

NRA TD 27/07

CROSS-SECTION AND HEADROOM



TABLE OF CONTENTS OF TD 27

- Introduction
- Design Principles
- Cross-Sections on Open Roads
- Cross-Sections at Structures
- Headroom at Structures
- References



1.0 INTRODUCTION

1.1 General

- This standard outlines the design principals and factors which should be considered by Designers in selecting road cross-sections and headroom.
- The standard applies to all National Roads and side roads diverted as part of a National Road Scheme.
- Where used for a Local Road Scheme, refer to the relevant Road Authority for their requirements.

1.0 INTRODUCTION

1.2 Important Definitions (Clause 1.11)

- Central Reserve : - The area which separates the carriageway of a dual carriageway and includes the widths of offside hard strips.
- Cross Section : - The road cross section incorporates all elements between the boundaries including :
 - Carriageways including cycle lanes
 - Central Reserve if any
 - Separation zones
 - Hard shoulders and hard strips
 - Verges including footpaths, cycle tracks
 - Cutting or embankment slopes
 - Berms and working spaces
- D2AP :- Dual two lane all purpose road.
- S2 : - Two lane single carriageway with carriageway lane width of up to 3.65m.

1.0 INTRODUCTION

1.2 Important Definitions (Clause 1.11) – Cont.

- Mainline – The c/w carrying the main flow of traffic.
- Nearside – Left hand side of vehicle when viewing a forward vehicle from behind.
- Type 1 Dual c/w – A divided all purpose road with two lanes in each direction constructed to the geometric standards of NRA TD9 and TD22.
- Type 2 Dual c/w – A divided all purpose road with two lanes in each direction constructed to the geometric standards of NRA TD10.
- Type 3 Dual c/w – A divided road with two lanes in one direction, one lane in the other direction, constructed to the geometric standards to NRA TD10.

1.0 INTRODUCTION

1.2 Important Definitions (Clause 1.11) – Cont.

- Roads : Urban and Rural :

Urban Roads – in a built up area and either

- a) single carriageway with a speed limit of 60kph or less; or
- b) dual carriageway with speed limit of 80kph or less.

Rural Roads : All other Roads:

- Verge : - The part of the road cross section alongside a carriageway but not including embankment or cutting slopes (includes the width of hard strips but excludes hard shoulders widths).

2.0 DESIGN PRINCIPLES

2.1 General

- The underlying principal is that Designers are given the maximum choice, so that there is flexibility to develop layout options that will meet NRA objectives (Clause 2.1).
- Designers should balance considerations of : -
 - Safety
 - Environmental Impact
 - Cost
 - Buildability of the Road Elements
 - Operation and Maintenance
 - Other Design Constraints
 - Health and Safety Responsibilities
- The Designer is not given choices over the widths of running lanes, hard strips, and hard shoulders for a particular type of road. Any variation is a 'Departure' (Clause 2.5).
- Designer does have flexibility over the width of work space, berms, side slopes, verges and central reserves although a reduction of verge or central reserve width below desirable minimum will require a Relaxation.

2.0 DESIGN PRINCIPLES

2.2 Design Progress

- In development of the road cross-section, the road pavement widths are fixed. In the widths which the Designer has flexibility, road side features will impact on the required widths such as :
 - Location of Safety Barriers – could be significant.
 - Drainage, Ducting, Services, Public Lighting.
 - Provision of Footpaths, Cycle Tracks.
 - Provision of Designated Lanes (Departures as per clause 2.14).
 - Berms, Landscaping Requirements.
- Requirements for Visibility on curved alignments and approaches to junctions may necessitate wider cross-section to accommodate wider verges and central Reserves (Clause 2.25 and TD 9).

3.0 CROSS-SECTIONS ON OPEN ROADS

(I.E. AWAY FROM STRUCTURES)

3.1 General

- Tables 2, 3, 4 and 5 gives detailed dimensions for the road pavements, verges and central reserves for National Roads both rural and urban in the open.
- Wide dual carriageways are not to be used without NRA agreement (Clause 3.2).
- Cross section of a side road which is not a National Road should be agreed with the NRA and the relevant Road Authority (Clause 3.3).
- Any reduction or increase (except as per Clause 3.6) in paved elements is a Departure from standard (Clause 3.4).
- Where there are different near-side edge treatment at merge / diverge locations, the transition is to take place over the length of the taper (Clause 3.10).

