



Bonneagar Iompair Éireann  
Transport Infrastructure Ireland

## TII Publications

GE PE DN CC OP AM RE

---

# Road Link Design for Type 2 and Type 3 Dual Carriageways

DN-GEO-03032  
December 2007

Withdrawn

## About TII

Transport Infrastructure Ireland (TII) is responsible for managing and improving the country's national road and light rail networks.

## About TII Publications

TII maintains an online suite of technical publications, which is managed through the TII Publications website. The contents of TII Publications is clearly split into 'Standards' and 'Technical' documentation. All documentation for implementation on TII schemes is collectively referred to as TII Publications (Standards), and all other documentation within the system is collectively referred to as TII Publications (Technical). This system replaces the NRA Design Manual for Roads and Bridges (NRA DMRB) and the NRA Manual of Contract Documents for Road Works (NRA MCDRW).

## Document Attributes

Each document within TII Publications has a range of attributes associated with it, which allows for efficient access and retrieval of the document from the website. These attributes are also contained on the inside cover of each current document, for reference. For migration of documents from the NRA and RPA to the new system, each current document was assigned with new outer front and rear covers. Apart from the covers, and inside cover pages, the documents contain the same information as previously within the NRA or RPA systems, including historical references such as those contained within NRA DMRB and NRA MCDRW.

## Document Attributes

<b>TII Publication Title</b>	<i>Road Link Design for Type 2 and Type 3 Dual Carriageways</i>
<b>TII Publication Number</b>	<i>DN-GEO-03032</i>

<b>Activity</b>	<i>Design (DN)</i>
<b>Stream</b>	<i>Geometry (GEO)</i>
<b>Document Number</b>	<i>03032</i>

<b>Document Set</b>	<i>Standards</i>
<b>Publication Date</b>	<i>December 2007</i>
<b>Historical Reference</b>	<i>NRA TD 10</i>

## NRA DMRB and MCDRW References

For all documents that existed within the NRA DMRB or the NRA MCDRW prior to the launch of TII Publications, the NRA document reference used previously is listed above under 'historical reference'. The TII Publication Number also shown above now supersedes this historical reference. All historical references within this document are deemed to be replaced by the TII Publication Number. For the equivalent TII Publication Number for all other historical references contained within this document, please refer to the TII Publications website.

---

**Volume 6 Section 1  
Part 1B**

**NRA TD 10/07**



**Road Link Design  
for  
Type 2 and Type 3  
Dual Carriageways**

**December 2007**

**Summary:**

This Standard sets out the design requirements for new Type 2 and Type 3 Dual Carriageways by reference to the other standards of the NRA DMRB and introducing particular requirements for these road types

---

**VOLUME 6    ROAD GEOMETRY**  
**SECTION 1    LINKS**

---

**PART 1B**

**NRA TD 10/07**

**ROAD LINK DESIGN  
FOR  
TYPE 2 AND TYPE 3  
DUAL CARRIAGEWAYS**

**Contents**

**Chapter**

1. Introduction
2. Type 2 Dual Carriageways
3. Type 3 Dual Carriageways
4. References
5. Enquiries



# 1 INTRODUCTION

1.1 There is a large gap, in terms of capacity, cost and safety, between the single and dual carriageways. This has led the NRA to consider other road categories, which could provide a capacity range between that of a Standard Single Carriageway and a Type 1 Dual Carriageway, i.e. between 11,600 and 20,000 Annual Average Daily Traffic (AADT).

1.2 Two new categories of divided roads, known as Type 2 and Type 3 Dual Carriageways have been introduced to fill this capacity gap.. This Standard provides design standards to be used for the design of schemes using these road types.

## Design Standards

1.3 This Standard applies to the new Type 2 and Type 3 Dual Carriageway road types. It shall be used in conjunction with NRA TD 9 to derive the Design Speed, and the appropriate values of geometric parameters for use in the design of the road alignment for roads of those types.

1.4 Details of the cross-sections of Type 2 and Type 3 Dual Carriageways are included in NRA TD 27.

1.5 In addition to road link design, this Standard includes advice on the provision of junctions and accesses on Type 2 and Type 3 Dual Carriageways, and the provision of traffic signs on Type 3 Dual Carriageways. Typical layouts for Type 3 Dual Carriageways are also included.

1.6 This Standard supersedes the Interim Advice Note on Road Link Design for 2+1 Roads, dated February 2006, and the Interim Advice Note on Road Link Design for 2+2 Roads, dated July 2006. Whilst the layout and content differ from the previous documents, few technical changes have been made. The principal changes from the previous Interim Advice Notes are:

- Details have been amended to match the revised cross-sections defined in NRA TD 27;
- Within the relevant traffic flow ranges, a Type 2 Dual Carriageway is the preferred road type for offline alignments. Type 3 Dual Carriageway

is the preferred type for increasing the capacity on an existing alignment;

- Climbing lanes are not normally required on Type 2 Dual Carriageways;
- Merging and diverging tapers are no longer prohibited for junctions on Type 2 Dual Carriageways or on the two lane side of a Type 3 Dual Carriageway;
- Where passing lanes overlap on a Type 3 Dual Carriageway, the cross-section is to be the same as a Type 2 Dual Carriageway; and
- On Type 3 Dual Carriageways, visibility to the low object is not required to the left at priority junctions with crossings of the central reserve.

## Definitions

1.7 For the definitions of the general road terms used in this Standard, such as components of the road (central reserve, verge, hard shoulder and hard strip, etc.), see BS 6100: Subsection 2.4.1 and NRA TD 9. In addition, the following particular terms are used:

**Type 2 Dual Carriageway:-** A divided all-purpose road with two lanes in each direction divided by a segregating barrier constructed to the cross-section standards set out for that road type in NRA TD 27 and the geometric standards set out in this Standard.

**Type 3 Dual Carriageway:-** A divided all-purpose road with two lanes in one direction and one in the other divided by a segregating barrier. The two-lane section is provided alternately for each direction of travel. The road is constructed to the cross-section standards set out for that road type in NRA TD 27 and the geometric standards set out in this Standard.

1.8 A single carriageway road with a climbing lane (see NRA TD 9) is not classed as a 'Type 3 Dual Carriageway'.

## Implementation

1.9 This Standard shall be used for the design of all lengths of new or improved road on national road schemes where it has been agreed with the National Roads Authority that a Type 2 or Type 3 Dual Carriageway is to be provided.

1.10 If this Standard is to be used for the design of non-national road schemes, the designer should agree with the relevant Road Authority the extent to which the document is appropriate in any particular situation.

## Interpretation

1.11 The design of Type 2 and Type 3 Dual Carriageways shall be in accordance with the other standards of the NRA DMRB as amended and supplemented by this Standard.

## Selection of Road Type

1.12 Studies of capacity and economics have shown that a Type 2 Dual Carriageway can be a suitable option for roads with flows of between 11,600 and 20,000 AADT in the design year and that a Type 3 Dual Carriageway can be a suitable option for roads with flows of between 11,600 and 14,000 Annual Average Daily Traffic (AADT) (see NRA TD 9). These road types are, therefore, recommended for consideration on roads with flows in those ranges.

1.13 The Type 2 Dual Carriageway is the preferred road type for road schemes on an offline alignment where design year flows of 11,600 to 20,000 AADT are predicted. All schemes with design year flows in that range should, therefore, be assessed for their suitability for construction as a Type 2 Dual Carriageway. However, this road type is not suitable for the on-line upgrading of an existing single carriageway road.

1.14 The Type 3 Dual Carriageway would be an appropriate road type for design year flows in the range of 11,600 to 14,000 AADT. However, for road schemes on an offline alignment the Type 2 Dual Carriageway is preferred.

1.15 The Type 3 Dual Carriageway is the preferred road type where an existing road is to be upgraded on-line, in order to increase the design year capacity to flows in the range of 11,600 to 14,000 AADT. However, factors such as number of accesses, junction spacing and gradient can have a significant impact, so the feasibility of a Type 3 Dual Carriageway should be examined on a scheme by scheme basis. Where frequent frontage access cannot be avoided, a Type 3 Dual Carriageway would not be appropriate.

1.16 A Type 3 Dual Carriageway may be considered for an offline alignment where it is impracticable to build a Type 2 Dual Carriageway.

## 2 TYPE 2 DUAL CARRIAGEWAYS

### Introduction

2.1 In order to narrow the gap in cost and traffic capacity between the Standard Single Carriageway and the Type 1 Dual Carriageway, the **Type 2 Dual Carriageway** has been developed. This has a 0.5m wide hard strip at the nearside instead of a 2.5m hard shoulder, and a narrower central reserve. Details of the cross-section are given in NRA TD 27.

2.2 The Type 2 Dual Carriageway is considered appropriate for use on national road schemes in rural areas where the traffic flow in the design year is between about 11,600 and 20,000 AADT. This chapter, accordingly, sets out design standards for such a road type for use on offline alignments ('greenfield').

### Application

2.3 Chapter 1 describes when it may be appropriate to design a road scheme using a Type 2 Dual Carriageway.

2.4 Type 2 Dual Carriageways should not be used for urban areas or where junctions, accesses or pedestrian activity are frequent.

2.5 Short isolated lengths of Type 2 Dual Carriageway should not be provided (see Paragraphs 2.39 to 2.43).

### Cross-Section

2.6 All aspects of cross-section and headroom on Type 2 Dual Carriageways shall be in accordance with NRA TD 27. This includes clearances at structures.

2.7 Any reduction or increase in the widths of the carriageways and hard strips would be a Departure from Standards, unless the increase results from widening on curves in accordance with NRA TD 9.

2.8 The use of a verge width greater than the minimum widths is allowed and is not considered a Relaxation or a Departure. The use of a lesser verge or central reserve width shall be a

Departure. Care shall be taken with the design in order to avoid the need for excessive widening of the central reserve in particular by using the relaxations on Stopping Sight Distances permitted under NRA TD 9.

2.9 In all cases full pavement construction shall be continued through the central reserve and a segregating barrier shall be provided.

2.10 Verges on Type 2 Dual should be designed to accommodate broken down vehicles. Care should be taken in the detailing of the drainage and pedestrian hard standing areas to provide this facility whilst avoiding the risk of stone scatter.

