route. Any authority or contractor not making adequate provision for pedestrians could, in the event of an accident, find themselves facing serious litigation.
- 2 Figure 13.58 shows a typical arrangement for the accommodation of pedestrians due to the temporary, and localised, excavation of the sidewalk. Such a situation may be an isolated excavation, with no other associated roadworks, such as a local repair to a water main, sewer, electrical cable or other underground service, or similar excavations may be required at one or more places within a larger site. In the latter case the signs provided within the ADVANCE WARNING AREA may be modified according to specific site requirements. It should be noted that the table of signs opposite is a typical listing only, and is not intended to be a definitive inventory.
- 3 Figure 13.58 shows the option to use modular PEDESTRIAN DIRECTION signs (see Volume 1, Chapter 4). The manufacture of temporary arrow signs TGP1, TGP2, TGP3 and TGP4 is, due to the square shape, identical. It is recommended that contractors order "left-" and "right-handed" versions of sign TGP9. These signs should only be used when the revised pathway available to pedestrians may not be obvious to them. Night-time conditions should be borne in mind when assessing this need. These pedestrian direction sign are particularly important to emphasise to pedestrians the need to NOT take a route within the roadway, either with, or in the face of, on-coming traffic. If a normally available path is completely cut-off to pedestrians, this should be indicated by means of NO PEDESTRIANS sign TR218 (or NO CYCLISTS OR PEDESTRIANS sign TR220).
- 4 The figure shows the use of TEMPORARY BARRICADE signs TW411. These may be replaced by a local authority if it has a custom made device. However, these need to have retroreflective properties and should not simply be painted. Any traffic cones shall be provided with retroreflective sleeves if left in place during times of poor visibility.

| TYPICAL SIGN REQUIREMENTS  |                      |               |                                  |
|--|----------------------|---------------|----------------------------------|
| Sign   | No                   | Size (mm)     | Quantity                         |
|   | TW336                | 900           | 2                                |
|   | TW329<br>TW330       | 900           | 1<br>1                           |
|   | TR104                | 900           | 2                                |
|   | TW411                | 300 X<br>1800 | 10 Min                           |
|   | TD4                  | 450           | Tapers 24<br>plus 10<br>per 100m |
|                                        | TR217<br>Optional    | 900           | 1                                |
|                                      | TGP4<br>plus<br>TGP9 | 900 X<br>675  | <sup>(1)</sup><br>1              |
|                                      | TGP3<br>plus<br>TGP9 | 900 X<br>675  | <sup>(1)</sup><br>1              |
|                                      | TGP1<br>plus<br>TGP9 | 900 X<br>675  | <sup>(1)</sup><br>1              |
| (1) Due to the modular nature of PEDESTRIAN DIRECTION signs, arrow signs may be used to point in any of four directions. |                      |               |                                  |

#### Checklist

- ☐ is pedestrian deviation within the roadway?
- ☐ are cones and barricades retroreflective?
- ☐ are PEDESTRIAN DIRECTION signs required for the safety of pedestrians?
- ☐ are pedestrian prohibition signs required?

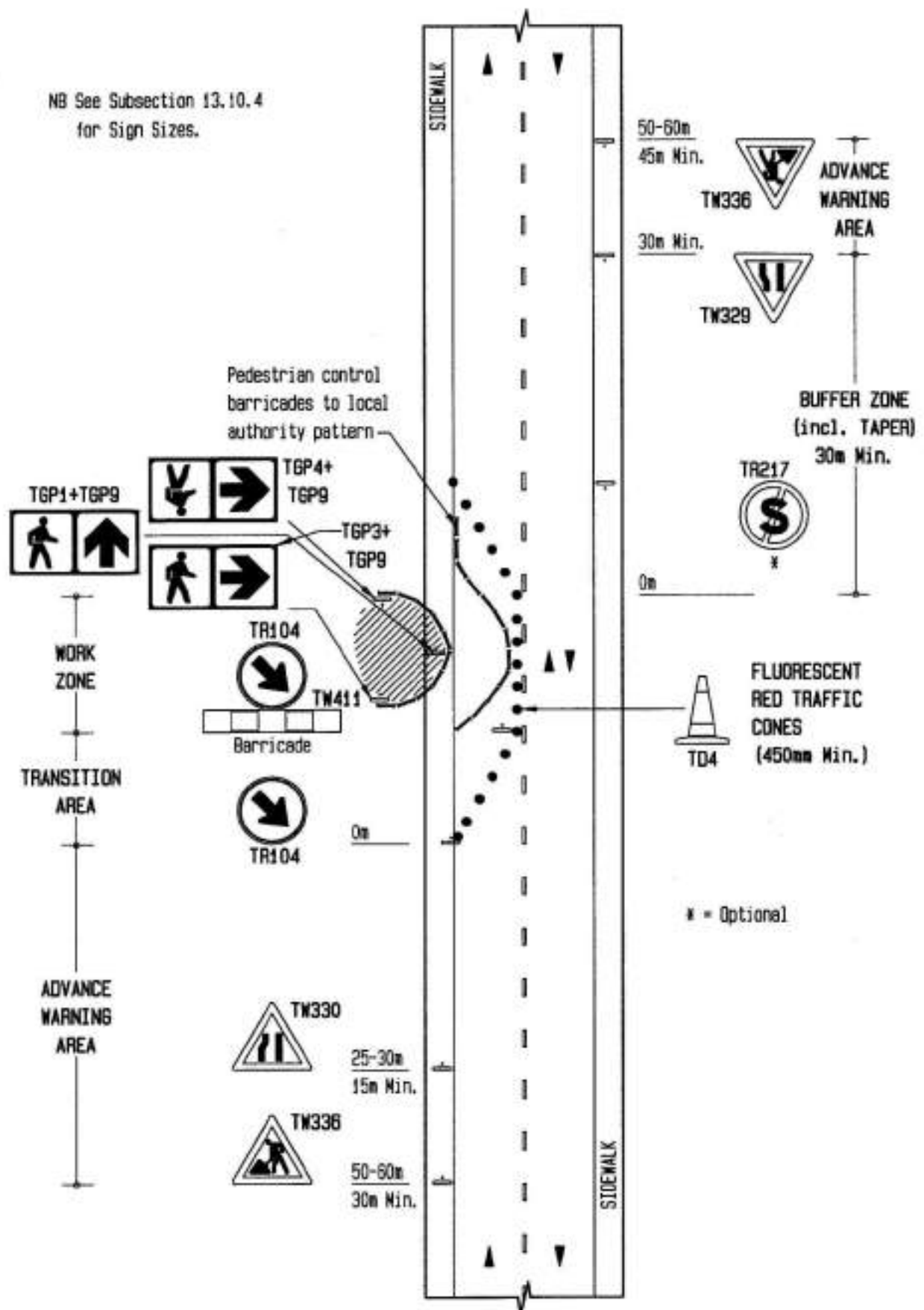







Fig 13.58

Footway Deviation



### 13.10.5 Localised Work Site - Good Visibility

- Figure 13.59 illustrates a very common work site in urban areas. The fact that the type of site occurs frequently and is often only in position for a short time, tends to result in very poor control of correct signing practices. The fact that the site is small and likely to be of short duration, is no excuse for not thinking through the requirements for correct signing practices and for not carrying them out.
- The sign inventory and application has been kept to a minimum to facilitate ease of use. This in itself is a reason for paying attention to localised details. Since the signing effectively comprises one "cluster" of three signs and a number of TRAFFIC CONES TD4, it is essential that the signs are visible and do not become hidden by other street clutter. The visibility of the signs is, for example, of higher priority than sticking faithfully to the distances noted in the figure. A particularly important local detail could be the presence of a crest in the road, in which case, the sign "cluster" may need to be moved a greater distance from the work site in order for it to be visible to approaching drivers. If such an action is taken, the TRANSITION AREA and longitudinal BUFFER ZONE should be extended so that vehicles cannot get between the cluster and the WORK AREA. This signing application is only appropriate for situations where sufficient space remains for two-way traffic. If two-way traffic is not possible, or a lane drop is required on a multi-lane road, then STOP/RV-GO control (Figure 13.37), temporary traffic signals (Figure 13.57), or one of the several lane-drop details (Figures 13.35, 13.36 or 13.37), should be considered.
- The service unit vehicle is shown parked on the "downstream" side of the WORK AREA to make the vehicle less vulnerable and make it easier to drive away from the site when necessary. However, under certain circumstances the vulnerability of the vehicle may be secondary to the safety of the workers, and it may be beneficial in fact to park the vehicle "upstream" of the WORK AREA, particularly if the vehicle is equipped with FLASHING YELLOW WARNING LIGHTS SS3.

| TYPICAL SIGN REQUIREMENTS  |                      |              |                                 |
|--|----------------------|--------------|---------------------------------|
| Sign   | No                   | Size (mm)    | Quantity                        |
|   | TW336                | 900          | 2                               |
|   | TR103<br>or<br>TR104 | 900          | 1                               |
|   | TW401                | 800 X<br>200 | 1                               |
|   | TD4                  | 450          | Taper 12<br>plus 10<br>per 100m |
|  | Maintenance<br>Stand |              | 1                               |

#### Checklist

- ☐ is the sign cluster clearly visible to approaching drivers?
- ☐ is there a crest in the road or a curve or sharp bend on the approach to the site?
- ☐ is there sufficient space available for two-way traffic to pass the WORK AREA?
- ☐ should the service vehicle be parked on the upstream side of the site?
- ☐ does the service vehicle have flashing yellow warning lights?

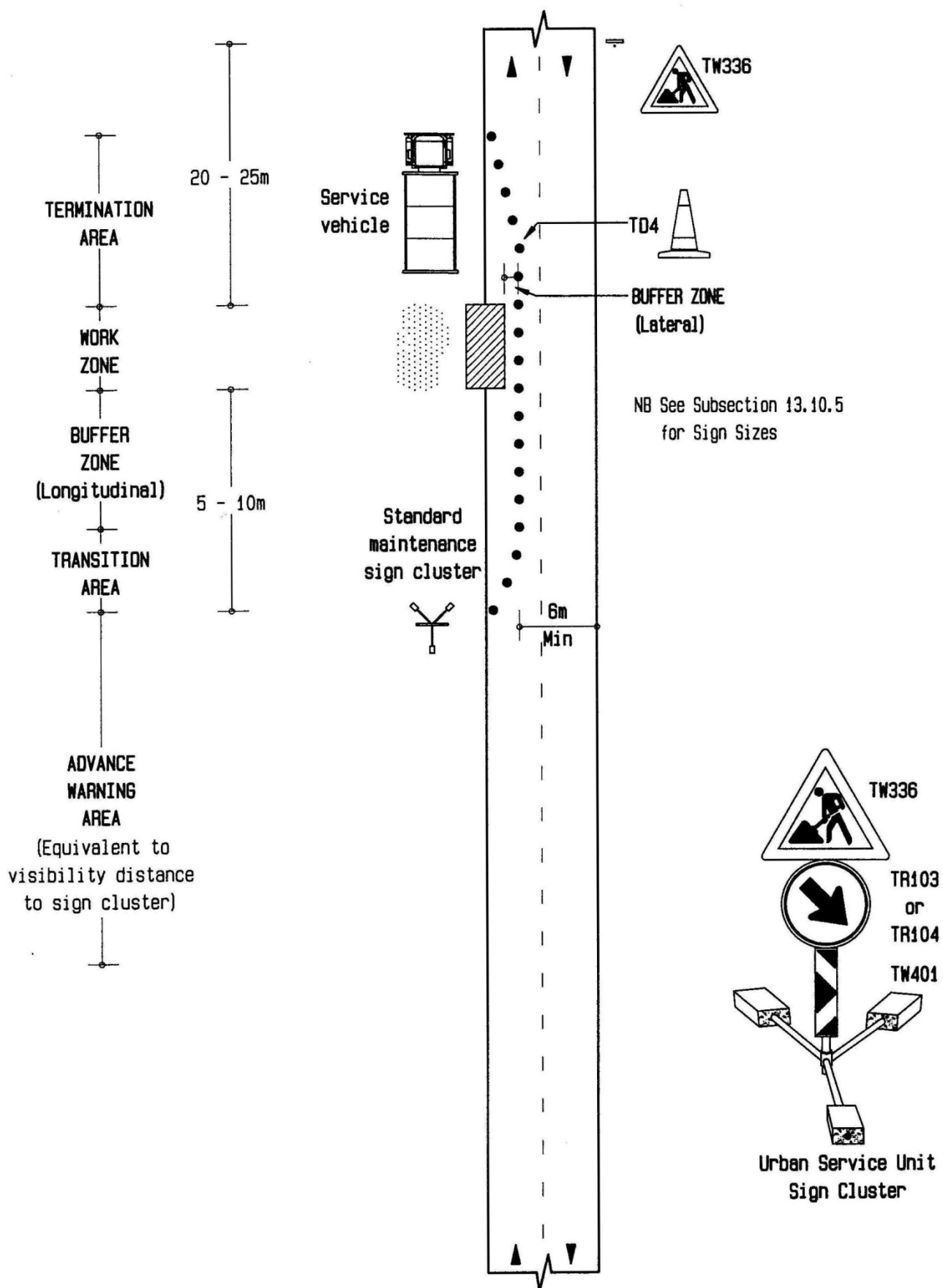


Fig 13.59






Localised Work Site – Good Visibility

### 13.10.6 Lane Closed Beyond a Junction

- 1 It is a common feature of urban roadworks that it is often necessary to work close to the corner of a junction, and often on the far side. It is also common that such junctions will be signalised. In order to avoid a merging movement within the junction, which has a real potential to "lock up" and affect the operation of the junction for other traffic flows, it is recommended that traffic be directed into the adjacent lane on the approach side of the junction, as shown in Figure 13.60, to correctly align vehicles to cross the junction and avoid the work site. The detail of Figure 13.60 should be considered as representative of appropriate signing principles. Individual sites will vary significantly, but can be dealt with safely, if the principles are adhered to and modified in detail as necessary.
- 2 Depending on the lane configuration at the junction, and the directions of flow of traffic, it may be possible to set the narrowing taper sufficiently far back from the STOP line to permit one or two left turning vehicles to enter the closed lane after having first gone round the tapered "island".
- 3 Since the roadworks may also affect turning traffic on the intersecting crossroad, it is recommended that ROADWORKS advance warning signs TW336 be placed conspicuously on the relevant approaches.

#### Checklist

- ☐ is there space to accommodate a coned-off island on the approach side of the junction?
- ☐ can such an island be set back to permit left turning traffic the use of the lane?
- ☐ have TW336 signs been placed on the intersecting side road?

| TYPICAL SIGN REQUIREMENTS  |       |            |                           |
|--|-------|------------|---------------------------|
| Sign   | No    | Size (mm)  | Quantity                  |
|   | TW336 | 900        | 3                         |
|   | TR104 | 900        | 3                         |
|   | TW330 | 900        | 1                         |
|   | TW411 | 300 X 1800 | 2                         |
|  | TD4   | 450        | Taper 20 plus 10 per 100m |

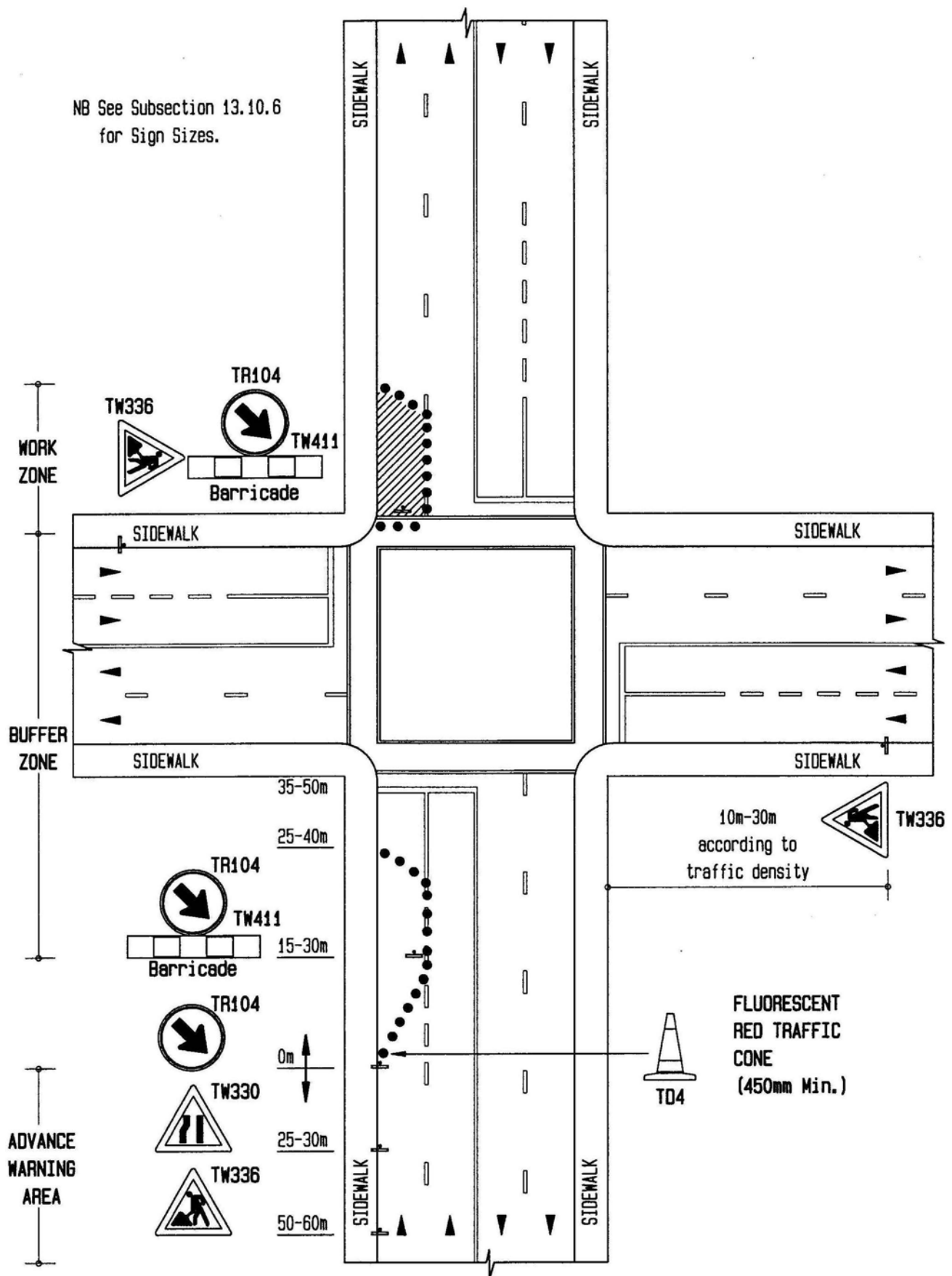


Fig 13.60








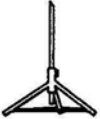
Lane Closed Beyond a Junction

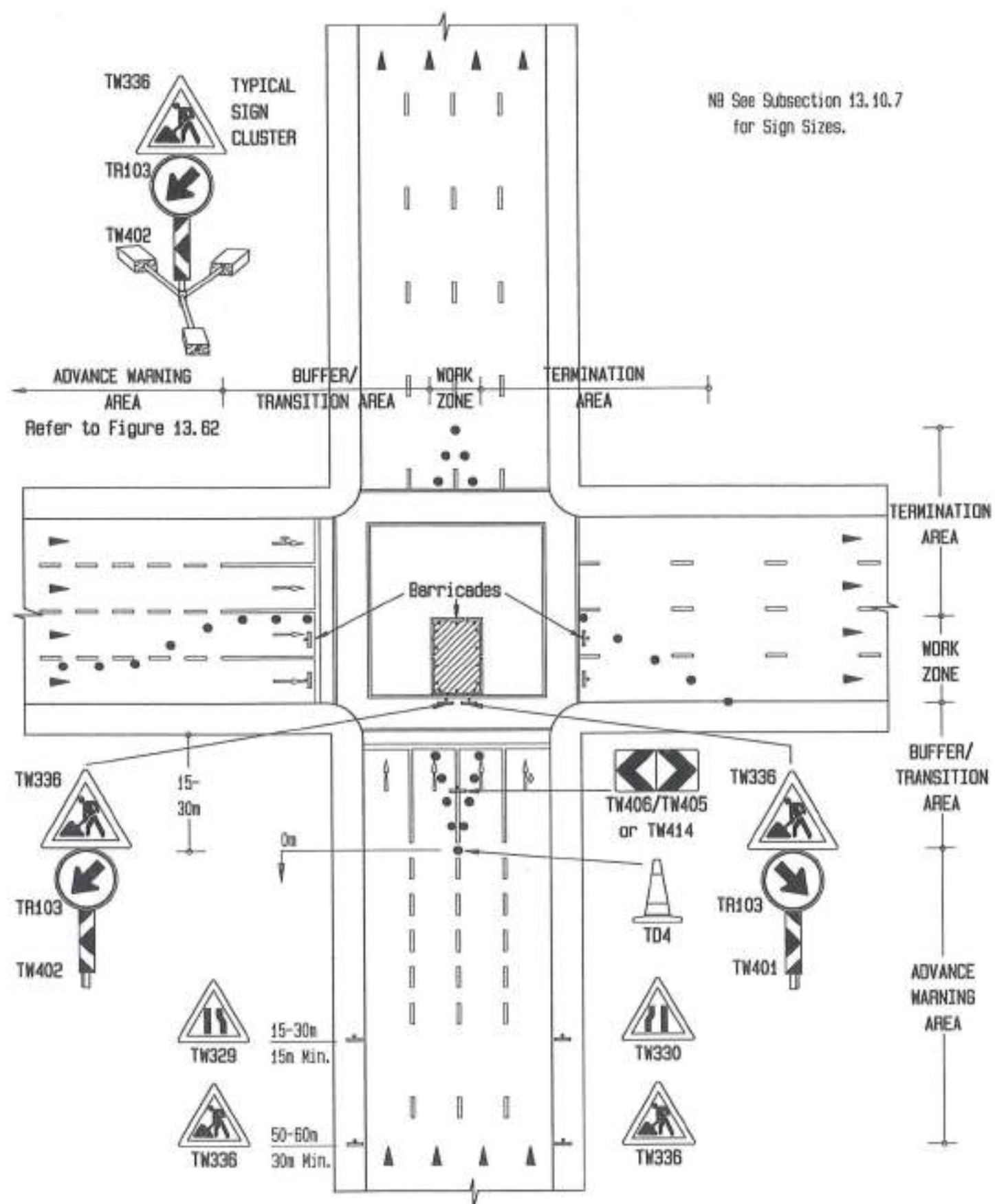
### 13.10.7 Work within a Junction

- 1 Figure 13.61 shows two details covering aspects of work within a junction. As with all similar cases (see Figure 13.60), there are a great many possible variables which may have an effect on the detail of such temporary signing applications. Details 13.61.1 and 13.61.2 should be considered as indicative of the appropriate basic signing concepts for such situations which are subject to detail refinement according to local circumstances.
- 2 Detail 13.61.1 shows work in the centre of one side of the junction between two one-way roadways. The effect on traffic is different for each of the intersecting approaches. In the one case, traffic can be diverted to both sides of the site. This will generally result in the merging of four lanes down to two. Such a traffic manoeuvre will only be practical during off-peak periods. The tapers on the approach side "island" shall be in accordance with the provisions of Table 13.5 and cone or delineator spacings should conform to Table 13.4. Traffic on the intersecting roadway also has to reduce from four lanes to two. Subject to the block length available, this should be accomplished in two parts - each part reducing by one lane at a time (see Figure 13.62). If necessary, one lane should be dropped on the previous block.
- 3 Detail 13.61.2 shows work in the centre of the junction area of intersecting two-lane, two-way roadways. Each approach is treated in the same way so that, on entry and exit paths, the normal two lanes are reduced to one lane. In this case the taper lengths making up the coned-off "islands" shall also conform to Table 13.5 and cone spacings should be according to Table 13.4.
- 4 If work in these types of environment cannot be confined to off-peak periods, then serious consideration should be given to a partial or complete road closure with the attendant need to redirect traffic using appropriate temporary ROUTE MARKER signs or DIRECTION signs.

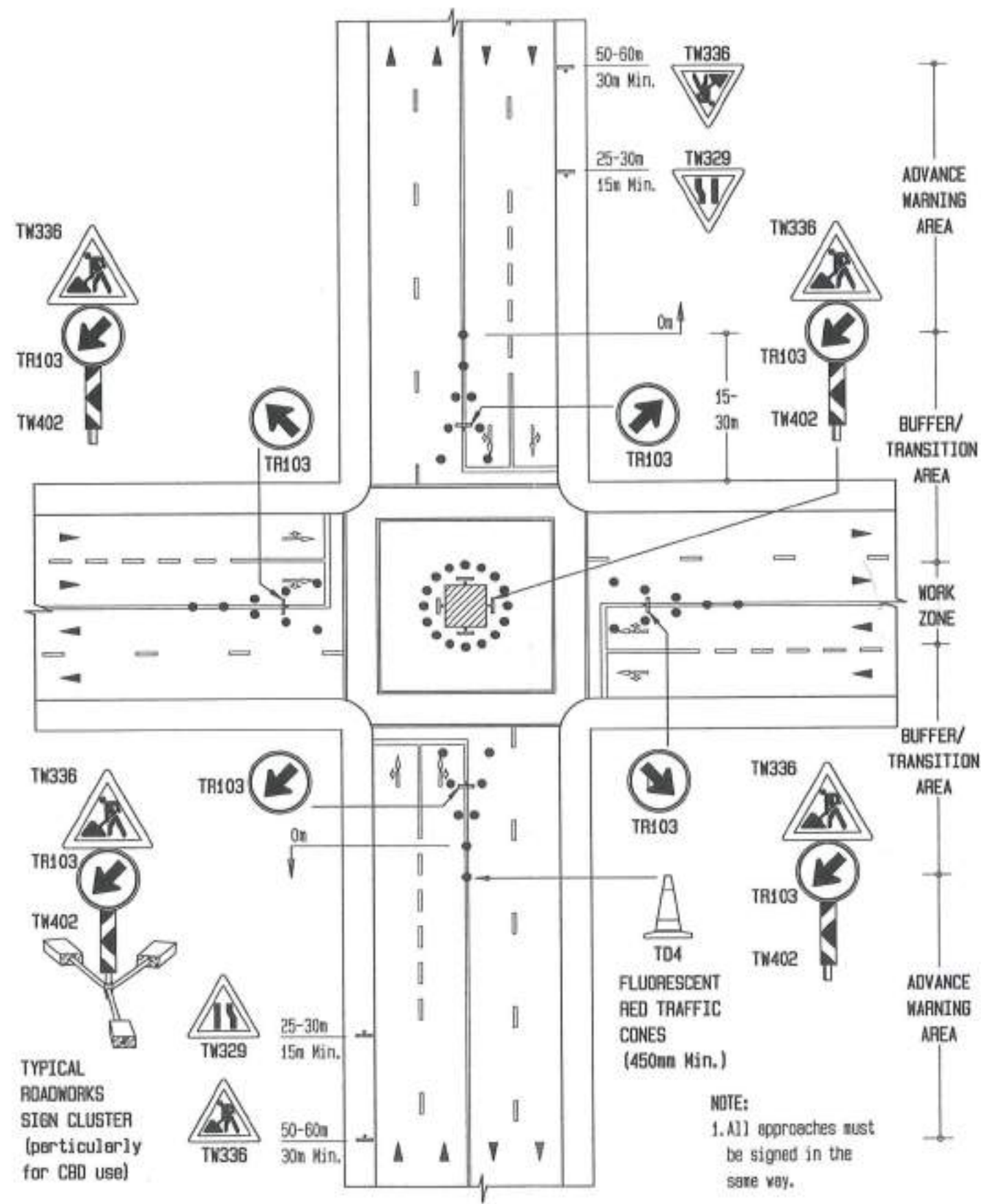
#### Checklist

- ☐ is work scheduled for a short period only?
- ☐ if work is to include peak traffic times will there be sufficient road capacity for traffic?
- ☐ will limited advance warning signing be adequate or should DIAGRAMMATIC signs be considered?
- ☐ will it be necessary to consider partial or full road closure?
- ☐ will temporary signs be required to redirect traffic by alternative routes?

| TYPICAL SIGN REQUIREMENTS   |                                   |               |  |
|---|-----------------------------------|---------------|--|
| Sign  | No                                | Size (mm)     | Quantity   |
|    | TW336                             | 900           | 5  |
|    | TW329<br>TW330                    | 900           | 1<br>1   |
|    | TR103<br>TR104                    | 900           | <sup>(1)</sup><br>2 or 8<br><sub>1<sup>(1)</sup></sub> |
|    | TW401<br>TW402                    | 800 X<br>200  | <sup>(1)</sup><br>2 <sup>(1)</sup> or 4 <sup>(2)</sup> |
|   | TD4                               | 450           | 26 <sup>(1)</sup><br>or<br>45 <sup>(2)</sup>           |
|    | TW411<br>Pedestrian<br>Barricades | 300 X<br>1800 | <sup>(3)</sup><br>14                                   |
|    | TW405/<br>TW406<br>or TW414       | 400           | <sup>(1)</sup><br>1                                    |
|    | Maintenance<br>Stand              |               | 4  |
| <p>(1) Number required for 4 lane, one-way operation junctions.</p> <p>(2) Number required for 4 lane, two-way operation junctions.</p> <p>(3) The number of pedestrian barricades required depends on the size of the work area.</p> |                                   |               |  |



### Detail 13.61.1



Detail 13.61.2




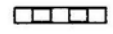


### Fig 13.61 Work Within a Junction

13.10.8 Work in a One-Way Street

- 1 In an urban context the signing application illustrated in Figure 13.62 could apply to a multi-lane one-way street in a central business district (CBD) environment, or to one carriageway of a dual carriageway roadway. The signing depicted recognises the likely shortage of space to accommodate signs, common in a CBD. As a result, LANE DROP advance warning signs TW214 (or TW215) are specified. If this specification is used, then the TW214/TW215 signs shall be mounted at an adequate height, likely to be well above the minimum recommended in Table 13.1, to ensure their visibility.
- 2 When space is available, as would be more likely on a dual carriageway roadway, it is recommended that the appropriate DIAGRAMMATIC signs be used in place of signs TW214/TW215. For details of such an application see Figure 13.80.
- 3 The specific application shows two out of four lanes dropped to create a work area. When two lanes are dropped, they shall be dropped one lane at a time with a suitable STABILIZING AREA between the two lane drop TRANSITION AREAS. If necessary, one lane shall be dropped within the preceding city block or section of road. Adequate longitudinal and lateral BUFFER ZONES must be provided. For medium to long term sites, road markings shall be removed over the lengths of the tapers.
- 4 Due to the proximity of pedestrians to the WORK AREA, it is essential that this area be well barricaded.
- 5 For full details of the setting out of signs on tapers see Tables 13.4 and 13.5, and Figures 13.77 and 13.78.