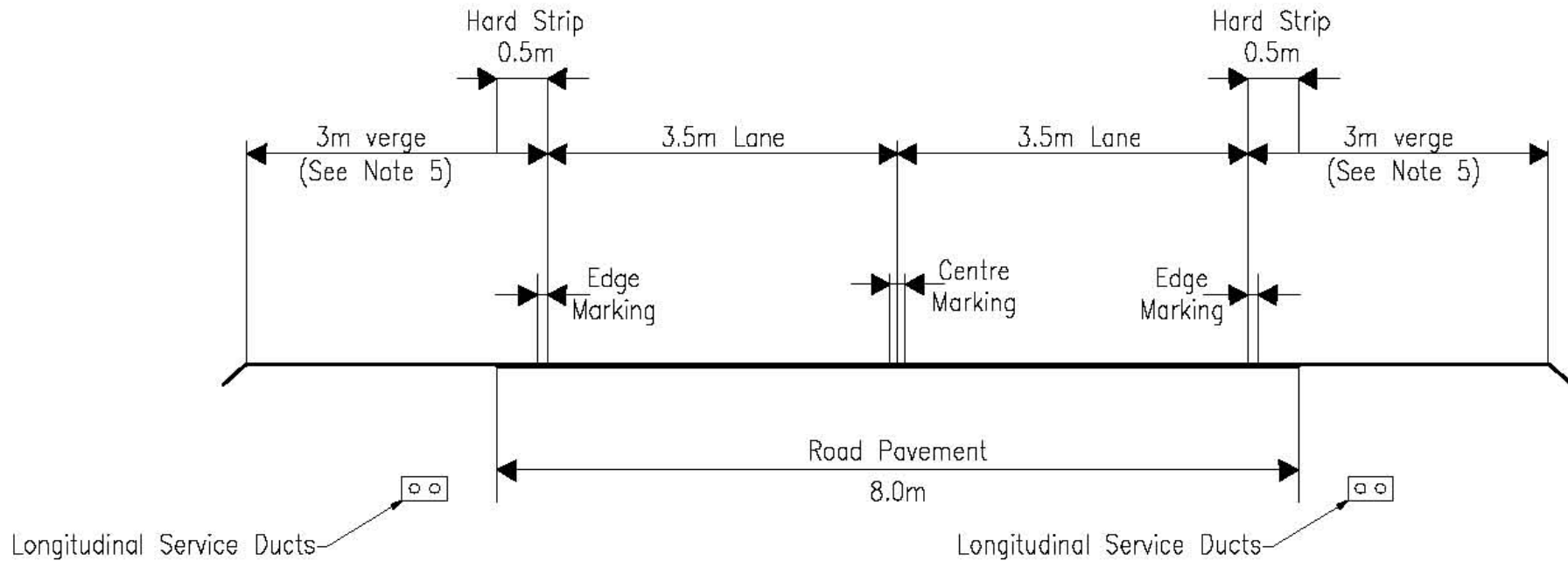
3.0 CROSS-SECTIONS ON OPEN ROADS

(I.E. AWAY FROM STRUCTURES)

3.1 General Cont.

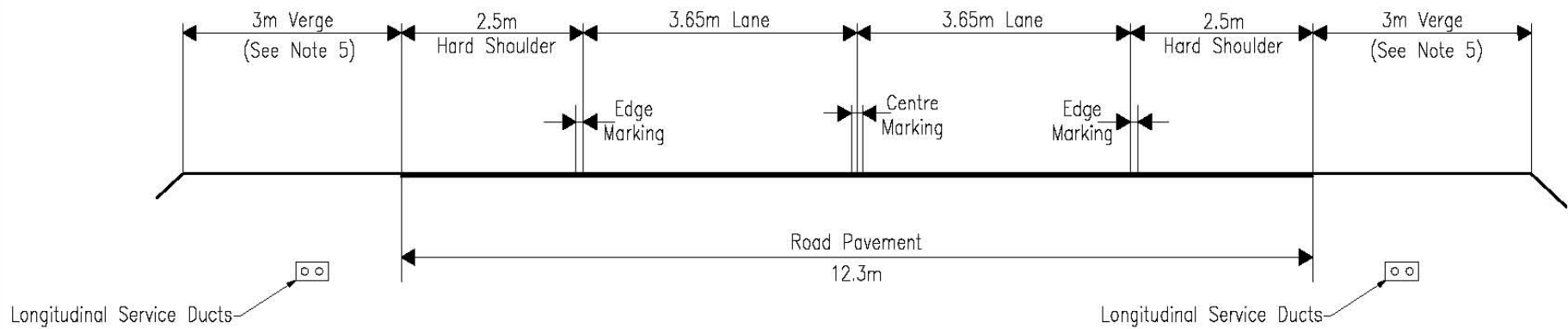
- Where kerbs are used on high speed roads they are to have a maximum height of 80mm and a 45 degree splay (clause 3.61).
- Verge or central reserve widths greater than the desirable widths do not require a Relaxation or Departure. Width less than desirable shall be regarded as a Departure.
- Urban Roads shall have raised verges (and kerbs) and footpaths as per Table 1.
- For Urban Roads should also refer to NRA TD 9 and 'Roads and Traffic in Urban Areas' for further guidance.
- It should be noted that all the road cross sections are currently being reviewed wrt non-motorised users.


