VOLUME 6 ROAD GEOMETRY
SECTION 1 LINKS

PART 2

TD 27/96

CROSS-SECTIONS AND HEADROOMS

SUMMARY

This Standard sets out the dimensional requirements for the highway cross sections for trunk roads including motorways both on open roads and at structures. It also gives requirements for headroom at structures.

INSTRUCTIONS FOR USE

1. Remove TD 27/86 and SH 2/92, which are superseded by TD 27/96 and archive as appropriate. This Standard also supersedes the MCHW 3, Series A drawings.

2. Insert TD 27/96 in Volume 6 Section 1.

3. Archive this sheet as appropriate.

Note: A quarterly Index with a full set of Volume Contents Pages is available separately from HMSO.

THE HIGHWAYS AGENCY

THE SCOTTISH OFFICE DEVELOPMENT DEPARTMENT

THE WELSH OFFICE
Y SWYDDFA GYMREIG

THE DEPARTMENT OF THE ENVIRONMENT FOR NORTHERN IRELAND

Cross-Sections and Headrooms

Summary: This Standard sets out the dimensional requirements for the highway cross-sections for trunk roads including motorways both on open roads and at structures excluding tunnels. It also gives requirements for headrooms at structures. It supersedes TD 27/86 and SH 2/92.

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REGISTRATION OF AMENDMENTS

Amend No	Page No	Signature & Date of incorporation of amendments	Amend No	Page No	Signature & Date of incorporation of amendments

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VOLUME 6 ROAD GEOMETRY
SECTION 1 LINKS

PART 2

TD 27/96

CROSS-SECTIONS AND HEADROOMS

Contents

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1. Introduction
2. Design Principles
3. Cross-Sections on Open Roads
4. Cross-Sections at Structures
5. Headroom at Structures
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1. INTRODUCTION

General

1.1 This Standard outlines the design principles and factors which should be considered by designers in selecting highway cross-sections and headroom. The process of design is described together with an approach to developing options.

1.2 This standard updates and supersedes **TD 27/86 and SH 2/92** in Scotland. This standard also supersedes the Series A drawings in the Highway Construction Details. The major changes are as follows:

i. Emphasis has been placed on the need to consider all relevant factors before choosing berm, side slope, verge or central reserve widths. Advice on the factors affecting this choice has been amplified.

ii. Greater flexibility in the width ranges for verges and central reserves has been introduced.

iii. Relaxations and Departures from this Standard have been defined.

iv. The presentation of information has been clarified and improved, with new Tables and additional Figures.

v. Definitions have been updated and extended.

Scope

1.3 This standard gives details of the cross-sections and headroom clearances to be used for trunk roads, including motorways, both on open roads and at structures.

1.4 This standard is not applicable to road tunnels.

1.5 For details of pedestrian and cycle subway dimensions see **TD 36 (DMRB 6.3.1)**, for footbridges see **BD 29 (DMRB 2.2)**, for equestrian subways and for agricultural crossings see **TA 57 (DMRB 6.3).**

Implementation

1.6 This standard should be used for the design and construction of all trunk road schemes including improvements. The exceptions are schemes currently being prepared where this would result in significant additional costs or delays.

Definitions

1.7 For the definitions of the general highway terms used in this Standard such as “highway types” (trunk roads, motorway and all-purpose roads etc) and “components of the highway” (central reserve, verge, hardshoulder, and hardstrip etc.) See **BS 6100: Subsection 2.4.1.**

1.8 Particular terms used in this Standard are defined as follows.

Bridge Length: - is the length of bridge parapet. Long underbridges are :

(a) Those on motorways exceeding 300m;

(b) Those on all-purpose roads exceeding 70m.

Bridleway: - Highway for use on foot or horseback.

Connector Road: - A collective term for slip roads, interchange links and loop roads.

Cross-section: - The highway cross-section incorporates all elements between the highway boundaries including carriageways, the central reserve, separation zones, hardshoulders, hardstrips, verges including any footway, cycle track or bridleway, cutting or embankment slopes, and berms. All dimensions are measured square to the line of the highway (see Figures 5 to 7 and Tables 2 to 5).

Cycle Lane: - A separate part of the carriageway for use by pedal cycles.

Cycle Track: - A separate part of a highway for use only by pedal cycles, and by pedestrians where permitted.

Interchange: - A grade separated junction that provides free flow of traffic from one mainline carriageway to another.

Interchange Link: - Refer to **TD 22 (DMRB 6.2)**

Loops: - Refer to **TD 22 (DMRB 6.2.1)**

Mainline: - The carriageway carrying the main flow of traffic; (generally traffic passing straight through a junction or interchange).

Maintained Headroom: - The minimum headroom which shall be preserved at all times.

New Construction Headroom: - The headroom which includes an allowance for resurfacing.

Overbridge: - A bridge that spans the road under consideration.

Pedestrian Access Provision: - That part of the verge on all-purpose roads provided to enable pedestrian movement through or over a structure.

Road Tunnel: - Refer to **BD 2 (DMRB 1.1) Part III**

Roads: Urban and Rural: - An Urban Road is a road which is in a built-up area and has either a single carriageway with a speed limit of 40mph or less, or has a dual carriageway, (including motorways), with a speed limit of 60 mph or less. All other roads are Rural Roads. Refer to **(R.T.U.A.).**

Slip Road: - Refer to **TD 22 (DMRB 6.2.1)**

Subway: - Underground passageway or tunnel for use by pedestrians, cyclists and sometimes equestrians.

Underbridge: - A bridge that carries the road under consideration.

Mandatory Sections

1.9 Sections of this document which form part of the standards the Overseeing Organisations expect in design are highlighted by being contained in boxes. These are the sections with which the Design Organisation must comply or must have agreed a suitable departure from standard with the relevant Overseeing Organisation. The remainder of the document contains advice and enlargement which is commended to designers for their consideration.

Relaxations within Standard

1.10 In difficult circumstances, the Design Organisation may relax a standard set out in this document to that relating to the next lowest design speed step. Refer to **TD 9 (DMRB 6.1.1)**. The Design Organisation shall record the fact that a Relaxation has been used in the design and the corresponding reasons for its use. On completion of the design, the Design Organisation shall report all such decisions to the Overseeing Organisation.

Departures from Standards

1.11 In exceptional situations, Overseeing Organisations may be prepared to agree to a Departure from Standard where the standard, including permitted Relaxations, is not realistically achievable. Design Organisations faced by such situations and wishing to consider pursuing this course shall discuss any such option at an early stage in design with the relevant Overseeing Organisation. Proposals to adopt Departures from Standard must be submitted by the Design Organisation to the Overseeing Organisation and formal approval received BEFORE incorporation into a design layout.

2. DESIGN PRINCIPLES

General

2.1 This section describes the principles to be followed when designing road cross-sections for new and improved all-purpose trunk roads and motorways. The underlying principle is that designers are given the maximum choice, so that there is flexibility to develop layout options that will meet the Overseeing Organisation's stated objectives.

2.2 Designers should balance considerations of safety, environmental impact, cost, buildability of the highway elements, operation, and maintenance. Where there are options for heights or widths, the selection process should include due consideration of these factors, and any other design constraints.

Range of Choice

2.3 The width of paved elements of the cross-section i.e. running lanes, hard shoulders and hardstrips, vary between different types of road. Dimensions have been selected on the basis of research, experience in the United Kingdom, and comparison with other countries' Standards, in order to give new and improved roads that maximise safety and are operationally efficient and cost effective. The designer is not given choices over the width of running lanes, hardshoulders and hardstrips for a particular type of road.