Checklist

- ☐ is there sufficient space for DIAGRAMMATIC signs?
- ☐ are the advance warning signs mounted high enough for good visibility?
- ☐ if traffic cones are used do they have clean retroreflective sleeves?

| TYPICAL SIGN REQUIREMENTS  |       |            |   |
|--|-------|------------|---|
| Sign   | No    | Size (mm)  | Quantity                                    |
|     | TW336 | 900        | 2   |
|     | TW214 | 900        | 2   |
|     | TR103 | 900        | 5   |
|     | TW411 | 300 X 1800 | <sup>(2)</sup><br>13 Min                    |
|     | TD4   | 450        | <sup>(1)</sup><br>Taper 30 plus 10 per 100m |
|    | TW402 | 800 X 200  | Taper 30 plus 10 per 100m                   |
| (1) TD4 and TW402 are alternatives.  |       |            |   |
| (2) The number of pedestrian barricades required depends on the size of the work area. |       |            |   |



NB See Subsection 13.10.8  
for Sign Sizes.

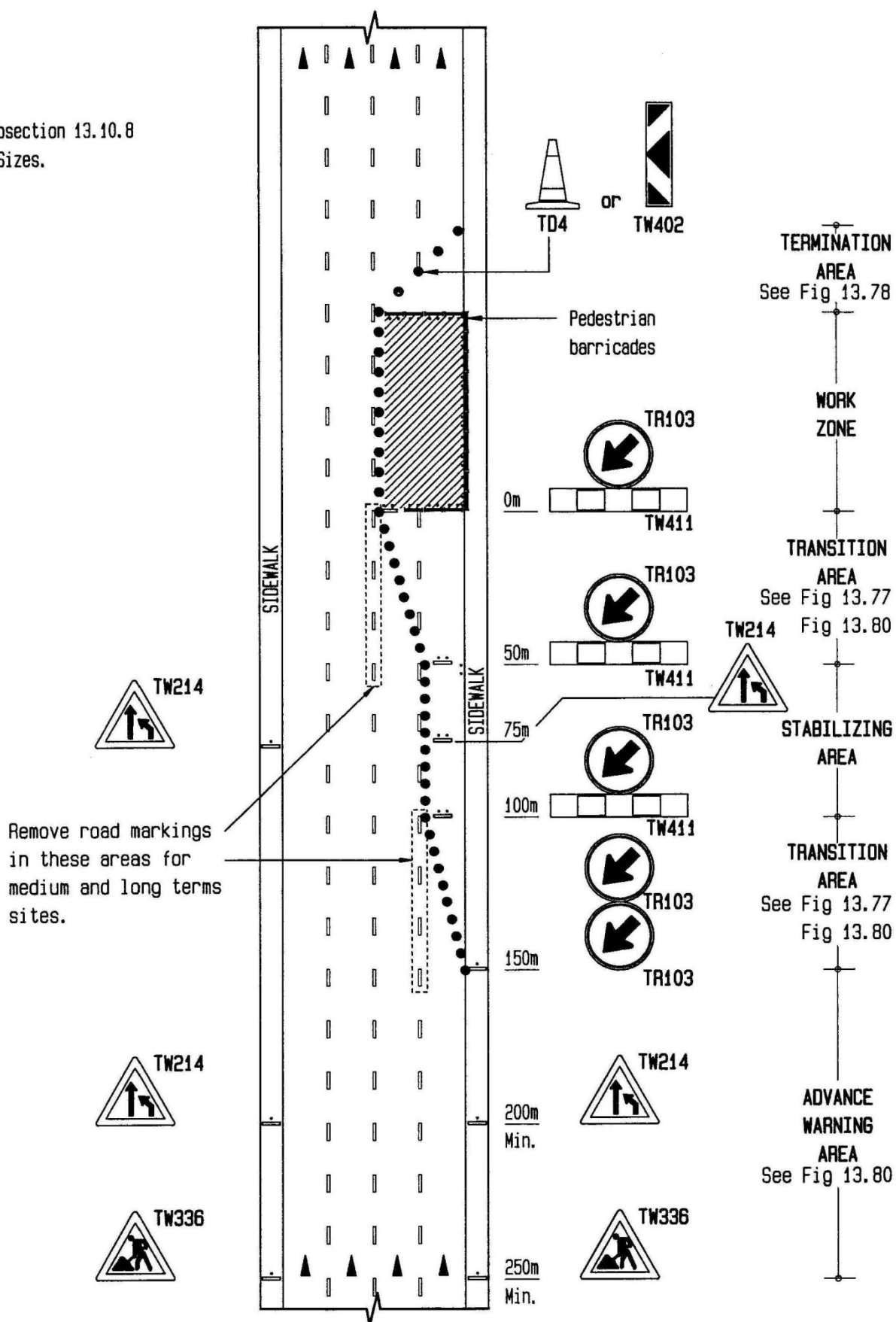


Fig 13.62












Work in a One-Way Street

### 13.10.9 Road Closure - CBD

- 1 The examples given in Figure 13.63 should not be considered as prescriptive to all road closure situations within typical central business district environments. They are representative of the sort of provisions which need to be dealt with, but the actual combination of circumstances is likely to vary widely. The two examples show a total road closure. This may be varied to accommodate construction traffic or local access. Typical signs used for such purposes are shown in Figures 13.18, 13.87 and 13.88.
- 2 The temporary regulatory and warning sign requirements for this type of closure will largely depend on the directional configuration of the intersecting streets and the need to make local lane use adjustments. In Detail 13.63.2, the traffic in the road that is closed is forced, due to the one-way system, to make a right turn. It is likely to be operationally very difficult to turn four lanes of traffic in parallel. In such a situation, it would likely improve operation to drop the inside lane in advance of the junction.
- 3 The examples portray a metropolitan CBD with numbered metropolitan routes. When a road closure of this nature is implemented, it is important to simultaneously provide temporary ROUTE MAKER ADVANCE DIRECTION and DIRECTION signs to lead drivers through the detour and back to their intended direction of travel. It may be advisable to give drivers entering the detour reassurance by means of a MAP-TYPE ADVANCE DIRECTION sign TGD9 which should show them, in a simple way, that they will be able to return to the route beyond the roadworks.
- 4 The principles indicated in the details and described in the previous paragraph are equally appropriate to smaller towns. When the roads concerned are provincial or regional numbered routes, the use of temporary ROUTE MARKER signs is recommended as an inexpensive solution to directing drivers through the detour.
- 5 Detours as significant as those illustrated here, should not be implemented without widespread advance publicity.
- 6 An inventory box is included to indicate the types of signs which will commonly be required, but quantities are a guideline only.

#### Checklist

- ☐ has a public information campaign been implemented?
- ☐ is the detour able to handle the re-directed traffic without major delays?
- ☐ should some wider ranging form of detour be considered?
- ☐ does local access to the site area need to be maintained - and if so can it be maintained?

| TYPICAL SIGN REQUIREMENTS  |                    |                |  |
|--|--------------------|----------------|--|
| Sign   | No                 | Size (mm)      | Quantity   |
|                                     | R3                 | 900            | 1  |
|                                     | TR105<br>TR106     | 900            | 1 <sup>(2)</sup>   |
|                                     | TR209<br>TR210     | 900            | 1<br>1   |
|                                     | TW336-WB           | 1200 X<br>1600 | <sup>(1)</sup><br>1 or <sup>(2)</sup><br>2   |
|                                     | TW336              | 1200           | <sup>(1)</sup><br>2 or <sup>(2)</sup><br>1   |
|                                     | TW407<br>TW408     | 1200 X<br>400  | <sup>(1)</sup><br>2 or <sup>(2)</sup><br>7<br><sup>(1)</sup><br>2 or <sup>(2)</sup><br>7 |
|                                   | TGE12.3<br>TGE12.4 | 900 X<br>600   | 1  |
|                                   | TGE12.1<br>TGE12.2 | 725 X<br>600   | 1  |
|                                   | TGE12.5            | 400 X<br>600   | <sup>(1)</sup><br>1  |
|                                   | TGD9               | 1800 X<br>2400 | 1  |
|                                   | TW409              | 2400 X<br>400  | <sup>(1)</sup><br>1  |
| (1) Number of signs required for two-way road junctions.<br>(2) Number of signs required for one-way road junctions. |                    |                |  |

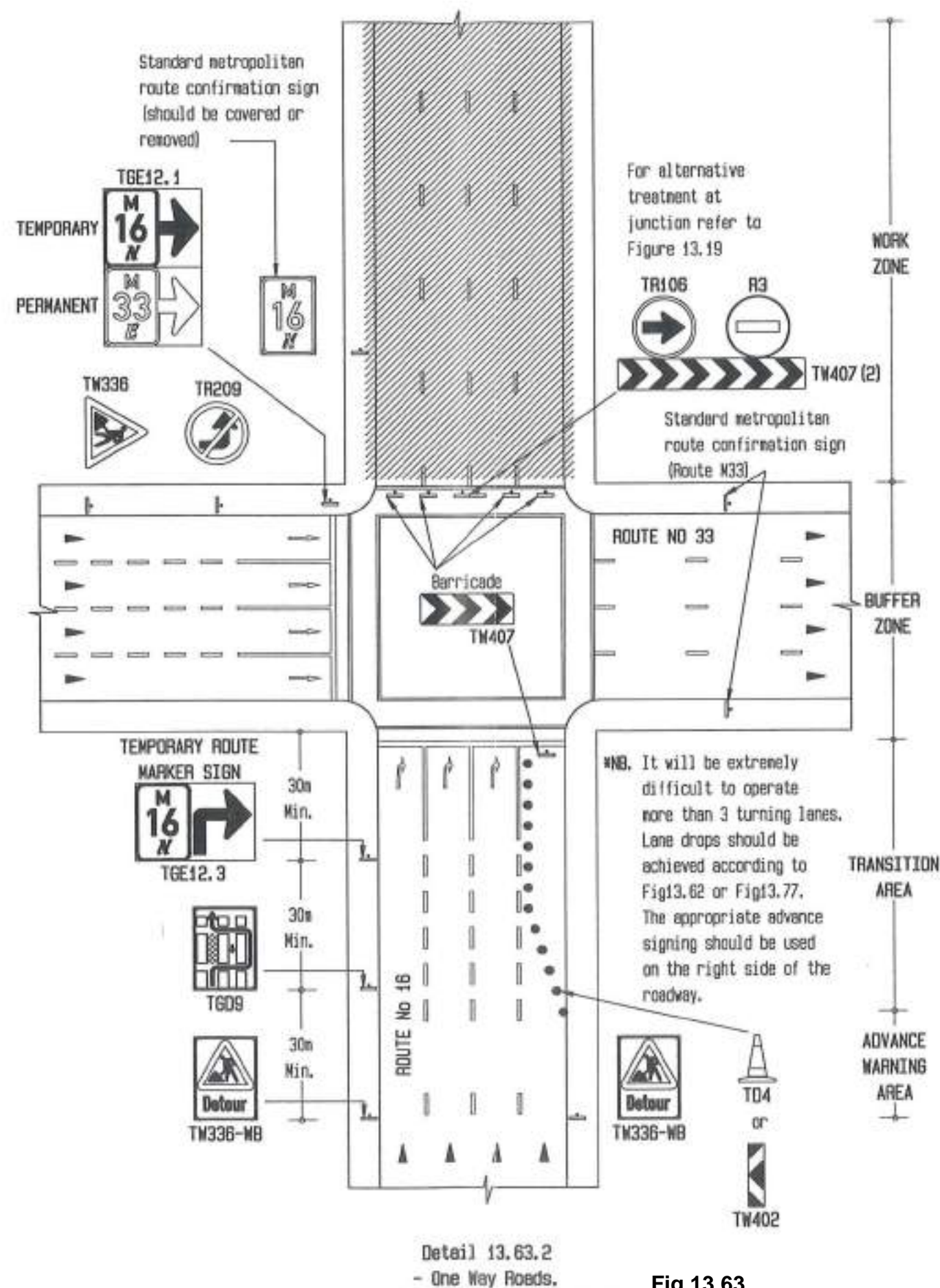
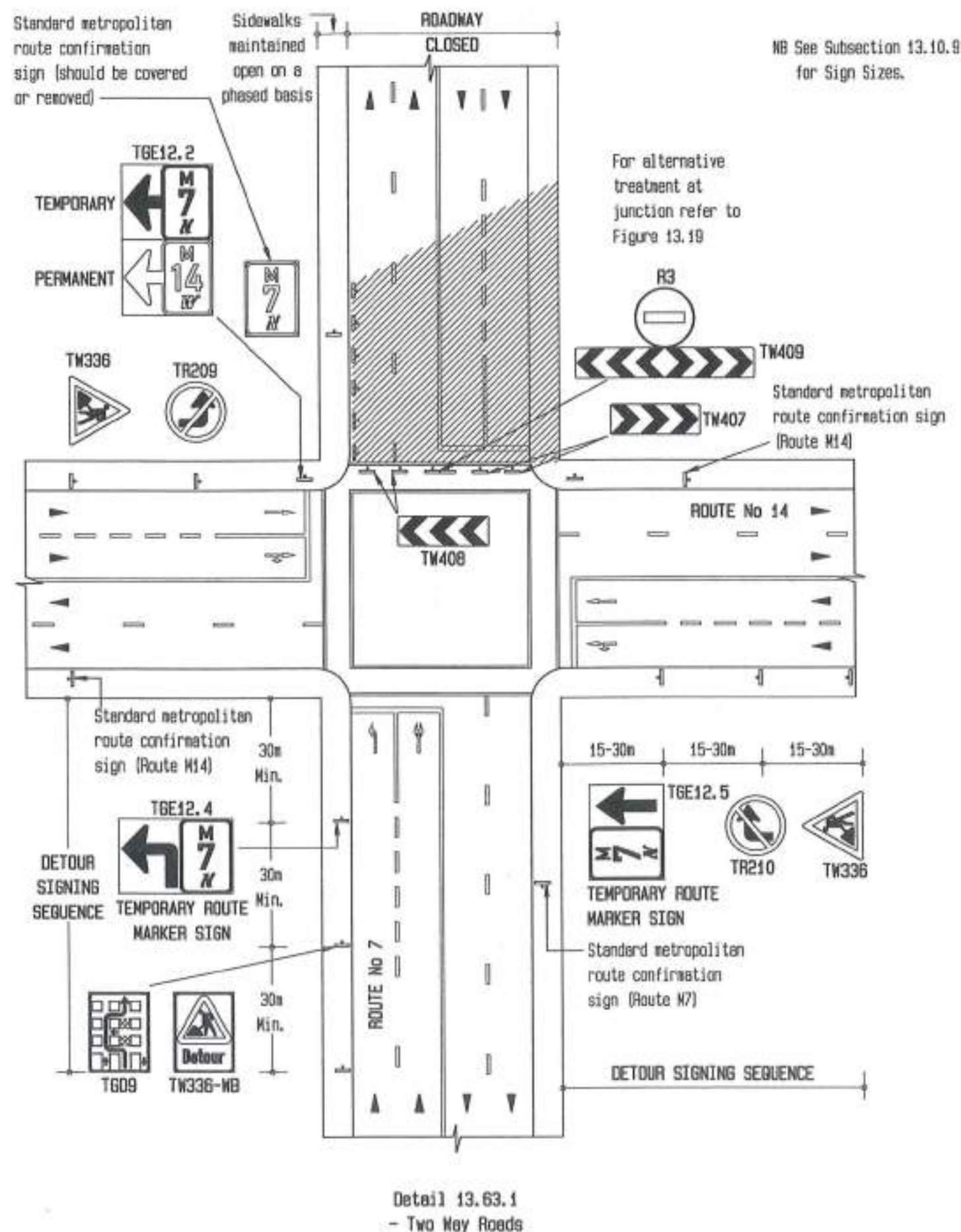


Fig 13.63  
Road Closure - CBD

### 13.10.10 Road Closure - Dual Carriageway Street

- The detail given in Figure 13.64 is somewhat simplistic for urban circumstances, representative of a typical dual carriageway roadway. No parking or property accesses are shown for instance. The signing and traffic management shown should therefore be considered as conceptual only. Significant additional signing may be required to cater for specific local circumstances.
- The lane reduction on the approach side to the junction is signed using a ROAD NARROWS sign TW330 on the basis that the lane is reintroduced to permit left turning traffic to make use of a short section. If the intersecting street is a one-way street (from left to right), the use of a left turn lane will not be necessary and a LANE DROP sign TW215 is recommended in place of sign TW330. Alternatively, if there is a need to permit a right turn, the lane drop arrangement can be mirrored.
- Subject to the time that the traffic management arrangement is in place, attention should be paid to the detail of no longer relevant, or incorrect road markings. Particularly under light traffic conditions drivers familiar with the deviation, may, for instance, react instinctively to a remaining mandatory arrow facing (now) the wrong way in the lane they are supposed to use.

#### Checklist

- ☐ should sign TW215 (or TW214) be used in place of sign TW330 (or TW329)?
- ☐ what direction and lane configuration does the cross street have?
- ☐ should this configuration affect the approach lane treatment?
- ☐ is the deviation through the junction sufficient to require the part-time or full-time use of a pointsman?

| TYPICAL SIGN REQUIREMENTS   |                |             |   |
|---|----------------|-------------|---|
| Sign  | No             | Size (mm)   | Quantity                                      |
|   | TW336          | 900         | 1   |
|   | TW330          | 900         | 1   |
|   | TW407          | 1200 X 400  | 1   |
|   | TR103<br>TR104 | 900         | 2<br>2  |
|   | R3             | 900         | 2   |
|   | TW411          | 300 X 1800  | 2   |
|   | TW211          | 900         | <sup>(1)</sup><br>1                           |
|   | TGS109         | 1200 X 1600 | <sup>(1)</sup><br>1                           |
|   | TIN 11.3       | 1200        | 1   |
|   | TD4            | 450         | Taper 8<br>plus 10<br>per 100m <sup>(2)</sup> |
|   | TW401          | 800 X 200   | Taper 8<br>plus 10<br>per 100m <sup>(2)</sup> |
| <sup>(1)</sup> TW211 and TGS109 are alternatives.<br><sup>(2)</sup> TD4 and TW401 are alternatives. |                |             |   |



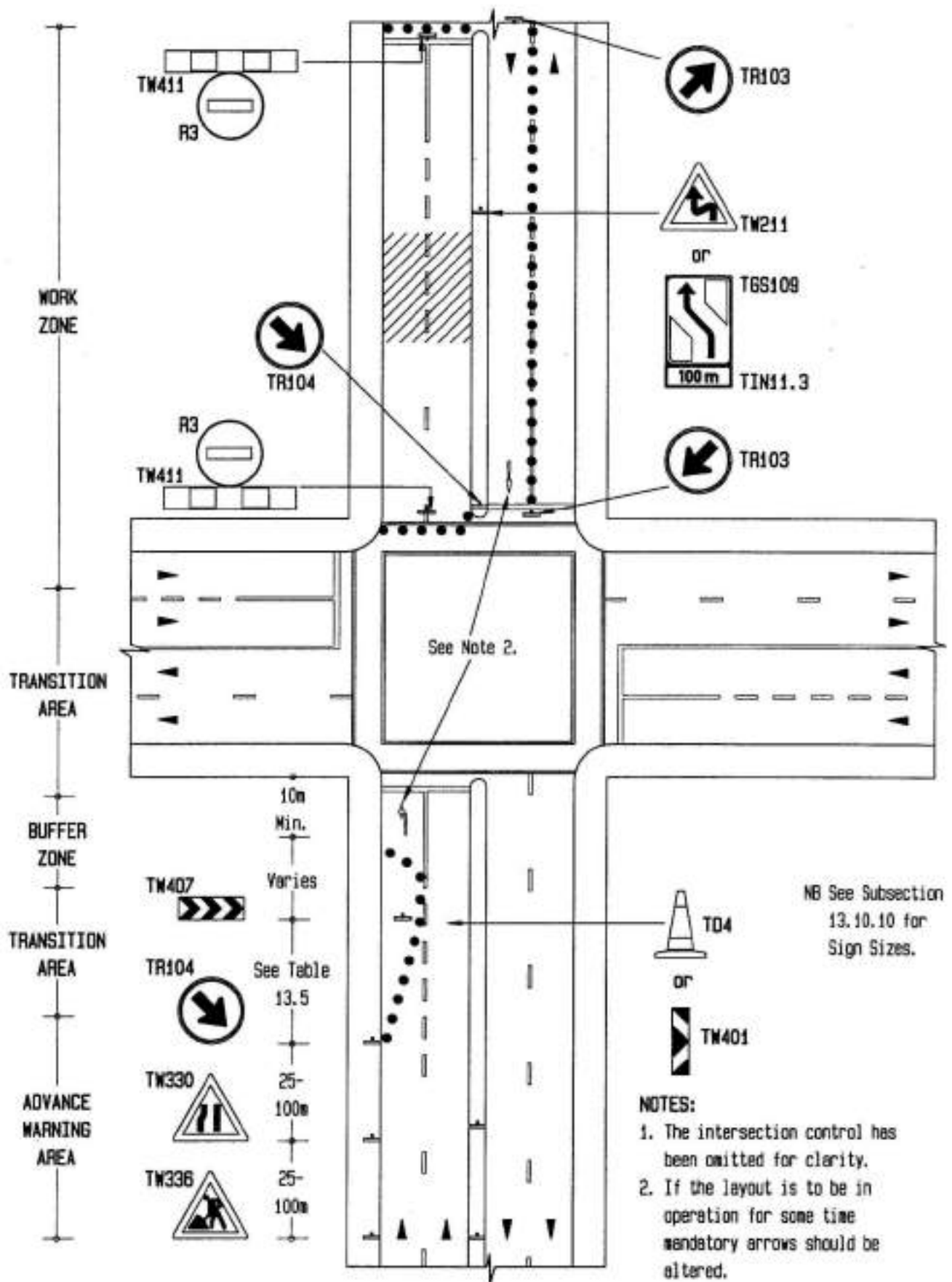


Fig 13.64

Road Closure – Dual Carriageway Street

### 13.10.11 Road Closure - Detour

- 1 The need to close a road may occur in an urban area for very similar reasons to those which may arise in a rural area (see Subsection 13.9.9). The details in Figure 13.65 illustrate various aspects of a possible urban road closure necessitated by work at a stream culvert or river bridge. A typical sign inventory is not included with this subsection because there are many variables which will affect a real-life situation that make the listing of an inventory inappropriate.
- 2 Detail 13.65.1 shows a section of suburban road network cut by a small river. "Road C" is closed at the river crossing. The signing elements which such a situation may require are shown in the other details and are referred to typical points in Detail 13.65.1. The site itself will require a road closure barrier for safety reasons. An appropriate sign arrangement is shown in detail 13.65.2. Alternative barrier arrangements are covered in Figures 13.87 and 13.88.
- 3 In a road network such as that illustrated, there will be certain junctions which will be strategically relevant when redirecting traffic around the closed section of "Road C". Such junctions are between "Roads C and E" and "Roads C and G". Detail 13.65.3 shows a simple signing treatment appropriate for non-arterial streets. Typical signing for more highly classified streets is illustrated in Figures 13.52 and 13.88.
- 4 It is relevant to indicate to drivers approaching "Road C" on intersecting side streets within the area affected by the detour that "Road C" is closed. This can be achieved simply by the use of special examples of NO THROUGH ROAD signs TIN20 to TIN23 as shown in Details 13.65.4 and 13.65.5.

#### Checklist

- ☐ can the street be closed to all traffic or will local access be required?
- ☐ are there suitable streets available on which to establish a detour?
- ☐ are temporary ROUTE MARKER signs or DIRECTION signs required?
- ☐ are there any missing STREET NAME signs within the area affected by the road closure and the detour?