REDUCED SINGLE CARRIAGEWAY (S2)



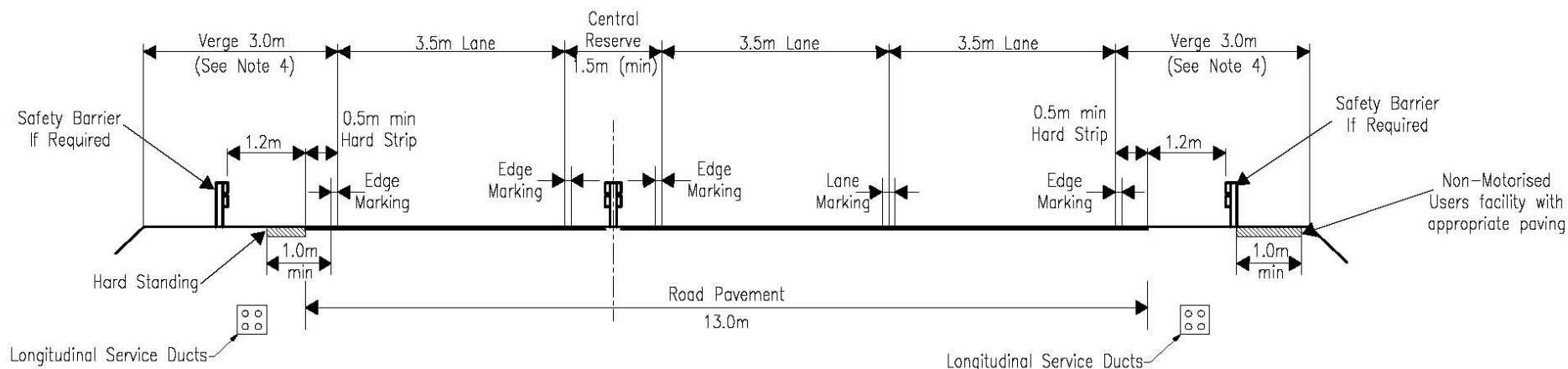
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			P2	11/07		RCD/
			P1	3/00		000/1
			Issue	Date		

STANDARD SINGLE CARRIAGEWAY (S2)



 NRA NATIONAL ROADS AUTHORITY	ROAD CONSTRUCTION DETAILS	ROAD TYPE AND CROSS-SECTION	P3	01/09	STANDARD SINGLE CARRIAGEWAY (S2)	Drawing No. RCD/000/2
			P2	11/07		
			P1	3/00		
			Issue	Date		

TYPE 3 DUAL CARRIAGEWAY

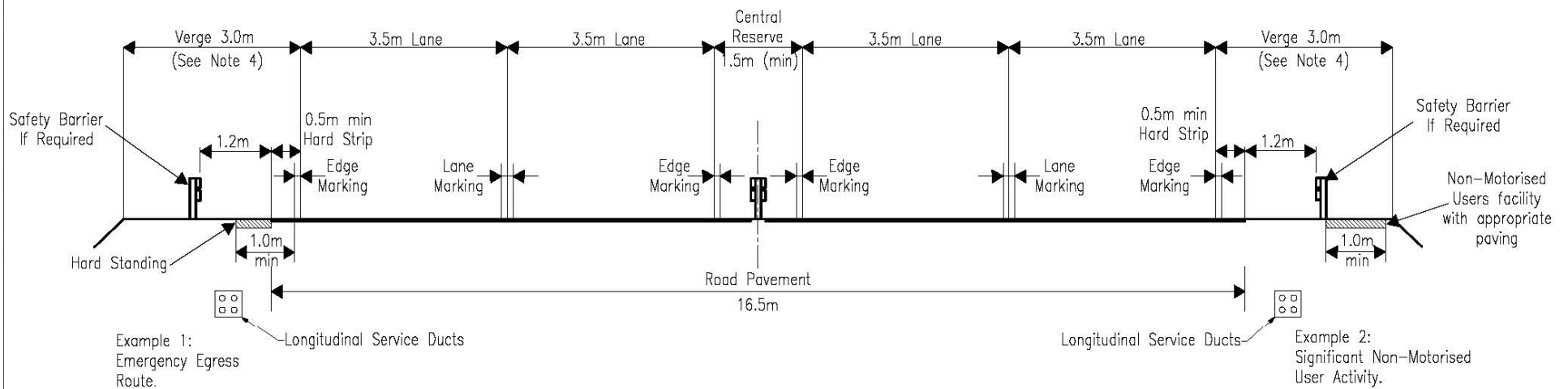


Example 1:
Emergency Egress
Route.

Example 2:
Significant Non-Motorised
User Activity.