### Alignment

2.11 Type 2 Dual Carriageways should be designed with the objectives of safety and uncongested flow in mind. This will require not only appropriate design of the horizontal and vertical alignments but also careful attention to the location of junctions.

2.12 Standards for the alignment of Type 2 Dual Carriageways shall be in accordance with NRA TD 9 and the following requirements, which indicate how that Standard is to be adapted for that road type.

### Design Speed

2.13 The Design Speed and related design parameters for a Type 2 Dual Carriageway shall be derived in accordance with NRA TD 9 using the following factors:

- Alignment Constraint,  $A_c = 6.6 + B/10$  where B = Bendiness (total angle the road turns through), degrees/km;
- Layout Constraint,  $L_c = 12$  where there are 5 or less accesses per km, or  $= 13$  where there are 6 to 8 accesses per km;
- The Mandatory Speed Limit on a Type 2 Dual Carriageway will normally be 100km/h where it is a national road and 80km/h where it is a non-national road.

2.14 A Design Speed greater than 100A km/h on national roads or 85A km/h on non-national roads shall not be used.

#### *Relaxations and Departures*

2.15 Should there be a need for Relaxations or Departures from Standards on a Type 2 Dual Carriageway, the requirements of NRA TD 9 in relation to Relaxations and Departures shall be followed.

#### *Sight Distance*

2.16 The requirements for Stopping Sight Distance (SSD) shall be in accordance with NRA TD 9 for dual carriageways.

#### *Horizontal Alignment*

2.17 The requirements for horizontal alignment shall be in accordance with NRA TD 9 for dual carriageways and with the following paragraph.

2.18 On sections of Type 2 Dual Carriageway with radii greater than that required in NRA TD 9 for Minimum R without elimination of adverse camber and transitions (i.e.  $V^2/R < 5$ ), the crossfall or camber should be 2.5%. The crown for crossfall or camber should be located within the central reserve, preferably at the centre, where superelevation does not apply.

#### *Vertical Alignment*

2.19 The requirements for vertical alignment shall be in accordance with NRA TD 9 for dual carriageways and with the following paragraphs.

2.20 The Desirable Maximum gradient for the design of Type 2 Dual Carriageways shall be 4%. Slightly steeper gradients are permitted as Relaxations in hilly terrain, but Departures from Standards will be required for any proposals to adopt gradients steeper than 5%.

2.21 The vertical alignment should follow the topography closely, with the horizontal alignment phased to match. The horizontal and vertical alignments should be coordinated to produce a smooth and flowing layout: the principles given in NRA TD 9 for a Type 1 Dual Carriageway should be followed wherever practicable.

#### *Climbing Lanes*

2.22 Climbing lanes will not normally be required on Type 2 Dual Carriageways, since the road type is not intended for use with traffic flows greater than 20,000 AADT. At these flows the two lanes will be adequate for overtaking on hills.

2.23 However, should there be a need for a climbing lane in exceptional circumstances, the design shall be in accordance with NRA TD 9 for dual carriageways and with the following paragraph.

2.24 On Type 2 Dual Carriageways, climbing lanes shall be formed by the provision of an additional 3.5m lane. Reduction of lane widths below 3.5m is not permitted.

#### *Emergency Access*

2.25 Emergency Crossing Points and Emergency Access Links are not required in accordance with NRA TD 9, although Emergency Access Links may be provided if there are suitable locations.

## Junction Strategy

2.26 Type 2 Dual Carriageways should be designed so as to minimise the number of junctions and to provide drivers with straightforward junction layouts. Only the following junction types are permitted for use on this road type, as described below:

- Roundabout;
- Compact grade separation; and
- Left-in/left-out;

2.27 Junctions with roads carrying a traffic flow of 3,000 AADT or more in the design year should generally be roundabouts. Where the side road traffic flow, in the design year, is in the range 1,000 to 3,000 AADT, compact grade separated solutions are appropriate. Less trafficked roads (carrying a design year flow of less than 1,000 AADT in the design year) should generally be bridged over the Type 2 Dual Carriageway without a junction. However, left-in/left-out junctions may be suitable where there is a roundabout not far away to facilitate U-turns. At-grade crossings of the central reserve will not be permitted.

2.28 The aim should be to provide drivers with layouts that have consistent standards and are not confusing. On lengths of Type 2 Dual Carriageway, sequences of junctions should not therefore involve many different layout types. The safest road schemes are usually the most straightforward ones that contain no surprises for the driver.

## Typical Junction Layouts

2.29 Junction layouts should be in accordance with the geometric standards of TD 42, together with the following additional requirements. Layouts should be derived by assembling the relevant components for each part of the junction, as described in TD 42.

### *Roundabouts*

2.30 Roundabouts will be appropriate for major junctions on many Type 2 Dual Carriageways. They shall be designed in accordance with the requirements of TD 16.

### *Compact Grade Separated Junctions*

2.31 Compact grade separated junctions shall be designed in accordance with TD 40.

### *Left-in/Left-out Junctions*

2.32 Frequent junctions occurring along the length of the carriageway should be avoided where practicable: it is safer to concentrate turning traffic at the major junctions. Where such junctions are provided they shall be restricted to left-in and left-out turning movements only, with no crossing of the central reserve. The layout described in TD 42 / TD 40 for 'local grade separation' is preferred. U-turns will only be possible at roundabouts or compact grade separated junctions. Therefore, left-in/left-out junctions should only be provided where U-turns can be made within a reasonable distance.

## Vehicular Accesses

2.33 Direct vehicular access from private property or developments onto Type 2 Dual Carriageways should be avoided as far as practicable. Where accesses are to be provided their number should be severely limited and the requirements of TD 41 shall be adhered to. Accesses shall be permitted for left-in/left-out turns only.

2.34 All accesses should be checked to ensure that they can cater for the swept path of appropriate vehicles.

### Non-Motorised User Requirements.

2.35 Facilities for Non-Motorised Users (NMUs) alongside a Type 2 Dual Carriageway shall be provided in accordance with NRA TD 27. NMUs should be encouraged by signage to use alternative parallel routes, for example, the old road.

2.36 The need for NMUs to cross the road at roundabouts should be considered and suitable provision made. At compact grade separated junctions, provision should be made for NMUs to use the bridge over or under the main alignment.

2.37 The need for NMUs to cross the dual carriageway away from junctions should be avoided wherever possible. Where there is sufficient demand for a crossing point between junctions, an underpass or NMU overbridge should be considered. A flow of about 10 NMUs in any hour may warrant such a provision.

### Bus Stops.

2.38 Bus stops should generally be avoided on Type 2 Dual Carriageways. Stops should remain on existing alternative routes. In exceptional circumstances where a bus stop is required, a bus lay-by must be provided and should be located where grade separated pedestrian access is available. Care should be taken to avoid creating conflicting traffic movements at junctions.

### Changes in Carriageway Type

2.39 Changes between lengths of Type 2 and Type 3 Dual Carriageways may be made wherever appropriate by means of critical or non-critical changeovers.

2.40 Short isolated lengths of Type 2 Dual Carriageway should not be provided within roads with carriageways of types other than Type 3 Dual Carriageway. If lengths of Type 2 Dual Carriageway within a generally single carriageway road or vice versa are unavoidable, they should be at least 5km long and preferably 10km. Junctions should be located either at the change of road type or at least 1km away. The same criteria apply where it is necessary to construct lengths of Type 2 Dual Carriageway within a Type 1 Dual Carriageway or vice versa.

2.41 Where there is a change from a Type 2 Dual Carriageway to a single carriageway the use of a roundabout is strongly recommended as a terminal junction. A roundabout slows all traffic and helps to indicate the change of cross section.

2.42 Where the road type changes between a Type 2 Dual Carriageway and another type of carriageway, other than at a roundabout, the layout shall provide a smooth transition. Wherever possible, the changes in width should be developed by using the road curvature to provide the transition. Where widths are narrowing, a taper of approximately 1:70 should be used for the lane or edge marking which has the greatest lateral shift. Where widths are increasing, a taper of approximately 1:40 should be used for the lane or edge marking which has the greatest lateral shift.

2.43 The appropriate road signs and markings to denote the change in road category shall be provided in accordance with the Traffic Signs Manual.

## Lane Segregation and Safety Barriers

2.44 Type 2 Dual Carriageways shall be provided with physical lane segregation using an IS EN 1317 compliant product in the central reserve. The segregating barrier shall have a minimum Containment Level of N2, an Impact Severity Level of A or B and a Working Width of W5 (1.8m) or less, in accordance with EN 1317-2 (see NRA TD 19). The segregating barrier width shall not exceed 0.3 m at any point above the road surface in order to fit within the central reserve provided under the standard and so as not to encroach onto the hard strips. In all other respects the segregating barrier shall be in accordance with NRA TD 19, except that the Working Width may be such that under design impact conditions the segregating barrier will be permitted to instantaneously deflect into the opposing traffic lane. However, no part of the segregating barrier may permanently deflect more than 0.2m into the opposing traffic lane.

2.45 Terminals in the central reserve shall be such that all parts above the surface of the road lie between the hard strips. It is important for there to be a stagger between the ends of adjacent barriers.

2.46 Relaxations of up to two Design Speed steps below the Desirable Minimum Stopping Sight Distance are permitted for visibility to the low object at the segregating barrier, provided Desirable Minimum Stopping Sight Distance is obtained to a 1.05m high object (see NRA TD 9).

2.47 Safety barriers in the verges of Type 2 Dual Carriageways shall be in accordance with the requirements of NRA TD 19.

2.48 Central reserve segregating barriers shall be fitted with reflectors in accordance with the Traffic Signs Manual. Reflectors should generally be provided at approximately 24m centres. Where hatching is provided in the central reserve, the reflectors on the central reserve barrier should be provided at approximately 12m centres.

## Traffic Signs and Road Markings

2.49 Traffic signs at junctions on Type 2 Dual Carriageways shall be in accordance with the Traffic Signs Manual, based on the requirements

for signing at junctions on dual carriageways. Stop signs and road markings shall be provided on the minor roads.

2.50 Where a length of Type 2 Dual Carriageways joins onto a length of single carriageway, the signs for 'road divides' and 'dual carriageway ends' shall be provided in accordance with the Traffic Signs Manual to indicate the start and end of a central reserve.