2.4 The designer does, however, have some flexibility over the width of berms, side slopes, verges and central reserves.

2.5 The verge width on either side of the paved area may be a factor affecting the severity of accidents where vehicles run off the carriageway. Research has indicated that only a small proportion of injury accidents, perhaps 2% or 3% in open country, would be avoided if verges were to be doubled in width. Consequently, safety aspects will not normally be a factor when choosing a verge width greater than the desirable width, provided visibility requirements are met. Details of when to provide safety fences or safety barriers in verges and central reserves to protect against collisions between vehicles and roadside objects or features are given in **TD 19 (DMRB 2.2), TD 32 (DMRB 2.2.3) and Highways Construction Details (MCHW 3.2).**

2.6 The width between the back of the verge and the highway boundary will depend on the terrain, the need to accommodate environmental mitigation measures, the engineering or geotechnical measures used to accommodate changes in ground levels, and any need to include differing types and widths of drain and other services in the berm.

Environmental Aspects

2.7 Environmental aspects may effect elements of the cross-section. **The Good Roads Guide HA 55 to HA 63 (DMRB 10.1.1 to DMRB 10.3.1), HA 67 (DMRB 10.4.1) and DMRB Vol 11** describe the approach to be taken.

Design Process

2.8 For the purposes of developing initial layouts, the designer's objective should be to determine the appropriate width for the highway cross-section, and any variation in width required. Features included in the cross-section can affect the choice of width, and to assist the designer, Table 1 lists features that commonly occur within the highway. The Table also lists the Standards, Advice Notes and other documents that contain further details. Some features, safety fences, for example, can have a significant effect on the cross-section width whilst other features, road signs, for example, are usually accommodated within the side slopes and berms.

2.9 The preferred locations for features in verges and the central reserve may often coincide or overlap, and the designer should be aware of the potential for such conflicts. Generally, there is far more below the surface of verges and central reserves than is apparent on the surface, and some underground features must be readily accessible for routine maintenance purposes. Engineering solutions can usually be designed to overcome conflicts where space is limited, but these may increase costs. Figures 1 to 4 illustrate the size and extent of typical features above and below ground that might be located in the verge and central reserve of rural roads. With the wide range of features that actually occur, details are best designed individually for each situation.

Other Features Within the Highway Cross-section

2.10 In addition to the features listed in Table 1, there are other items that frequently occur within the highway. A checklist of the most common of these items is as follows:-

Bridleways
Cycle Tracks
Culverts
Fencing
Footways
Foundations
Geotechnical Monitoring Equipment
Geotextiles
Hardstandings
Landscaping
Communications Equipment
Overbridges
Apparatus of Utility Companies and other Authorities
Subways
Tracks for Equestrians
Underbridges

Visibility

2.11 On curved alignments and approaches to junctions, it may be necessary to widen the cross-section, particularly verges and central reserves, to ensure that drivers and other road users can see the appropriate distances, and that the layout meets the visibility requirements. Refer to **TD 9 (DMRB 6.1.1).**

TABLE 1
FEATURES COMMONLY OCCURRING IN THE HIGHWAY CROSS-SECTION

FEATURE	STANDARD ADVICE OR GUIDANCE	TITLE
Agricultural Cattle/Horse Crossings	TA 56 (DMRB 8.2)	Hazardous Cattle Crossings; use of Flashing Amber Lights
	TA 57 (DMRB 6.3)	Roadside Features
Animal Tunnels	HA 59 (DMRB 10.1.5)	The Good Roads Guide
Anti-Dazzle Fences	TA 57 (DMRB 6.3)	Roadside Features
Arrester Beds	TA 57 (DMRB 6.3)	Roadside Features
Drains	(MCHW 3.1)	Highway Construction Details
	HA 37 (DMRB 4.2)	Hydraulic Design of Road Edge Surface Water Channels
	HA 39 (DRMB 4.2)	Edge of Pavement Details
	TA 26 (DMRB 6.3)	Withdrawal of Motorway Design Memorandum
Footbridges	BD 29 (DMRB 2.2)	Design Criteria for Footbridges
Sign/Signal Gantries	BD 51 (DMRB 2.2.4)	Design Criteria for Portal and Cantilever Sign / Signal Gantries
Kerbing	HA 39 (DMRB 4.2)	Edge of Pavement Details
	TA 57 (DMRB 6.3)	Roadside Features
	(MCHW 3.1)	Highway Construction Details
Lay-bys	TA 69 (DMRB 6.3.3)	Location and Layout of Lay-bys
Lighting Columns	BS 5489 Part 1	Road Lighting: Guide to General Principles
	BD 26 (DMRB 2.2.1)	Design of Lighting Columns
	TD 30 (DMRB 8.3)	Design of Road Lighting for All-Purpose Trunk Roads
	BS 5649 / EN40	Lighting Columns
	TD 34 (DMRB 8.3)	Design of Road Lighting for Motorway Trunk Roads

FEATURE	STANDARD ADVICE OR GUIDANCE	TITLE
Loop Detectors	HD 20 (DMRB 9.3.1)	Loop Detectors for Motorways
Traffic Control and Communications	(DMRB 9,9a and 9b)	Network Traffic Control and Communications
	(MCHW 3.1)	Highway Construction Details
Motorway Markers	(MCHW 3.1)	Highway Construction Details
	TA 26 (DMRB 6.3)	Withdrawal of Motorway Design Memorandum
Parapets	BS 6779 Parts 1,2 & 3	Highway parapets for bridges and other structures
	BD 52 (DMRB 2.3.3)	The Design of Highway Bridge Parapets
Pedestrian Guardrails	BS 3049	Specification: Pedestrian Guard Rails (Metal)
	TA 57 (DMRB 6.3)	Roadside Features
	BA 48 (DMRB 2.2.2)	Pedestrian Protection at Headwalls, Wing Walls and Retaining Walls
Police/Observation Platforms on Motorways	TA 66 (DMRB 6.3.2)	Police Observation Platforms on Motorways
Services	(MCHW 3.1)	Highway Construction Details
	TA 26 (DMRB 6.3)	Withdrawal of Motorway Design Memorandum
Signs	TSM	Traffic Signs Manual
Slope Strengthening	HA 44 (DMRB 4.1.1)	Earthworks: Design and Preparation of Contract Documents
Traffic Signals	TA 18 (DMRB 6.2)	Junction Layout for Control by Traffic Signals
Vehicle Safety Fences/ Safety Barriers	TD 19 (DMRB 2.2)	Safety Fences and Barriers
	TD 32 (DMRB 2.2.3)	Wire Rope Safety Fence
	(MCHW 3.2)	Highway Construction Details

3. CROSS-SECTIONS ON OPEN ROADS

General

3.1 Figures 5 to 12 show the location of the elements within the highway cross-section and Tables 2 to 5 give detailed dimensions for each element. The information covers trunk roads of all types, rural motorways, rural all-purpose roads, urban motorways and urban all-purpose dual carriageway roads, together with associated interchange links, loops and on and off slip roads.

3.2 The cross-section of a side road, which is not a trunk road and is diverted or improved on-line as part of a trunk road scheme, should be agreed with the relevant Highway Authority.

Pavement Width

3.3 The width of the paved elements of the cross-section i.e. carriageways, hard shoulders and hardstrips, shall normally be as given in this Standard. Any reduction or increase in the width of these elements is a Departure from Standard.

Traffic Lane Widths

3.4 Traffic lane widths shall be as detailed in Figures 5 to 7. In Scotland and Northern Ireland, a carriageway width of 6.0m may be used on single carriageway all-purpose roads with a design year flow of 5000 AADT or less.