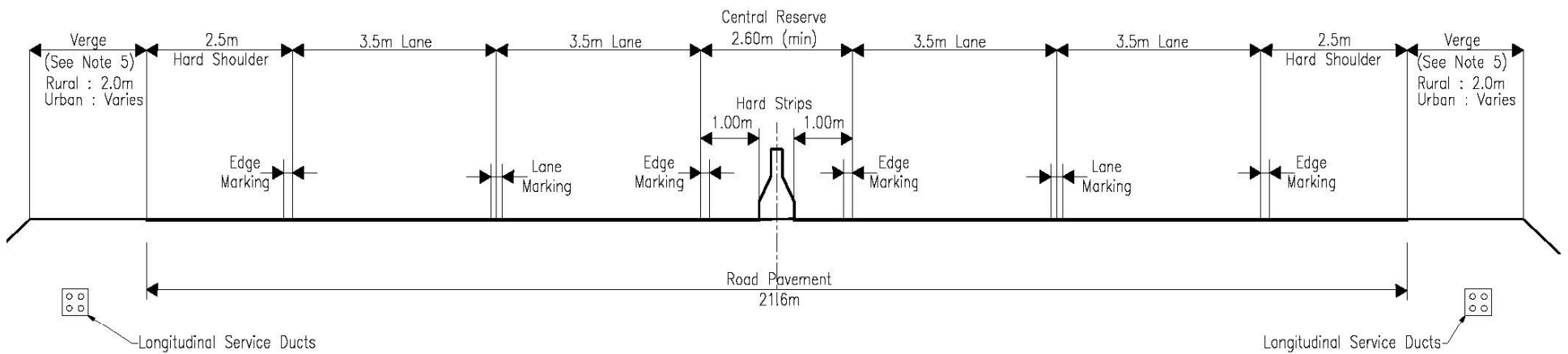
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			P2	11/07		
			P1	3/00		
			Issue	Date		


TYPE 2 DUAL CARRIAGEWAY (D2AP)



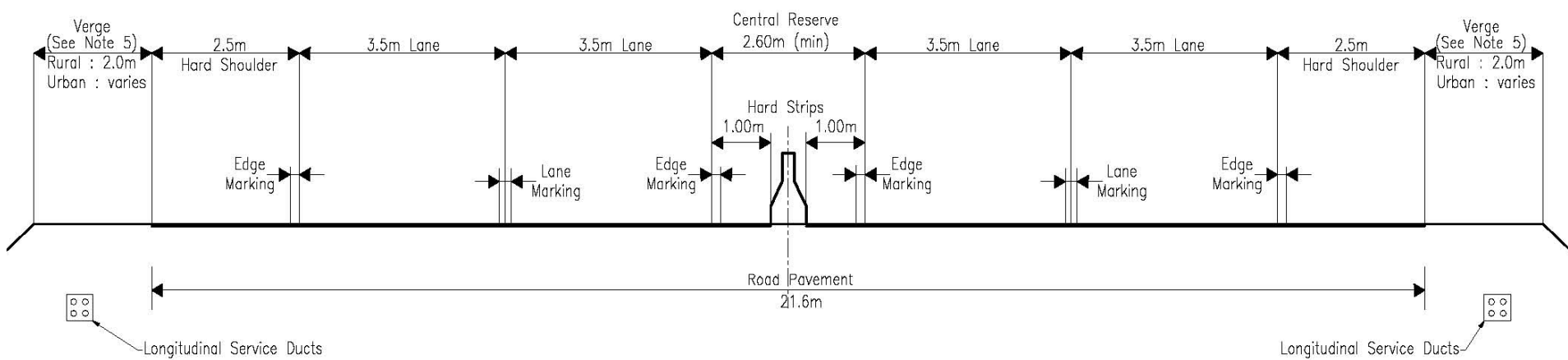
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			P1	3/00		000/4
			Issue	Date		


TYPE 1 DUAL CARRIAGEWAY (D2AP)



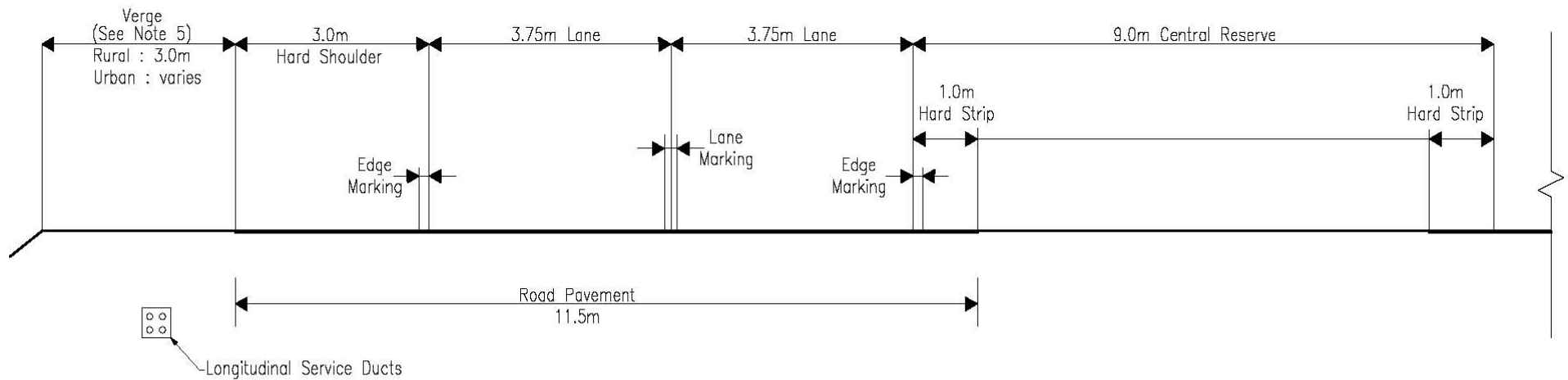
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			P2	11/07		
			P1	3/00		
			Issue	Date		