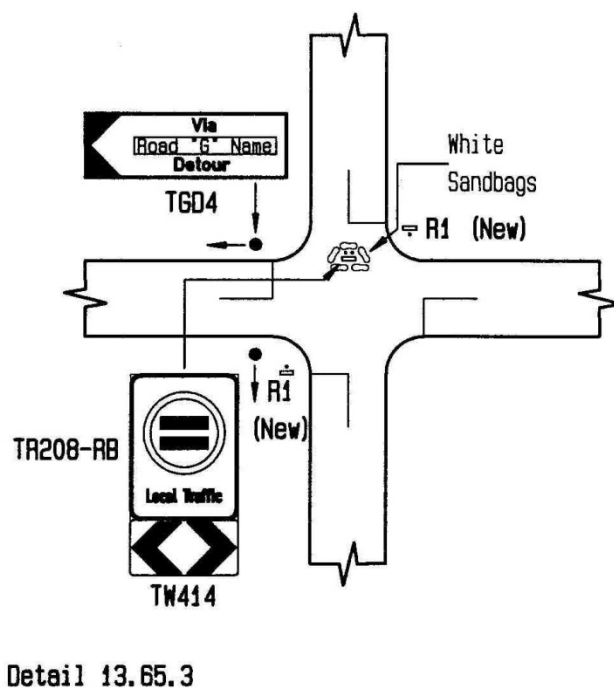
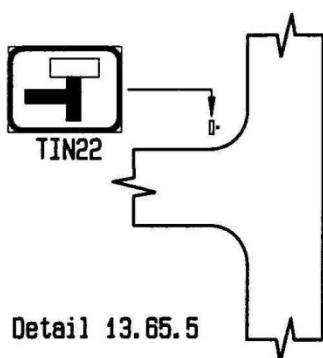
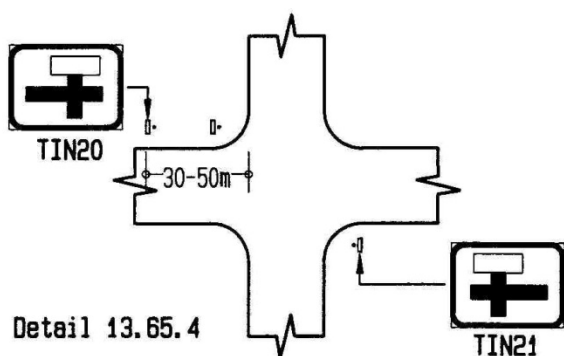
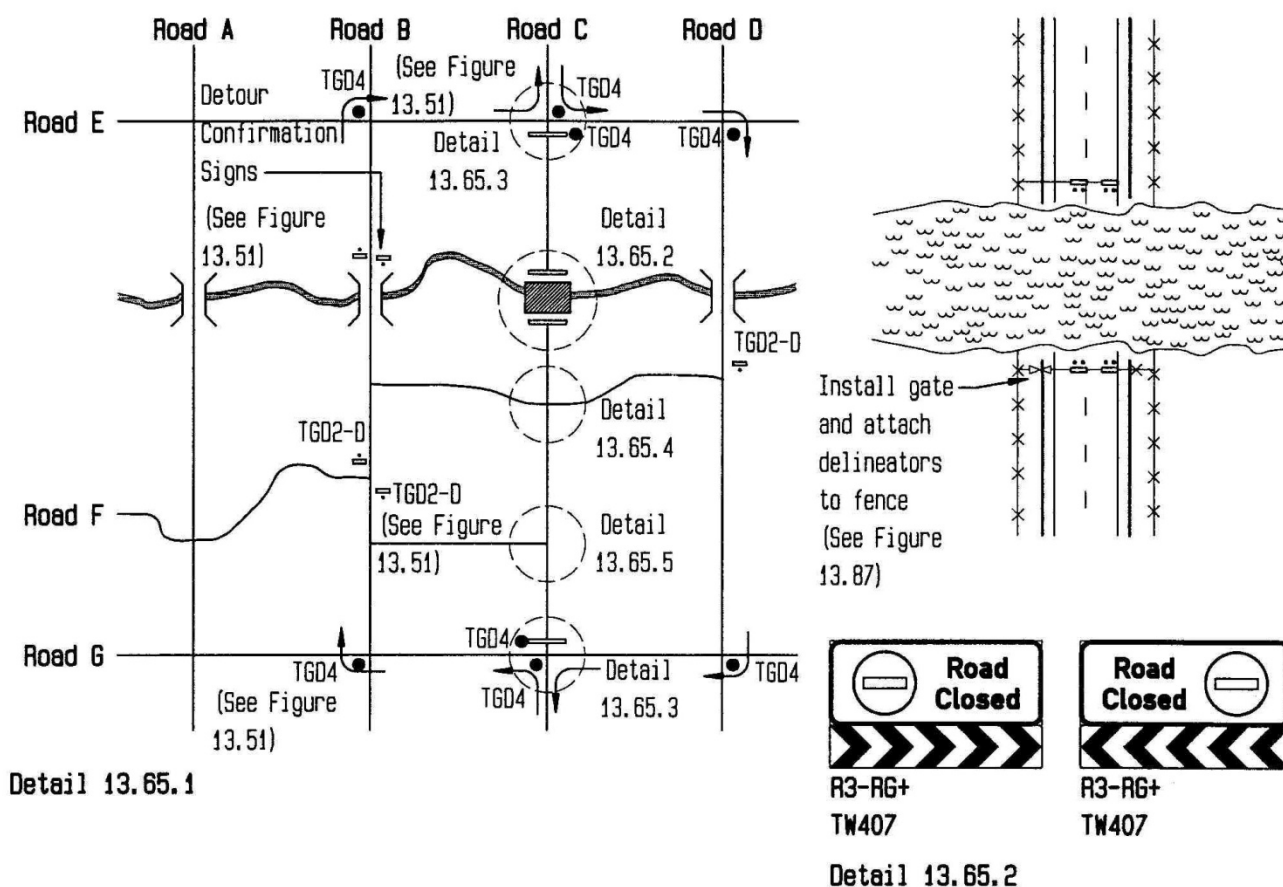


Fig 13.65

Road Closure - Detour





## **13.11 SIGNING APPLICATIONS FOR FREEWAYS AND DUAL CARRIAGEWAY ROADS**

### **13.11.1 General**


1 The applications of temporary signing for roadworks covered in Sections 13.8 to 13.12 have been subdivided into categories for ease of reference. These categories are:

- (a) short term works (Section 13.8)
- (b) rural roads (Section 13.9)
- (c) urban roads (Section 13.10)
- (d) freeways and dual carriageway roads (Section 13.11).

Section 13.12 provides enlarged details of elements covered in other sections and may be appropriate to any or all of the categories listed above.

2 The categorisation of applications used should only be considered to be general in nature. Many applications may be appropriate in several or all categories. Such applications are only detailed once to avoid duplication. Practitioners who do not find the application they are seeking in their first choice of category should therefore check other categories. If their required application is not covered, it will be necessary to determine a similar situation and to adapt it, with care, to their needs.

3 Sections 13.9 and 13.10 deal with rural and urban situations respectively. These terms also should be considered as general, and if a "rural" application is appropriate within an urban area, the application details should be used with appropriate adjustments to sign spacing and sizes. The signing of roadworks in peri-urban areas will most likely be catered for by rural category applications.

- 4 In the various figures the following rules or conventions apply:
- (a) all signs are correctly oriented for the direction of travel to which they apply;
  - (b) to avoid confusion with any arrows on road signs or marking, the direction of travel of traffic is, where relevant, indicated thus  ;
  - (c) all details are given in metres **but all may be directly used as "paces" in practice.**

5 Signs should be sized as recommended in Volume 1. As a rule of thumb the following sizes are appropriate for regulatory, warning and diagrammatic signs:

- (a) Gravel roads:
  - (i) circular signs - 1200 mm diameter;
  - (ii) triangular signs - 1200 mm side length;
  - (iii) diagrammatic signs - 1200 mm x 1600 mm;
- (b) Bituminous, concrete or brick surfaced roads:
  - (i) circular signs - 1200 mm diameter;
  - (ii) triangular signs - 1500 mm side length;
  - (iii) diagrammatic signs - 1200 mm x 1600mm.
- (c) Urban streets:
  - (i) circular signs - 900 mm/1200 mm diameter;

(ii) triangular signs - 900 mm/1200 mm side length;

(iii) diagrammatic signs - 1200 mm x 1600 mm.

### **13.11.2 Freeway / Dual Carriageway Roadworks**

1 Freeways and dual carriageway roads carry large volumes of traffic at the highest possible level of service. It is therefore imperative that the traffic management and temporary signing of such roads during roadworks be of the highest possible standard. The traffic management and signing techniques illustrated in the examples in this section have been used widely, and, when correctly operated, have proven to be very effective.

2 Due to widely varying operating characteristics during a single 24-hour period, one freeway roadworks traffic management solution normally has to be effective for conditions ranging from severe congestion, to high speed free-flowing traffic. Under these circumstances, accident levels are almost certain to be higher than those pertaining prior to the roadworks. **Careful attention to detail and frequent monitoring of signs and conditions will ensure that any increase in the accident rate will be kept to a minimum.**

3 The examples in this section include situations dealing with alterations to the normal lane configuration which commonly require a lengthy sequence of many signs as well as more localised situations which occur within interchanges where space for traffic accommodation measures may be severely limited.









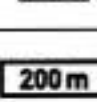
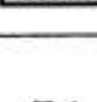
4 The figures and texts in this section cover mainly the ADVANCE WARNING AREA(S) of the applications being discussed. All of these applications will require one or more TRANSITION AREA, BUFFER ZONE/STABILIZING AREA and TRANSITION AREA. **The sign inventories given in each subsection apply in principle to the advance warning area signing. To obtain a total inventory for a site designers will have to identify all components and add together the inventory requirements.** This will commonly involve adding the requirements for an application in Section 13.11 to one or more enlarged detail requirements from Section 13.12.

### 13.11.3 Lane Closure - Day Time Only

- 1 The application of temporary signing shown in Figure 13.66 is similar to other figures illustrating lane drop situations. The principle differences are that this example shows a lane drop on a two-lane, one-way roadway (normally part of a dual carriageway) and it assumes high approach speeds. If the situation is not isolated but occurs within a larger roadworks site, the signing level should be adjusted in accordance with the operating speed prevailing (see Section 13.4).
- 2 Since the lane drop is short term, and during daytime only, delineation may be provided by means of TRAFFIC CONES TD4. Signing in the taper area is very limited compared to long term installations so that 700 mm TRAFFIC CONES, preferably made more conspicuous with white retroreflective sleeves, are recommended. Although signing within the transition and work area is kept to a minimum, the advance signing indicated must be provided otherwise traffic will arrive at the lane drop travelling too fast for safe merging to occur. Apart from the hazard this represents, congestion will occur as a result, making the installation very inefficient in its operation.
- 3 Detail 13.66.1 shows dropping of the "Slow" lane. **This application is not recommended for roadways with high volumes and/or a significant percentage of heavy vehicles.** The dropping of the "Fast" lane as shown in Detail 13.66.2 is generally preferred. If necessary, this can be followed by a lane shift to the right (see Figures 13.77 to 13.79). **The sign inventories for all taper details must be added to that given in this subsection.**
- 4 If advance signing has to be reduced due to time or space considerations, it is recommended that a full set of signs on one side of the road be omitted, rather than by decreasing in the length of the sequence. Which set may be omitted is likely to be site specific due to space or visibility conditions. The side offering the best visibility to all traffic should be retained with a preference for the "fast" side of the carriageway. In this event the start of the taper must be clearly identified to all traffic. **The reduction in signing referred to is not recommended on three or more lane cross sections.** According to experience, signs TGS101 (or TGS102) may be replaced by signs TW214 (or TW215) of an adequate size.

#### Checklist

- ☐ how many lanes are there on the section of road on which the lane is to be closed?
- ☐ what is the anticipated traffic approach speed during the period of lane closure?
- ☐ can lane closure during peak traffic periods be avoided?
- ☐ can the required level of signing be accommodated within the space available?
- ☐ will the lane closure cross off and on ramps - or can this be avoided?

| INSTALLATION INVENTORY  |                                   |                |   |
|---|-----------------------------------|----------------|---|
| Sign  | No                                | Size (mm)      | Quantity                                |
|    | TR103<br>TR104                    | 1200           | 2 or 3 <sup>(1)</sup>                   |
|    | TR201-80<br>TR201-80<br>TR201-100 | 1200           | 3<br>2<br>2                             |
|    | R201-120                          | 1200           | 2                                       |
|    | TW336                             | 1500           | 4                                       |
|    | TW214<br>TW215                    | 1500           | 2 <sup>(2)</sup><br>of each             |
|    | TW411                             | 300 X<br>1800  | 1                                       |
|    | TGS101<br>TGS102                  | 1200 X<br>1600 | 2 <sup>(2)</sup><br>of each             |
|    | TD4                               | 750            | 35 Min<br>plus 10<br>per 100m<br>closed |
|    | TIN 11.3<br>TIN 11.3              | 1200<br>1500   | 2<br>2                                  |
|    | FLAGS                             | 450 X<br>450   | 4                                       |
| (1) If possible provide 2 x TR103/TR104 signs at the start of the taper.<br>(2) TW214/TW215 may be used instead of TGS101/TGS102. |                                   |                |   |

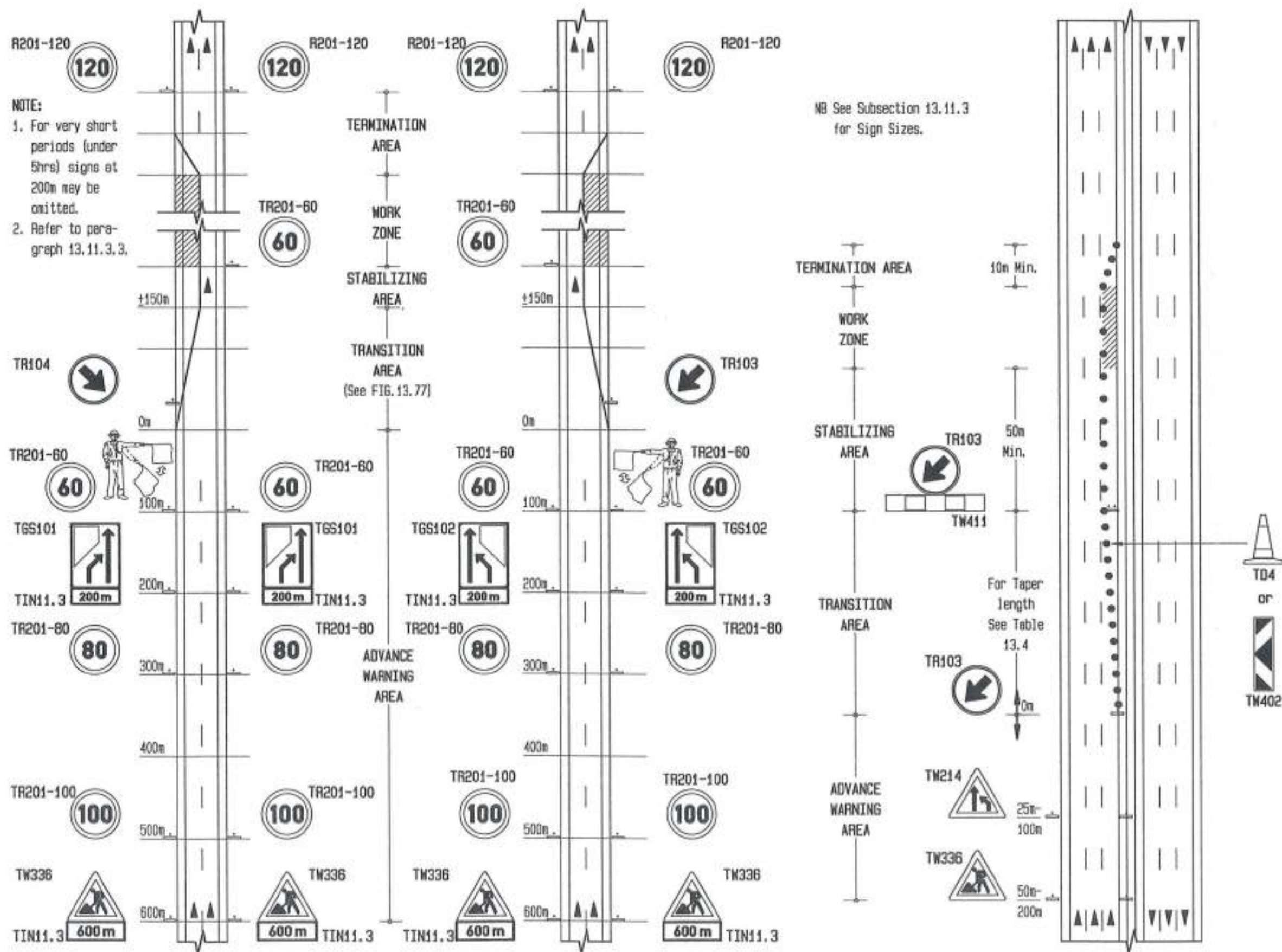








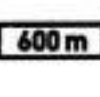
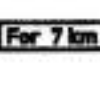

Fig 13.66  
 Lane Closure – Daytime Only

**13.11.4 Lane Closure - Right Lane Long Term**

- 1 The signing application illustrated in Figure 13.67 achieves the same purpose as that in Detail 13.66.2 but the signing in the ADVANCE WARNING AREA is significantly more extensive to allow for long term use.
- 2 All tapers and the WORK AREA shall be delineated by DELINEATOR PLATE signs TW401 and TW402. If the depth of excavation exceeds 600 mm, serious consideration should be given to the provision of a temporary barrier. Such a barrier shall be made adequately visible by means of DELINEATOR PLATE signs mounted on top of the barrier (although the effectiveness of this is limited due to the right side profile of dipped headlamps), or by GUARDRAIL DELINEATORS TD1 (see Volume 1, Chapter 7). The end treatment of any such barrier must be carefully detailed (see Figure 13.28).
- 3 For full details of the signing treatment of the TRANSITION AREA and TERMINATION AREA see Figures 13.77 and 13.78. **The inventories required for these details must be added to that given with this subsection.**
- 4 Designers preparing specifications and drawings for this type of long term roadworks signing application should familiarise themselves with Section 13.3 - "Traffic Management", in particular the details on BUFFER ZONES (see Figure 13.20), with Section 13.4 - "Setting of Speed Limits at Roadworks", and with Section 13.5 - "Temporary Delineation". If one or more interchanges fall within the section of road under construction, see Figure 13.74.

**Checklist**

- ☐ can the ADVANCE WARNING AREA safely be shortened ?
- ☐ should a public relations message be placed ahead of the first sign (see Figure 13.18)?
- ☐ is there more than one TRANSITION AREA?
- ☐ have all required sign inventories been added together?
- ☐ are there any interchanges within the WORK AREA?

| INSTALLATION INVENTORY  |                                   |              |                                |
|---|-----------------------------------|--------------|--------------------------------|
| Sign  | No                                | Size (mm)    | Quantity                       |
|    | TW336-WA                          | 1200 X 1600  | 2                              |
|    | TR201-60<br>TR201-80<br>TR201-100 | 1200         | 2 <sup>(1)</sup><br>3 Min<br>2 |
|    | R201-120                          | 1200         | 2                              |
|    | TGS102                            | 1200 X 1600  | 4                              |
|    | TR214                             | 1200         | 1                              |
|  | TW336                             | 1500         | 5 Min <sup>(1)</sup>           |
|  | TIN 11.3                          | 1200<br>1500 | 6<br>2                         |
|  | TIN 11.2                          | 1500         | 1 Min <sup>(1)</sup>           |
|  | TIN 11.4                          | 1500         | 2                              |
| (1) The number of signs required will depend on the length of the work area.          |                                   |              |                                |



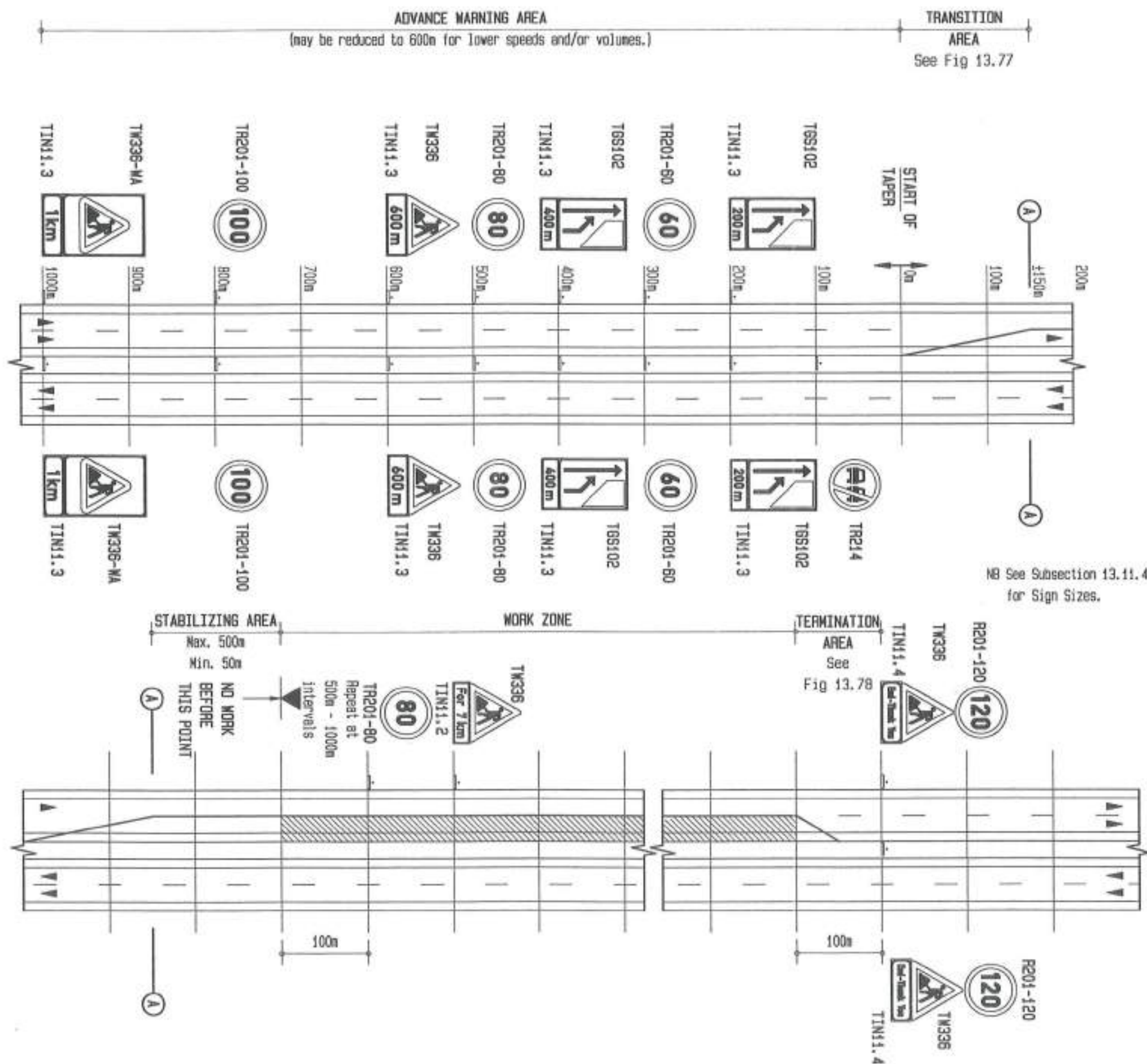












Fig 13.67  
Lane Closure – Right Lane  
Long Term

13.11.5 Lane Closure - Left Lane Long Term

- 1
- Figure 13.68 shows a signing application for a long term roadworks site which is similar to the short term site covered by Detail 13.66.1. Figure 13.68 gives the preferred treatment for a WORK AREA over the "Slow" lane. The traffic management technique used requires that the "Fast" lane is dropped first. This uses a sign sequence which is the same as shown in Figure 13.67 (so that one sign inventory will cover both types of application up to the end of the first TRANSITION AREA (1) - in fact, if dropping of the "Fast" lane first is adopted as a basic principle, it will mean that this is always the case, and drivers will become familiar with a standardised initial approach treatment to all major sites). After this transition traffic flow must be allowed to settle down within the STABILIZING AREA before the next TRANSITION AREA (2) where traffic is transferred from the "Slow" lane back to the "Fast" lane. This stabilizing area also serves as an ADVANCE WARNING AREA (2) for the second transition.
- 2
- All tapers and the WORK AREA shall be delineated by DELINEATOR PLATE signs TW401 and TW402. If the depth of excavation exceeds 600 mm, serious consideration should be given to the provision of a temporary barrier. Such a barrier shall be made adequately visible by means of DELINEATOR PLATE signs mounted on top of the barrier (although the effectiveness of this is limited due to the right side profile of dipped headlamps), or by GUARDRAIL DELINEATORS TD1 (see Volume 1, Chapter 7). The end treatment of any such barrier must be carefully detailed (see Figure 13.28).
- 3
- For full details of the signing treatment of the TRANSITION AREA and TERMINATION AREA see Figures 13.77 and 13.78. **The inventories required for these details must be added to that given with this subsection.**
- 4
- Designers preparing specifications and drawings for this type of long term roadworks signing application, should familiarise themselves with Section 13.3 - "Traffic Management", in particular the details on BUFFER ZONES (see Figure 13.20), with Section 13.4 - "Setting of Speed Limits at Roadworks", and with Section 13.5 - "Temporary Delineation". If one or more interchanges fall within the section of road under construction, see Figure 13.74.

Checklist

- ☐ can the ADVANCE WARNING AREA safely be shortened ?
- ☐ should a public relations message be placed ahead of the first sign (see Figure 13.18)?
- ☐ have all required sign inventories been added together?
- ☐ are there any interchanges within the WORK AREA?

| INSTALLATION INVENTORY  |                                   |              |             |
|---|-----------------------------------|--------------|-------------|
| Sign  | No                                | Size (mm)    | Quantity    |
|    | TW336-WA                          | 1200 X 1600  | 2           |
|    | TR201-60<br>TR201-80<br>TR201-100 | 1200         | 2<br>3<br>2 |
|    | R201-120                          | 1200         | 2           |
|    | T6S102                            | 1200 X 1600  | 4           |
|    | T6S107                            | 1200 X 1600  | 1           |
|   | TR214                             | 1200         | 1           |
|  | TW336                             | 1500         | 5           |
|  | TIN 11.3                          | 1200<br>1500 | 7<br>2      |
|  | TIN 11.2                          | 1500         | 1           |
|  | TIN 11.4                          | 1500         | 2           |



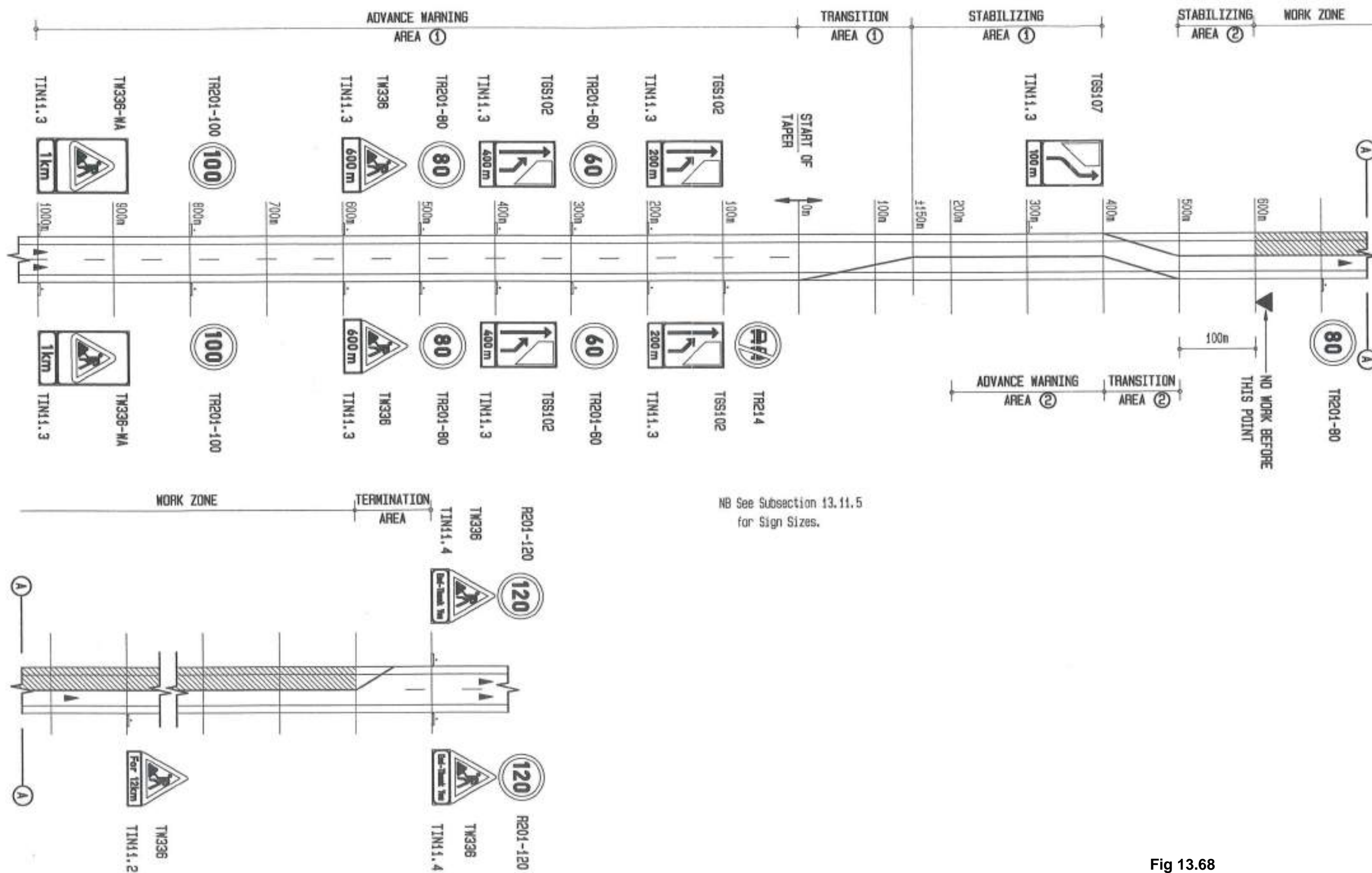


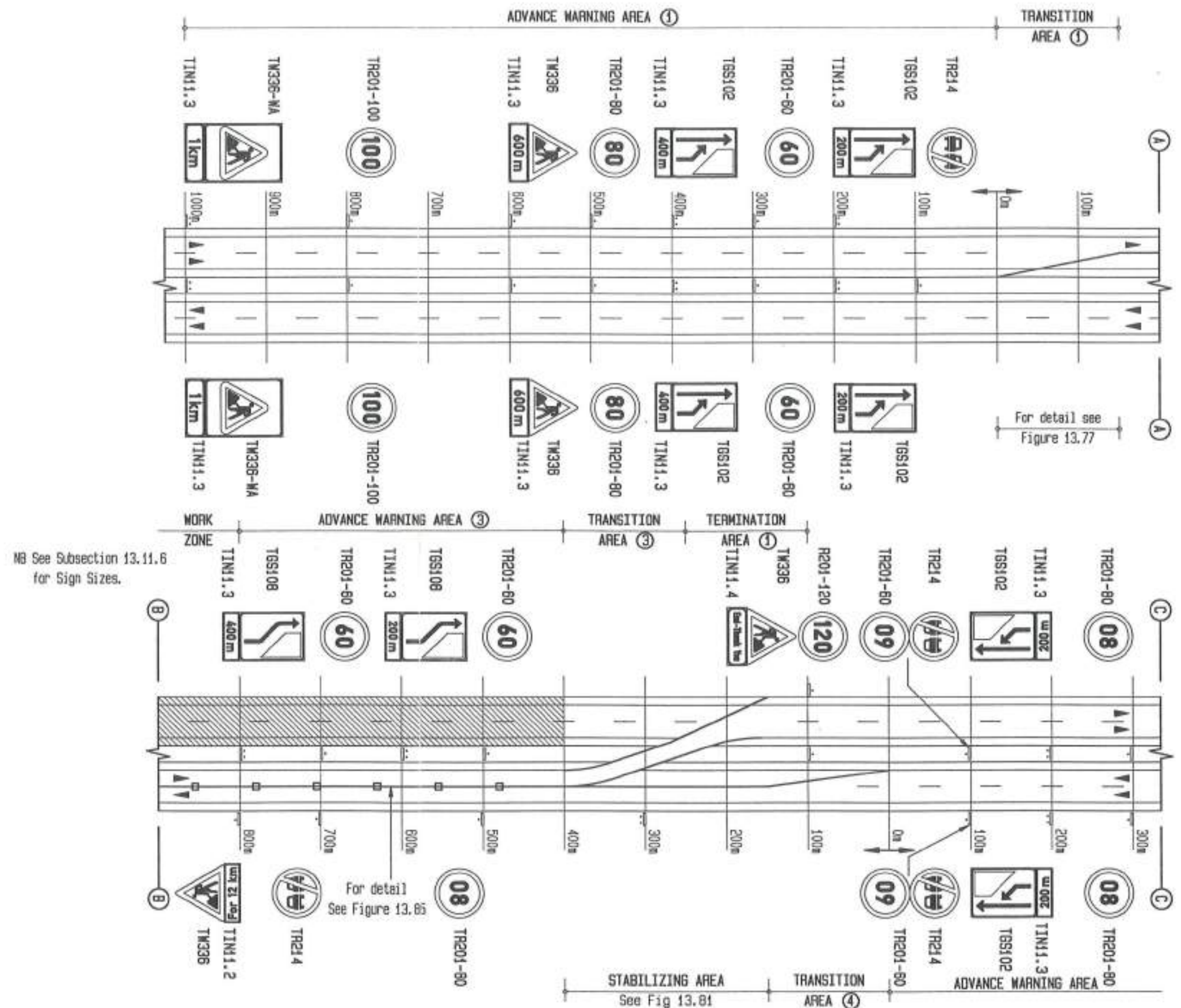
Fig 13.68  
Lane Closure – Left Lane  
Long Term