3.5 Additional information on the start and finish of climbing lanes incorporated into single and dual carriageway roads can be found in Chapter 5 of **TD 9 (DMRB 6.1.1).**

3.6 Traffic lanes should be widened on curves of low radius to allow for the swept path of long vehicles. See **TD 9 (DMRB 6.1.1) and TD 42 (DMRB 6.2.6)**.

Hardshoulder/Hardstrip/Carriageway Edge Treatment

3.7 Where slip roads, interchange links and loop road join or leave main carriageways the edge detail may change from hardshoulder to hardstrips and carriageway edge.

3.8 Transitions between different edge details should take place as follows: -
Motorway merges and diverges: over the length of the nose.
All-purpose merges: on the approach to the back of the nose, at a taper of 1 in 30.
All-purpose diverges: over the length of the nose.

3.9 On connector roads the gain of hardstrip resulting from superelevation shall take place over approximately 20m immediately before 0% crossfall, and loss of hardstrip over approximately 20m after 0% crossfall. The length may be varied to ensure smooth edgelines.

3.10 See **TD 22 (DMRB 6.2.1)** for layout of Merges and Diverges.

Berm, Side Slope, Verge and Central Reserve Widths

3.11 Berm and side slope widths should be chosen to match the local situation. For verges and central reserves however, the widths given in Tables 2 to 5 should be the first option considered although other dimensions may be used in circumstances where this would be preferable. These circumstances might range from a need to minimise landtake to a requirement to accommodate a large amount of equipment and features in a location where land is not so limited.

3.12 The use of a width greater than the desirable width is not a Relaxation or Departure. Reference should be made to **TD 42/95 (DMRB 6.2.6)** for guidance on widening the central reserve at major/ minor junctions on dual carriageway all-purpose roads.

3.13 There may be benefits in using dimensions less than the desirable widths for these elements, and these cases should be regarded as Relaxations. The requirements of other standards may limit the scope for width reductions. For example, the space needed for roadside features and where necessary the safety fences or safety barriers to protect them.

3.14 Variations of verge and central reserve widths in close succession should be avoided. The designer should consider how the scheme design will integrate with adjacent highway sections and the route as a whole.

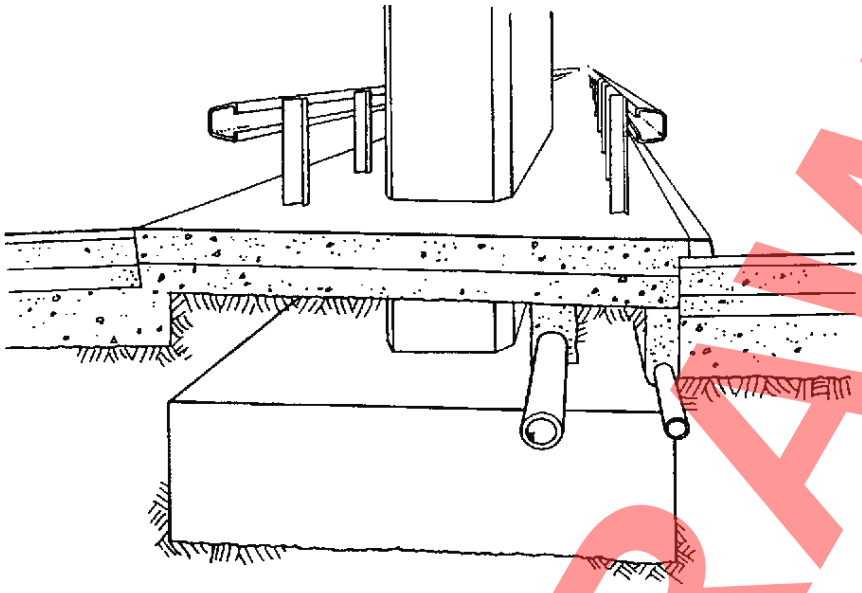
3.15 Provision for pedestrians and cyclists should be made where a local need has been identified. The width and location of such provision should have the agreement of the overseeing organisation. See **Environmental Assessment (DMRB Vol 11)**.

Urban Areas

3.16 In urban areas raised verges or raised footways may be provided to the relevant widths given in Table 6.

3.17 In urban areas there may be numerous items of street furniture within the highway cross-section.

3.18 See **TD 9 (DMRB 6.1.1) and (RTUA)** for further advice on designing urban single and dual carriageway roads.

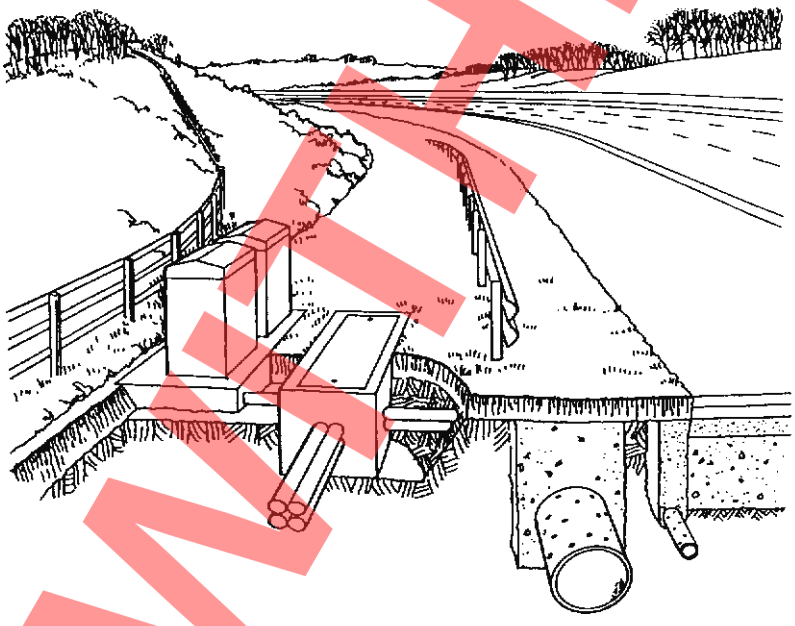


An example of:

Safety Fencing
Bridge Column
Bridge Foundation
Carrier Drain
Fin, Filter Drain

FIGURE 1

SECTION OF MOTORWAY CENTRAL RESERVE

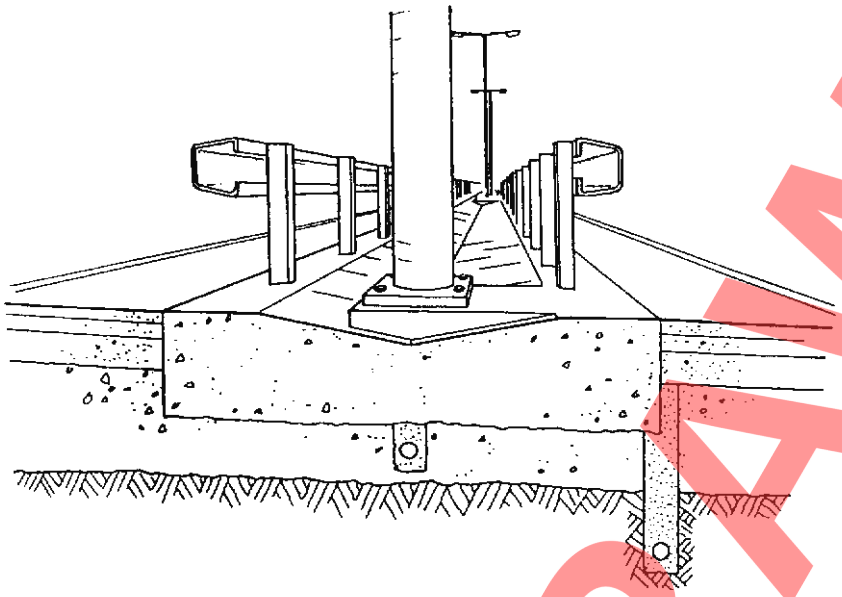


An example of:

Motorway Communication Cabinets
Ducting and Chambers
Safety Fence
Fin, Filter & Carrier Drain

FIGURE 2

SECTION OF MOTORWAY VERGE

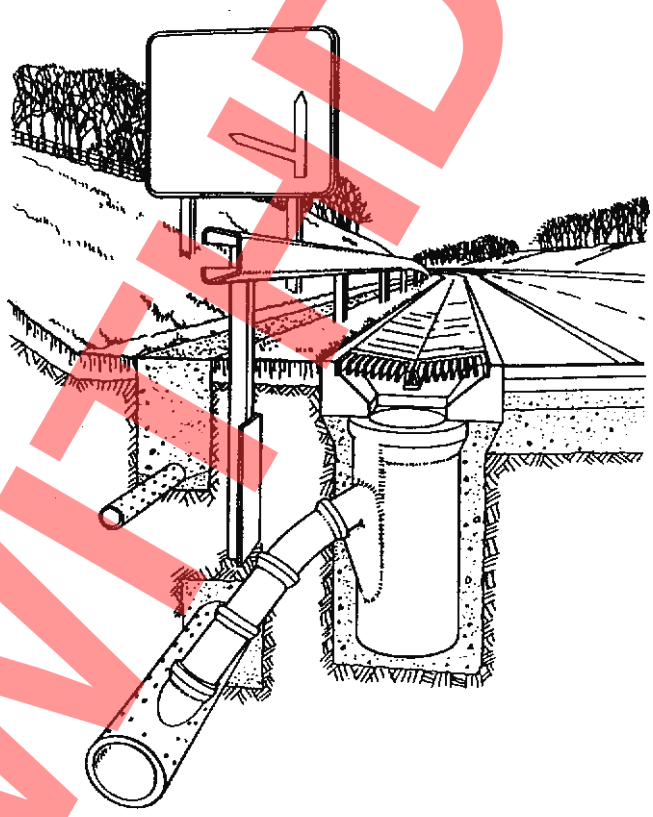


An example of:

Safety Fencing
Drainage Channel
Fin Drain
Lighting Column
Lighting Cable

FIGURE 3

SECTION OF DUAL ALL-PURPOSE ROAD CENTRAL RESERVE



An example of:

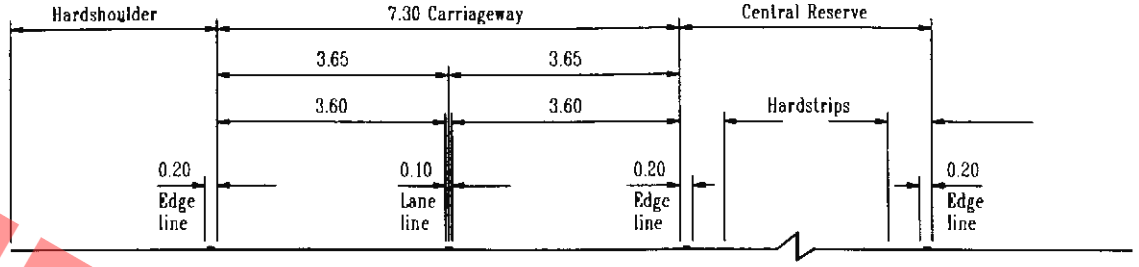
Road Sign
Safety Fence
Drainage Channel
Carrier Drain
Gulley Connection
Filter Drain

FIGURE 4

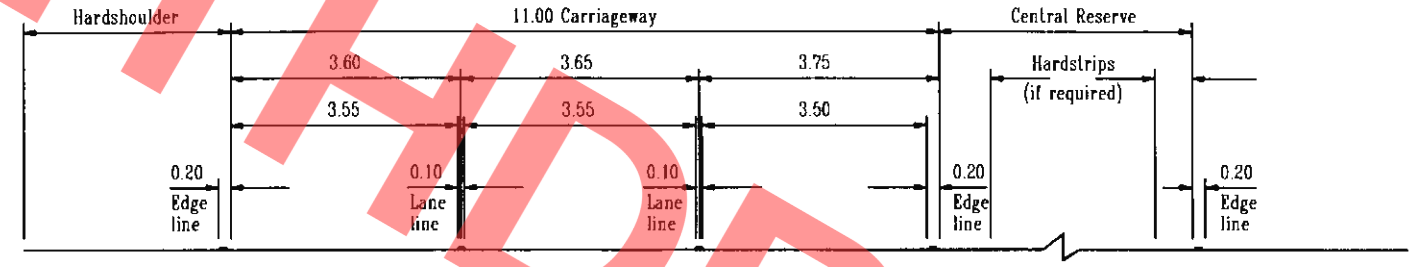
SECTION OF ALL-PURPOSE ROAD VERGE

NOTES

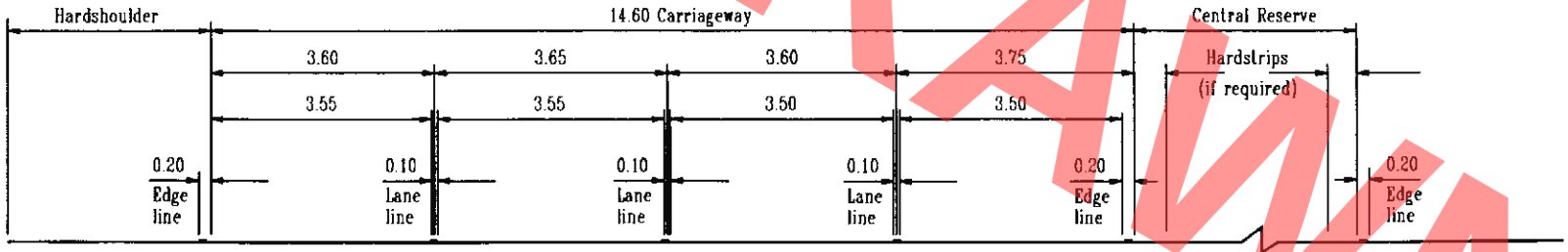
1. All dimensions are in metres
2. See Figures 8 12 for details of cross-section elements.
3. See Tables 2-5 for dimensions of cross-section elements



DUAL TWO LANE MOTORWAY (D2M)



DUAL THREE LANE MOTORWAY (D3M)



DUAL FOUR LANE MOTORWAY (D4M)

FIGURE 5

LANE WIDTHS AND CARRIAGEWAY MARKINGS: RURAL AND URBAN MOTORWAYS (MAINLINE)