STANDARD DUAL CARRIAGEWAY MOTORWAY (D2M) & (D2UM)



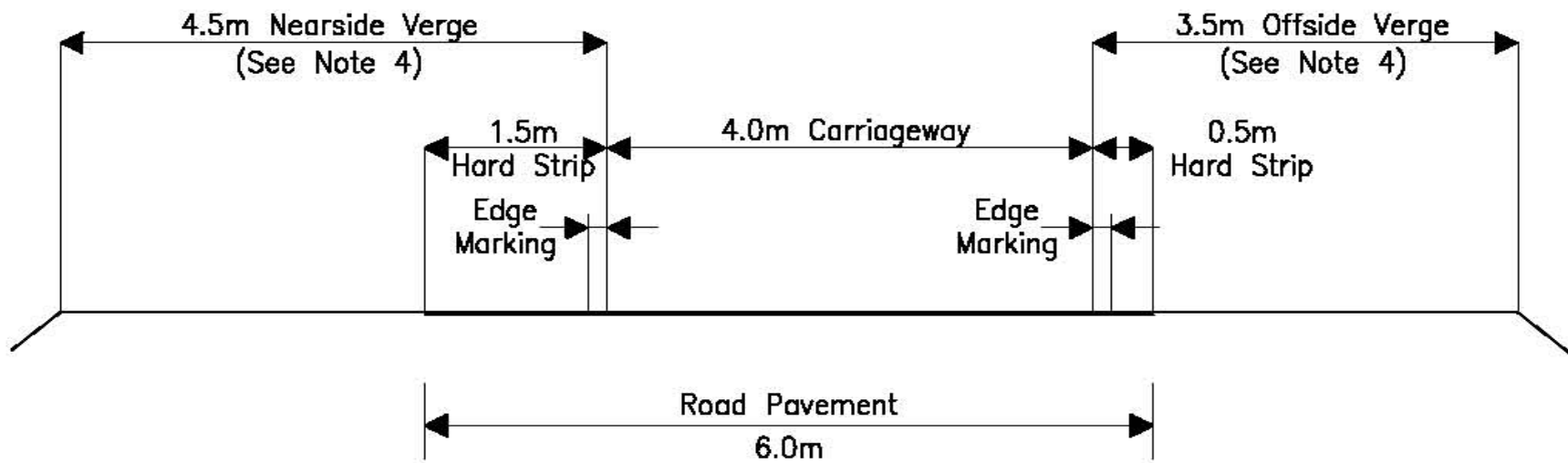
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			P2	11/07		
			P1	3/00		
			Issue	Date		


WIDE DUAL CARRIAGEWAY MOTORWAY (D2M)



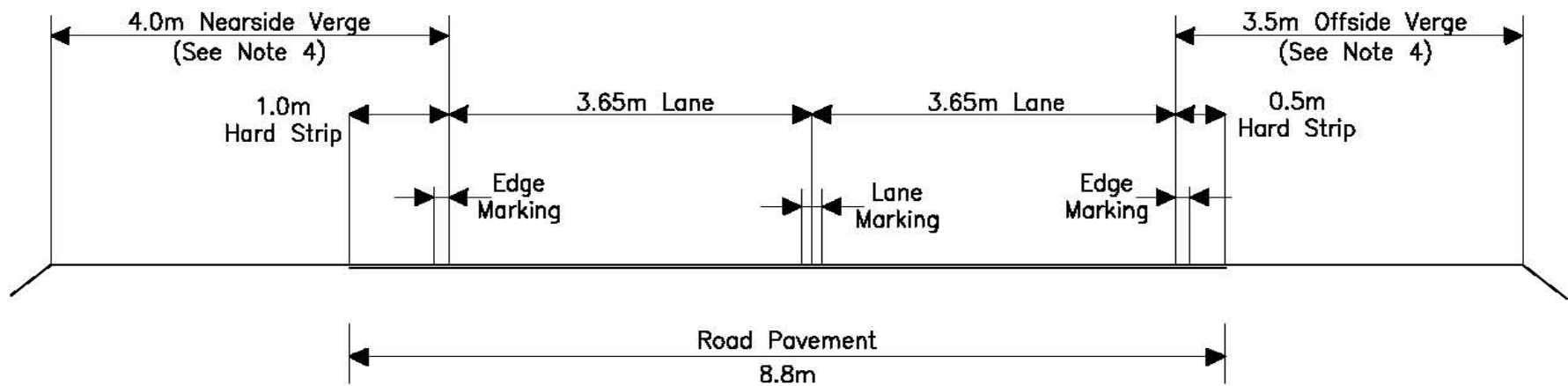
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			P2	11/07		
			P1	3/00		RCD/ 000/7
			Issue	Date		