2.51 Continuous white lines, in the form of raised rib road markings, shall be provided to mark the edges of the central reserve. Hatching is not required in the central reserve except at junctions. Other road markings shall be in accordance with the Traffic Signs Manual, based on the requirements for a dual carriageway.

2.52 Where wide areas of hatching are provided, the use of coloured surfacing may be considered.



## 3 TYPE 3 DUAL CARRIAGEWAYS

### Introduction

3.1 There is a large gap, in terms of capacity, cost and safety, between the standard single carriageway and a dual carriageway. A number of European countries have, therefore, developed a new road type, often referred to as a '2+1 Road' but implemented in Ireland as a **Type 3 Dual Carriageway**, which consists of two lanes in one direction of travel and one in the other. The two-lane section, which provides the overtaking opportunity, alternates with a one-lane section at intervals of about 1 to 2km. This is illustrated schematically in Figure 3/1. A segregating barrier is required in the central reserve.

3.2 The Type 3 Dual Carriageway is considered appropriate for use on national road schemes in rural areas where the traffic flow in the design year is between about 11,600 and 14,000 AADT. However, the road type is intended mainly where a road is to be upgraded on-line, to increase the capacity of the existing road. This chapter, accordingly, sets out design standards for such a road type, for use both for on-line upgrading of existing roads ('retrofit') or exceptionally on offline alignments ('greenfield'). As well as describing alignment standards it includes details of features such as junctions and accesses.

### Application

3.3 Chapter 1 describes when it may be appropriate to design a road scheme using a Type 3 Dual Carriageway.

3.4 Type 3 Dual Carriageways should not be used for urban areas or where junctions, accesses or pedestrian activity are frequent.

3.5 Where existing standard or wide single carriageway roads are exhibiting problems, it may be appropriate to improve the road by converting it to a 2+1 configuration. Such 'retrofitting' may require relatively minor alterations to the existing road, with little or no widening of the carriageway required.

3.6 Short isolated lengths of Type 3 Dual Carriageway should not be provided (see Paragraphs 3.64 to 3.67).

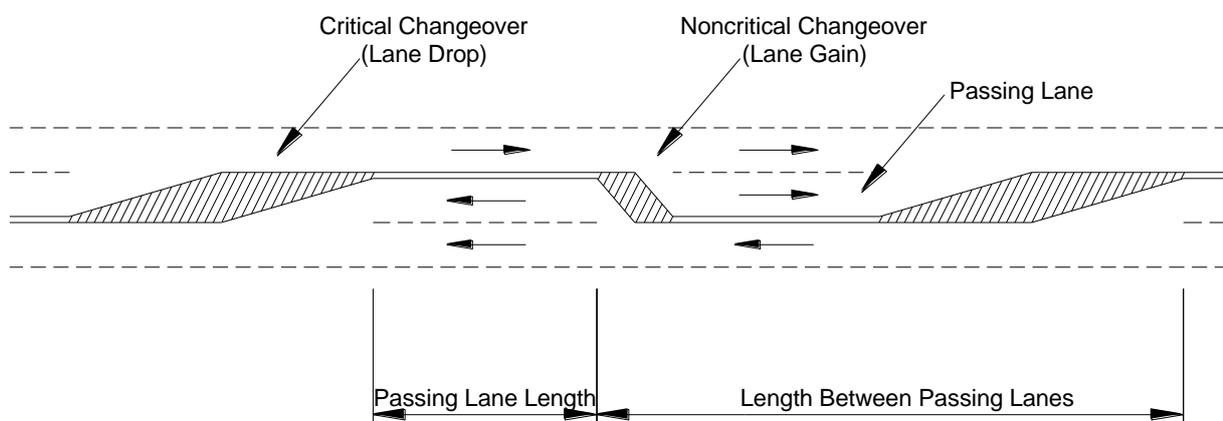


Figure 3/1: Schematic Layout of a Type 3 Dual Carriageway

## Cross-Section

3.7 All aspects of cross-section and headroom on Type 3 Dual Carriageways shall be in accordance with NRA TD 27. This includes clearances at structures.

3.8 Any reduction or increase in the widths of the carriageways and central reserve hard strips would be a Departure from Standards, unless the increase results from widening on curves in accordance with NRA TD 9. Local widening of the central reserve at junctions shall comply with the requirements below.

3.9 The use of a verge width greater than the minimum widths is allowed and is not considered a Relaxation or a Departure. The use of a lesser verge or central reserve width shall be a Departure. Care shall be taken with the design in order to avoid the need for excessive widening of the central reserve, in particular by using the relaxations on Stopping Sight Distances permitted under NRA TD 9.

3.10 In all cases full pavement construction shall be continued through the central reserve and a segregating barrier shall be provided.

3.11 Verges on Type 3 Dual should be designed to accommodate broken down vehicles. Care should be taken in the detailing of the drainage and pedestrian hard standing areas to provide this facility whilst avoiding the risk of stone scatter.

### *Pinch Points*

3.12 At restricted locations, for example on a long viaduct or at a difficult pinch point, the cross-section may be reduced to omit the passing lane. The resulting cross-section should be the same as a Type 3 Dual Carriageway except with two one-lane sections side by side (see NRA TD 27). This layout, with a central reserve barrier, will avoid the confusion that could occur if the cross-section were to be changed to that of a single carriageway road and back again (see also Paragraphs 3.64 to 3.67).

### *Type 3 Dual Carriageways with Overlapping Passing Lanes*

3.13 In some instances, it may be appropriate to provide two overlapping two-lane sections, thus forming a Type 3 Dual Carriageway with

overlapping passing lanes. This is most likely to occur on long hills where the uphill two-lane section functions as a climbing lane (see Paragraph 3.30). The cross-section at such locations should be the same as for a Type 2 Dual Carriageway (see NRA TD 27).

3.14 This layout, i.e. a length of Type 2 Dual Carriageway within a Type 3 Dual Carriageway, may be used where traffic flows or other considerations make it appropriate.

## Alignment

3.15 Type 3 Dual Carriageways should be designed with the objectives of safety and uncongested flow in mind. This will require not only appropriate design of the horizontal and vertical alignments but also careful attention to the arrangement of the two-lane sections and the location of junctions.

3.16 Standards for the alignment of Type 3 Dual Carriageways shall be in accordance with NRA TD 9 and the following requirements, which indicate how that Standard is to be adapted for that road type.

### *Design Speed*

3.17 The Design Speed and related design parameters for a Type 3 Dual Carriageway shall be derived in accordance with NRA TD 9 using the following factors:

- Alignment Constraint,  $A_c = 6.6 + B/10$  where  $B$  = Bendiness (total angle the road turns through), degrees/km;
- Layout Constraint,  $L_c = 18$  where there are 5 or less accesses per km, or  $= 20$  where there are 6 to 8 accesses per km;
- The Mandatory Speed Limit on a Type 3 Dual Carriageway will normally be 100km/h where it is a national road and 80km/h where it is a non-national road.

3.18 A Design Speed greater than 100A km/h on national roads or 85A km/h on non-national roads shall not be used.

### *Relaxations and Departures*

3.19 Should there be a need for Relaxations or Departures from Standards on a Type 3 Dual Carriageway, the requirements of NRA TD 9 in relation to Relaxations and Departures shall be followed.

### *Sight Distance*

3.20 The requirements for Stopping Sight Distance (SSD) shall be in accordance with Chapter 2 of NRA TD 9 for dual carriageways.

3.21 Relaxations below the Desirable Minimum Stopping Sight Distance may be made at the discretion of the designer as described in NRA TD 9. However, on or near the bottom of long grades on Type 3 Dual Carriageways steeper than 3% and longer than 1.5km, the scope for Relaxations shall be reduced by 1 Design Speed step.

### *Horizontal Alignment*

3.22 The requirements for horizontal alignment shall be in accordance with NRA TD 9 and the following paragraphs.

3.23 On sections of Type 3 Dual Carriageway with radii greater than that required in NRA TD 9 for Minimum R without elimination of adverse camber and transitions (i.e.  $V^2/R < 5$ ), the crossfall or camber should be 2.5%. On new alignments, the crown for crossfall or camber shall be located within the central reserve, preferably at the centre, where superelevation does not apply. However, when an existing road is converted to a Type 3 Dual Carriageway, it is acceptable for the crown to be within a traffic lane.

### *Vertical Alignment*

3.24 The requirements for vertical alignment shall be in accordance with NRA TD 9 and the following paragraphs.

3.25 The Desirable Maximum gradient for the design of Type 3 Dual Carriageways shall be 4% on new alignments and 5% for on-line upgrading of existing roads. Slightly steeper gradients are permitted as Relaxations in hilly terrain, but Departures from Standards will be required for

any proposals to adopt gradients steeper than 5% on new alignments and 6% for on-line upgrading of existing roads.

3.26 The vertical alignment should follow the topography closely, with the horizontal alignment phased to match. The horizontal and vertical alignments should be coordinated to produce a smooth and flowing layout: the principles given in NRA TD 9 for a Type 1 Dual Carriageway should be followed wherever practicable.

### *Climbing Lanes*

3.27 On Type 3 Dual Carriageways a climbing lane consists of the provision of a two-lane 'passing lane' section over the requisite length of road. Thus, the road is arranged such that the uphill carriageway is the side with two lanes.

3.28 On Type 3 Dual Carriageways on hills with gradients ( $G = 100H/L$ ) greater than 2% and longer (L) than 500m a climbing lane will normally be justified if the height risen (H) is equal to or greater than the value shown in Table 3/1 for the relevant traffic flow. The height risen (H) and length (L) shall be calculated between two standard points on the hill in accordance with NRA TD 9.

**Table 3/1: Justification for Climbing Lane on Type 3 Dual Carriageway**

Design Year Traffic Flow Two-Way (AADT)	Height Risen (H)
8,000 – 11,000	20m
> 11,000	15m

3.29 Where the above criteria are met, a two-lane uphill section should be provided over the relevant length of the hill between points 'S' and 'F' (see NRA TD 9). The general principles of the climbing lane should be in accordance with the requirements of NRA TD 9 for single carriageways, but the cross-section, road markings and the geometric layout at each end shall be in accordance with the requirements for Type 3 Dual Carriageways. Designers should note that, at the end of a two-lane section (including at a climbing lane) on a Type 3 Dual Carriageway, the onus is

on the overtaking traffic to yield to traffic in the left lane.