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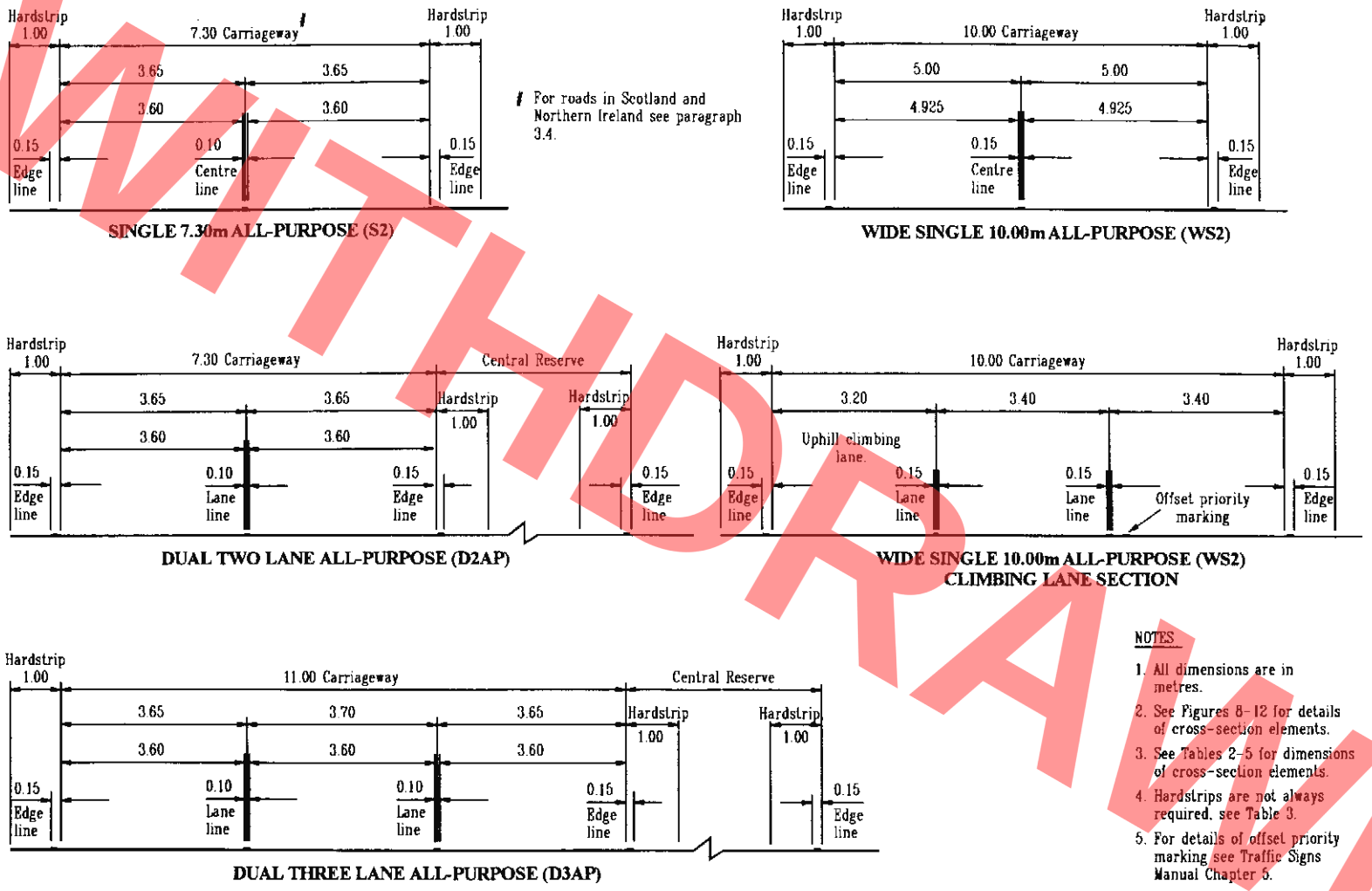

NOTES

1. All dimensions are in metres.
2. See Figures 8–12 for details of cross-section elements.
3. See Tables 2–5 for dimensions of cross-section elements.
4. Hardstrips are not always required, see Table 3.
5. For details of offset priority marking see Traffic Signs Manual Chapter 5.

FIGURE 6

LANE WIDTHS AND CARRIAGEWAY MARKINGS: RURAL ALL-PURPOSE ROADS (MAINLINE)

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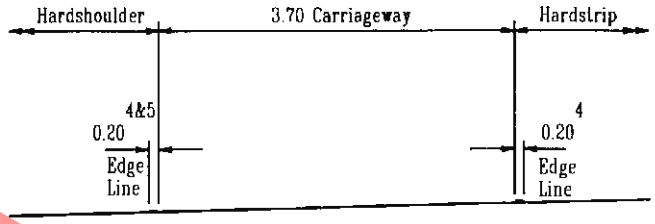
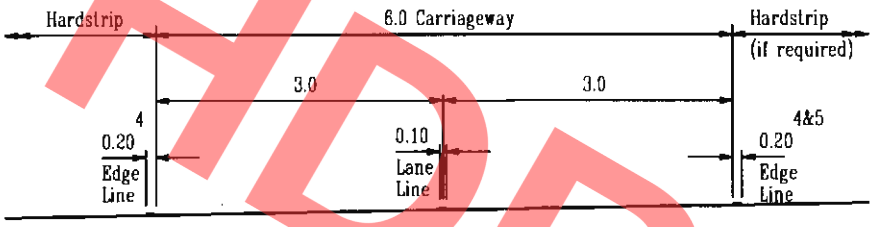
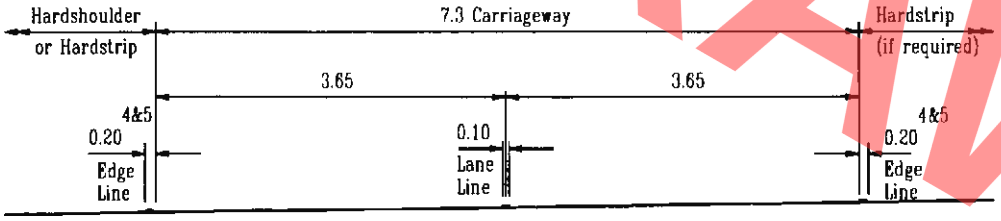
1-LANE SLIPROAD INTERCHANGE LINKS AND LOOPS: MOTORWAY AND ALL-PURPOSE ROAD



2-LANE DIVERGE SLIPROAD: MOTORWAY AND ALL-PURPOSE ROAD



2-LANE MERGE SLIPROAD INTERCHANGE LINKS AND LOOPS: MOTORWAY AND ALL-PURPOSE ROAD



NOTES

1. All dimensions are in metres.
2. See Tables 2–5 for dimensions of cross-section elements.
3. Slip roads with superelevation falling towards the offside, should have an offside hardstrip.
4. Edge lines shown are for motorways. For all-purpose roads use 0.15m.
5. Where no hardstrip is required then edge line is included in carriageway dimensions.

FIGURE 7

**LANE WIDTHS AND CARRIAGEWAY MARKINGS:
RURAL AND URBAN MOTORWAYS AND ALL-PURPOSE SLIP ROADS,
INTERCHANGE LINKS AND LOOPS**

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TABLE 2

DIMENSIONS OF CROSS SECTION ELEMENTS FOR RURAL MOTORWAYS INCLUDING SLIP ROADS, INTERCHANGE LINKS AND LOOPS

	NEARSIDE				OFFSIDE		
	VERGE[1,4]	HARDSTRIP[2]	HARDSHOULDER[2]	CARRIAGEWAY[2]	HARDSTRIP[2]	VERGE[1,4]	CENTRAL RESERVE[1]
MAINLINES							
Dual 2 Lane (D2M)	1.50	N/A	3.30	7.30	0.70	N/A[5]	4.00
Dual 3 Lane (D3M)	1.50	N/A	3.30	11.00	N/A	N/A[5]	4.00
Dual 4 Lane (D4M)	1.50	N/A	3.30	14.60	N/A	N/A[5]	4.00
SLIP ROADS : MERGES AND DIVERGES							
1 Lane	2.00	N/A	2.30	3.70	1.00[3]	3.00	N/A
2 Lane	1.50	N/A	3.30	7.30	0.70	3.00	N/A
SLIP ROAD : MERGE ONLY							
1 Lane	2.00	N/A	3.30	3.70	1.00[3]	3.00	N/A
SLIP ROAD : DIVERGE ONLY							
2 Lane	3.00	1.0	N/A	6.0	1.00[3]	3.00	N/A
INTERCHANGE LINK AND LOOPS : MERGES AND DIVERGES							
1 Lane	1.50	N/A	3.30	3.70	0.70	3.00	N/A
2 Lane	1.50	N/A	3.30	7.30	0.70	3.00	N/A