SLIP ROADS, INTERCHANGE LINKS AND LOOPS: 1 LANE



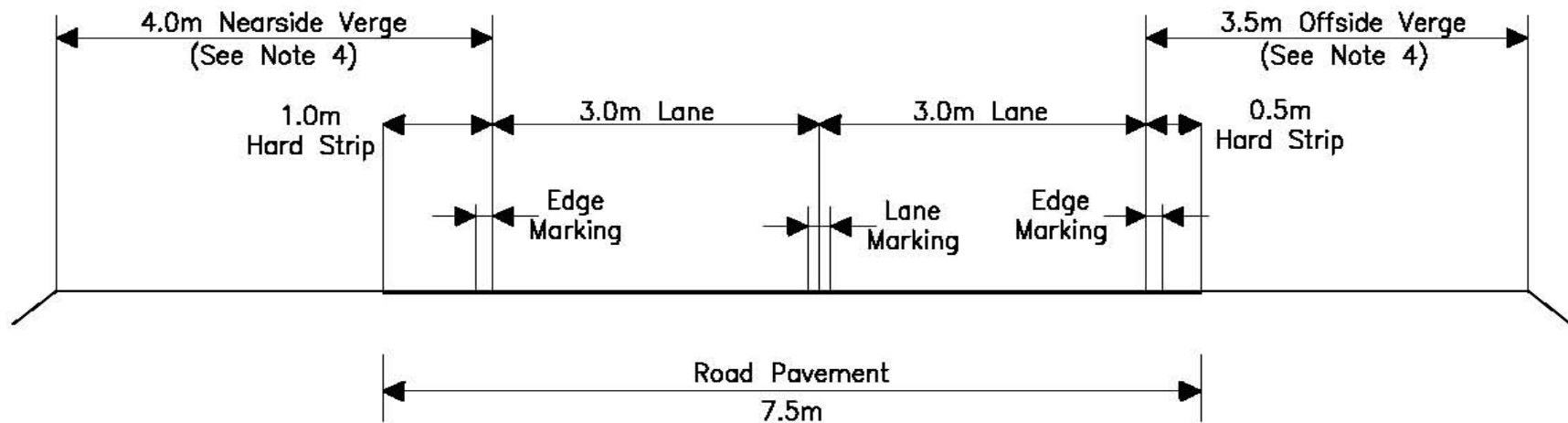
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			P1	3/00		RCD/ 000/8
			Issue	Date		


SLIP ROADS, INTERCHANGE LINKS AND LOOPS: 2 LANE



 NRA NATIONAL ROADS AUTHORITY	ROAD CONSTRUCTION DETAILS	ROAD TYPE AND CROSS-SECTION	P2	11/07	SLIP ROADS, INTERCHANGE LINKS AND LOOPS : 2 LANE	Drawing No.
			P1	3/00		RCD/
			Issue	Date		000/9

DIVERGE SLIP ROADS ONLY 2 LANE



 NRA NATIONAL ROADS AUTHORITY	ROAD CONSTRUCTION DETAILS	ROAD TYPE AND CROSS-SECTION	P2	11/07	DIVERGE SLIP ROADS ONLY 2 LANE	Drawing No.
			P1	3/00		RCD/ 000/10
			Issue	Date		

4.0 CROSS-SECTIONS AT STRUCTURES

4.1 General

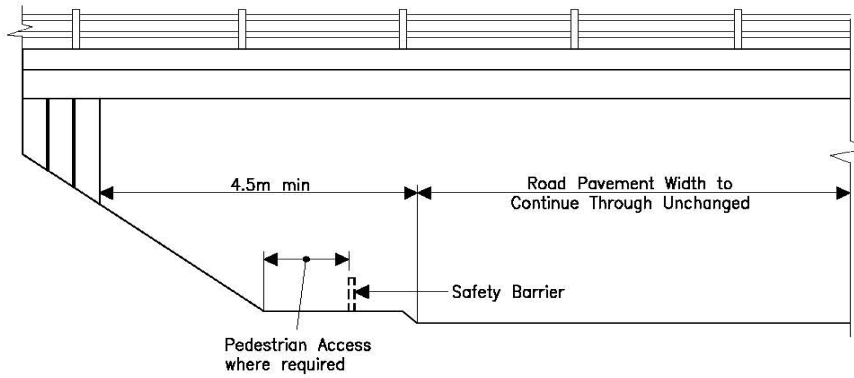
- NRA RCD 000/11 give cross-section details at bridge structures. However widening maybe required to give the stopping sight distances where the road alignment is on a curve (Clause 4.1).
- Variations of cross-section provision at bridges in close succession are to be avoided (Clause 4.2).
- Carriageway widths, hard shoulder and hard strip widths are to be maintained through or over structures (Clause 4.6 and 4.7).
- Width of Central Reserves applicable to the adjacent open road section should be continued through or over the structure.

4.0 CROSS-SECTIONS AT STRUCTURES

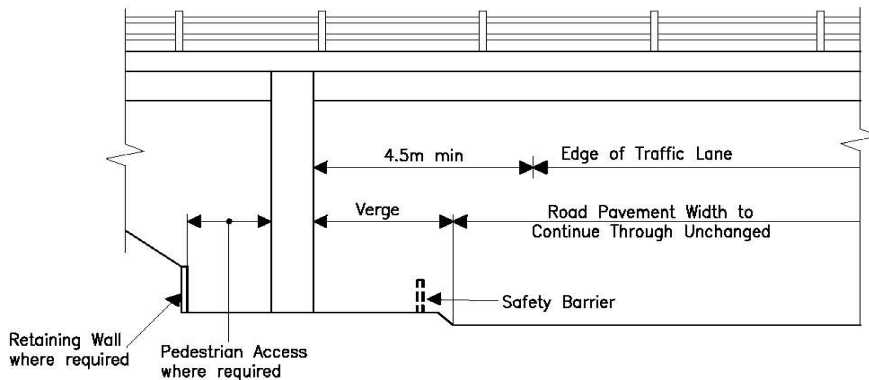
4.1 General Cont.