### 13.11.6 Carriageway Closure – Contraflow 2 Lane/2 Way

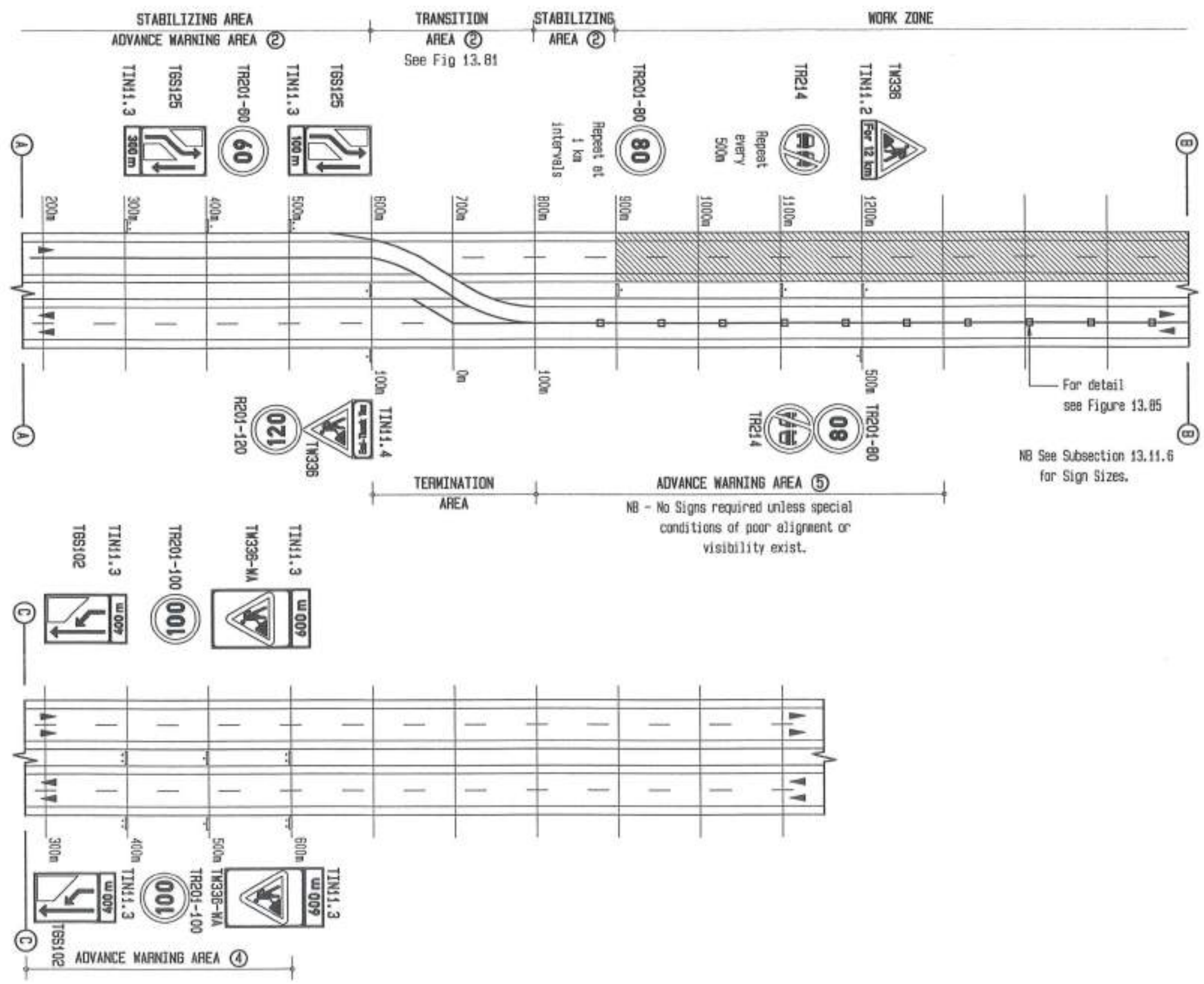
- The application covered by Figure 13.69 (over two pages) is a very common application when a freeway or at-grade dual carriageway is in need of major rehabilitation or up-grading. Provided they are well managed, applications using the techniques illustrated have worked successfully under heavy traffic conditions.
- The procedure requires three major TRANSITION AREAS, in the one direction of travel, as follows:
  - the first transition drops the "Fast" lane;
  - the second transition involves a median crossover from the left side of the one carriageway to the left side of the other carriageway;
  - the third transition is the reverse of that described in (b).
- The signing and detail for the lane drop is identical to that used in Figures 13.67 and 13.68 (see also Figure 13.77). Detail of a typical single lane median crossover is covered in Figure 13.81. This figure is also relevant, in principle, for the return crossing through the median (third transition).
- Figure 13.69 shows the deviation carriageway operating in a 2 lane/2 way configuration. **This arrangement does not permit overtaking opportunities, and for this reason, is not recommended for distances of more than 2 km.** Failure to adhere to this recommendation could have significant adverse effects on the safety of the site. Figure 13.70 shows a preferred lane configuration on the deviation which gives overtaking opportunities.
- Traffic flowing in the opposite direction, to that described so far, is also subject to a "Fast" lane drop TRANSITION AREA (4). Both directions utilize TERMINATION AREAS.
- Designers are recommended to also read paragraphs 13.11.5.2 to 13.11.5.4.

#### Checklist

- ☐ is the site under 2 km in length?
- ☐ can the carriageway carrying the deviation operate with three lanes (see Figure 13.70)?







| INSTALLATION INVENTORY |                                   |              |                      |
|------------------------|-----------------------------------|--------------|----------------------|
| Sign                   | No                                | Size (mm)    | Quantity             |
|                        | TW336-WA                          | 1200 X 1600  | 4                    |
|                        | TR201-80<br>TR201-80<br>TR201-100 | 1200         | 7<br>7 Min<br>4      |
|                        | R201-120                          | 1200         | 2                    |
|                        | T6S102                            | 1200 X 1600  | 8                    |
|                        | T6S125                            | 1200 X 1600  | 2                    |
|                        | TR214                             | 1200         | 6 Min <sup>(1)</sup> |
|                        | T6S108                            | 1200 X 1600  | 2                    |
|                        | TW336                             | 1500         | 6                    |
|                        | TIN 11.3                          | 1200<br>1500 | 16<br>2              |
|                        | TIN 11.2                          | 1500         | 2                    |
|                        | TIN 11.4                          | 1500         | 2                    |

(1) The number of signs required depends on the length of the work area.

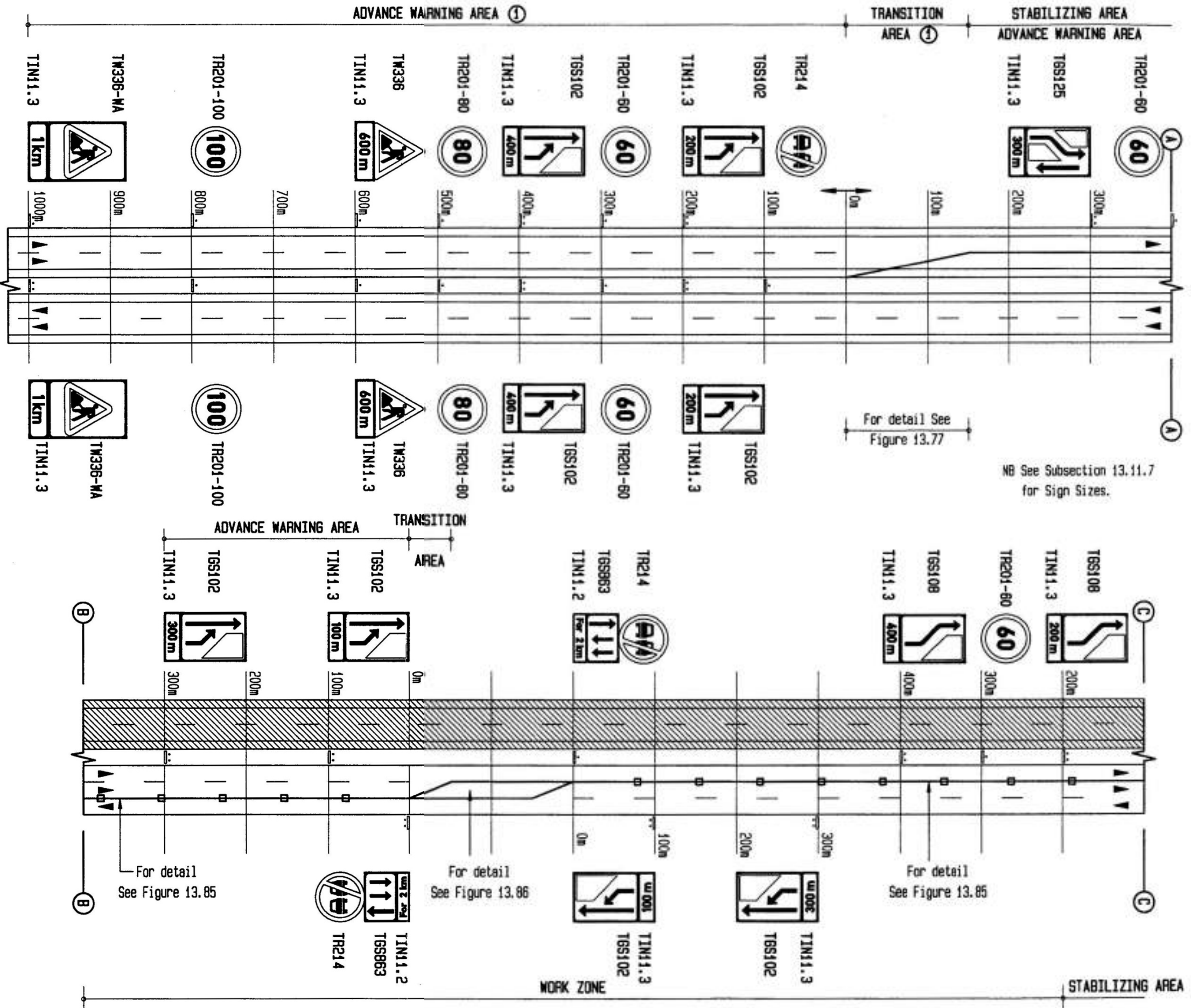
Fig 13.69  
Carriageway Closure – Contraflow  
2 Lane/2 Way

13.11.7 Carriageway Closure – Contraflow  
3 Lane/2 Way

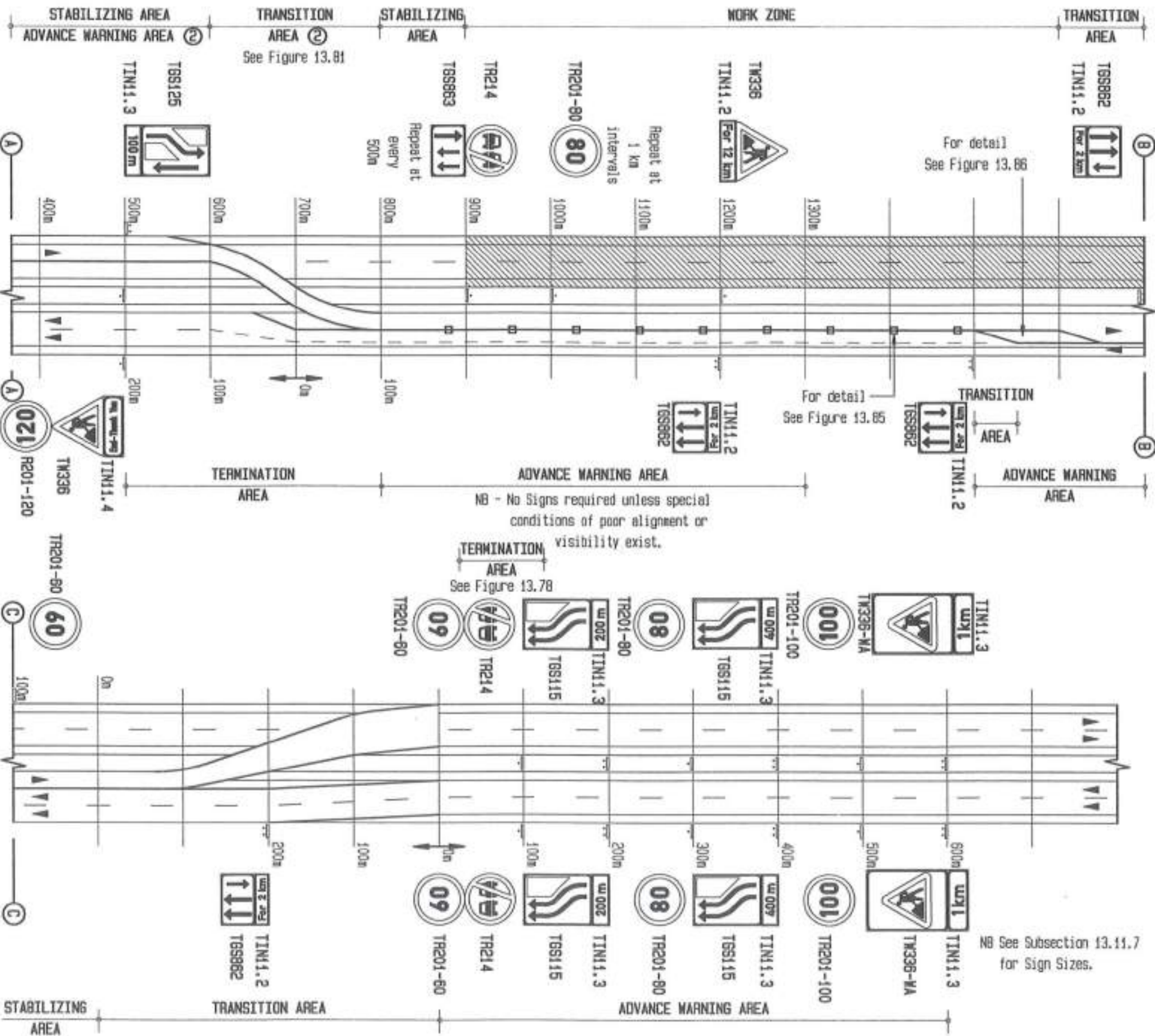
- 1 Figures 13.69 and 13.70 are similar except for the lane configuration on the deviation. In Figure 13.70 traffic is subjected to a "Fast" lane drop, stabilized, then diverted through a median crossover to the opposing carriageway. On the deviation, traffic is operating in a 3 lane cross-section, initially in a 1-2 lane configuration. After some distance, the configuration is changed to a 2-1 lane layout. This type of treatment permits regular overtaking opportunities in both directions (see Figure 13.86).
- 2 This type of application is appropriate if there is no option but to work on a long section of roadway at one time. However, the alterations in lane configuration should be made as frequently as is practical. It is recommended that such changes occur at spacings of 1 km to 2 km. When planning the positions of changes in configuration account should be taken of the vertical profile of the road. It may be desirable to provide two lanes on uphill sections of the road, although, if the hills are steep, there may also be safety advantages to two lane downhill sections if these permit heavy vehicles to "crawl" in the "Slow" lane. It should be noted that these changes in configuration require signing in their ADVANCE WARNING AREAS.
- 3 It is recommended that the dividing line between opposing streams of traffic be treated as illustrated in Figure 13.85, and that NO OVERTAKING signs TW214 be displayed at regular intervals. The use of temporary LANE CONFIGURATION signs TGS861, TGS862 and TGS863, with SUPPLEMENTARY PLATE signs TIN11.2 giving the distance for which the configuration continues, may be of advantage (see Figure 13.18).
- 4 Designers are recommended to also read Subsection 13.11.6.

Checklist

- ☐ is the site longer than 2 km?
- ☐ is the deviation set out in a 3 lane cross-section?
- ☐ are there regular alterations in lane configuration within the deviation?







| INSTALLATION INVENTORY |                                   |              |                                |
|------------------------|-----------------------------------|--------------|--------------------------------|
| Sign                   | No                                | Size (mm)    | Quantity                       |
|                        | TW336-MA                          | 1200 X 1600  | 4                              |
|                        | TR201-60<br>TR201-80<br>TR201-100 | 1200         | 7<br>5 Min <sup>(1)</sup><br>4 |
|                        | R201-120                          | 1200         | 1                              |
|                        | TGS102                            | 1200 X 1600  | 8                              |
|                        | TGS125                            | 1200 X 1600  | 2                              |
|                        | TR214                             | 1200         | 6 Min <sup>(1)</sup>           |
|                        | TGS108                            | 1200 X 1600  | 2                              |
|                        | TGS115                            | 1200 X 1600  | 4                              |
|                        | TGS863                            | 1200 X 800   | 3 Min <sup>(1)</sup>           |
|                        | TW336                             | 1500         | 4                              |
|                        | TIN 11.3                          | 1200<br>1500 | 20<br>2                        |
|                        | TIN 11.2                          | 1500         | 7                              |
|                        | TIN 11.4                          | 1500         | 1                              |
|                        | TGS862                            | 1200 X 800   | 4                              |

(1) The number of signs required depends on the length of the work area.









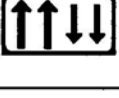

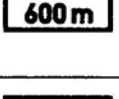
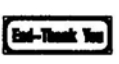
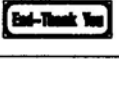
Fig 13.70  
Carrieway Closure – Contraflow  
3 Lane/2 Way

### 13.11.8 Carriageway Closure -Contraflow 4 Lane/2 Way

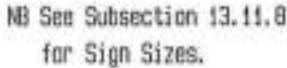
- Figure 13.71 shows a similar basic roadworks situation to those shown in Figures 13.69 and 13.70, except that the lane configuration in the deviation consists of 4 lanes operating with 2 lanes in each direction. Such a lane configuration will be warranted for the heaviest of traffic volumes, when no significant reduction in capacity is acceptable. To achieve this, it may be necessary to construct temporary widening of the carriageway carrying the deviation.
- In this application there is only one TRANSITION AREA at the beginning of the deviation and another at the end, through both of which traffic is diverted without a lane drop through a median crossover (for detail see Figure 13.82). **The geometry of the reverse curve should be of a high standard so that traffic is not unduly impeded through the curves.** For details of different options for the design of reverse curves refer to Figure 13.24, and to Section 13.4 for details regarding the setting of temporary speed limits, and therefore the design standards for reverse curves.
- The dividing line between the two streams of traffic should be treated as illustrated in Figure 13.85. When traffic volumes are high and it is required to keep traffic flowing at a relatively high speed, the use of a barrier on the dividing line may be warranted.
- The sign inventories for the median crossovers must be added to that listed for this application.

#### Checklist

- ☐ are the lanes through the reverse curves wide enough for heavy vehicles?
- ☐ is a physical barrier required on the dividing line within the deviation?

| INSTALLATION INVENTORY  |                                   |              |             |
|---|-----------------------------------|--------------|-------------|
| Sign  | No                                | Size (mm)    | Quantity    |
|    | TW336-WA                          | 1200 X 1600  | 4           |
|    | TR201-60<br>TR201-80<br>TR201-100 | 1200         | 6<br>6<br>4 |
|    | R201-120                          | 1200         | 3           |
|    | TGS115<br>TGS116                  | 1200 X 1600  | 4<br>2      |
|    | TGS120                            | 1200 X 1600  | 2           |
|    | TGS126                            | 1200 X 1600  | 4           |
|  | TW336                             | 1500         | 7           |
|  | TR214                             | 1200         | 3           |
|  | TGS861                            | 1500 X 800   | 2           |
|  | TW212-WA                          | 1200 X 1600  | 1           |
|  | TIN 11.3                          | 1200<br>1500 | 16<br>2     |
|  | TIN 11.2                          | 1500         | 2           |
|  | TIN 11.4                          | 1500         | 3           |





**Fig 13.71**  
**Carriageway Closure – Contraflow**  
**4 Lane/2 Way**













**13.11.9 Work in Median**

- 1 This application of temporary traffic signing is very specific to a work situation in a dual carriageway road during which the road is being widened within the median. The main purpose of the signing is to control the entry and egress of construction traffic from the median and to warn the general public that the movements are likely to occur with the attendant need for higher levels of concentration.
- 2 Since this type of situation is likely to be only part of a larger roadworks operation, the required signing has to be added to whatever is needed by the overall signing plan. If necessary, the more general signing level should be reduced somewhat in order to make sure the exit and entry signing will be clearly visible. Subject to prevailing visibility conditions this is a typical situation where the use of special grades of high luminance fluorescent/retroreflective material for the median access control signs may be worthy of consideration.
- 3 If there are early indications that the driving public is not observing the hazard represented by the reduction in speed of construction vehicles prior to leaving the roadway (from the "fast" lane), it is recommended that the signing be supplemented by a flagman instructed to operate only when an exiting truck is approaching. Temporary speed limits should preferably be related to the general conditions prevailing, and **NOT** to the localised requirements of the construction vehicle movements. Flagmen may also be effective to warn the public when a construction vehicle is re-entering the road.
- 4 A major roadworks site may have a number of such median access points. It has proven effective in such cases to identify each access by a number associated with the TW344 sign. Construction vehicle drivers can then be advised which of the several accesses they are to use on a trip-by-trip basis.

**Checklist**

- ☐ can access points be sited where visibility is good even if this means that construction traffic may travel some distance on the median?
- ☐ can exit points from the median be sited so that construction vehicle drivers have clear sight in order to judge gaps in traffic?
- ☐ if gaps in traffic are likely to be very limited can traffic be effectively slowed by a flagman to allow construction vehicles entry?
- ☐ is the use of special grades of high luminance fluorescent/retroreflective material warranted to assist identification of entry/exit points?
- ☐ are there several entry points and will it be of assistance to number these?

| INSTALLATION INVENTORY  |                      |                                      |   |
|---|----------------------|--------------------------------------|---|
| Sign  | No                   | Size (mm)                            | Quantity                                |
|    | TR201-60<br>TR201-80 | 1200                                 | 4 <sup>(2)</sup><br>4                   |
|    | R201-120             | 1200                                 | <sup>(2)</sup><br>2                     |
|    | TW344<br>TW345       | 1500                                 | 3<br>3                                  |
|    | TGS131               | 1200 X<br>1600                       | 4 to 6                                  |
|    | TW402                | 150 X 600<br>200 X 800<br>300 X 1200 | 60 plus<br>4 per 100m<br>site<br>length |
|   | TIN 11.2             | 1200                                 | 2                                       |
|    | TIN 11.3             | 1200                                 | 4                                       |
|    | TIN 11.4             | 1500                                 | <sup>(3)</sup><br>4                     |
|    | TIN 11.5             | 1500                                 | 2                                       |
|    | FLAGS                | 450 X<br>450                         | 6                                       |
| (1) This installation is for use within a roadworks site. Extra advance signs will be required if used on its own.<br>(2) Speeds according to site.<br>(3) Special text supplementary plates. |                      |                                      |   |

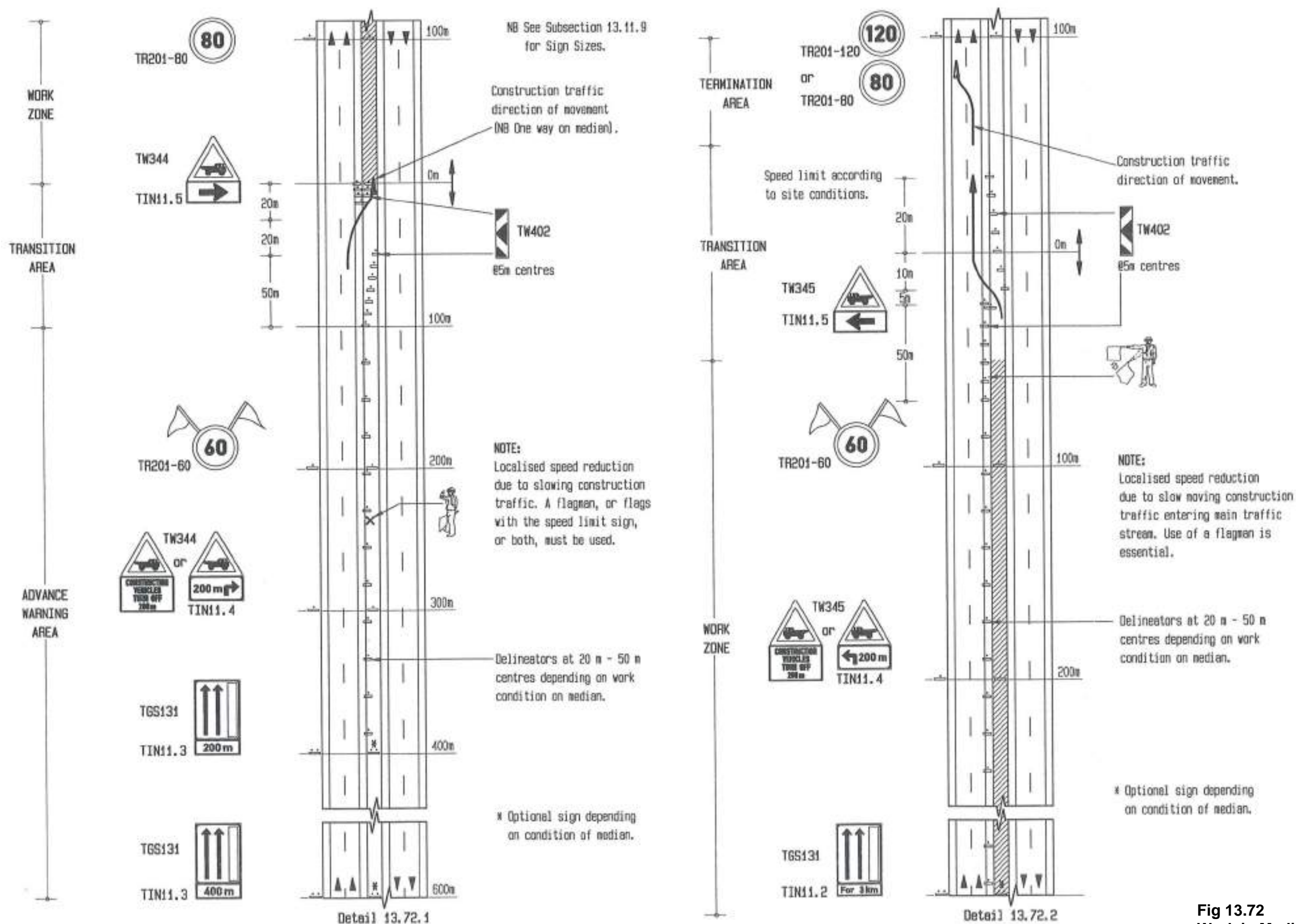


Fig 13.72  
Work in Median

13.11.10 2 Lanes Closed











- 1 If a carriageway has more than three lanes in one direction, it may be acceptable to close two lanes in order to make reconstruction more efficient. Figure 13.73 shows the signing required in advance of such a double lane drop. As with other lane drops which have been detailed, it is recommended that the "Fast" lanes be dropped "first", irrespective of which lanes ultimately have to be worked on. **It is NOT recommended to work on one or more lanes with traffic flowing past on the left AND the right.**
- 2 The DIAGRAMMATIC signs used on a road of this importance should accurately reflect the number of lanes. The two lane drop TRANSITION AREAS must be sufficiently far apart that:

(a) traffic flow can stabilize after negotiating the lane drop; AND

(b) there is sufficient distance to accommodate the signs for the second lane drop.
- 3 Full details of the lane drop tapers are covered in Figure 13.80 (although the figure illustrates a three lane carriageway). Details of delineator spacings and tapers are given in Tables 13.4 and 13.5, and Figure 13.29.