3.30 Where the length of the climbing lane on a Type 3 Dual Carriageway is such that the one-lane downhill section would be longer than 3,000m, a section of two-lane carriageway should be provided for downhill traffic too (see Paragraph 3.35). This will result in a length with the cross-section of a Type 2 Dual Carriageway. The two-lane downhill section needs to be only long enough to provide a reasonable overtaking opportunity (see Paragraph 3.34).

3.31 Even where there is no need for a climbing lane, the design of Type 3 Dual Carriageways should be coordinated with the vertical alignment so that the two-lane sections function as climbing lanes. Wherever practicable therefore, two-lane sections should be arranged to coincide with up gradients. Speed differentials between light and heavy vehicles are greater on up gradients, so provision of two-lane sections on up gradients will allow more vehicles to overtake in a given length and will reduce driver frustration.

3.32 Even where there is no need for a climbing lane, a two-lane section should not be terminated on a hill with a gradient greater than 2% and longer than 300m. Instead, the two-lane section should be extended to point 'F', 220m beyond the point where the gradient reduces to 2% (see NRA TD 9).

#### *Emergency Access*

3.33 Emergency Crossing Points and Emergency Access Links are not required in accordance with NRA TD 9, although Emergency Access Links may be provided if there are suitable locations. The design of the central reserve segregating barrier on a Type 3 Dual Carriageway is such that the barrier can be dismantled to allow vehicles to pass over it (see Paragraph 3.69).

### **Passing Lane Length**

3.34 In order for a Type 3 Dual Carriageway to be effective, the traffic in both directions needs to be given opportunities to overtake. Thus, the side of the carriageway with two lanes (the passing lane) needs to change over at intervals. The length of an individual two-lane section is a compromise between allowing a length long enough to enable a platoon of traffic to overtake a slower vehicle on the two-lane side and short enough to avoid causing delay and frustration to traffic on the one-lane side. Lengths will also be determined by the road geometry, location of junctions, etc. Passing lanes should have a full width length of between 1,000m and 2,000m. A full width length of between 800m and 1,000m would be a Relaxation, while a full width length less than 800m would be a Departure from Standard.

3.35 Long single lane lengths should be avoided: a length between full width passing lanes in the range from 2,500m to 3,000m would be a Relaxation, while a length greater than 3,000m would require a Departure from Standard.

### **Changeovers**

3.36 Locations where the passing lane changes from use by one direction of travel to use by the other are '**changeovers**'. There are two principal types. A '**critical**' changeover is one immediately downstream of a lane drop (see Figure 3/1). It is called critical because vehicles in the middle lane are heading towards one another, so a substantial buffer is needed. A '**non-critical**' changeover is one immediately upstream of a lane addition. This is not so critical as vehicles in the middle lane are heading away from one another.

3.37 Changeovers should be sited at junctions where practicable (see Paragraphs 3.43 and 3.44). However, where changeovers occur away from junctions they shall be in accordance with the layouts shown in Figures 3/2 and 3/3. Critical changeovers shall not be permitted where the curve radius is Band D or below (see NRA TD 9).

3.38 Not used



## Typical Junction Layouts

3.41 Junction layouts should be in accordance with the geometric standards of TD 42, together with the following additional requirements. Layouts should be derived by assembling the relevant components for each part of the junction, as described in TD 42. At some locations on 'retrofit' schemes, junction layouts in accordance with the following paragraphs may not be practicable. In such locations approval for relevant Departures from Standards will need to be sought from the NRA.

3.42 Not used.

### *Roundabouts*

3.43 Roundabouts will be appropriate for major junctions on many Type 3 Dual Carriageways. They should be designed in accordance with the requirements of TD 16. Two-lane sections may start directly at the exit from the roundabout. Similarly, a two-lane section may terminate at a roundabout with the overtaking lane becoming the right-hand entry lane into the roundabout.

### *Compact Grade Separated Junctions*

3.44 On Type 3 Dual Carriageways with relatively high traffic flows, it may be appropriate to provide compact grade separated junctions. Such junctions shall be designed in accordance with TD 40. On a length of Type 3 Dual Carriageway with compact grade separated junctions there shall be no breaks in the central reserve. All major junctions shall be compact grade separated (or roundabout), while minor ones shall be left-in/left-out only. U-turns will only be possible at the compact grade separated junctions. Accesses should be severely limited or avoided altogether. Where practicable, layouts should be designed so that merging occurs on two-lane sections, thereby avoiding the problems of merging into a single lane. This can be achieved if the junction is at a non-critical changeover. Roundabouts may be provided at the most significant junctions on a length with compact grade separated junctions.

### *Right-turn Priority Junctions*

3.45 Priority junctions permitting right turns shall be sited at changeovers. Therefore the passing lanes are terminated either side of the junction, leaving a ghost island at the junction, with one 3.5m lane in each direction. Typical layouts are illustrated in Figures 3/4 and 3/5 and relevant dimensions are tabulated in Table 3/2. A 3.5m right turn lane width adjacent to a 2.0m wide ghost island shall be provided. Apart from the dimensions shown in the figures, the layout should be in accordance with the geometric standards of TD 42.

### *Left-in/Left-out Junctions*

3.46 Where junctions are provided on either the one-lane or two-lane side, they shall be restricted to left-in and left-out turning movements only, with no crossing of the central reserve. The layout described in TD 42 / TD 40 for 'local grade separation' is preferred. This junction type is only suitable for lightly trafficked minor roads or private accesses. Such junctions shall not be provided within 100m of a critical changeover. Where junctions of this type are required on opposite sides of the road, the side roads shall be staggered by a nominal 10m to avoid the appearance of a through road.

Notes:  
 a = Turning length (+ queuing length if required)  
 b = Deceleration length  
 c = Direct taper length  
 j = Full width island length  
 For required lengths see Table 3/2

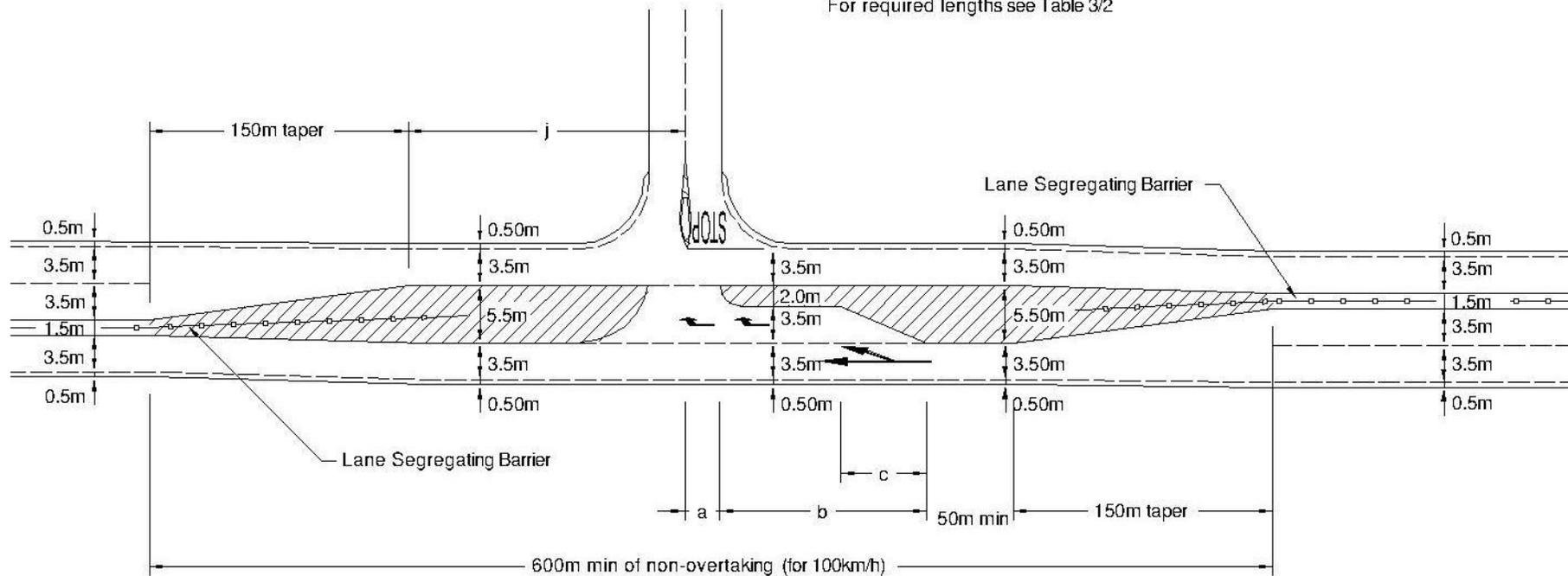


Figure 3/4: Junction Layout at Critical Changeover

Table 3/2: Required Dimensions at Junctions

Design Speed of Type 3 Dual Carriageway (km/h)		100 km/h	85 km/h	70 km/h
a	Turning Length (and Queuing Length if required: see TD 42)	10 m	10 m	10 m
b	Deceleration Length	80 m	55 m	40 m
c	Direct Taper Length	25 m	15 m	15 m
j	Full Width Island Length	160 m	120 m	90 m

Notes:

- a = Turning length (+ Queuing length if required)
- b = Deceleration Length
- c = Direct Taper Length
- For required lengths see Table 3/2