- Verges at Underbridges shall be raised (80mm maximum on high speed roads) with widths as per Table 6 (varying between 0.6m and 2.0m) (Clause 4.13).
- Verges beneath Overbridges shall be not less than 2.0m. Where there is an abutment adjacent to the carriageway, the face of the abutment is to be at least 4.5m from the edge of the road pavement. If the bridge support is a pier closest to the road, the set-back to the face of the pier maybe 2 metres minimum.

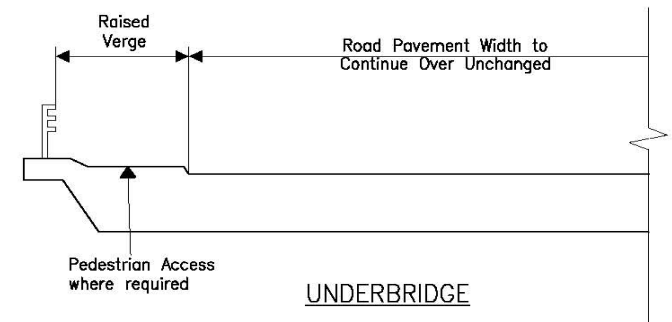
CROSS-SECTIONS AT STRUCTURES



OVERBRIDGE WITH ABUTMENT
AT BACK OF VERGE



OVERBRIDGE WITH PIER
AT BACK OF VERGE



UNDERBRIDGE

Notes :-

1. All dimensions are in metres
2. See NRA TD27 for dimensions of cross-section elements

Scale 1:100

TABLE 6: VERGE WIDTHS ON UNDERBRIDGES

Road Type	Location	Pedestrian Usage (see Paragraph 4.11)	Bridge Length m	Raised Verge Width m
Motorway	Nearside	-	All	0.60
	Offside	-	All	0.60
All-Purpose Road	Nearside	Regular	≤ 100	2.00
		Regular	>100	1.50
	Occasional	All	1.50	
	Offside*	All	All	0.60

Note: * For bridges carrying Non-National Roads it may be appropriate to treat one side as the offside despite the road carrying two-way traffic. See paragraph 4.5.

5.0 HEADROOM AT STRUCTURES

5.1 General

- At Overbridges and at other structures over a road, Table 7 gives the 'New Construction Headroom' and 'Maintained Headroom' varying between 5.03m and 5.7m (Clause 5.1).
- Additional Headroom is to be provided:
 - At location of vertical sag curves (Table 8)
 - To allow for deflection of the structure (Clause 5.9)
 - Where required by Utility Companies.
- Headroom requirements are the minimum – greater headroom may be provided if it is economical and / or environmentally acceptable (Clause 5.3).
- The relevant standard headroom is to be provided over:
 - The full pavement width (carriageway, hard shoulder and or hard strip).
 - The full verge width unless protected by a safety fence (see Clause 5.6 (e) and Figure 1).
 - The full central reserve width.

TABLE 7 STANDARD HEADROOM AT STRUCTURES

TYPE OF STRUCTURE	NEW CONSTRUCTION HEADROOM (M)	MAINTAINED HEADROOM (M)
Overbridges	5.30	5.03
Footbridges and Sign / Signal Gantries	5.70	5.41
Free Standing Temporary Structures	N/A	5.41

FIGURE 1: HEADROOM AT STRUCTURES

National Roads Authority
Design Manual for Roads and Bridges

Volume 6 Section 1
Part 2 NRA TD 27/07

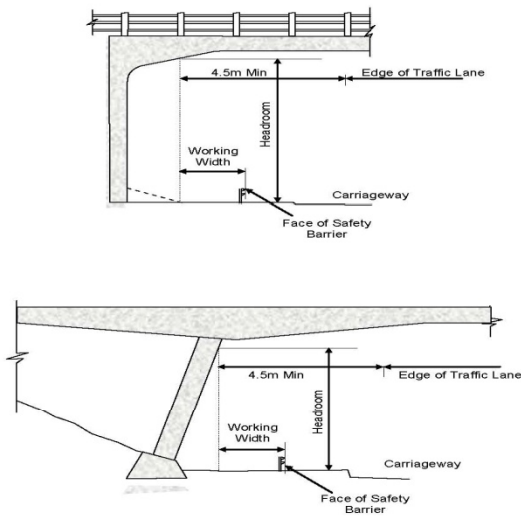


Figure 1:
Headroom at Structures

December 2007

25

GUIDANCE ON WHICH ROAD STANDARD TO USE

1 Strategic Decision

- Government has decided on certain minimum standards for certain elements of the network. For example, the National Development Plan 2000 to 2006 contains a development strategy to develop the major national primary routes to Galway, Limerick, Cork, Waterford and to the border north of Dundalk, to motorway / high quality dual carriageway standard in their entirety. This decision is aimed at providing a minimum level of service 'C' on the major national primaries (i.e. average inter-urban speed of 94kph on a dual carriageway and 105 kph on a motorway). This decision is based on national strategic considerations and not on traffic flows alone.