Checklist

- ☐ can two lanes adequately accommodate all the traffic?
- ☐ is there sufficient space to provide the required STABILIZING AREA?

| INSTALLATION INVENTORY  |                       |              |          |
|---|-----------------------|--------------|----------|
| Sign  | No                    | Size (mm)    | Quantity |
|    | TW336-MA              | 1200 X 1600  | 2        |
|    | TR201-80<br>TR201-100 | 1200         | 9<br>2   |
|    | R201-120              | 1200         | 2        |
|    | TGS106                | 1500 X 1600  | 6        |
|    | TGS104                | 1200 X 1600  | 4        |
|  | TGS131                | 1200 X 1600  | 2        |
|  | TW336                 | 1500         | 2        |
|  | TIN 11.3              | 1200<br>1500 | 4<br>6   |
|  | TIN 11.2              | 1200         | 2        |
|  | TIN 11.4              | 1500         | 2        |



[illegible]

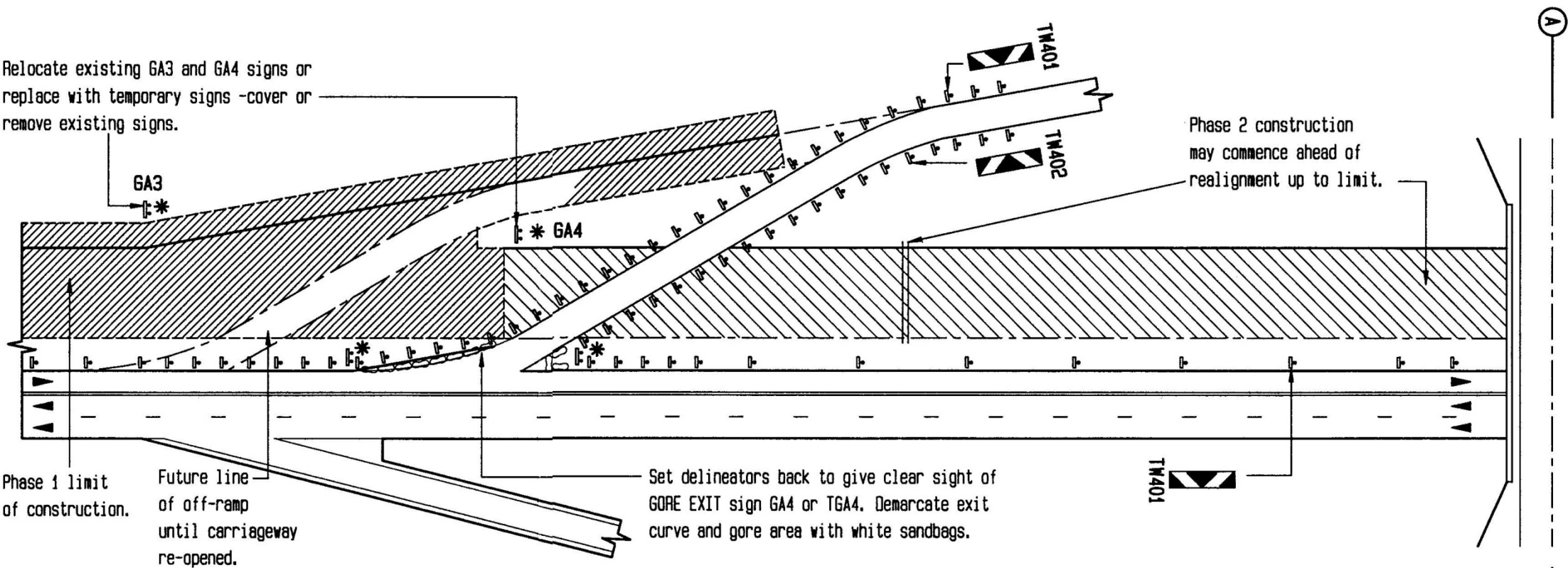
**Fig 13.73**  
**2 Lanes Closed**

13.11.11 On-Ramp/Off Ramp - Amended Configuration

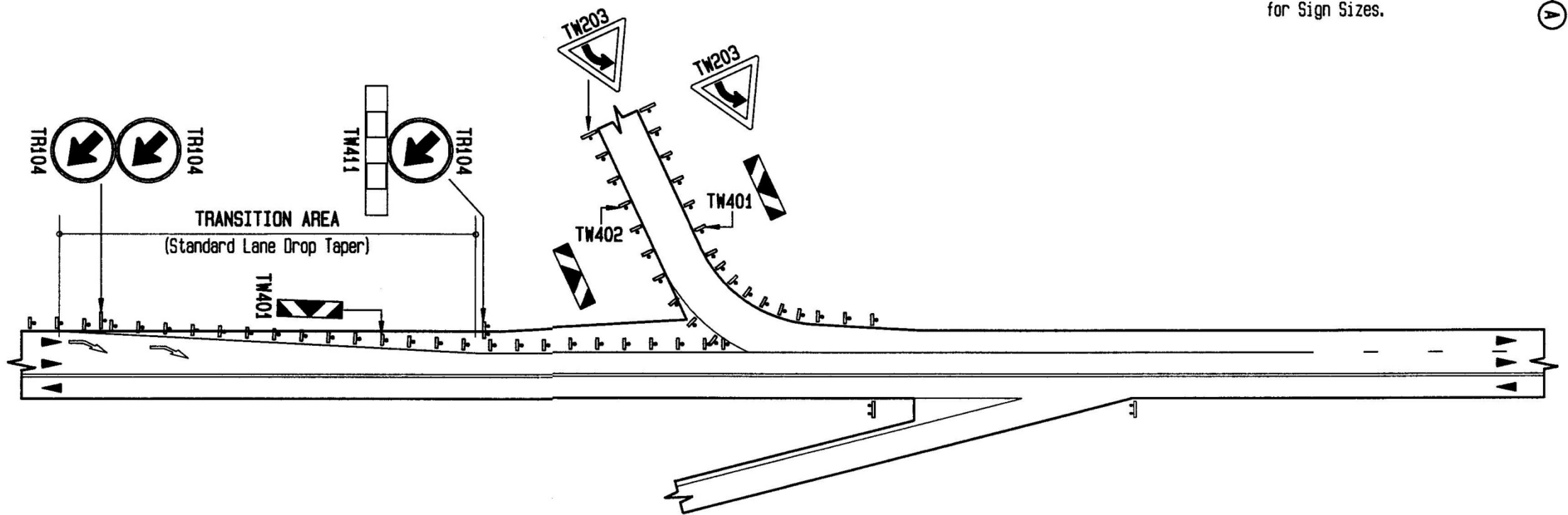
- 1 The various roadworks applications covered in Figures 13.67 to 13.73 may all include one or more interchanges within the WORK AREA. Subject to the relationship between the diverted traffic and the on- and off-ramps it will be necessary to provide temporary connections across the carriageway under construction. The geometry of these connections will commonly be to low standards due to space constraints. These low standards may contribute to slow exit speeds or indecision on the part of drivers. Every effort must therefore be made to limit such effects.
- 2 Detail 13.74.1 shows a typical arrangement of temporary on-ramps and off-ramps. The detail allows for the relocation of the ramps when the area over which they were first positioned needs to be reconstructed (or vice versa). The temporary alignments of the ramps are defined by DELINEATOR PLATE signs TW401 and TW402. These signs should be positioned carefully. Figures 13.90 and 13.91 give more details on the treatment of these areas.
- 3 If it is necessary to provide good on-ramp capacity, Details 13.74.2 and 13.74.3 offer two options to permit relatively free-flow entry. Detail 13.74.2 shows one of the two through lanes being dropped to accommodate an acceleration lane for traffic which otherwise will have to enter the roadway slowly due to the sharp curvature at the entry point. Detail 13.74.3 shows localised widening through the on-ramp gore area to permit two lanes of traffic and hence an opportunity for entering traffic to accelerate. Which, of these options may be exercised, if any, is dependent on the NET benefit to traffic? The options are likely to have a net benefit if through traffic is light and on-ramp traffic is heavy.

Checklist

- ☐ may be exercised is off-ramp capacity acceptable in terms of the reductions in curve radius?
- ☐ may be exercised can the on-ramp configuration be arranged to allow entering traffic to accelerate effectively and merge with freeway traffic?

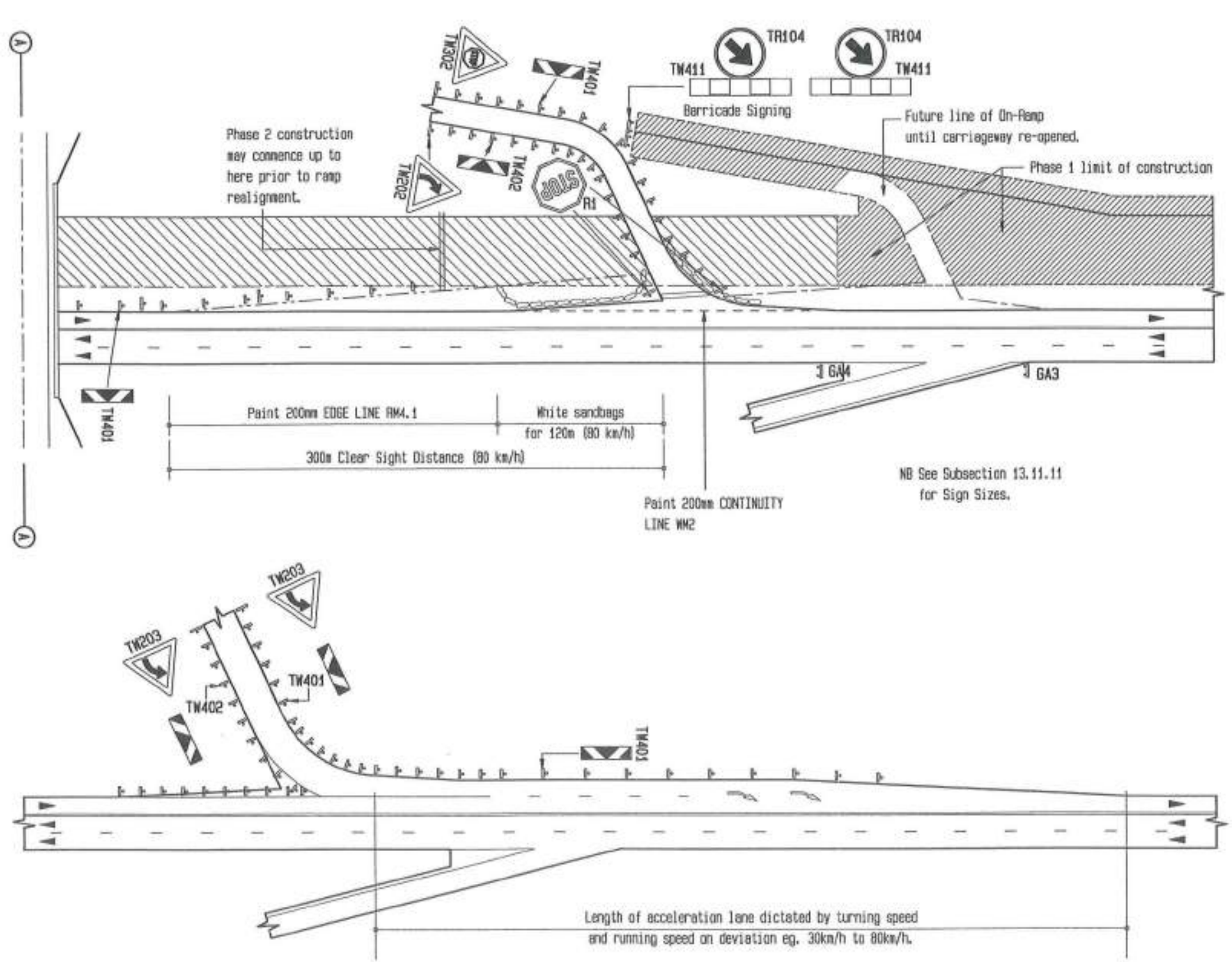


Detail 13.74.1



Detail 13.74.2 Alternative Treatment if 3 Lane Configuration Permits. On-Ramp Slow but Free-Flowing - Through Traffic Reduced to One Lane (Only Practical with Moderate Volumes).





| INSTALLATION INVENTORY |                   |               |          |
|------------------------|-------------------|---------------|----------|
| Sign                   | No                | Size (mm)     | Quantity |
|                        | TW401<br>TW402    | 800 X<br>200  |          |
|                        | TR104             | 1200          |          |
|                        | TW203             | 1500          |          |
|                        | TW411             | 300 X<br>1800 |          |
|                        | TW202             | 1500          |          |
|                        | R1                | 1200          |          |
|                        | TW302             | 1500          |          |
|                        | WHITE<br>SANDBAGS |               |          |

Detail 13.74.3 Alternative Treatment to Improve On-Ramp Capacity Provided Space is Available for Temporary Acceleration

Fig 13.74 On-Ramp/Off-Ramp – Amended Configuration













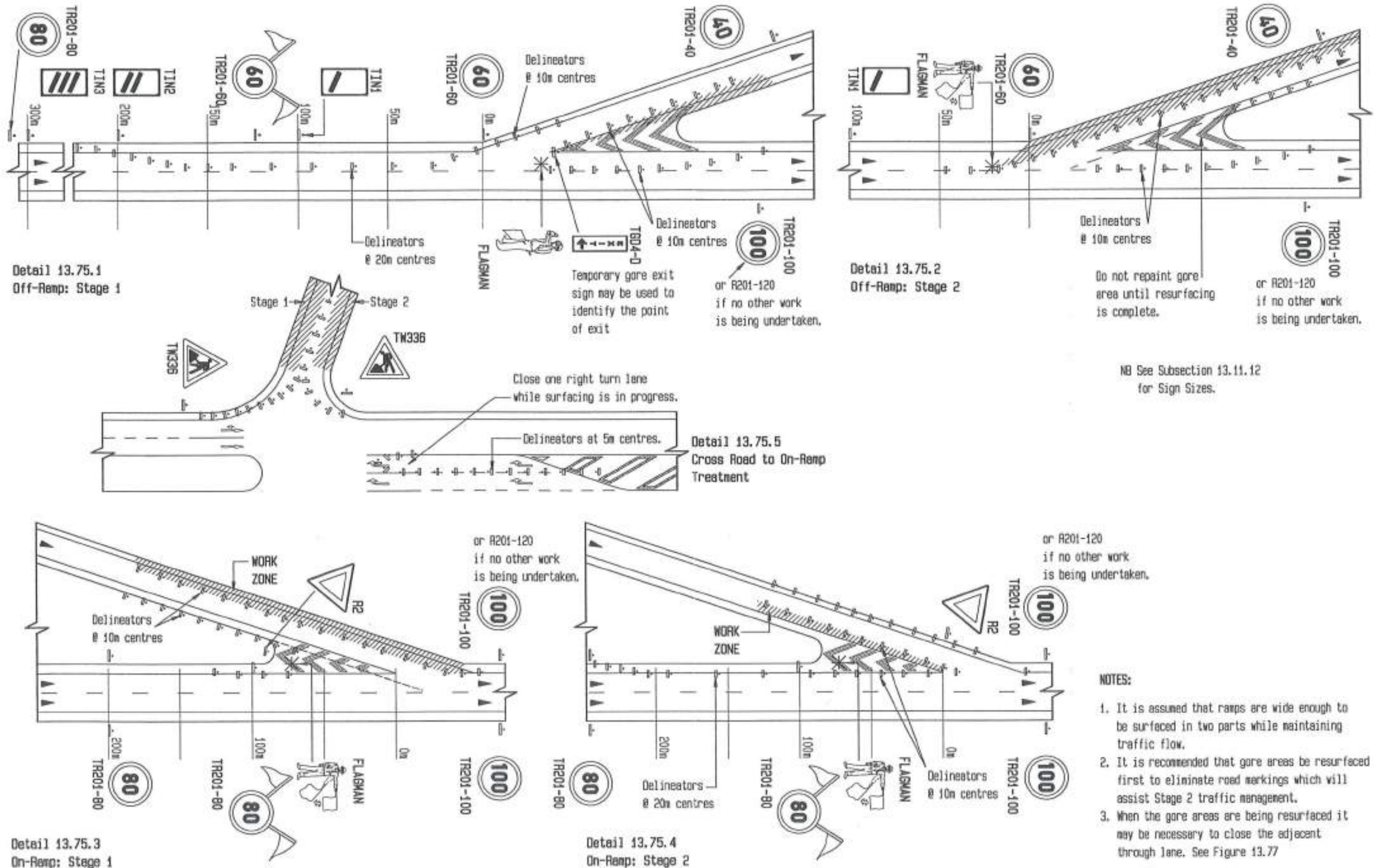
### 13.11.12 Resurfacing – Freeway Interchange Ramps - Diamond

- 1 Due to the limited width of many off-ramps and on-ramps, resurfacing or reconstruction operations may require complete closure for a short period of time, or that the work be undertaken in half widths of the ramp. Figure 13.75 shows a variety of details as to how this may be achieved.
- 2 Details 13.75.1 and 13.75.2 indicate a two stage approach at the exit point to an off-ramp. Construction can be continued for the full length of the ramp in this manner. Due to the restricted width on the ramp and the revised treatment at the point of exit, the use of a flagman to warn drivers at this point is recommended.
- 3 Details 13.75.3 and 13.75.4 show a similar arrangement in respect of an on-ramp. In this case, the function of a flagman can be to warn straight through traffic of entering traffic at lower speeds than normal due to the ramp configuration.
- 4 When necessary, STOP or YIELD control may be implemented at the on-ramp junction with the main carriageway. It has to be accepted, however, that such control will result in delays to both entering traffic and to main carriageway traffic.
- 5 Construction of the sort shown in Figures 13.75 and 13.76 may require special plant to operate in the confined space available. In each of the cases illustrated, the inventory of signs should be added to that required for the full work site. Careful planning should result in the inventory for one ramp only being required.

#### Checklist

- ☐ can the ramps be worked on in half sections?
- ☐ can work on ramps be organised to minimise the effects on traffic without serious cost implications?
- ☐ is suitable plant available to work in the limited space?
- ☐ if the ramps have to be closed can traffic be accommodated at adjacent ramps?

| TYPICAL INVENTORY   |                |            |                      |
|---|----------------|------------|----------------------|
| Sign  | No             | Size (mm)  | Quantity             |
|    | TR201-40       | 1200       | 2                    |
|   | TR201-60       |            | 2                    |
|   | TR201-80       |            | 2                    |
|   | TR201-100      |            | 2                    |
|    | R201-120       | 1200       | 2                    |
|    | TIN 1          | 1200 X 700 | 1                    |
|    | TIN 2          | 1200 X 700 | 1                    |
|    | TIN 3          | 1200 X 700 | 1                    |
|   | TN336          | 1500       | 2                    |
|  | R2             | 1500       | 2                    |
|  | TW401<br>TW402 | 800 X 200  | 40-50<br>per<br>ramp |
|  | FLAGS          | 450 X 450  | 4                    |
|  | TGA4-D         | 800 X 1280 | 1                    |








**Fig 13.75**  
Resurfacing – Freeway Interchange  
Diamond Ramps

13.11.13 Resurfacing – Freeway Interchange Ramps – 360° Loop

- 1 Figure 13.76 indicates a similar half width construction plan to that shown in Figure 13.75 suitable for circular ramps used at parclo and systems interchanges. It will be very difficult to redirect traffic at a systems interchange to permit full closure of a ramp.
- 2 Construction of the sort shown in Figures 13.75 and 13.76 may require special plant to operate in the confined space available. In each of the cases illustrated, the inventory of signs should be added to that required for the full work site. Careful planning should result in the inventory for one ramp only being required.

Checklist

- ☐ can the ramps be worked on in half sections?
- ☐ can work on ramps be organised to minimise the effects on traffic without serious cost implications?
- ☐ is suitable plant available to work in the limited space?
- ☐ if the ramps have to be closed can traffic be accommodated at adjacent ramps?

| TYPICAL INVENTORY   |                |               |  |
|---|----------------|---------------|--|
| Sign  | No             | Size (mm)     | Quantity   |
|  | TR201-40       | 1200          | 2  |
|   | TR201-60       |               | 4  |
|   | TR201-80       |               | 4  |
|   | TR201-100      |               | 4  |
|  | R201-120       | 1200          | 4  |
|  | R2             | 1500          | 1  |
|  | TW401<br>TW402 | 800 X<br>200  | 20m centres<br>on straight<br>10m centres<br>on loop |
|  | TGA4-D         | 800 X<br>1280 | 1  |



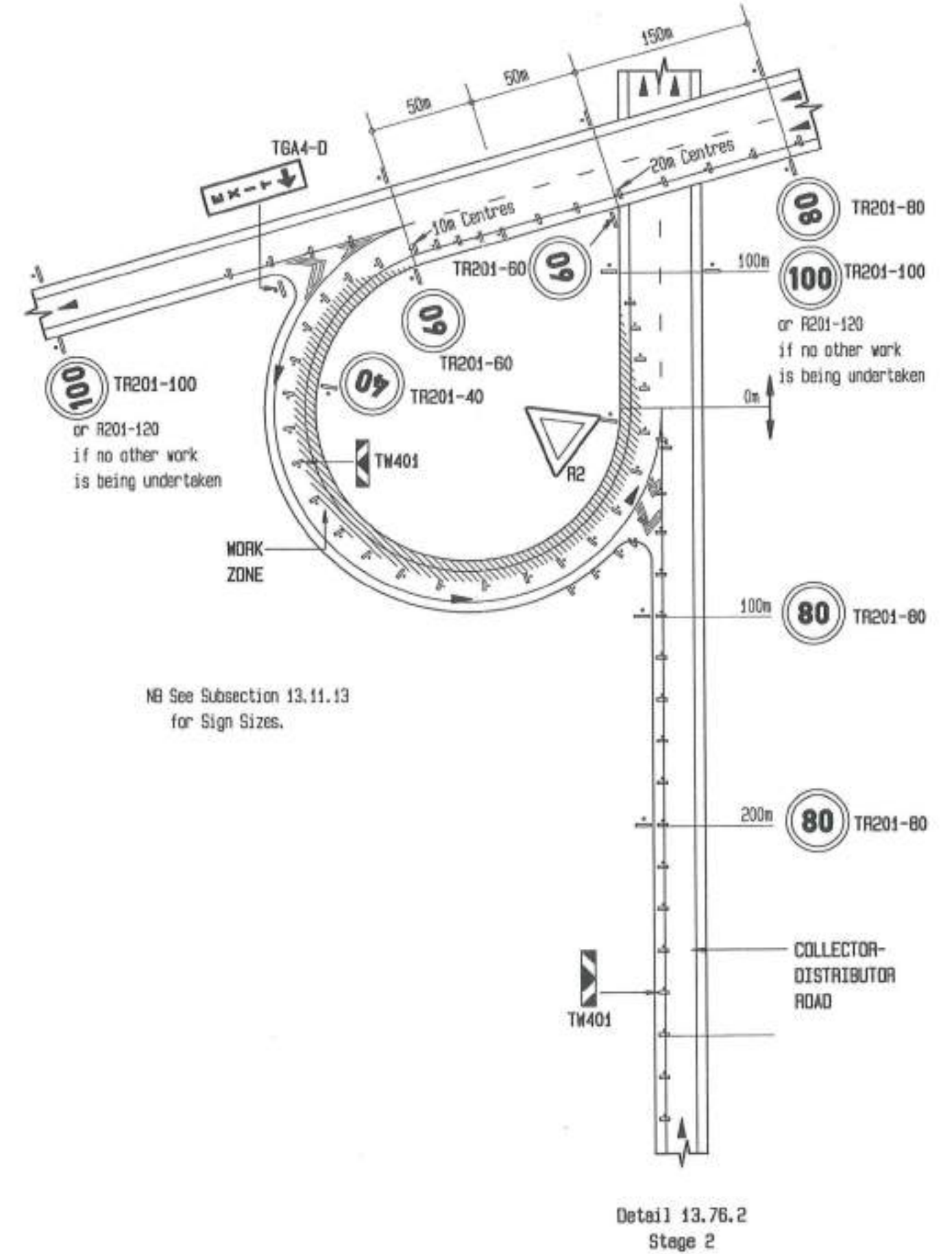
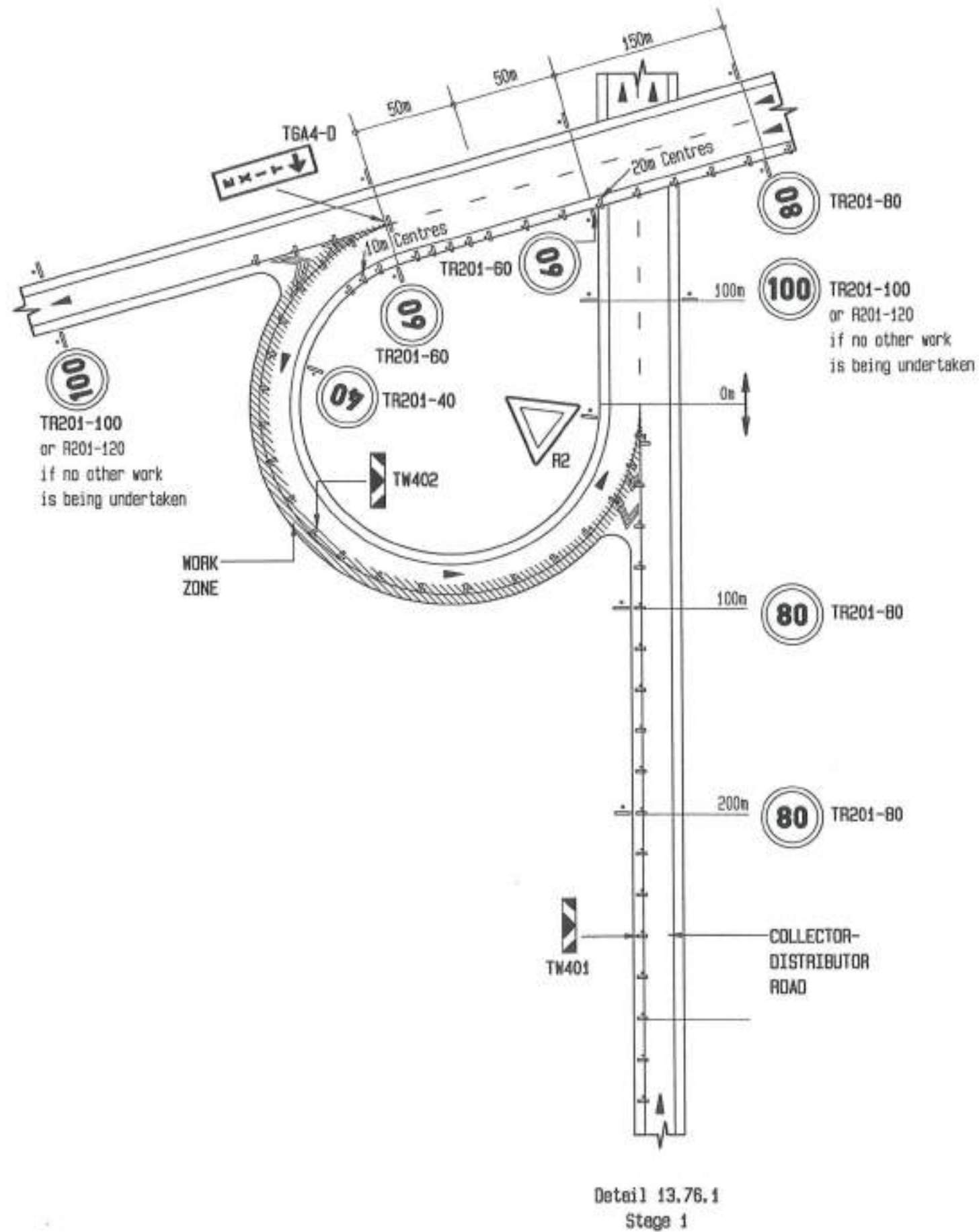


Fig 13.76  
Resurfacing – Freeway Interchange  
360° Loop Ramps



## **13.12 ENLARGED STANDARD DETAILS – ALL APPLICATIONS**


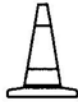


### **13.12.1 General**

- 1 The details in this section are individual elements from many of the examples given in Sections 9.8 to 9.11. They are depicted to a larger scale than has been possible in the more general figures so that the specific details of their arrangement, or setting out on the roadway, may be clearer.
- 2 Many of these enlarged standard details refer to elements which comprise components of temporary traffic control zones as described in Figure 13.20 including:
  - (a) TRANSITION AREA elements:
    - (i) tapers;
    - (ii) crossovers;
  - (b) TERMINATION AREA taper.