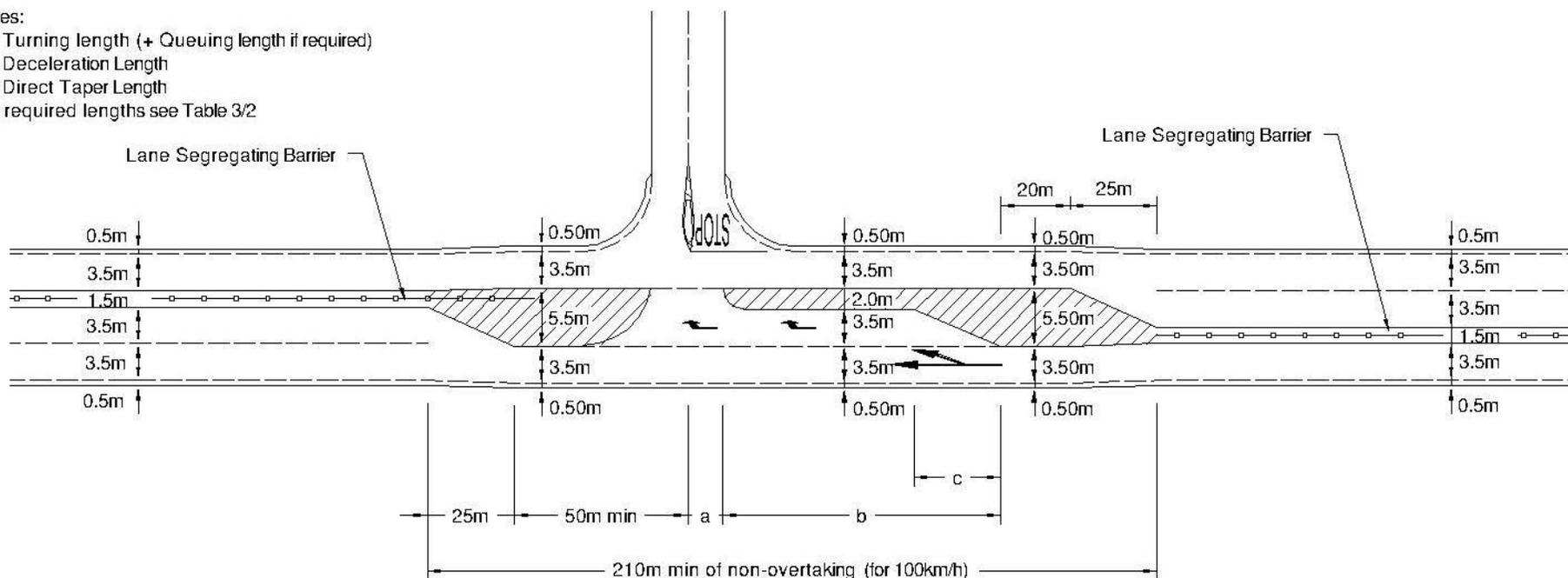


Figure 3/5: Junction Layout at Non-critical Changeover

*U-Turn Facilities*

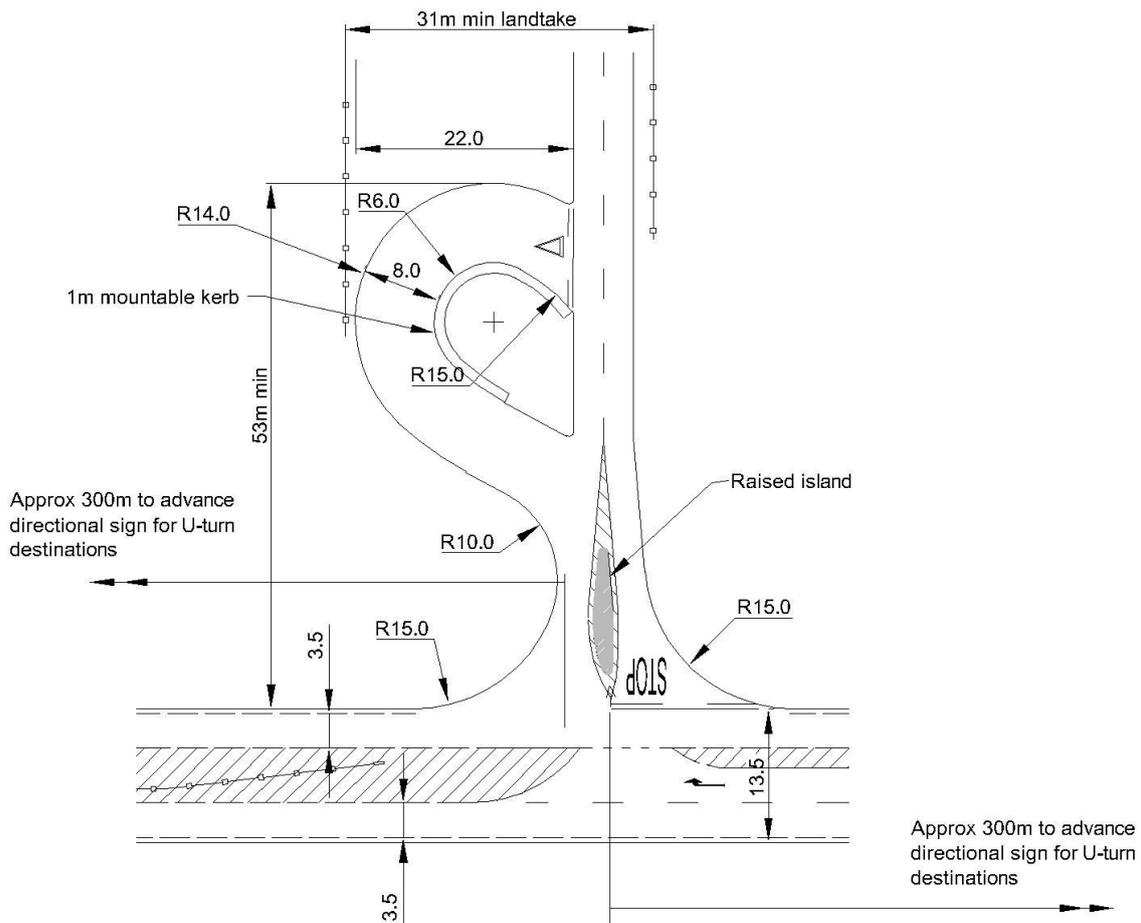
3.47 On some lengths of Type 3 Dual Carriageway where there are several accesses or junctions permitting left-in/left-out only, there may be a need to allow for vehicles wishing to make U-turns in order to minimise inconvenience to landowners and other users of the minor junctions. Roundabouts provide a safe way of allowing U-turns at junctions, but it would not normally be appropriate to construct a roundabout just for U-turns.

3.48 U-turn facilities can be provided at right turn priority junctions by providing a turning loop in the minor road, as illustrated in Figure 3/6. Such a layout allows U-turns in either direction.

3.49 Where it is necessary to provide a U-turn facility away from a right turn priority junction, a mainline U-turn loop can be provided at a minor

road or a private access, as illustrated in Figures 3/7 and 3/8. The preferred location for such layouts is at a changeover. Where a U-turn loop is provided at a passing lane length, the loop shall not be provided on the two-lane side, so as to avoid the need for turning traffic to cross two through lanes. It will be noted that these U-turn facilities permit right turns into the side road or access but not out. They also allow U-turns in one direction only. Similar U-turn loops could be provided where there is no minor road or private access, but it is better to combine a loop with a side road or access.

3.50 Careful signing will be required on the approaches to all U-turn facilities (except roundabouts) to alert drivers to the U-turn loop.