Notes:

1) Verge and central reserve dimensions are desirable values.
2) Carriageway hardshoulder and hardstrip dimensions are fixed values, any alternative is a Departure.
3) Hardstrip provided only if a carriageway falls to right hand side.
4) Where a hardstrip is present the corresponding verge dimension given includes the hardstrip. Where hardshoulder is present the corresponding verge dimension given does not include the hardshoulder.
5) For details of offside verges at divided structures see Paragraph 4.10.
6) For guidance on selection of slip roads, interchange link and loop roads see **TD22 (DMRB 6.2)**.
7) All dimensions are in metres.

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TABLE 3

DIMENSIONS OF CROSS SECTION ELEMENTS FOR RURAL ALL-PURPOSE ROADS INCLUDING SLIP ROADS, INTERCHANGE LINKS AND LOOPS

	NEARSIDE				OFFSIDE		
	VERGE[1,4]	HARDSTRIP[2]	HARDSHOULDER[2]	CARRIAGEWAY[2]	HARDSTRIP[2]	VERGE[1,4]	CENTRAL RESERVE[1]
MAINLINES							
Single (S2)	3.50	1.00	N/A	7.30[6]	N/A	N/A[7]	N/A
Wide Single (WS2)	3.50	1.00	N/A	10.00	N/A	N/A[7]	N/A
Dual 2 Lane (D2AP)	3.50	1.00	N/A	7.30	1.00	N/A[7]	4.50
Dual 3 Lane (D3AP)	3.50	1.00	N/A	11.00	1.00	N/A[7]	4.50
SLIP ROADS : MERGES AND DIVERGES							
1 Lane	2.00[5]	N/A	2.30	3.70	1.00[3]	3.00	N/A
2 Lane	3.50	1.00	N/A	7.30	0.70	3.50	N/A
SLIP ROAD : MERGE ONLY							
1 Lane	2.00[5]	N/A	3.30	3.70	1.00[3]	3.00	N/A
SLIP ROAD : DIVERGE ONLY							
2 Lane	3.00[5]	1.0	N/A	6.0	1.00[3]	3.00	N/A
INTERCHANGE LINK AND LOOPS : MERGES AND DIVERGES							
1 Lane	3.50	1.6	N/A	3.70	0.70	3.50	N/A
2 Lane	3.50	1.0	N/A	7.30	0.70	3.50	N/A

Notes:

1) Verge and central reserve dimensions are desirable values.
2) Carriageway hardshoulder and hardstrip dimensions are fixed values, any alternative is a Departure.
3) Hardstrip provided only if a carriageway falls to right hand side.
4) Where a hardstrip is present the corresponding verge dimension given includes the hardstrip. Where hardshoulder is present the corresponding verge dimension given does not include the hardshoulder.
5 This dimension to be increased by 0.5m when adjacent to highway boundary.
6) For roads in Scotland and Northern Ireland see Paragraph 3.4.
7) For details of offside verges at divided structures see Paragraph 4.10.
8) For guidance on selection of slip roads, interchange link and loop roads see **TD22 (DMRB 6.2)**.
9) All dimensions are in metres.

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TABLE 4

DIMENSIONS OF CROSS SECTION ELEMENTS FOR URBAN MOTORWAYS INCLUDING SLIP ROADS, INTERCHANGE LINKS AND LOOPS

MOTORWAYS (Up to 85kph Design Speed)	NEARSIDE				OFFSIDE		
	VERGE[1]	HARDSTRIP[2]	HARDSHOULDER[2]	CARRIAGEWAY[2]	HARDSTRIP[2]	VERGE[1]	CENTRAL RESERVE[1]
MAINLINES							
Dual 2 Lane (D2UM)	Varies	N/A	2.75[3]	7.30	0.70 (0.3 min.)	N/A[4]	3.00
Dual 3 Lane (D3UM)	Varies	N/A	2.75[3]	11.00	0.70 (0.3 min.)	N/A[4]	3.00
Dual 4 Lane (D4UM)	Varies	N/A	2.75[3]	14.60	0.70 (0.3 min.)	N/A[4]	3.00
SLIP ROADS : MERGES AND DIVERGES							
1 Lane	Varies	N/A	2.30	3.70	N/A	Varies	N/A
2 Lane	Varies	N/A	2.75	7.30	N/A	Varies	N/A
SLIP ROAD : MERGE ONLY							
1 Lane	Varies	N/A	3.30	3.70	N/A	Varies	N/A
SLIP ROAD : DIVERGE ONLY							
2 Lane	Varies	1.00	N/A	6.00	N/A	Varies	N/A
INTERCHANGE LINK AND LOOPS : MERGES AND DIVERGES							
1 Lane	Varies	N/A	2.30	3.70	N/A	Varies	N/A
2 Lane	Varies	N/A	2.75	7.30	N/A	Varies	N/A

Notes:

1) Verge and central reserve dimensions are desirable values.
2) Carriageway hardshoulder and hardstrip dimensions are fixed values, any alternative is a Departure.
3) In difficult and constricted areas, where due consideration has been given to the maintenance requirements, the width may be exceptionally relaxed to 2m.
4) For details of offside verges at divided structures see Paragraph 4.10.
5) For guidance on selection of slip roads, interchange link and loop roads see **TD22 (DMRB 6.2)**.
6) All dimensions are in metres.

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TABLE 5

DIMENSIONS OF CROSS SECTION ELEMENTS FOR URBAN ALL-PURPOSE ROADS INCLUDING SLIP ROADS, INTERCHANGE LINKS AND LOOPS

ALL-PURPOSE ROADS (Up to 85kph Design Speed)	NEARSIDE			CARRIAGEWAY[2]	OFFSIDE		CENTRAL RESERVE[1]
	VERGE[1]	HARDSTRIP[2]	HARDSHOULDER[2]		HARDSTRIP[2]	VERGE[1]	
MAINLINES							
Dual 2 Lane (D2AP)							
With Footways	3.00 min.[3]	N/A	N/A	7.30	N/A	N/A[4]	2.25
No footways : Lanterns bracketed from buildings or suspended	1.00 min.	N/A	N/A	7.30	N/A	N/A[4]	1.8 (1.2 min.)
Dual 3 Lane (D3AP)							
With Footways	3.00 min.[3]	N/A	N/A	11.00	N/A	N/A[4]	2.25
No footways : Lanterns bracketed from buildings or suspended	1.0 min.	N/A	N/A	11.00	N/A	N/A[4]	1.8 (1.2 min.)
SLIP ROADS : MERGES AND DIVERGES							
1 Lane	Varies	N/A	2.30	3.70	N/A	Varies	N/A
2 Lane	Varies	1.00	N/A	7.30	N/A	Varies	N/A
SLIP ROAD : MERGE ONLY							
1 Lane	Varies	N/A	3.30	3.70	N/A	Varies	N/A
SLIP ROAD : DIVERGE ONLY							
2 Lane	Varies	1.00	N/A	6.00	N/A	Varies	N/A
INTERCHANGE LINK AND LOOPS : MERGES AND DIVERGES							
1 Lane	Varies	N/A	2.30	3.70	N/A	Varies	N/A
2 Lane	Varies	1.00	N/A	7.30	N/A	Varies	N/A

Notes:

1) Verge and central reserve dimensions are desirable values.
2) Carriageway hardshoulder and hardstrip dimensions are fixed values, any alternative is a Departure.
3) This dimension may be increased if it is recognised that additional uses or shared surfaces are required.
4) For details of offside verges at divided structures see Paragraph 4.10.
5) For guidance on selection of slip roads, interchange link and loop roads see **TD22 (DMRB 6.2)**.
6) All dimensions are in metres.