GUIDANCE ON WHICH ROAD STANDARD TO USE

2 Rural Roads

- Guidance for the layout features appropriate for various types of rural road cross-sections is given in Table 4 of TD 9/07 (Clause 6.2 of TD 9/07).
- Table 4 gives recommendations for each road type under :
 - Traffic Capacity for LOS 'D' (may need to be verified)
 - Access Treatment
 - Junction Treatment at Minor Roads
 - Junction Treatment at Major Roads

TABLE 4 FROM NRA TD 9: RECOMMENDED RURAL ROAD LAYOUTS

National Roads Authority
Design Manual for Roads and Bridges

Volume 6 Section 1
Part 1 NRA TD 9/07

Table 4: Recommended Rural Road Layouts

Type of Road ¹	Capacity (AADT) for Level of Service D	Edge Treatment	Access Treatment	Junction Treatment at Minor Road	Junction Treatment at Major Road
Reduced Single (7.0m) Carriageway S2	8,600	0.5m hard strips. Footways where required	Minimise number of accesses to avoid standing vehicles and concentrate turning movements.	Priority junctions, with ghost islands where necessary.	Ghost islands
Standard Single (7.3m) Carriageway S2	11,600	2.5m hard shoulders	Minimise number of accesses to avoid standing vehicles and concentrate turning movements.	Priority junctions, with ghost islands where necessary.	Ghost islands or roundabouts ² .
Type 3 Dual ³ (7.0m + 3.5m) Divided 2+1 lanes Primarily for retro fit projects	14,000	1.0m hard strips.	Minimise the number of accesses to avoid standing vehicles and concentrate turning movements.	Restricted number of left in/left out or ghost priority junctions.	Priority junctions or at-grade roundabouts.
Type 2 Dual ³ Divided 2+2 Lanes Carriageways. (2x7.0m)	20,000	0.5m hard strips	Left in / Left out	No gaps in the central reserve.	At-grade roundabouts and compact grade separation
Type 1 Dual Divided 2+2 Lanes Carriageways (2x7.0m)	38,100	2.5m hard shoulders	Left in / Left out	No gaps in the central reserve.	Left in / Left out and grade separation.
Standard Dual Divided 2+2 Lane (2X7.0m) Motorway (D2M)	44,100	2.5m hard shoulders	Motorway Regulations	No gaps in the central reserve.	Motorway standards Full-grade separation.
Wide Dual Divided 2+2 Lane (2X7.5m) Motorway (D2M)	55,500	3m hard shoulders	Motorway Regulations	No gaps in the central reserve	Motorway standards Full-grade separation.

- Notes:
1. For details of the standard road cross-sections, see NRA TD 27 and NRA TD 10 'Type 2 and Type 3 Dual Carriageways'
 2. Single lane dualling may be appropriate in some situations, but would be a Relaxation (see TD 42).
 3. See NRA TD 10 'Type 2 and Type 3 Dual Carriageways'

GUIDANCE ON WHICH ROAD STANDARD TO USE

3

- From the road scheme traffic studies the predicted design year AADT flows (normally taken as 15 years from the year of opening) should not exceed the capacity for LOS 'D' for the selected road cross-section and category of road. The chosen road type using traffic flows should then be checked against the achievement of recommended junction types, access treatment and environmental impacts.

GUIDANCE ON WHICH ROAD STANDARD TO USE

4 UK DMRB

- The equivalent Table 4 in the UK TD 9/93 does not state any traffic capacities for the different road cross-sections. Within the advice note TA 46/97 in the UK Volume 5, recommended traffic flow ranges for new Rural Road Links are listed in Table 2.1 for the year of opening. These flow ranges are given so that the resulting chosen road cross section can be economically assessed. This procedure has not been adopted by the NRA.

GUIDANCE ON WHICH ROAD STANDARD TO USE

5 URBAN ROADS

- As stated in Clause 6.3 of TD 9/07, it is not possible to tabulate overall layout characteristics for Roads in urban areas in the same way as for rural areas as the constraints of the existing urban fabric will result in Designs tailored to meet the site specific requirements. The capacity of the road scheme is likely to be controlled by the capacity of the junctions rather than the capacity of the link. Guidance on urban road cross-sections to use can be found by referring to:
 - Road Cross Sections stated for different categories of roads in local Road Authority Publications.
 - 'Roads and Traffic in Urban Area' as published by the Stationary Office in London.
 - TA 79/99 in Volume 5 of the UK DMRB which gives guidance on traffic capacities of Urban Roads.
 - TA 44/92 in Volume 5 of the UK DMRB which advises on capacities, queues etc at Road Junctions.