**Figure 3/6: U-Turn Loop in Minor Road**

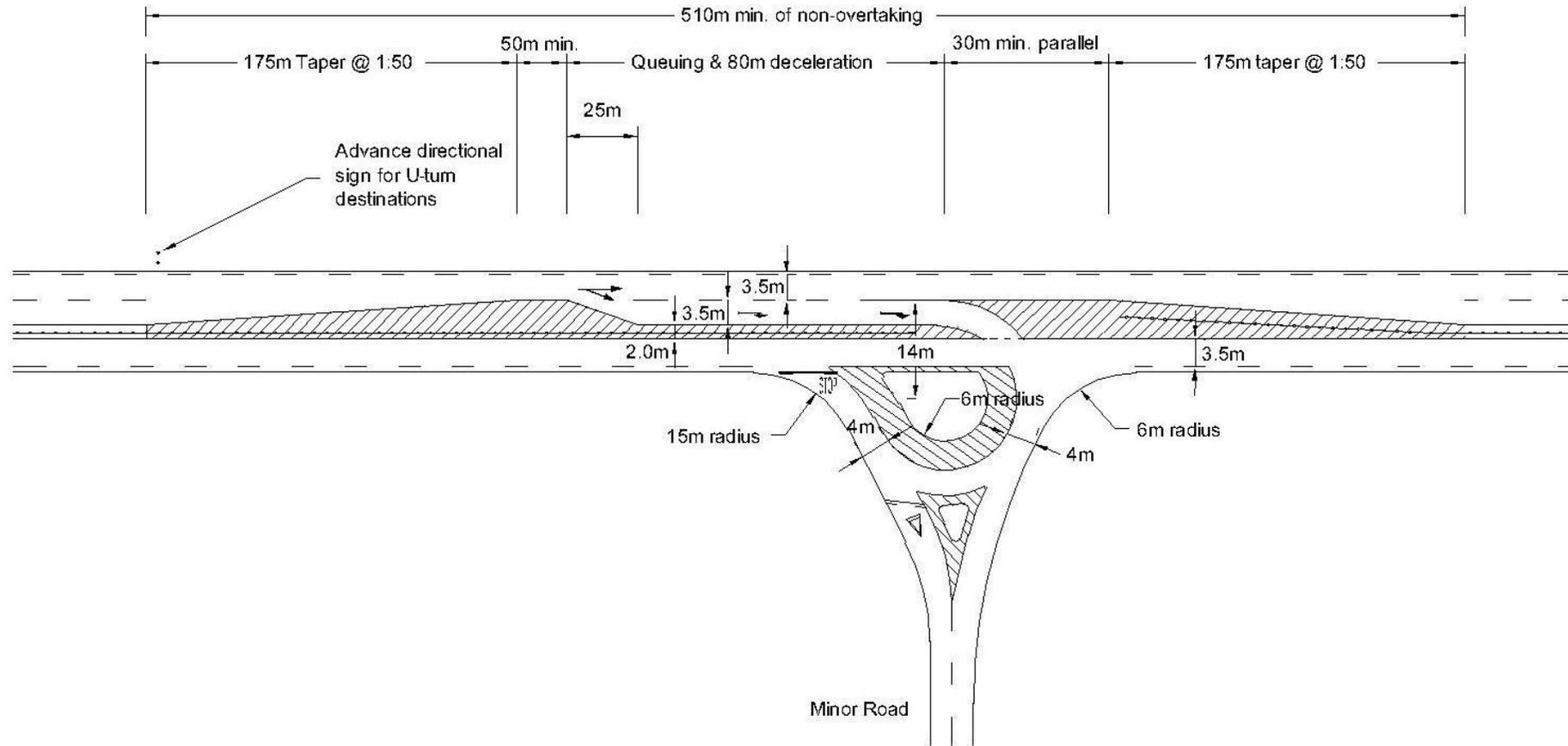


Figure 3/7: Mainline Turning Loop at Minor Road

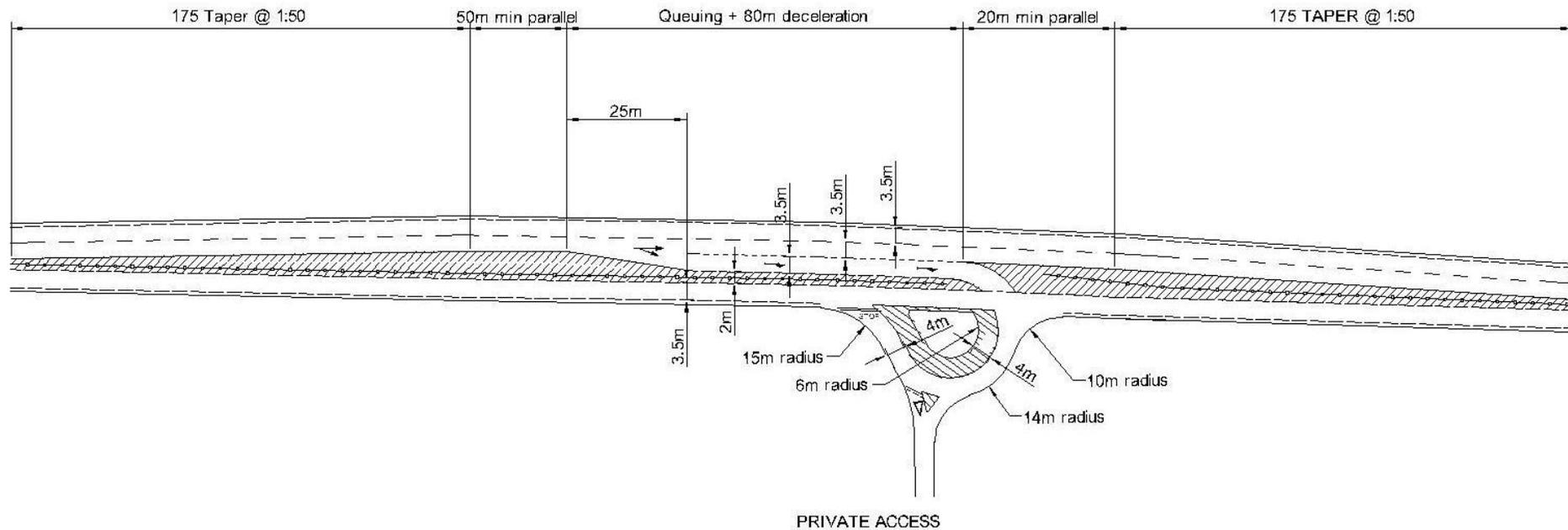


Figure 3/8: Mainline Turning Loop at Private Access

### *Staggered Junctions*

3.51 Crossroads are not permitted on Type 3 Dual Carriageways. Staggered junctions may be provided only at changeovers – not at passing lanes. Right/left staggers (where minor road traffic crossing the major road first turns right, proceeds along the major road and then turns left) are preferred to left/right staggers because traffic turning between the minor roads is less likely to have to wait in the centre of the major road.

3.52 The stagger distance of a junction is the distance along the major road between the centrelines of the two minor roads. The minimum stagger distance for a right/left stagger shall be 50m. For a left/right stagger, it shall be 100m for a 100km/h design speed, 75m for an 85km/h design speed and 60m for a 70km/h design speed. These left/right stagger distances are based on the sum of the two deceleration lengths lying side by side plus the turning lengths (and queuing lengths if appropriate) at each end.

3.53 The layouts of staggered junctions should be based on the layout for right-turn priority junctions as shown in Figures 3/4 and 3/5.

### *Visibility at Junctions*

3.54 Visibility at junctions shall be in accordance with the requirements of TD 42, except as described below. At junctions restricted to left in/left out, a single visibility splay to the right will suffice. At junctions where a crossing of the central reserve is permitted, the visibility splay to the left may be taken to the central reserve edge of the far carriageway on the major road, and visibility to the low object may be disregarded to the left provided full stopping sight distance to the high object is obtained. The central reserve segregating barrier may need to be terminated either side of the junction to avoid encroaching into the visibility splays; however, the gap in the barrier should be kept to a minimum.

### *Merging and Diverging Tapers*

3.55 Merging and Diverging tapers shall not be used on the single lane side of Type 3 Dual Carriageways.

### **Vehicular Accesses**

3.56 Direct vehicular access onto Type 3 Dual Carriageways from private property or developments should be avoided as far as practicable. Where accesses are to be provided, the requirements of TD 41 shall be adhered to. Accesses shall normally be permitted for left-in/left-out turns only. However, where it is necessary to combine a U-turn facility with a private access, as shown in Figure 3/8, the right turn in movement is also permitted. Left-in left-out accesses shall not be permitted within the length of a critical changeover nor within 150m on the approach to a critical changeover.

3.57 All accesses should be checked to ensure that they can cater for the swept paths of appropriate vehicles.

3.58 Temporary crossings of the central reserve for farm access shall only be allowed with the express permission of the NRA. These crossing points shall only be made available under the strict supervision of the Local Authority and shall be used only by exception. Five days advance notice will need to be given to the Road Authority Area Engineer prior to opening of the crossing. For details of a crossing layout see Figure 3/9.

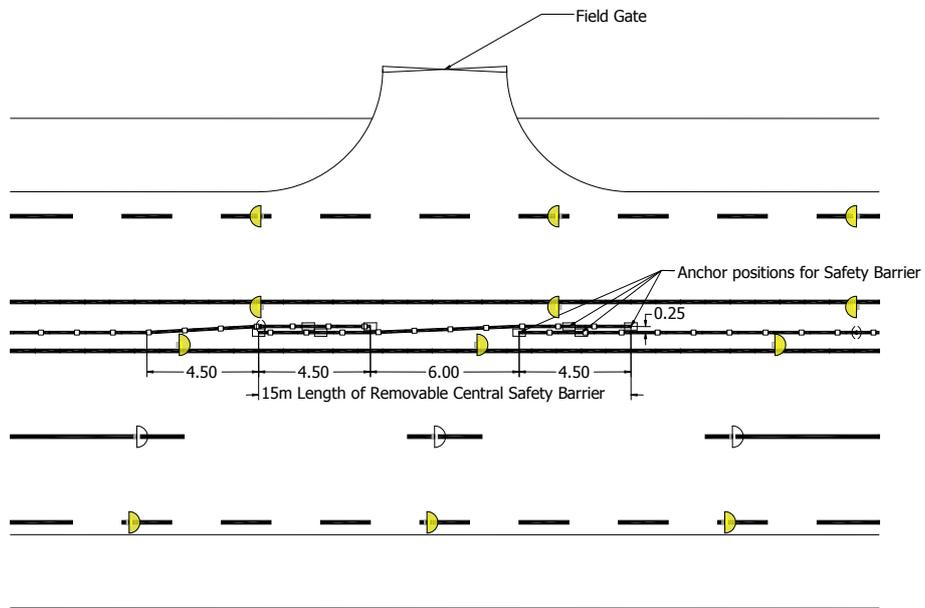


Figure 3/9: Field Access

### Non-Motorised User Requirements.

3.59 Where facilities are required for Non-Motorised Users (NMUs) alongside a Type 3 Dual Carriageway, they shall be provided in accordance with NRA TD 27. NMUs should be encouraged by signage to use alternative parallel routes, if available.

3.60 The need for NMUs to cross the road at roundabouts should be considered and suitable provision made. At compact grade separated junctions, provision should be made for NMUs to use the bridge over or under the main alignment.

3.61 The need for NMUs to cross the dual carriageway away from junctions should be avoided wherever possible. Where there is sufficient demand for a crossing point, provision of an underpass or NMU overbridge should be considered. A flow of about 10 NMUs in any hour may warrant such a provision.

3.62 An at grade crossing point away from a junction should only be provided where it is not practicable to provide a better facility. Where one is to be provided, the road should be reduced to one lane in either direction with a widened central reserve. A staggered crossing of the central reserve safety barrier should be provided, as indicated in Figure 3/10.

### Bus Stops

3.63 Bus stops should generally be avoided on Type 3 Dual Carriageways. Stops should, remain on existing alternative routes. In exceptional circumstances, where a bus stop is required a bus lay-by must be provided and should be located where grade separated pedestrian access is available. Care should be taken to avoid creating conflicting traffic movements at junctions.

### Changes in Carriageway Type

3.64 Changes between lengths of Type 3 and Type 2 Dual Carriageways may be made wherever appropriate by means of critical or non-critical changeovers (see Paragraphs 3.12 and 3.13).

3.65 Short isolated lengths of Type 3 Dual Carriageway should not be provided within roads with carriageways of types other than Type 2 Dual Carriageway. If lengths of Type 3 Dual Carriageway within a generally single carriageway road or vice versa are unavoidable, they should be at least 5km long and preferably 10km. Junctions should be located either at the change of road type or at least 1km away. The same criteria apply where it is necessary to construct a length of Type 3 Dual Carriageway within a Type 1 Dual Carriageway or vice versa.

3.66 Where it is appropriate to change from a Type 3 Dual Carriageway to a single carriageway or Type 1 or Type 2 Dual Carriageway, use of a roundabout as a terminal junction is strongly recommended. A roundabout slows all traffic and helps to indicate the change of cross section.

3.67 Where there is a change between a Type 3 Dual Carriageway and a single carriageway, other than at a roundabout, the preferred arrangement is for traffic leaving the Type 3 Dual Carriageway to be on a one lane length and traffic entering the Type 3 Dual Carriageway to join a two-lane length. The start of the Type 3 Dual Carriageway shall be preceded by a taper of 1/50, as shown in Figure 3/11. If traffic leaving the Type 3 Dual Carriageway is on a two-lane length, it will be necessary to reduce that side of the carriageway to a single lane section in a manner similar to a critical changeover.