### 13.12.2 Lane Drop Taper - Upstream Transition Area

- 1 Figure 13.77 illustrates a typical lane drop taper in greater detail than depicted in individual traffic control figures given in other sections of this chapter.
- 2 The detail given here must be considered as additional to the signing indicated in sign sequence examples unless noted otherwise e.g. Figure 13.66.
- 3 The number of DELINEATOR PLATE signs TW401 or TW402, or of TRAFFIC CONES TD4, which are required for a specific taper is dependant on the shift absorbed by the taper and the rate of shift. For further details see Section 13.5 - "Temporary Delineation" and specifically Tables 13.4 and 13.5. As a general rule, for a 3.5 m wide lane, an upstream lane drop taper should consist of 12 to 15 delineators or cones equally spaced along the taper.
- 4 It is recommended that when a shoulder exists, the taper be extended across the shoulder, since this is also dropped. It may increase the conspicuity at the start of the taper if the taper rate across the shoulder is made half that used on the taper, i.e. 1 in 10 rather than 1 in 20.
- 5 In a similar way, it is recommended that the delineator or cone spacing used on the taper be retained for the length of the longitudinal BUFFER ZONE or STABILIZING AREA following the taper, and that the spacing only be increased once the work area is reached.
- 6 The use of shift and taper rates (i.e. 1 in 20) is appropriate for design purposes, however, if traffic accommodation drawings are being provided, it is better that the start and end points of the required taper be identified on the road chainage, or that the length in metres (and paces) be stated rather than the rate.

| TAPER ONLY INVENTORY  |                |  |   |
|---|----------------|--|---|
| Sign  | No             | Size (mm)  | Quantity  |
|  | TW401<br>TW402 | 150 X 600<br>200 X 800<br>250 X 1000<br>300 X 1200 | 12 to 15 for<br>3,5m lane<br>plus 5 for<br>shoulder |
|  | TD4            | 450<br>750   | As above  |
|  | TR103<br>TR104 | 900<br>(urban)<br>1200<br>(rural)                  | 2 to 5  |
|  | TW411          | 300 X 1800<br>(urban)<br>400 X 2400<br>(rural)     | 1 to 3  |

#### Checklist

- ☐ has the number of delineators or cones required for each taper been included in the sign quantities derived from the appropriate figure or figures being used to design the traffic accommodation?

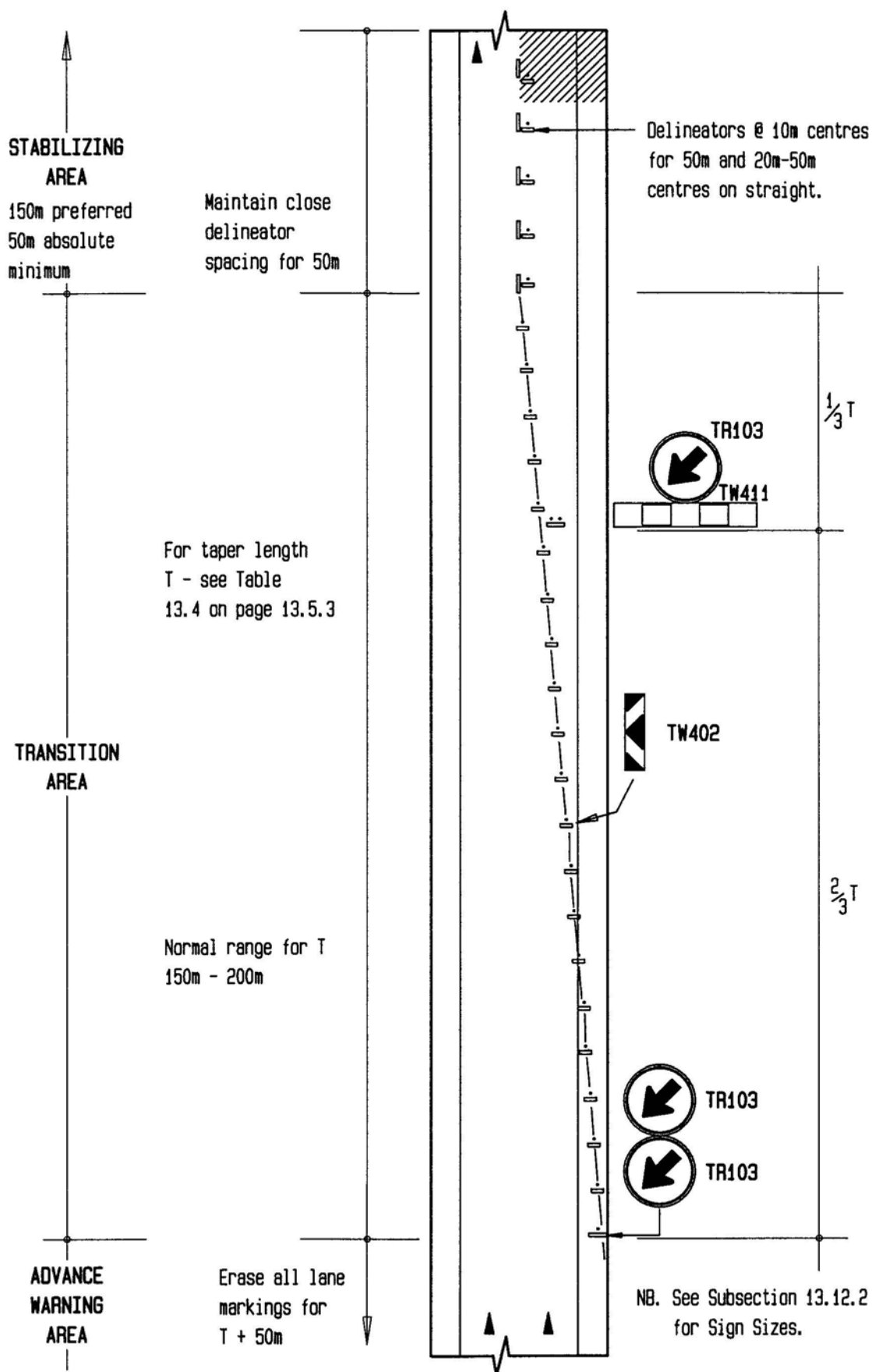



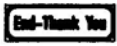


Fig 13.77

Lane Drop Taper – Upstream Transition Area

### 13.12.3 Taper - Downstream Termination Area

- 1 The TERMINATION AREA is one of the standard components of a roadworks site as set out in Figure 13.20. In this respect, the function of site termination must be considered and understood, but, because this is the point where a restricted road cross-section is returned to a normal cross-section, the standards applied are relatively low. Since the taper operates in a "downstream" manner, drivers will adopt a flatter line for comfort. Figure 13.78 shows a typical arrangement with a rapid 1 in 5 to 1 in 10 taper beyond the end of the work area. For details of delineator or cone spacings, and acceptable taper rates, refer to Tables 13.4 and 13.5 respectively.
- 2 Figure 13.78 also illustrates signs normally provided beyond the end of the TERMINATION AREA. If a temporarily reduced speed limit has been posted within the roadworks site, it is strongly recommended that drivers be reminded of the prevailing speed limit on their return to normal conditions. It is also recommended to associate this message with a final display of the "Roadworks" sign TW336 together with a brief public relations message such as "End - Thank You" on a TIN11.4 SUPPLEMENTARY PLATE sign.
- 3 Whilst less essential than on the approach side of a taper, it is recommended that a section of lane line from the start of the taper be erased to open up the full road cross-section.

| TYPICAL SIGN REQUIREMENTS   |                |  |                                       |
|---|----------------|--|---------------------------------------|
| Sign  | No             | Size (mm)  | Quantity                              |
|  | TW401<br>TW402 | 150 X 600<br>200 X 800<br>250 X 1000<br>300 X 1200 | 5 for taper<br>plus 5 for<br>shoulder |
|  | R201-120       | 900<br>(urban)<br>1200<br>(rural)                  | 2                                     |
|  | TW336          | 900<br>(urban)<br>1200<br>(rural)                  | 2                                     |
|  | TIN 11.4       | 900<br>(urban)<br>1200<br>(rural)                  | 2                                     |

#### Checklist

- ☐ is the termination area at the end of the roadworks site or is it simply at a change from one restricted state to a less restricted state?
- ☐ has there been a reduction of speed limit within the site?
- ☐ is it advisable to remove 60 m to 100 m of lane line from the start of the taper?

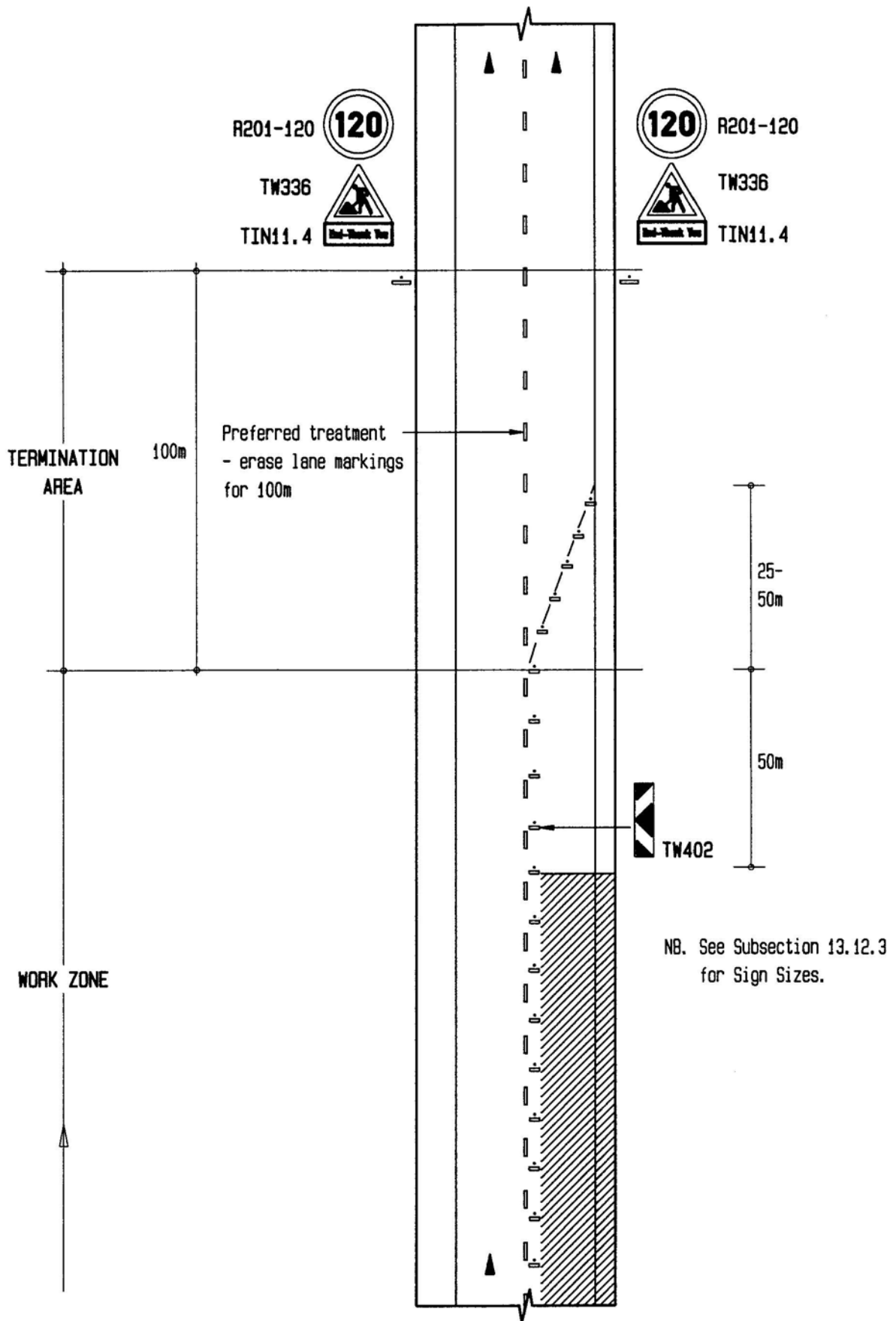





Fig 13.78

Taper –Downstream Termination Area

### 13.12.4 Lane Shift Taper - Transition Area

- 1 The detail covered by Figure 13.79 is appropriate when policy dictates that the "fast" lane be dropped approaching a restricted roadway width at a roadworks site, but where the work area lies in the path of the "slow" lane. The TRANSITION AREA shown is therefore commonly likely to be the second transition before reaching the BUFFER ZONE and WORK AREA. The first transition will be the taper dropping the "fast" or median side lane.
- 2 A shift from the left lane to right lane may be necessitated by the need for work ahead in the left lane or the shift may precede another transition created by a median crossover to the far side carriageway. The rate of shift (taper rate) and cone/delineator spacing shall be in accordance with Tables 13.4 and 13.5.
- 3 Since the shifting roadway is defined by the physical presence of cones or delineators, it is recommended that the width of roadway be not less than 4 metres. All standard road markings shall be erased along the length of the lane shift. To enhance the alignment edges, temporary LEFT and RIGHT EDGE LINE markings are recommended. These lines should be retroreflective and they may be further supplemented by yellow (left) and white (right) roadstuds.
- 4 The signing inventory is additional to that derived for any roadworks traffic management situation illustrated in other sections.

| TYPICAL SIGN REQUIREMENTS   |                |  |          |
|---|----------------|--|----------|
| Sign  | No             | Size (mm)  | Quantity |
|  | TW401<br>TW402 | 150 X 600<br>200 X 800<br>250 X 1000<br>300 X 1200 |          |
|  | TR104          | 900<br>(urban)<br>1200<br>(rural)                  | 3        |
|  | TW411          | 300 X 1800<br>(urban)<br>400 X 2400<br>(rural)     | 1        |

#### Checklist

- ☐ are traffic cones provided with retroreflective sleeves?
- ☐ are delineators more appropriate than cones?
- ☐ have road markings been erased within the shifted lane?
- ☐ are temporary edge line markings and/or roadstuds warranted?

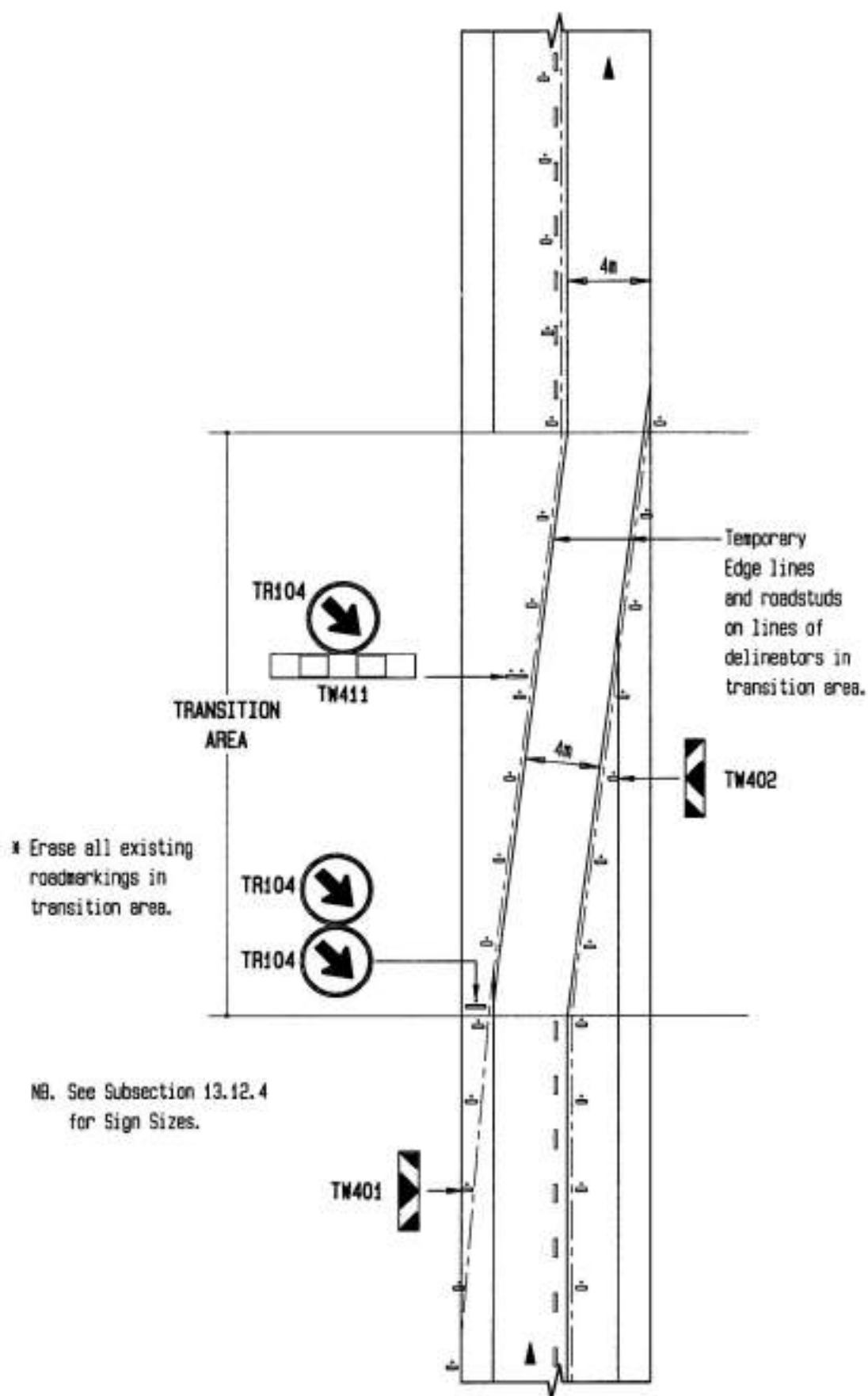


Fig 13.79

Lane Shift Taper – Transition Area











### 13.12.5 Double Lane Drop Tapers - Upstream Transition Area

- 1 The purpose of Figure 13.80 is to illustrate the overall effect of two tapers required by a double lane drop. Any roadway with three lanes in one direction will likely carry significant volumes of traffic. The dropping of two out of three lanes should therefore be undertaken with care.
- 2 In Figure 13.80, the various standard function traffic management areas are numbered to show the succeeding components of the double lane drop. Due to the expected high traffic volumes, DIAGRAMMATIC signs are recommended.
- 3 In order to assist the merging operation, it is recommended that road markings be omitted within the taper areas. The dictating factors in determining the length of STABILIZING AREA (1) are:
  - (a) sufficient longitudinal space to locate a sequence of a pair of diagrammatic signs;
  - (b) sufficient length of roadway to allow traffic flow, affected by the tapers, to merge safely and proceed in the remaining lane(s)?

#### Checklist

- ☐ check to see that the sign inventory is not duplicated in the main application inventory?
- ☐ can the single remaining lane adequately accommodate traffic?
- ☐ is the site a short term one or a medium to long-term one?

| TYPICAL SIGN REQUIREMENTS   |          |  |                                |
|---|----------|--|--------------------------------|
| Sign  | No       | Size (mm)                                      | Quantity                       |
|    | TGS104   | 1200 X 1600                                    | 4                              |
|    | TGS102   | 1200 X 1600                                    | 4                              |
|    | TR201-60 | 1200   | 2                              |
|    | TR103    | 1200   | 6                              |
|   | TR214    | 1200   | 1                              |
|  | TN411    | 300 X 1600<br>(urban)<br>400 X 2400<br>(rural) | 2                              |
|  | TN402    | 800 X 200                                      | 30 taper<br>plus 5<br>per 100m |
|  | TIN 11.3 | 1200   | 8                              |

**NOTE:**

1. The detail shown here is applicable to freeway or other high speed dual carriageway roadways for work lasting more than 24 hours.

NB See Subsection 13.12.5 for Sign Sizes.

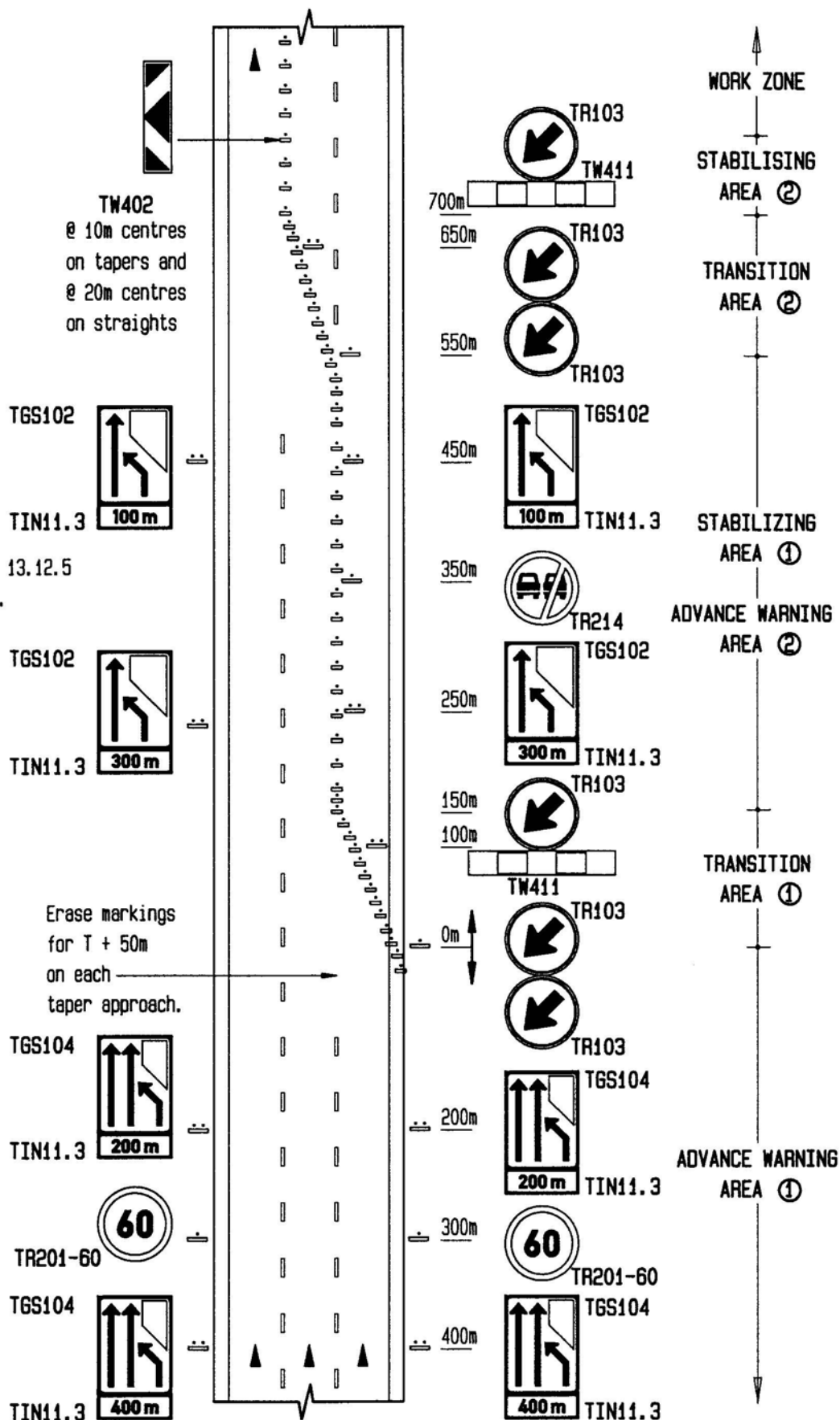







Fig 13.80

Double Lane Drop Taper – Upstream Transition Area

### 13.12.6 Crossover Reverse Curve – Single Lane Transition Area

- Figure 13.81 shows the signing detail for a single lane crossover of a central median island of a dual carriageway roadway. This type of TRANSITION AREA will commonly be the second or even third in an approach sequence to the WORK AREA which comprises one carriageway of the dual carriageway roadway (see Figure 13.70 in Section 13.11). The preceding traffic control sequence will most likely be a lane drop TRANSITION AREA followed by a STABILIZING AREA which will accommodate the advance signing (DIAGRAMMATIC signs) for the crossover. In this case the crossover leads into a three lane cross-section (see Figures 13.20 and 13.86).
- The horizontal alignment of the crossover should be designed to the highest standard consistent with space constraints. A minimum lane width within the crossover of 4 metres is recommended. This should be increased for designs which incorporate minimum horizontal reverse curve design (see Figure 13.81 for a two-lane crossover detail). For full details of crossover alignment design options, refer to Section 13.4 and Figures 13.24 to 13.26.
- An installation of this size will warrant the use of DELINEATOR PLATE signs TW401 and TW402. The use of TR104/TW411 barricade signing above and behind the delineators is recommended. A formal "Road Closure" barricade should be established at the beginning of the BUFFER ZONE. The signing of the barricade should conform to one of the options illustrated in Figures 13.18, 13.19 and 13.87.
- The sign inventory listed for this type of crossover should be added to the basic sign requirements listed under the application with which it is to be used e.g. Figure 13.70, plus any other inventory items for additional transition details to be used within the site.

| TYPICAL SIGN REQUIREMENTS   |                             |  |                  |
|---|-----------------------------|--|------------------|
| Sign  | No                          | Size (mm)  | Quantity         |
|  | TR103<br>TR104              | 900<br>(urban)<br>1700<br>(rural)                  | 2<br>4           |
|  | TW401<br>TW402              | 150 X 600<br>200 X 800<br>250 X 1000<br>300 X 1200 | 20 Min<br>30 Min |
|  | Road<br>closed<br>barricade | 1200 X<br>2400                                     | 2                |
|  | TW411                       | 300 X 1800<br>(urban)<br>400 X 2400<br>(rural)     | 1                |
|  | TW407<br>TW408              | 400 X<br>1200                                      | 2<br>2           |

#### Checklist

- ☐ is the crossover wide enough and free-flowing enough for heavy vehicles and the set speed limit?
- ☐ are TR104/TW411 barricades in place?
- ☐ is the alignment of the crossover demarcated by retroreflective edge line markings and/or roadstuds?
- ☐ is the length of STABILIZING AREA preceding the crossover adequate to achieve stable traffic flow?