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4. CROSS-SECTIONS AT STRUCTURES

General

4.1 The cross-sections detailed in Figures 8 to 12 and Tables 6 and 7 assume a straight horizontal alignment of the carriageway. If this is not the case the verges and central reserve may require widening to give the requisite stopping sight distances in **TD 9 (DMRB 6.1.1)**.

4.2 Variations of cross-section provision at bridges in close succession shall be avoided, except where sight distance requirements dictate otherwise. The verge and central reserve widths appropriate for the longest structure shall be used. Individual cases shall be treated on their merits.

4.3 The requirements of this Standard are not applicable to road tunnels.

4.4 The cross-section of a side road, which is not a trunk road and is diverted or improved "on-line" as part of a trunk road scheme, should be agreed with the relevant Highway Authority.

Traffic Lane Widths

4.5 Lane widths shall be maintained through or over a structure.

Single Lane Side Roads

4.6 If a structure is required under or over an existing single lane rural side road, the carriageway width of that side road shall be retained provided all the following requirements are met:

a) Traffic flows are not expected to exceed 200 vehicles per day.

b) The carriageway width is not less than 3.60m and the lateral width of cross-section, over which minimum headroom is provided in accordance with Paragraph 5.5, is not less than 6.60m.

c) Passing bays, which shall be inter-visible, are provided at each side of the structure.

d) Adequate sight distance is maintained.

e) The relevant Highway, Planning and Technical Approval Authorities, shall be consulted on the width provision.

Hardshoulders and Hardstrips

4.7 Where hardshoulders or hardstrips are provided adjacent to the edges of the carriageway they shall be continued at the same width through or over the structure. On motorway underbridges, hardstrips with a minimum width of 0.7m, shall be provided at both sides of the central reserve (see Figures 8 to 11).

Central Reserves

4.8 The width of central reserve applicable to the adjacent open road section should be continued through the structure except in the case of long underbridges, where the width may be reduced to a minimum of 2.5m.

Verges at Underbridges and Overbridges

4.9 In planning the overall width required, consideration should be given to the space necessary for structural elements of the bridge, including:- foundations, items such as bridge joints, drainage runs, electrical equipment/services, safety fences or safety barriers.

Consideration should also be given to maintenance operation needs.

4.10 At underbridges, a raised verge 0.6m minimum width and with a maximum kerb height of 75mm shall be provided on the left hand side of motorways, rural all-purpose roads and their associated slip roads, and, on the right hand side at divided structures of motorways, rural all-purpose dual carriageways, slip roads, interchange link roads and loop roads (see Figures 8 to 12).

4.11 On all-purpose road overbridges, underbridges, elevated roads and viaducts, the minimum left hand verge width can be varied depending upon the overall length of the structure and the likely pedestrian flows. Provision may also need to be made for pedal cyclists.

4.12 At overbridges on all-purpose roads, the minimum width of paved pedestrian access shall be 1.0m.

4.13 Verge widths may need to be increased to allow adequate visibility, particularly where a bridge is located on a horizontal curve.

Safety Fences, Safety Barriers and Bridge Parapets

4.14 Safety fences, safety barriers and bridge parapets shall be positioned in accordance with the requirements of **TD 19 (DMRB 2.2), TD 32 (DMRB 2.2.3), BD 52 (DMRB 2.3.3)** and the **Highway Construction Details (MCHW 3.2)**.

Pedestrian Usage Requirements

TABLE 6:
RURAL ALL-PURPOSE DUAL CARRIAGEWAY ROADS
(INCLUDING SLIP ROADS AND LINK ROADS)

OVERBRIDGE			UNDERBRIDGE		
PEDESTRIAN USAGE	VERGE WIDTH	PEDESTRIAN ACCESS WIDTH	BRIDGE LENGTH	PEDESTRIAN ACCESS WIDTH	VERGE WIDTH
REGULAR	3.00	1.65 MIN	≤70	2.00 MIN	3.00
			>70	1.50 MIN	2.50
OCCASIONAL	2.50	1.00 MIN	≤70	1.50 MIN	2.50
			>70	1.00 MIN	2.00

TABLE 7:
RURAL ALL-PURPOSE SINGLE CARRIAGEWAY ROADS

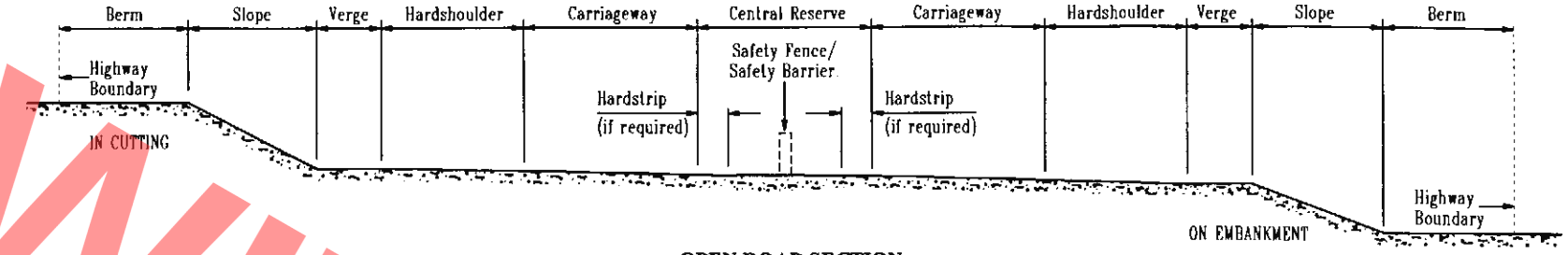
OVERBRIDGE		UNDERBRIDGE		
PEDESTRIAN USAGE	PEDESTRIAN ACCESS WIDTH	BRIDGE LENGTH	PEDESTRIAN ACCESS WIDTH	VERGE WIDTH
REGULAR	1.65 MIN	≤70	2.00 MIN	3.00
		>70	1.50 MIN	2.50
OCCASIONAL	1.00 MIN	≤70	1.50 MIN	2.50
		>70	1.00 MIN	2.00

THE FOLLOWING CRITERIA APPLY ONLY WHEN A HARDSTRIP IS NOT PRESENT THROUGH OR OVER A STRUCTURE

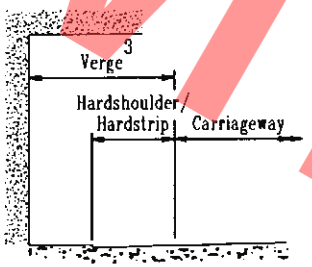
PEDESTRIAN USAGE	2 WAY TRAFFIC FLOW (vpd)	VERGE WIDTH	BRIDGE LENGTH	2 WAY TRAFFIC FLOW (vpd)	VERGE WIDTH
REGULAR	>2500	3.00	≤70	>2500	3.00
	≤2500	2.00	>70	>2500	2.00
			ANY	≤2500	
OCCASIONAL	>2500	2.00	ANY	>2500	2.00
	≤2500	1.50		≤2500	1.50