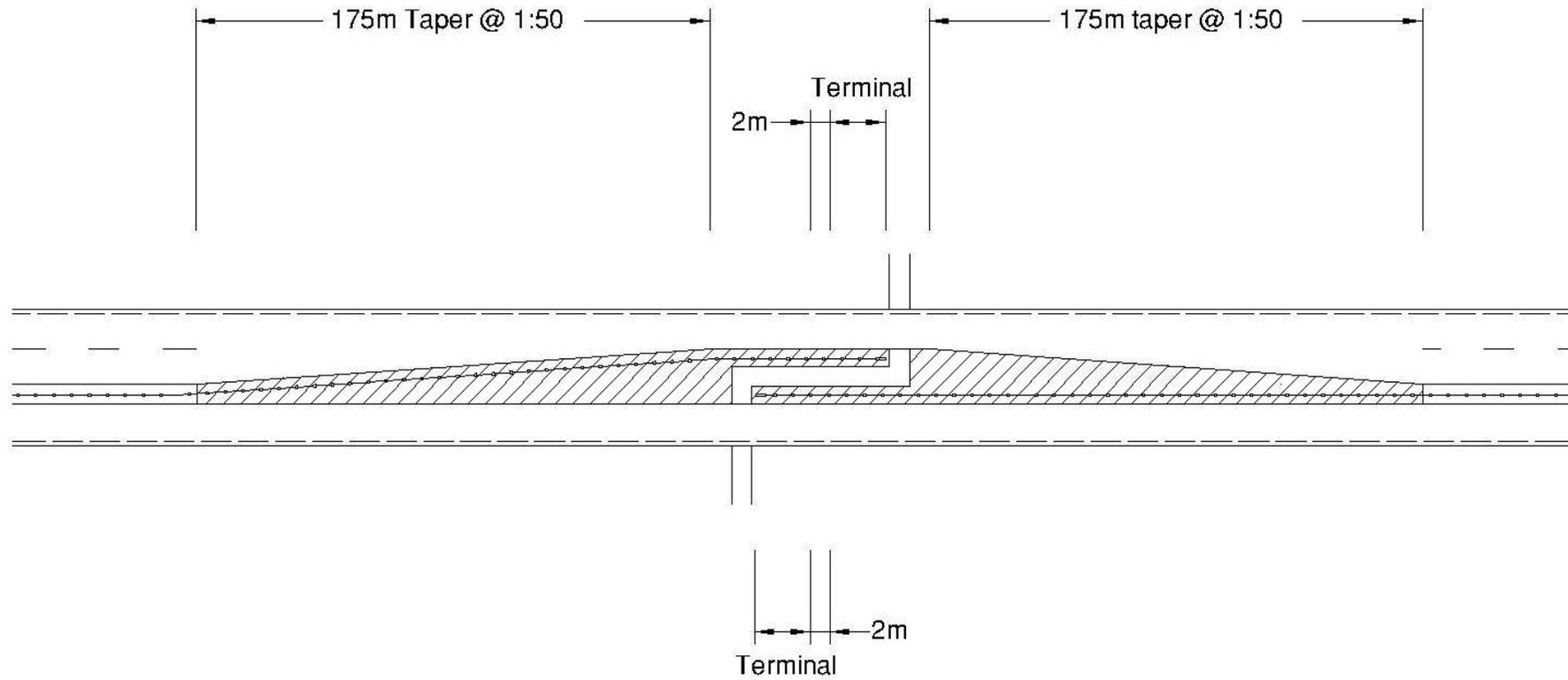


Figure 3/10: At Grade Pedestrian Crossing Facility

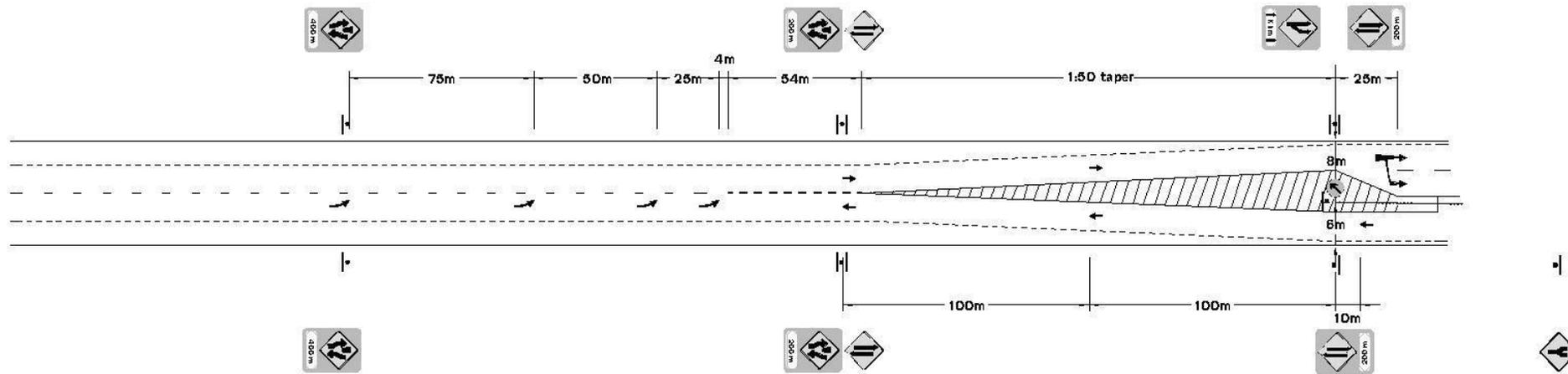


Figure 3/11: Change Between Standard Single Carriageway and Type 3 Dual Carriageway

### Passing Bays

3.68 To allow for breakdowns and very slow vehicles, passing bays should be provided near the mid length of each one-lane length on a Type 3 Dual Carriageway. The layout of the passing bay should be in accordance with Figure 3/12. Wherever practicable, passing bays should not be sited on the inside of bends or near junctions or signing. The bay can also function as a bus bay.

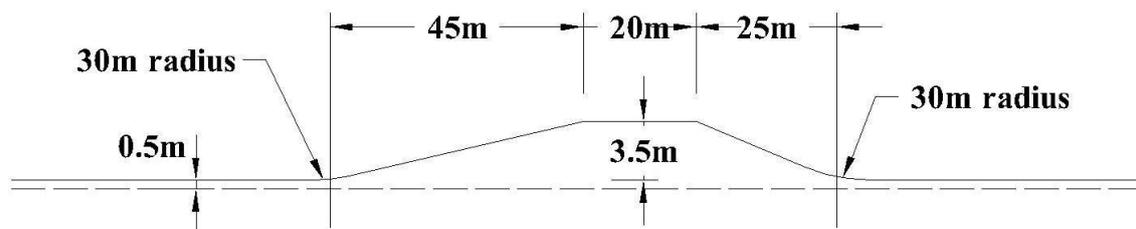


Figure 3/12: Passing Bay

## Lane Segregation and Safety Barriers

3.69 Type 3 Dual Carriageways shall be provided with physical lane segregation using an IS EN 1317 compliant product in the central reserve. The segregating barrier shall have a Containment Level of N2 and an Impact Severity Level of A or B, and a Working Width of W5 (1.8m) or less, in accordance with EN 1317-2 (see NRA TD 19). The segregating barrier width shall not exceed 0.3m in order to fit within the central reserve provided under the standard and so as not to encroach onto the hard strips. In all other respects the segregating barrier shall be in accordance with NRA TD 19, except that the Working Width may be such that under design impact conditions the segregating barrier will be permitted to deflect into the opposing traffic lane. However, no part of the segregating barrier may come to rest more than 0.2m into the opposing traffic lane.

3.70 To allow for emergencies and for maintenance after an impact, the segregating barrier assembly shall be capable of being dismantled and reassembled by two or three people without hand power tools or machinery. If a contraflow situation is required (after an accident or breakdown for example) the system shall be capable of allowing the vertical or support members to be removed and the longitudinal members to be removed or lowered to ground level for a minimum distance of 16m at any or multiple points along its length to let vehicles pass over uninhibited and safely. The system shall be such that it can be reassembled manually without the use of hand power tools or machinery back to its original position and assembly, as tested in accordance with EN 1317-2.

3.71 Terminals in the central reserve shall be such that all parts above the surface of the road lie between the hard strips. At junctions and other locations where vehicles cross the central reserve, the segregating barrier terminals shall be located as close to the junction as practicable, subject to the visibility requirements for the turning traffic. It is important for there to be a stagger between the ends of the segregating barrier.

3.72 Relaxations of up to two Design Speed steps below the Desirable Minimum Stopping Sight Distance are permitted for visibility to the low object at the central reserve segregating

barrier, provided Desirable Minimum Stopping Sight Distance is obtained to a 1.05m high object (see NRA TD 9). See also Paragraph 3.54 concerning visibility to the left when turning right at priority junctions

3.73 Safety barriers in the verges of Type 3 Dual Carriageways shall be in accordance with the requirements of NRA TD 19.

3.74 Central reserve segregating barriers shall be fitted with reflectors in accordance with the Traffic Signs Manual. Reflectors should generally be provided at approximately 24m centres. Where hatching is provided in the central reserve, the reflectors on the central reserve barrier should be provided at approximately 12m centres.

## Traffic Signs and Road Markings

3.75 The start and end of each passing lane on a Type 3 Dual Carriageway shall be signed in accordance with the Traffic Signs Manual, as indicated in Figure 3/13. Where the changeover occurs at a junction, the traffic signs indicating the start and end of the passing lanes should be positioned so as not to conflict with the signs for the junction.