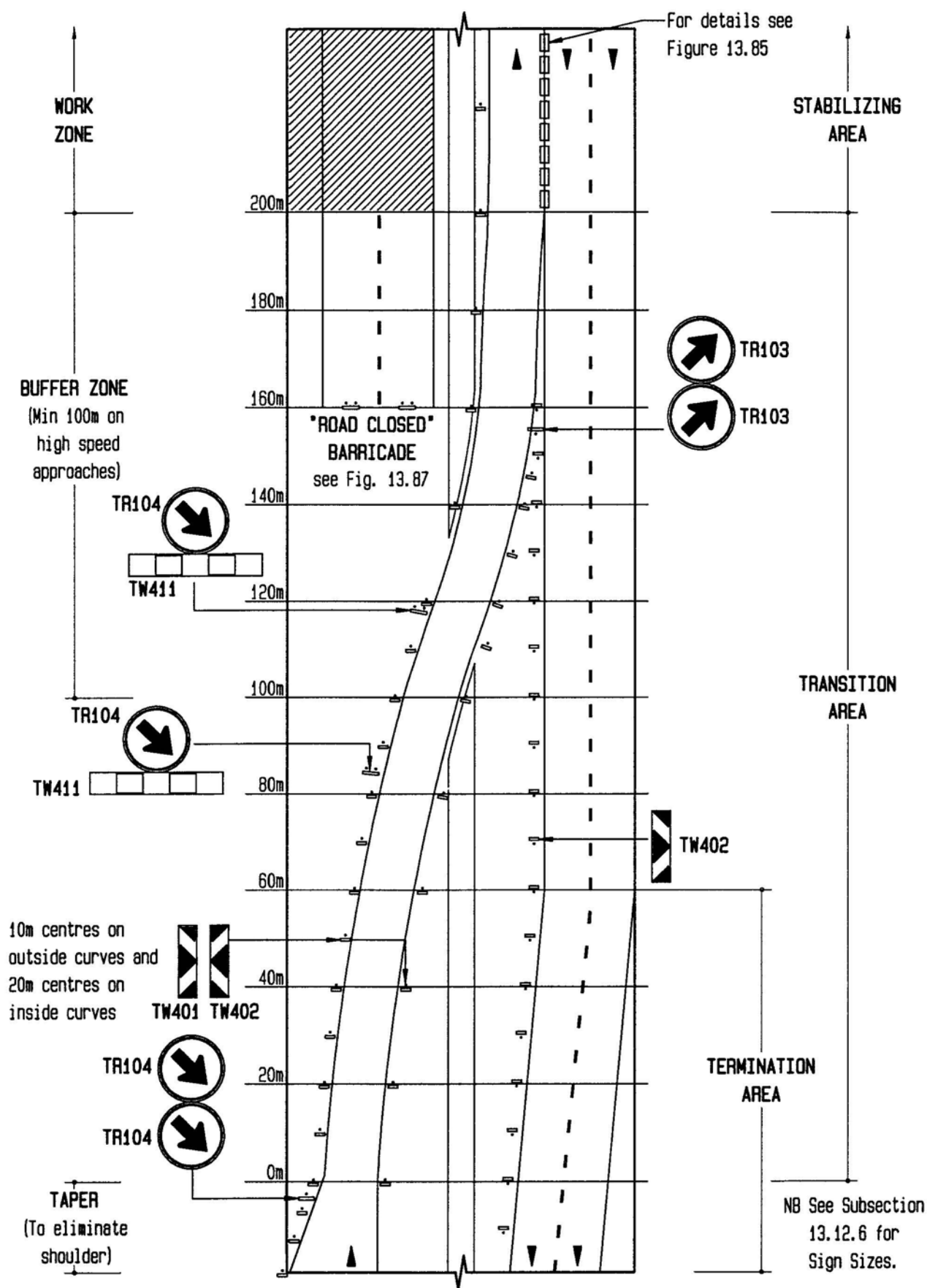







Fig 13.81

Crossover Reverse Curve – Single Lane - Transition Area

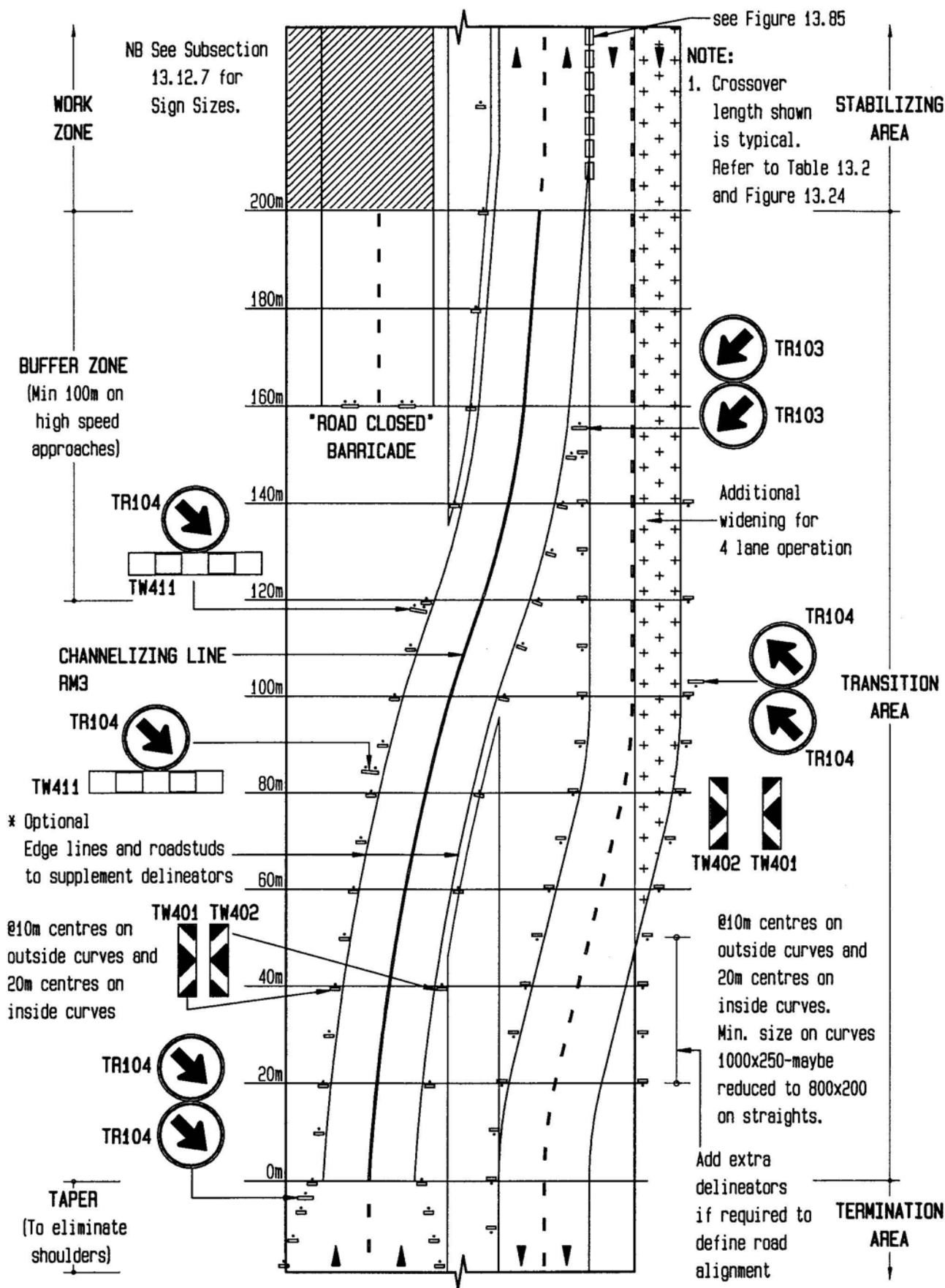
### 13.12.7 Crossover Reverse Curve - 2 Lane Transition Area

- 1 The detail covered by Figure 13.82 is similar to that given in Figure 13.81 with the exception that two lanes are taken through the crossover into a 4-lane, 2-way section of deviation on the opposite carriageway of a dual carriageway (see Figure 13.71).
- 2 All the design and signing statements given in Subsection 13.12.6 are appropriate to the signing application illustrated in Figure 13.82 and these should also be read.
- 3 In addition to the details covered in Subsection 13.12.6 it is important that lane changing movements through the crossover be inhibited to promote stable traffic flow through this TRANSITION AREA. It is recommended that a CHANNELIZING LINE marking RM3 (between traffic streams travelling in the same direction - this has the same function as a NO OVERTAKING LINE marking RM1). Because of the specification of this marking, it is further recommended that the edges of the crossover roadway be defined on the left by a yellow LEFT EDGE LINE marking RM4.1 and on the right by a white RIGHT EDGE LINE marking RM4.2. These edge lines may be supplemented by roadstuds.
- 4 The sign inventory listed for this type of crossover should be added to the basic sign requirements listed under the application with which it is to be used e.g. Figure 13.71, plus any other inventory items for additional transition details to be used within the site.

| TYPICAL SIGN REQUIREMENTS  |                          |                       |          |
|--|--------------------------|-----------------------|----------|
| Sign   | No                       | Size (mm)             | Quantity |
|  | TR103                    | 900<br>(urban)        | 2        |
|  | TR104                    | 1200<br>(rural)       | 6        |
|   | TW401                    | 200 X 800             | 28 Min   |
|  | TW402                    | 250 X 1000            | 25 Min   |
|  | Road closed<br>barricade | 1200 X<br>2400        | 2        |
|  | TW411                    | 300 X 1800<br>(urban) | 2        |
|  |                          | 400 X 2400<br>(rural) |          |
|  | TW407                    | 400 X                 | 2        |
|  | TW408                    | 1200                  | 2        |

#### Checklist

- ☐ are the lanes through the crossover wide enough for heavy vehicles and the set speed limit?
- ☐ should heavy vehicles be prohibited from the right side lane?
- ☐ should roadstuds be provided for the edge lines (and the central channelizing line)?
- ☐ should INFORMATION ARROW GM4.1 be applied strategically to both lanes within the crossover?








**Fig 13.82**

### Crossover Reverse Curve – 2 Lane Transition Area



### 13.12.8 Start of Deviation Reverse Curve - Upstream Transition Area

- 1 The detail in Figure 13.83 should be read in conjunction with Figures 13.54 and 13.55 and Subsections 13.9.13 and 13.9.14. The sign inventory for the reverse curve TRANSITION AREA illustrated in Figure 13.83 should be added to that specified for the appropriate deviation detail being applied.
- 2 The similarity between Figures 13.83 and 13.82, particularly within the crossover, should be noted. The crossover in Figure 13.82 operates in a one-way mode, whereas, that in Figure 13.83 works in a two-way mode. If there is any risk of confusion to drivers, additional NO OVERTAKING signs TR214 (see Figure 13.55) and/or advance warning signs TW212 should be considered.
- 3 A formal "Road Closure" barricade should be established at the beginning of the BUFFER ZONE. The signing of the barricade should conform to one of the options illustrated in Figures 13.18, 13.19 and 13.87.
- 4 The horizontal alignment of the reverse curve into and out of the deviation should be designed to the highest standard consistent with space and cost constraints. A minimum lane width within the reverse curve section of 4 metres is recommended. If there is a significant percentage of heavy vehicles in either, or both, directions this width should be further increased. For full details of reverse curve design options refer to Section 13.4 and Figures 13.24 to 13.26.

| TYPICAL SIGN REQUIREMENTS   |                             |  |                                      |
|---|-----------------------------|--|--------------------------------------|
| Sign  | No                          | Size (mm)                                      | Quantity                             |
|  | TR104                       | 900<br>(urban)<br>1200<br>(rural)              | 8                                    |
|  | TW401<br>TW402              | 150 X 600<br>200 X 800                         | 27 Min<br>plus 8<br>for<br>shoulders |
|  | Road<br>closed<br>barricade | 1200 X<br>2400                                 | 2                                    |
|  | TW411                       | 300 X 1800<br>(urban)<br>400 X 2400<br>(rural) | 4                                    |
|  | TW407<br>TW408              | 400 X<br>1200                                  | 2<br>2                               |






#### Checklist

- ☐ is there a vertical curve coincident with the reverse horizontal curve?
- ☐ are delineators mounted high enough, or are they large enough to define both horizontal and vertical curvature if required?
- ☐ are lane widths wide enough to accommodate heavy vehicles simultaneously in both directions?
- ☐ are TR104/TW411 barricades in place?
- ☐ if the reverse curve geometry is to minimum standards have approaching traffic speeds been satisfactorily reduced?



### 13.12.9 Deviation Crossover Reverse Curve - Transition Area

- 1 The terms "deviation" and "detour" are described in Subsection 13.9.14. A deviation tends to be fitted into available space parallel to the road under construction. In a rural environment, it may be necessary on occasions to move the deviation from one side of the WORK AREA to the other, and *vice versa*. Figure 13.84 shows a typical example of such a deviation crossover of the WORK AREA. This form of crossover is a form of TRANSITION AREA, and shall be preceded by appropriate signs in ADVANCE WARNING AREAS (see Figure 13.55).
- 2 As with all reverse curves of this nature, they should be designed to the highest standard possible in terms of available space. The details given in Section 13.4 and Figures 13.24 to 13.26 are relevant to the design of such a reverse curve. It has been fairly common practise in the past to make this type of crossover to very low geometric standards because it is preferred to keep the section of the main roadway affected by the crossover to a minimum. Care should be exercised so that if this is done, a hazardous and unreasonable situation is not created for drivers.
- 3 Formal "Road Closed" barricades should be established at the limits of the section of roadway being crossed. These barricades should be positioned safely, with an effective buffer zone between them and traffic. The signing of the barricade should conform to one of the options illustrated in Figures 13.18, 13.19 and 13.87.
- 4 The sign inventory for this form of crossover TRANSITION AREA should be added to that specified for the appropriate deviation detail being applied e.g. Figure 13.54 and Figure 13.55.

| TYPICAL SIGN REQUIREMENTS   |                             |  |                              |
|---|-----------------------------|--|------------------------------|
| Sign  | No                          | Size (mm)                                      | Quantity                     |
|  | TR103                       | 900<br>(urban)<br>1200<br>(rural)              | 8                            |
|  | TW401<br>TW402              | 150 X 600<br>200 X 800                         | 50 Min<br>plus 5<br>per 100m |
|  | Road<br>closed<br>barricade | 1200 X<br>2400                                 | 4                            |
|  | TW411                       | 300 X 1800<br>(urban)<br>400 X 2400<br>(rural) | 4                            |
|  | TW407<br>TW408              | 400 X<br>1200                                  | 4<br>4                       |

#### Checklist

- ☐ can drivers accurately determine the severity of the reverse curve?
- ☐ if there is a vertical curvature of significance associated with the crossover (rising and falling over the established road construction for example) and is it clearly discernible?
- ☐ are effective "Road Closed" barricades in place?
- ☐ will construction traffic have to enter the WORK AREA at the "Road Closed" barricades - if so, will a flagman be required to control traffic and construction vehicles?

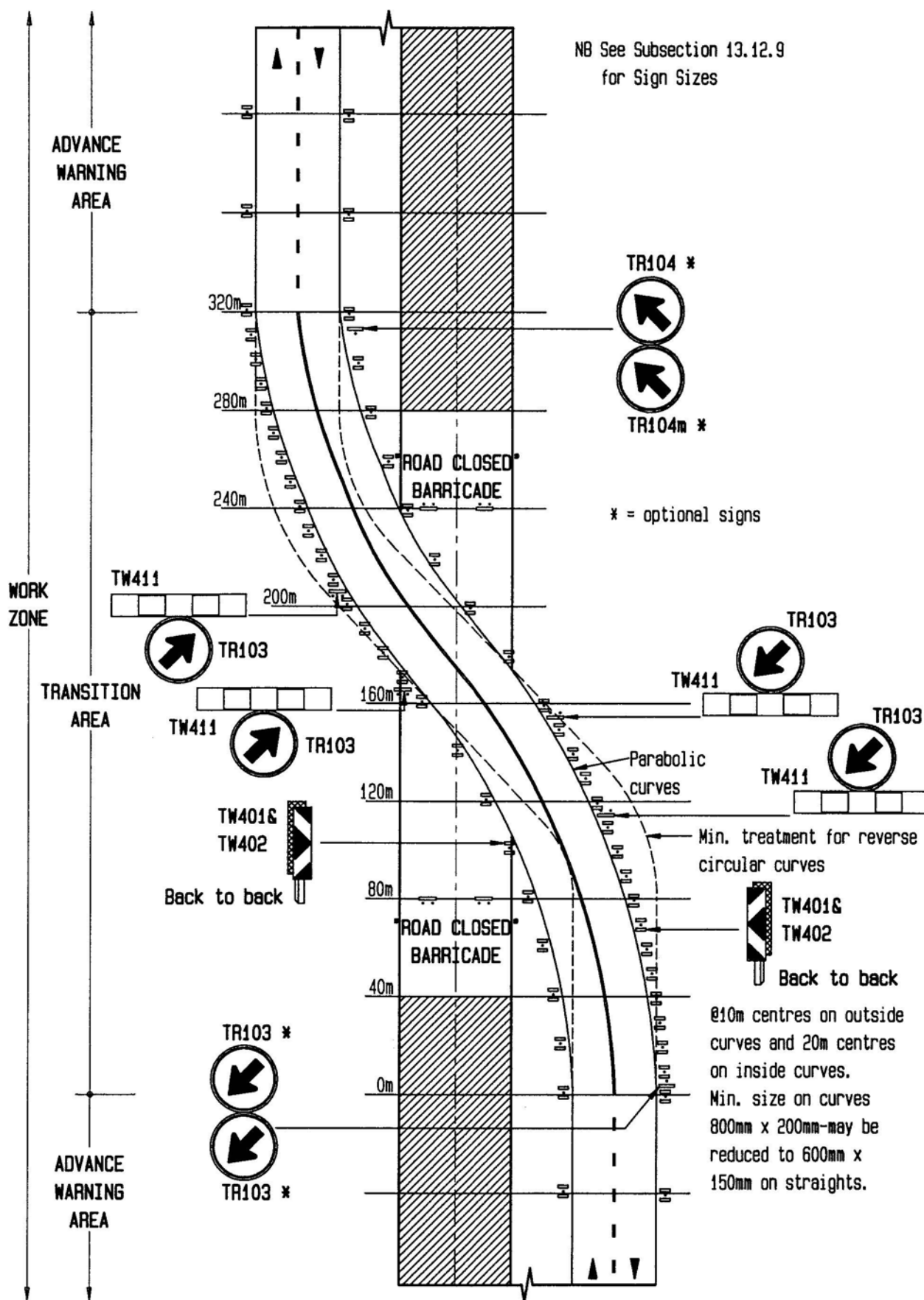


Fig 13.84

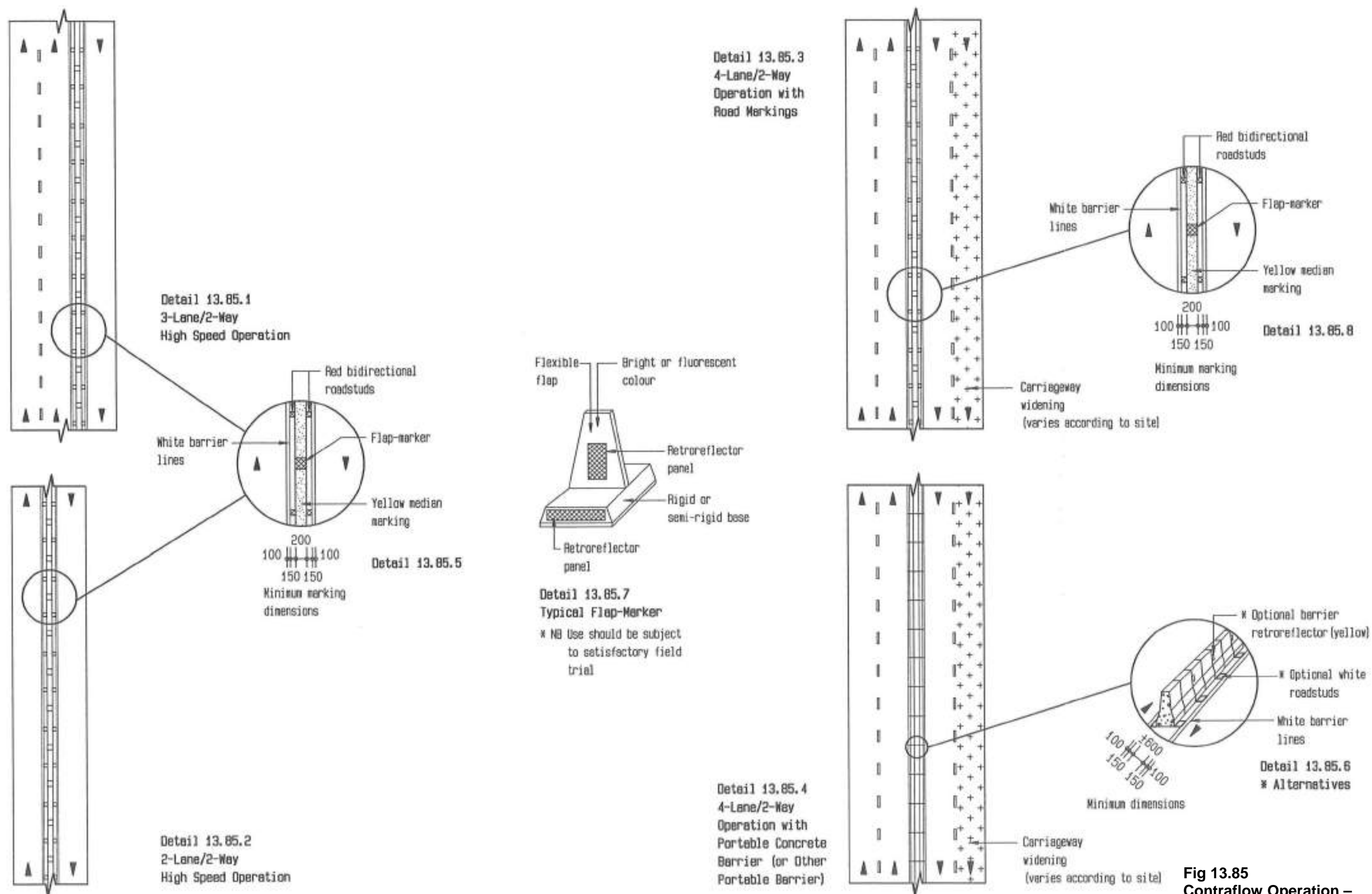
Deviation Crossover Reverse Curve - Transition Area

### 13.12.10 Contraflow Operation - Road Markings

- 1 Experience of major deviations for freeway, or dual carriageway rehabilitation, has shown that special attention often needs to be paid to the marking of the division between two-way streams of traffic under such circumstances. The basic need for this special effort generally arises from one or both of two factors:
  - (a) long sections of deviation without overtaking opportunities; and/or
  - (b) a wide mix of traffic types, including large/slow-moving vehicles.
- 2 The common operational feature of deviations requiring special consideration is that one carriageway of a dual carriageway roadway is temporarily used to carry two-way traffic. One of the resultant risks, is that eventually drivers forget this, and assume that they can use the "other" lane, with potentially disastrous results. Two-way operation of one carriageway can occur in a number of configurations. Figure 13.85 illustrates three options, namely:
  - (a) 2-lane 2-way;
  - (b) 3-lane 2-way;
  - (c) 4-lane 2-way.
- 3 When a 2-lane carriageway, with shoulders, is converted to 2-way operation, it is recommended that a form of PAINTED ISLAND marking RM5 be used as shown in Details 13.85.1 to 13.85.3. This marking comprises a central yellow continuous line flanked by NO CROSSING LINE marking RM2. Red bidirectional roadstuds may be specified and, in addition, it may prove effective to provide one of the proprietary "Flap-Markers" as illustrated in Detail 13.85.7. The use of flap-markers is particularly appropriate if there is a history of overtaking related accidents. The markers are, however, costly and have a high rate of attrition. A carefully monitored field trial is recommended before purchasing large numbers of such delineation devices.
- 4 Detail 13.85.1 shows a 3-lane, 2-way cross-section. This offers overtaking opportunities in one direction which is an improvement over that offered by the cross-section in Detail 13.85.2. However, it is necessary to reverse the configuration of lanes at regular intervals in a long deviation (see Figures 13.70 and 13.86 for examples and more details).
- 5 Details 13.85.3 and 13.85.4 show two options for the separation of 2-way traffic on a 4-lane cross-section. Details 13.85.3 and 13.85.8 are essentially the same as used for Details 13.85.1 and 13.85.2. Detail 13.85.4 shows a portable barrier between opposing traffic streams. This treatment is warranted when the deviation is carrying very high traffic volumes. The use of concrete "New Jersey" style barriers is costly but may still be cost effective if head-on accidents are prevented. This cost may be significantly offset if the barriers are ultimately intended to form part of the final construction of the road. Detail 13.85.6 shows ways in which concrete barriers can be made more visible at night. When concrete barriers are used it is important to treat the ends, where traffic is first exposed to the barrier, with great care. Figure 13.28 details various aspects of barrier specification.

#### Checklist

- ☐ are there safe overtaking opportunities within the deviation?
- ☐ how long is the deviation?
- ☐ what is the distance between overtaking opportunities?
- ☐ is the accident rate between entry and exit points significantly above what experience shows would be likely?
- ☐ can the dividing line be further enhanced using audio-tactile devices such as "Flap-Markers"?



**Fig 13.85**  
Contraflow Operation –  
Road Markings








13.12.11 Contraflow Operation - 3 Lane Change Over Buffer Zone

- 1 The detail given in Figure 13.86 is of an intermediate nature. Taper rates and numbers of delineation devices should be consistent with the detail in Figures 13.77 to 13.80. In addition the information given in Section 13.5 - "Temporary Delineation" is relevant with particular reference to Figure 13.29 and Tables 13.4 and 13.5.
- 2 The provision of 3-lane/2-way operation of traffic on one carriageway of a dual carriageway during construction or reconstruction of the other carriageway has become a fairly common practice. A disadvantage of such a configuration, particularly over long distances, is that in one direction, overtaking opportunities are denied by the provision of only one lane. It is therefore good practice to change over the configuration at regular intervals from 1-2 to 2-1 to give fair overtaking opportunities in both directions. In hilly country, the two lane sections should, if possible, be located on the uphill sections.
- 3 Figure 13.86 shows examples of the BUFFER ZONE or STABILIZING AREA consistent with a lane drop situation at the change-over of lanes. It should be noted that the lane drop taper is a Merge Taper, and must be significantly longer than the Termination Taper beyond which traffic will quickly accommodate itself within the two lanes available. The function of the BUFFER ZONE is to offer a run-off area within which vehicles can be stopped if the merge action is aborted for some reason. The worst case scenario, which should determine the overall length of the parallel section of the BUFFER ZONE, is if two vehicles travelling in opposite directions were to abort their merging manoeuvres at the same time. Typical stopping distance values are given below.

| STOPPING DISTANCE ON LEVEL ROADS |                       |
|----------------------------------|-----------------------|
| Design Speed (km/h)              | Stopping Distance (m) |
| 40                               | 45                    |
| 50                               | 65                    |
| 60                               | 85                    |
| 80                               | 140                   |
| 100                              | 205                   |
| 120                              | 285                   |

Checklist

- ☐ is sufficient longitudinal space available to accommodate a "worst case" BUFFER ZONE?
- ☐ if not how can the maximum length feasible be achieved?
- ☐ can the BUFFER ZONE be located so that the merge areas are clearly visible?
- ☐ is there adequate space in advance of the BUFFER ZONE from the merge approach to accommodate a full advance warning sign sequence?

| TYPICAL SIGN REQUIREMENTS   |                          |                    |          |
|---|--------------------------|--------------------|----------|
| Sign  | No                       | Size (mm)          | Quantity |
|  | TR103                    | 900 (urban)        | 2        |
|   | TR104                    | 1700 (rural)       | 6        |
|  | TW401                    | 200 X 800          | 28 Min   |
|   | TW402                    | 250 X 1000         | 25 Min   |
|  | Road closed<br>barricade | 1200 X 2400        | 2        |
|  | TW411                    | 300 X 1800 (urban) | 2        |
|   |                          | 400 X 2400 (rural) |          |
|  | TW407                    | 400 X              | 2        |
|   | TW408                    | 1200               | 2        |

NOTE: 1. Signs shown only for Buffer Zone. Advance sign sequences are required.

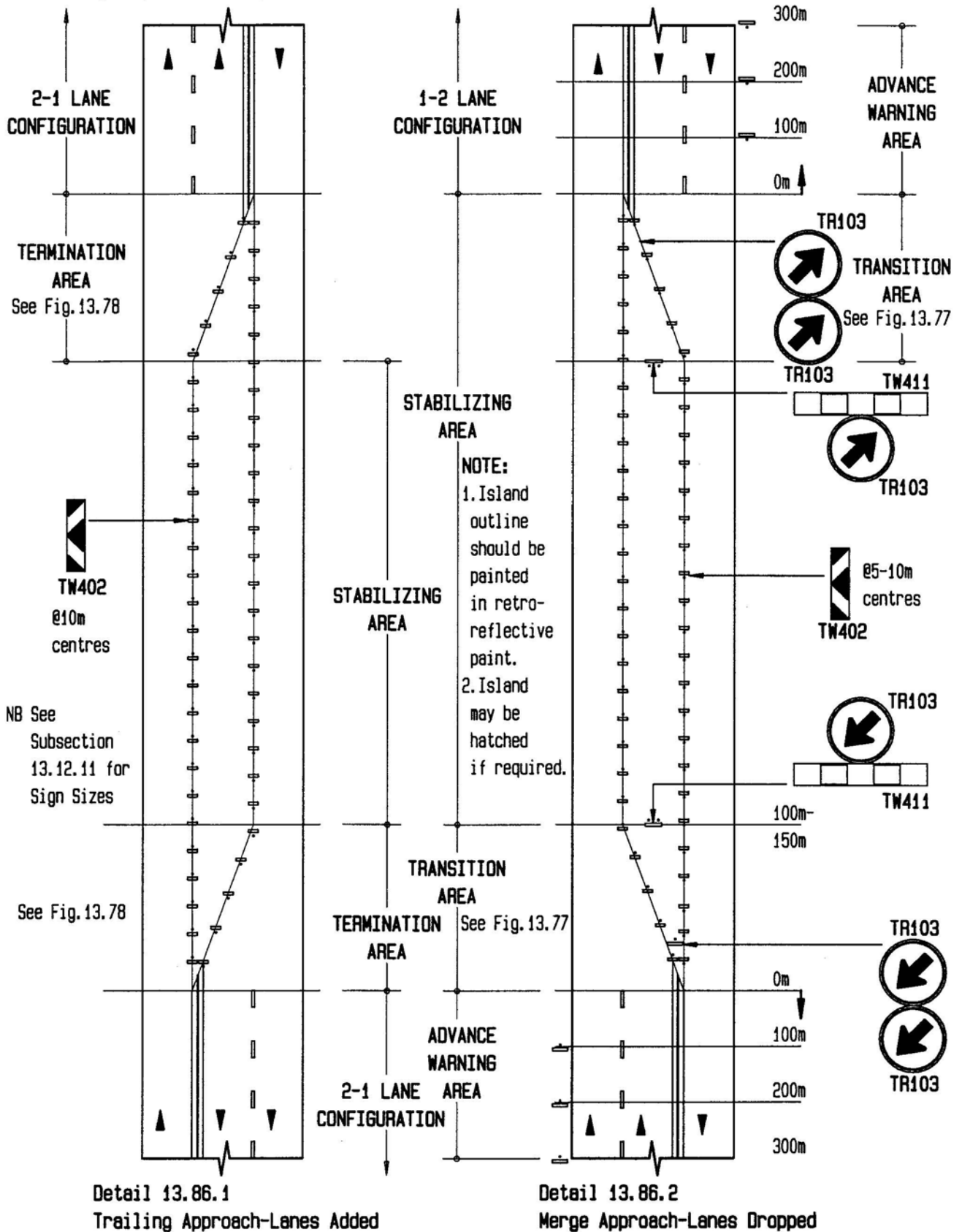


Fig 13.86

Contraflow Operation – 3 Lane Change Over Buffer Zone

### 13.12.12 Road Closed Barrier / Barricades

- 1 For the purposes of categorising temporary road traffic signing and related traffic control devices at roadworks, the following descriptions of terms commonly used in this chapter are relevant:

**“barricade:** is a temporary and portable device used to demarcate a restricted area set aside for a special use, such as roadworks or traffic surveys - **a barricade is not capable of withstanding vehicular impact”; and**

**“barrier:** is a permanent or temporary device erected on, or adjacent to, the roadway at hazardous locations which **is capable of physically preventing vehicles from leaving the roadway**, or from entering an area temporarily closed to traffic for roadworks or other special operations.”

- 2 Detail 13.87.1 in Figure 13.87 shows a section of road approaching a flooded river/washed-away bridge. As an initial precaution, once detours have been established, the barricade at Y-Y could be established closing the road to all traffic (see Detail 13.87.5). In due course, once work has commenced to repair flood damage a work site may be established. In order to provide room for the contractor's equipment, the barricade may be relocated further from the river, or a second barricade (Detail 13.87.3) or a barrier (Detail 13.87.4) may be established at X-X.
- 3 Figure 13.87 gives three representative examples of HIGH VISIBILITY signs suitable for such barricades or barriers. The sign examples all incorporate what amount to double CHEVRON signs TW407 and TW408. When mounted side-by-side as “A”/“B”, “C”/“D” or “E”/“F” the combination represents a variation of ROAD CLOSED CHEVRON hazard marker TW410.
- 4 For a total road closure use of NO ENTRY sign R3 is recommended. It should be noted that as a CONTROL regulatory sign, there is no temporary version of sign R3.
- 5 If limited access is to be permitted beyond the barricades, such as to contractor's vehicles or even local residents, the use of NO UNAUTHORISED TRAFFIC sign TR208 is appropriate.
- 6 Any fencing or guardrails forming part of the barricade or barrier must be made visible both by day and night to avoid drivers mistakenly thinking that they can drive round the signs. The simplest way to achieve acceptable visibility is by using DELINEATOR PLATE signs TW401 and TW402 on either side of the larger signs. Barriers and barricades of the type illustrated will of course be preceded by a full set of advance warning signs within the ADVANCE WARNING AREA (see Figure 13.50). The use of a STOP control immediately in front of the barricade is recommended so that access may be granted, under control, to authorised visitors.
- 7 Figure 13.88 gives details of the sort of barricades which can form part of the detour treatment at the closest junctions to the site. Figures 13.52 and 13.65 cover the more general aspects of the establishment of detours in rural and urban environments respectively.

#### Checklist

- ☐ has a detour been established?
- ☐ should initial temporary signs be replaced by a semi-permanent “Road Closed” barrier pending the start of repair work?
- ☐ is it appropriate to create a contractors “yard” on the road itself, either beyond the barrier, or between the barrier and a secondary barricade?

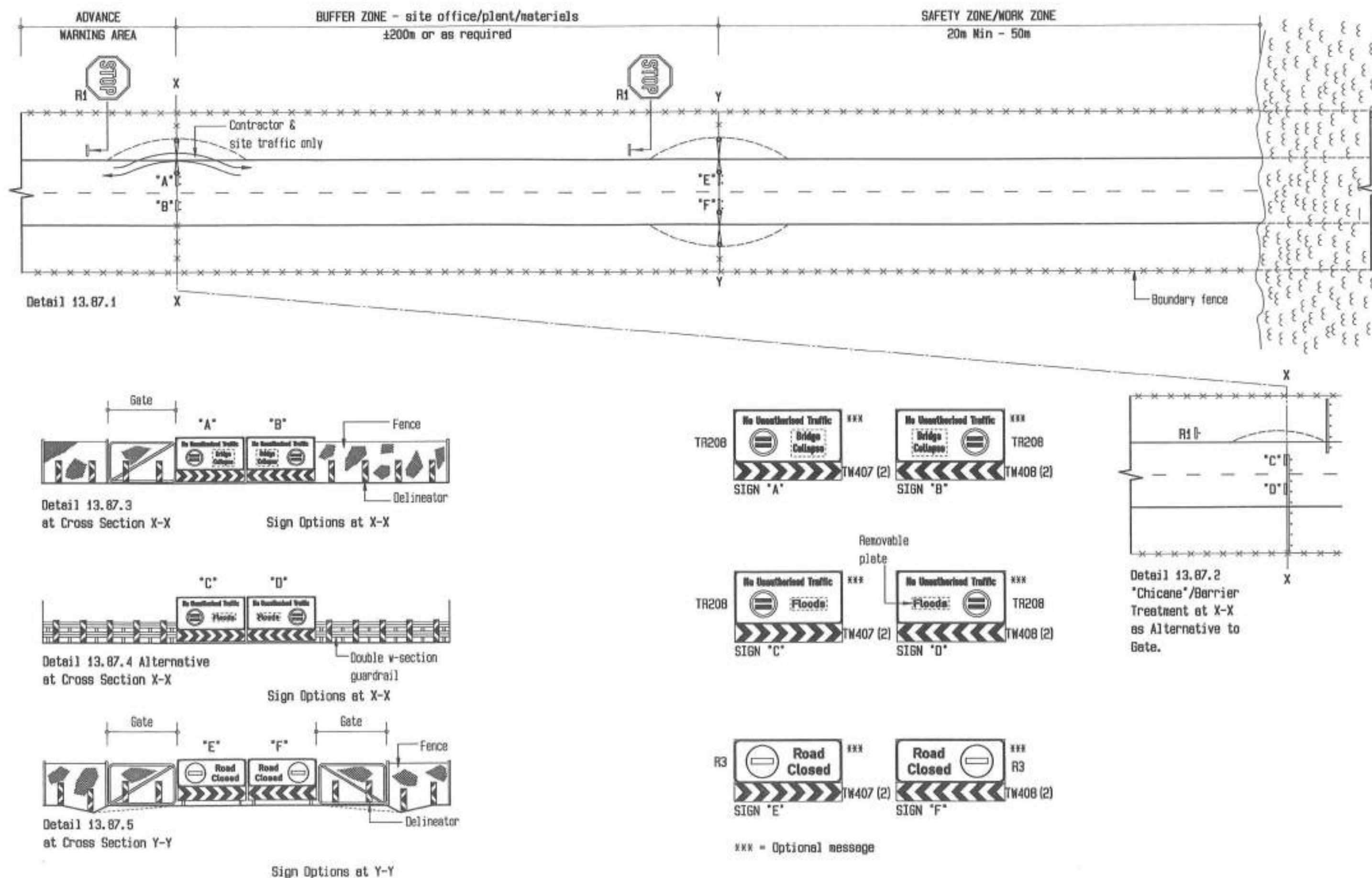


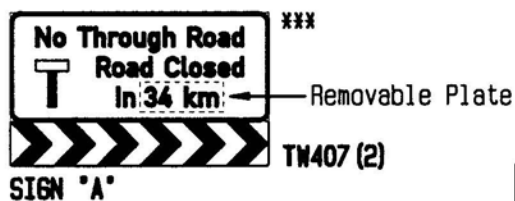
Fig 13.87  
Road Closed Barrier/Barricade

**13.12.13 No Through Road Barricades**

- 1 Figure 13.88 should be read in conjunction with Figures 13.50, 13.52 and 13.87, which all relate to the signing of a temporary road closure due to some major incident or event, and to the detour which needs to be established to avoid the site. The signing shown presumes an incident site a long way from the junction e.g. 34 km and 47 km, but the treatments will be just as appropriate for much shorter distances.
- 2 Detail 13.88.1 shows what amounts to a “chicane” barricade using two horizontal HIGH VISIBILITY signs “A” and “B”. The junction concerned, which may have had straight through priority towards the site, has been converted into a 4-Way STOP controlled junction. Signs “A” and “B” are temporary information signs relying largely on text messages, but including variations on the NO THROUGH ROAD symbol. If provision of a text message is a problem due to multiple language requirements, then it is recommended that the sign message be limited to a larger NO THROUGH ROAD symbol with a distance indicated or the “closed” leg of the junction.
- 3 Detail 13.88.2 also shows conversion of the junction to 4-Way STOP control but with a triangular sandbag island to inhibit straight-on movements into the closed road. This island carries three horizontal style HIGH VISIBILITY signs in the pattern of “C” and “D”. Once again these signs utilize text but the option to use the NO THROUGH ROAD symbol is also available. This detail also illustrates what is often a common need at such junctions, namely the ability to turn vehicles around with, if possible, one single point turn.
- 4 Appropriate advance signing should be placed on all three approaches to indicate the direction of the detour (see Figure 13.52). Similar details are illustrated in an urban environment in Figure 13.65.

**Checklist**

- ☐ have all STOP signs been converted to 4-WAY STOP signs R1.4?
- ☐ are text signs acceptable?
- ☐ does space exist for vehicles, including large heavy vehicles to turn round (is the junction large enough to be converted into a temporary traffic circle)?



\*\*\* = Optional message

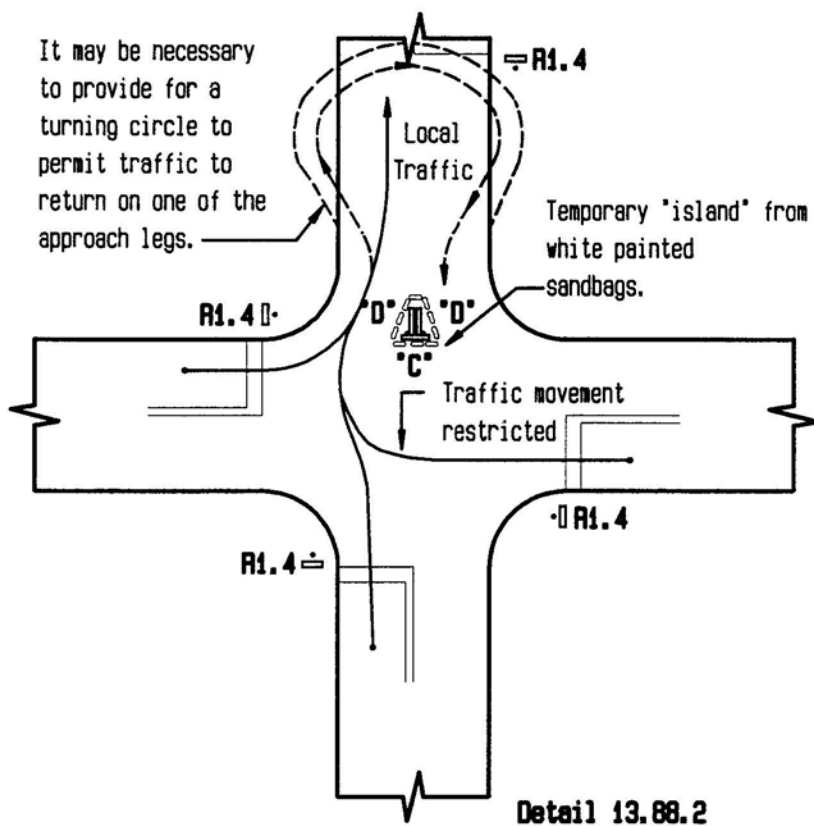
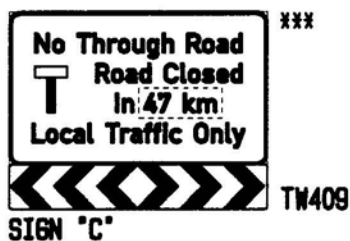
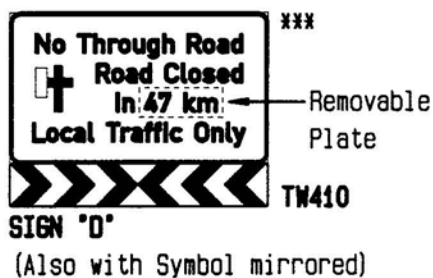
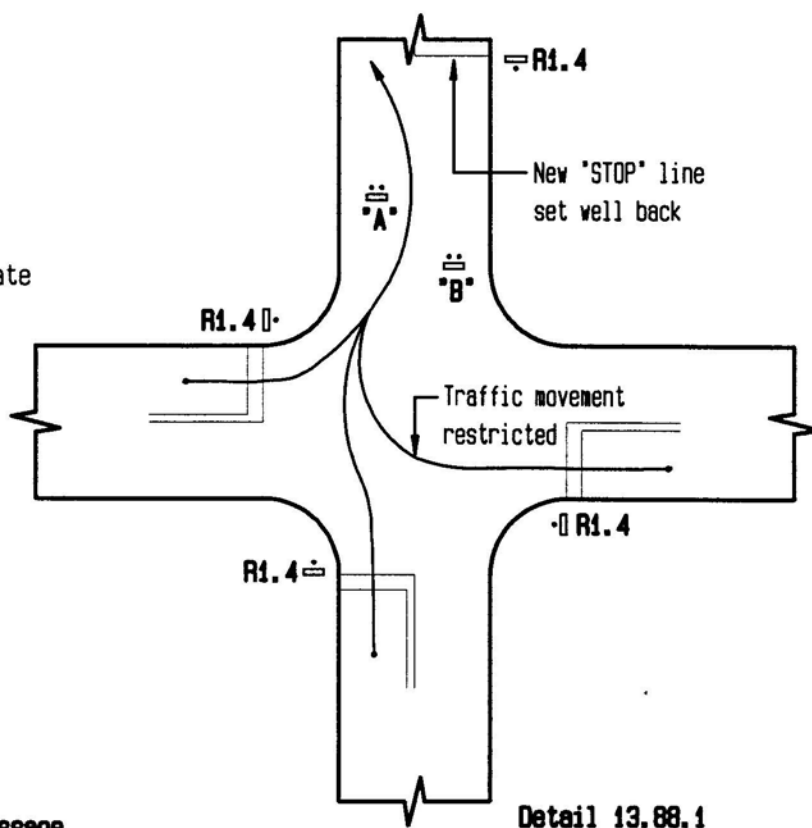







Fig 13.88

No Through Road - Barricades



### 13.12.14 Freeway Off-Ramp - Amended Alignment - 1

- 1 The temporary treatment of freeway off ramps and on ramps present roadworks traffic management difficulties. Figures 13.89 to 13.91 illustrate a number of techniques which may assist designers to resolve such difficulties. The details in Figure 13.89 are relevant to many of the applications covered in Section 13.11 but are particularly relevant to Figures 13.74 to 13.76, and to long term conditions.
- 2 Detail 13.89.1 shows one carriageway of a freeway dual carriageway carrying two-way traffic where work is required to be undertaken in the area of the gore which necessitates the closure of the lane approaching the gore. In these circumstances, the simplest solution is likely to be to divert all traffic to the off ramp, across the intersecting road and back onto the freeway via the on ramp. The assistance of a pointsman or flagman is likely to be required at the ramp/intersecting street junction. In the event that the lane adjacent to the gore has to be closed to traffic beyond the subsequent on ramp, traffic will have to be redirected on the lower hierarchy road network towards the freeway destination. To reduce the risk of driver confusion it is recommended that a temporary EXIT DIRECTION sign TSD2 be mounted with the standard GA2 sign, or as close to the exit point as possible, if the GA2 sign is some distance in advance of this point. This signing treatment will also be appropriate for a 2-lane, 2-way single carriageway freeway, when one lane has to be closed.
- 3 Detail 13.89.2 shows a more conventional situation on a 2-lane, one-way carriageway where the median side lane is closed. The main effort here is to provide reassurance to drivers wishing to reach the straight-on destination that they should not exit the freeway. A temporary straight-on TGD1 sign may be strategically located within the WORK AREA if possible.
- 4 All TRANSITION AREA and WORK AREA delineation should be provided by DELINEATOR PLATE signs TW401 and TW402, as appropriate. The use of KEEP LEFT signs TR103 and BARRICADE sign TW411 across the closed lane in Detail 13.89.1 is strongly recommended.

| TYPICAL SIGN REQUIREMENTS  |       |            |             |
|--|-------|------------|-------------|
| Sign   | No    | Size (mm)  | Quantity    |
|  | TR103 | 1200       | 4           |
|   | TW402 | 800 X 200  | 10 per 100m |
|  | TW411 | 300 X 1800 | 2           |
|  | TGD2  | Varies     | 1           |
|  | TGD1  | Varies     | 1           |

#### Checklist

- ☐ will lane be closed for some time?
- ☐ can traffic volumes be handled adequately by means of the off ramp and on ramp?
- ☐ will pointsmen/flagmen be required on the cross road?
- ☐ will drivers need reassurance that they can still reach their intended destination in a straight-on direction?



### 13.12.15 Freeway Off-Ramp - Amended Alignment - 2

- 1 Figure 13.90 gives detailed information for the treatment of a temporary off ramp alignment. The example shown in Detail 13.90.1 shows an off ramp extended to meet the single open lane which is on the median side of the carriageway. Detail 13.90.2 shows an amended off ramp/freeway junction at which the angle of departure is much sharper than normal (see also Figures 13.74, 13.75 and 13.76).
- 2 The principle illustrated in these details is intended to improve drivers' perception of the alignment of the exit roadway. A disadvantage of DELINEATOR PLATE signs in this type of situation is that it becomes very difficult, particularly at night, to identify the "gap" through which drivers are intended to exit the freeway. This is because delineators on the near side and far side of the off ramp are superimposed visually on each other, and effectively, the visual gaps between them can become reduced. It is possible that this effect could be reduced by placing delineators so close together that the gaps are so small that the line appears continuous. This concept is likely to be costly and should be subjected to a field trial before being adopted.
- 3 On the basis that vehicle lights are brightest on the left and close to ground level, it is recommended that the alignment of the ramp exit be clearly defined at and/or close to ground level - even below delineator level. To achieve this, a wider than normal LEFT EDGE LINE marking RM4.1, should be provided, with yellow roadstuds at close intervals of 6 metres. The roadstuds may even be doubled up for additional visual impact.
- 4 Since such areas are prone to accidents due to driver misjudgement, the line of the off ramp could be defined by white sandbags which should have a retroreflective property. Behind the sandbags the delineators can be more openly spaced, which should reduce the problem of determining the appropriate "gap" to drive through.
- 5 When the gore is shifted significantly from its normal position, a temporary GORE EXIT DIRECTION sign TGA4 may be specified. This can be relocated as the alignment of the off ramp is varied during construction. (See Figure 13.74.)

#### Checklist

- ☐ is there a risk that the exit path to the off ramp may be visually confused?
- ☐ have extra wide edge lines been specified?
- ☐ are closely spaced roadstuds warranted?
- ☐ could a continuous line of brightly marked white sandbags provide the visual continuity required to identify the exit path?

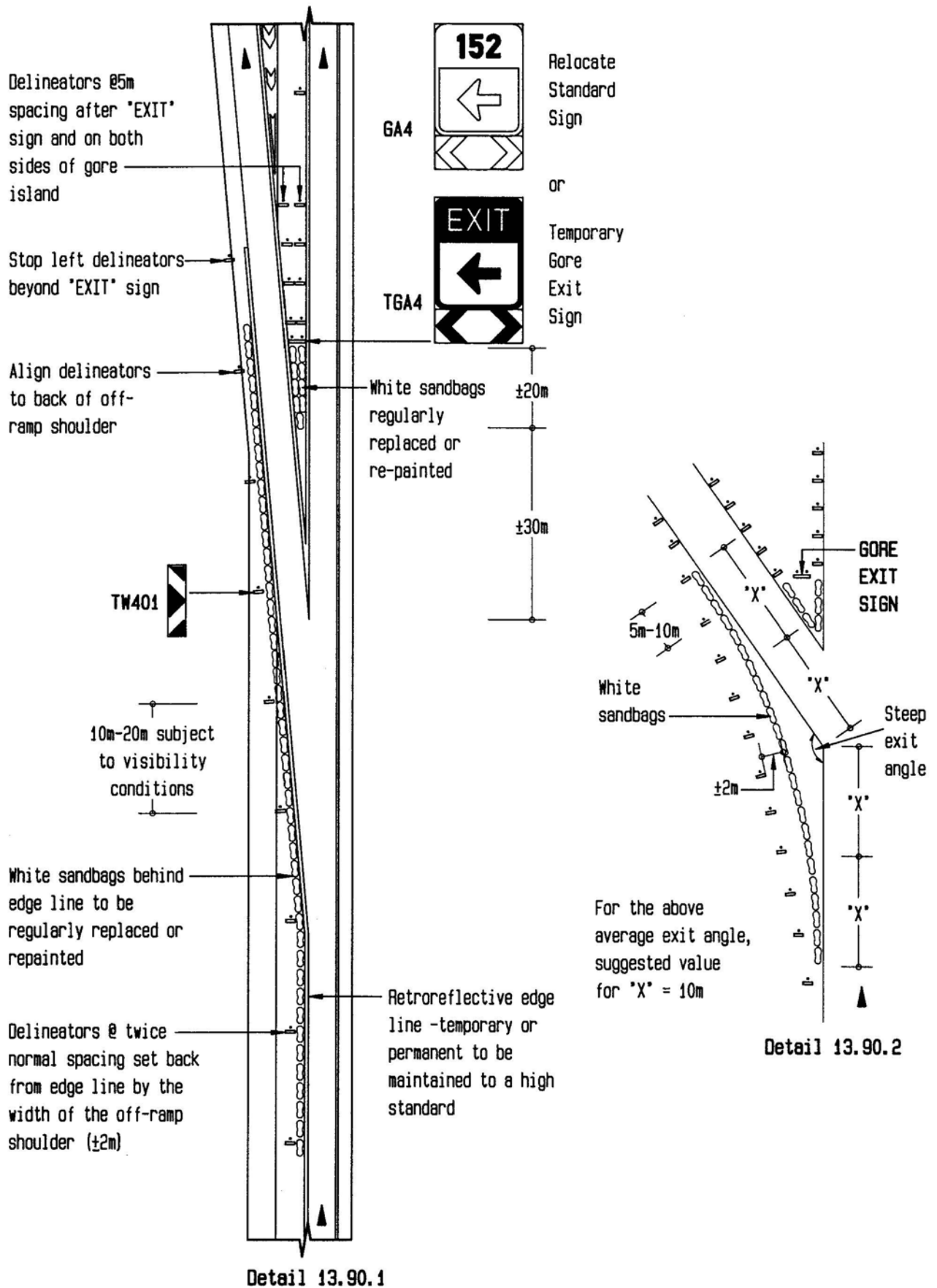


Fig 13.90

Freeway Off-Ramp – Amended Alignment - 2

### 13.12.16 Freeway On-Ramp - Amended Alignment

- 1 Treatment of revised on ramp alignment is generally much simpler than treatment of off ramps. Since drivers are tending to accelerate into a merge situation, it is relatively easy to reduce speed smoothly to avoid conflict situations. The detail in Figure 13.91 comprises a lateral shift of all road markings to the right to accommodate the closure of the near side lane (as in Figure 13.90). In order to accommodate the design acceleration length required, the road markings are extended in the line of the carriageway for an appropriate distance.
- 2 An alternative treatment, bringing the on ramp in to meet the through carriageway at a coarser angle, will almost certainly require the imposition of a STOP or YIELD control at the point of entry (see Figure 13.74). This type of treatment should be used with care since it will reduce on ramp capacity significantly, and the resultant slow moving entry of vehicles into the only free flowing lane will cause significant friction in this lane and reduced capacity.

#### Checklist

- ☐ can a free flowing merging on ramp be accommodated?
- ☐ are traffic volumes low enough that the friction caused by STOP or YIELD control will not represent a problem?

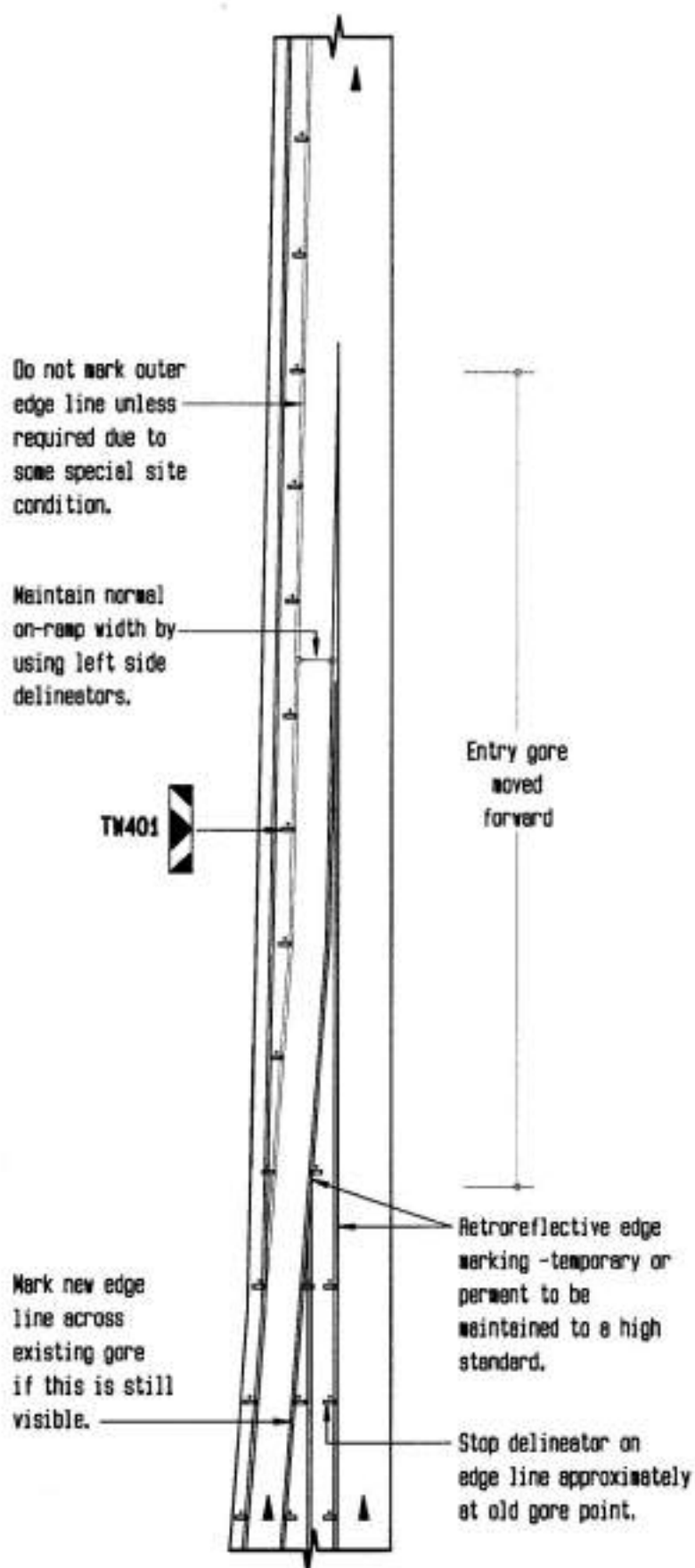


Fig 13.91

Freeway On-Ramp – Amended Alignment