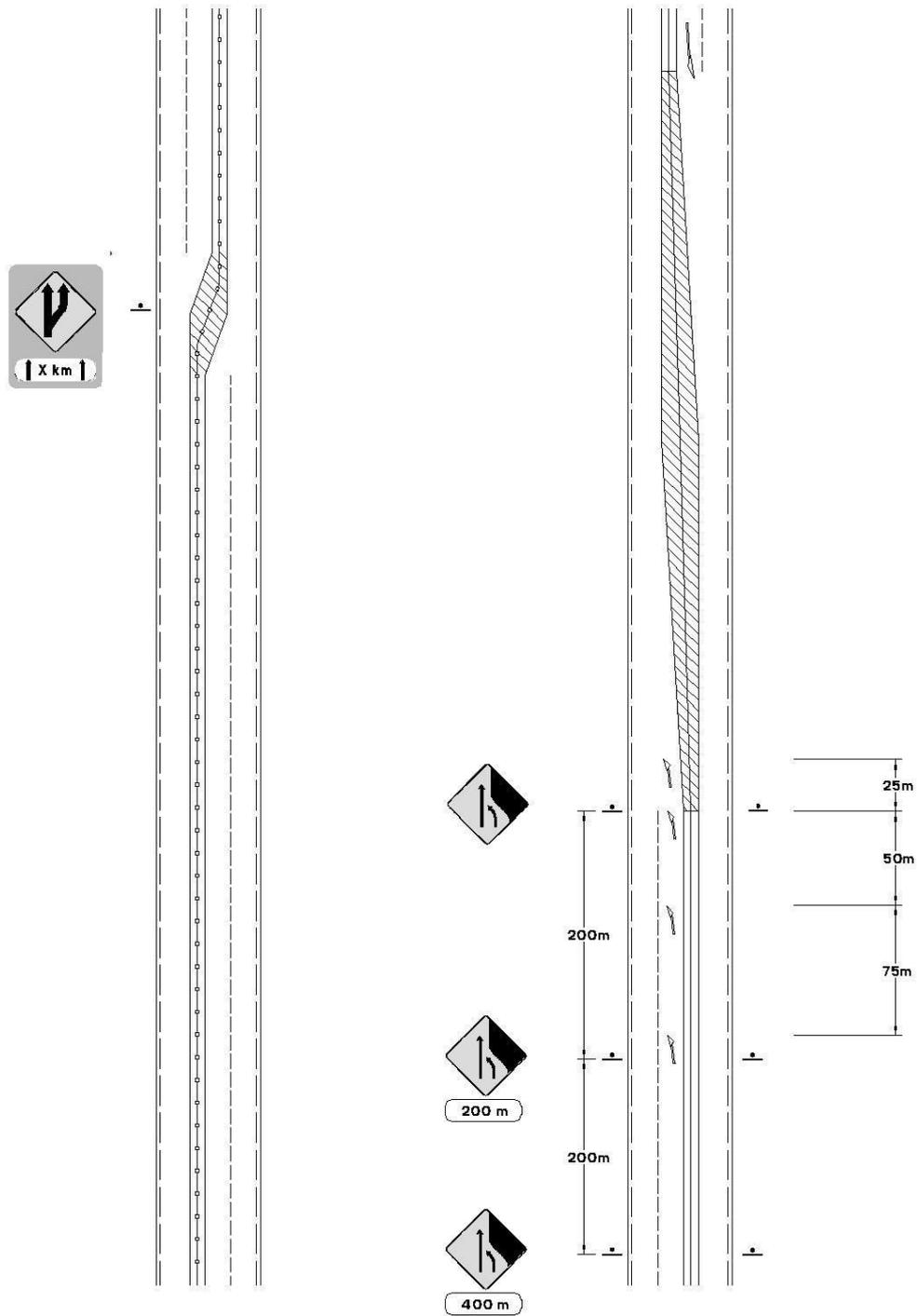
3.76 Signs at junctions on Type 3 Dual Carriageways shall be in accordance with the Traffic Signs Manual, based on the requirements for signing at junctions on dual carriageways. Stop signs and road markings shall be provided on the minor roads.

3.77 Where a U-turn facility is to be provided, directional signs shall be used to indicate the paths to be followed by all turning traffic, as shown in the example in Figure 3/14.

3.78 Where a length of Type 3 Dual Carriageway joins onto a length of single carriageway, the signs for 'road divides' and 'dual carriageway ends' shall be provided in accordance with the Traffic Signs Manual to indicate the start and end of a central reserve (see Figure 3/11).

3.79 Continuous white lines, in the form of raised rib road markings, shall be provided to mark the edges of the central reserve. Hatching is not required in the central reserve except at changeovers and junctions. Other road markings

shall be in accordance with the Traffic Signs Manual, based on the requirements for a dual carriageway.



a) Start of Passing Lane

b) End of Passing Lane

- Notes:
1. Figure shows signs for one direction of travel only.
  2. Signs at the end of the passing lane to be erected on both sides of the road.

Figure 3/13: Signs at Start and End of Passing Lane

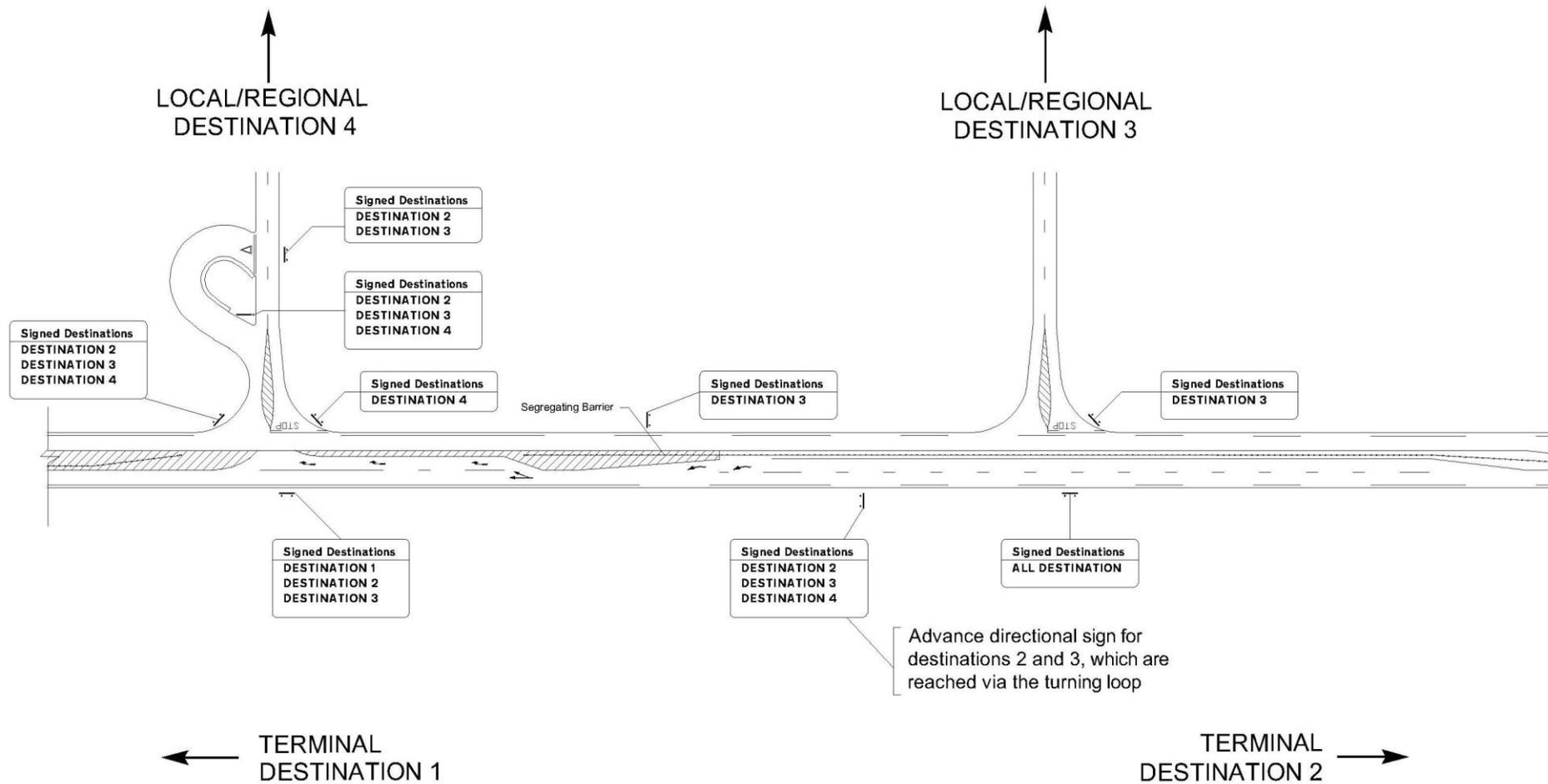


Figure 3/14: Directional Signs at U-Turns



## 4. REFERENCES

British Standards Institution. *BS 6100: Subsection 2.4.1, Glossary of Building and Civil Engineering Terms: Highway Engineering*. BSI, Milton Keynes.

Department of Transport. *Traffic Signs Manual*. DoT, Dublin, 2008. [Note: the Traffic Signs Manual published by the Department of the Environment in 1996 is currently being revised. The revised manual is due for publication in June 2008. The signs described in this Standard are in accordance with the October 2007 draft of the revised manual.]

Highways Agency (UK). Design Manual for Roads and Bridges (DMRB), read in conjunction with the NRA Addenda contained in the NRA DMRB:

TD 40 (DMRB 6.2.5) – *Layout of Compact Grade Separated Junctions*.

TD 42 (DMRB 6.2.6) – *Geometric Design of Major/Minor Priority Junctions*.

TD 41 (DMRB 6.2.7) – *Vehicular Access to All-Purpose Roads*.

National Roads Authority. NRA Design Manual for Roads and Bridges (NRA DMRB):

NRA TD 19 (NRA DMRB 2.2.8A) – *Safety Barriers*.

NRA TD 9 (NRA DMRB 6.1.1) – *Road Link Design*.

NRA TD 27 (NRA DMRB 6.1.2) – *Cross-Sections and Headroom*.

National Standards Authority of Ireland. *IS EN 1317-2: Road Restraint Systems – Part 2: Performance Classes, Impact Test Acceptance Criteria and Test Methods for Safety Barriers*. NSAI, Dublin.



## 5. ENQUIRIES

5.1 All technical enquiries or comments on this Standard should be sent in writing to:

Head of Engineering Operations  
National Roads Authority  
St Martin's House  
Waterloo Road  
Dublin 4



.....  
E O'CONNOR  
Head of Engineering Operations



Bonneagar Iompair Éireann  
Transport Infrastructure Ireland



Ionad Ghnó Gheata na  
Páirce,

Stráid Gheata na Páirce,  
Baile Átha Cliath 8, Éire



Parkgate Business Centre,  
Parkgate Street,  
Dublin 8, Ireland



[www.tii.ie](http://www.tii.ie)



[info@tii.ie](mailto:info@tii.ie)



+353 (01) 646 3600



+353 (01) 646 3601