Notes:

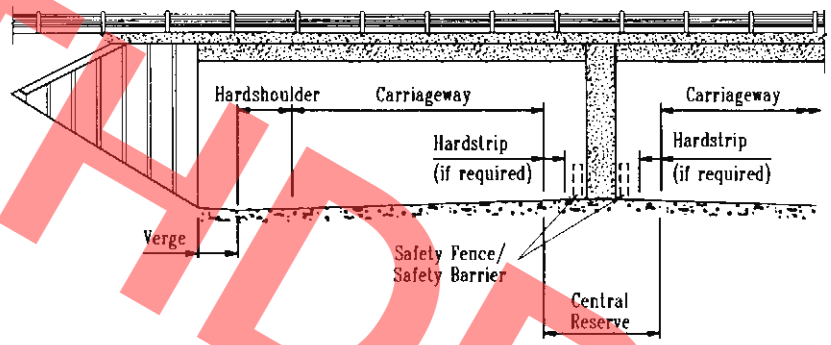
1) The information given in the tables is to be read in conjunction with Figures 8 to 12.
2) **Regular Usage** - Where there is a clearly defined local need with a predicted maximum flow of more than 25 pedestrians per hour and / or footways are provided on contiguous sections of road.
3) **Occasional Usage** - Where the predicted maximum flow of pedestrians is less than 25 per hour.



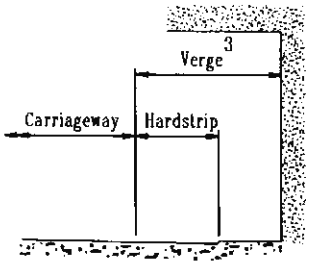
OPEN ROAD SECTION



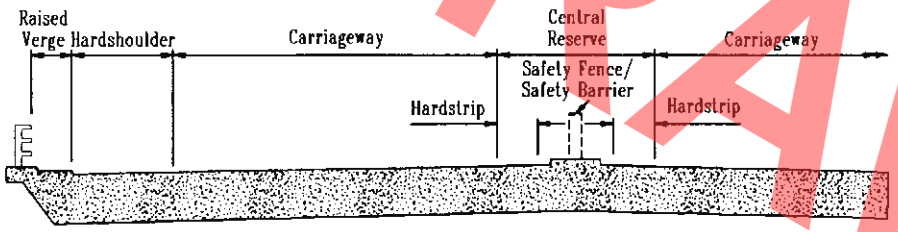
DETAIL FOR SLIP ROADS (L.H SIDE)



OVERBRIDGE



DETAIL FOR SLIP ROADS INTERCHANGE LINK AND LOOP ROADS (R.H SIDE)



UNDERBRIDGE

NOTES.

1. See Figure 5 for lane widths, edge and lane line details.
2. See Table 2 for dimension of cross-sectional elements.
3. See note 4 Table 2.

FIGURE 8

CROSS SECTION ELEMENTS OF RURAL MOTORWAYS

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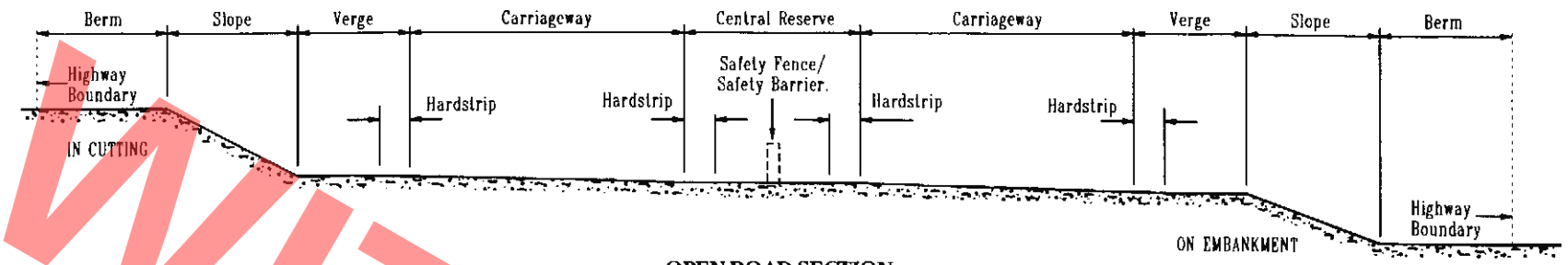
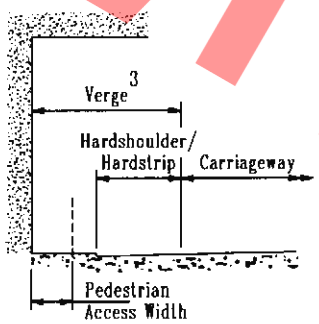
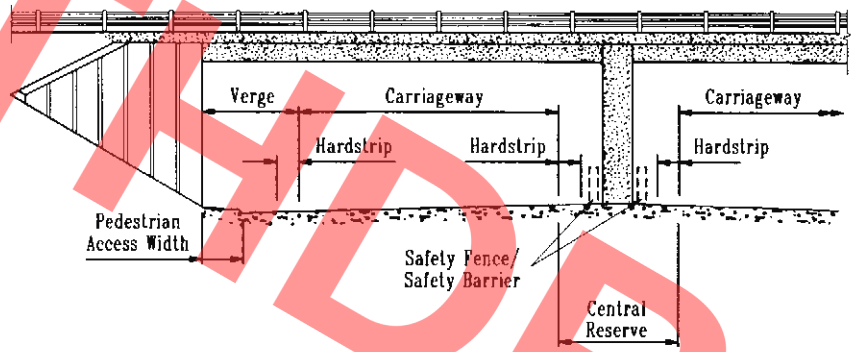


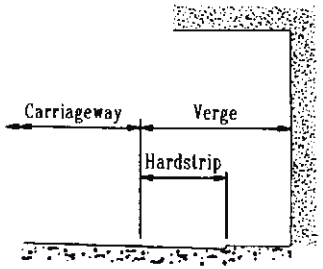
OPEN ROAD SECTION



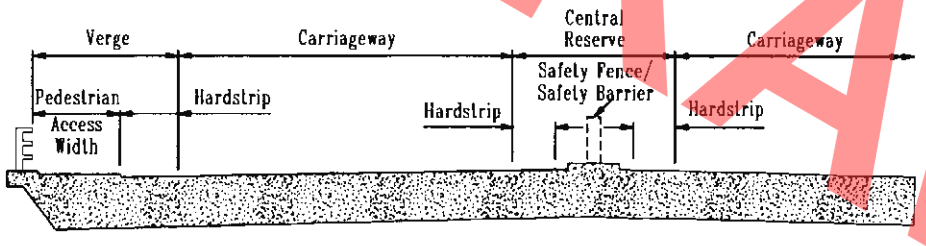
DETAIL FOR SLIP ROADS
(L.H SIDE)



OVERBRIDGE



DETAIL FOR SLIP ROADS
INTERCHANGE LINK AND LOOP ROAD
(R.H SIDE)



UNDERBRIDGE

NOTES.

1. See Figure 6 for lane widths, edge & lane line details.
2. Hardstrips are not always required see Table 3.
3. See note 4 Table 3.

FIGURE 9

CROSS SECTION ELEMENTS OF RURAL ALL-PURPOSE DUAL CARRIAGEWAY ROADS

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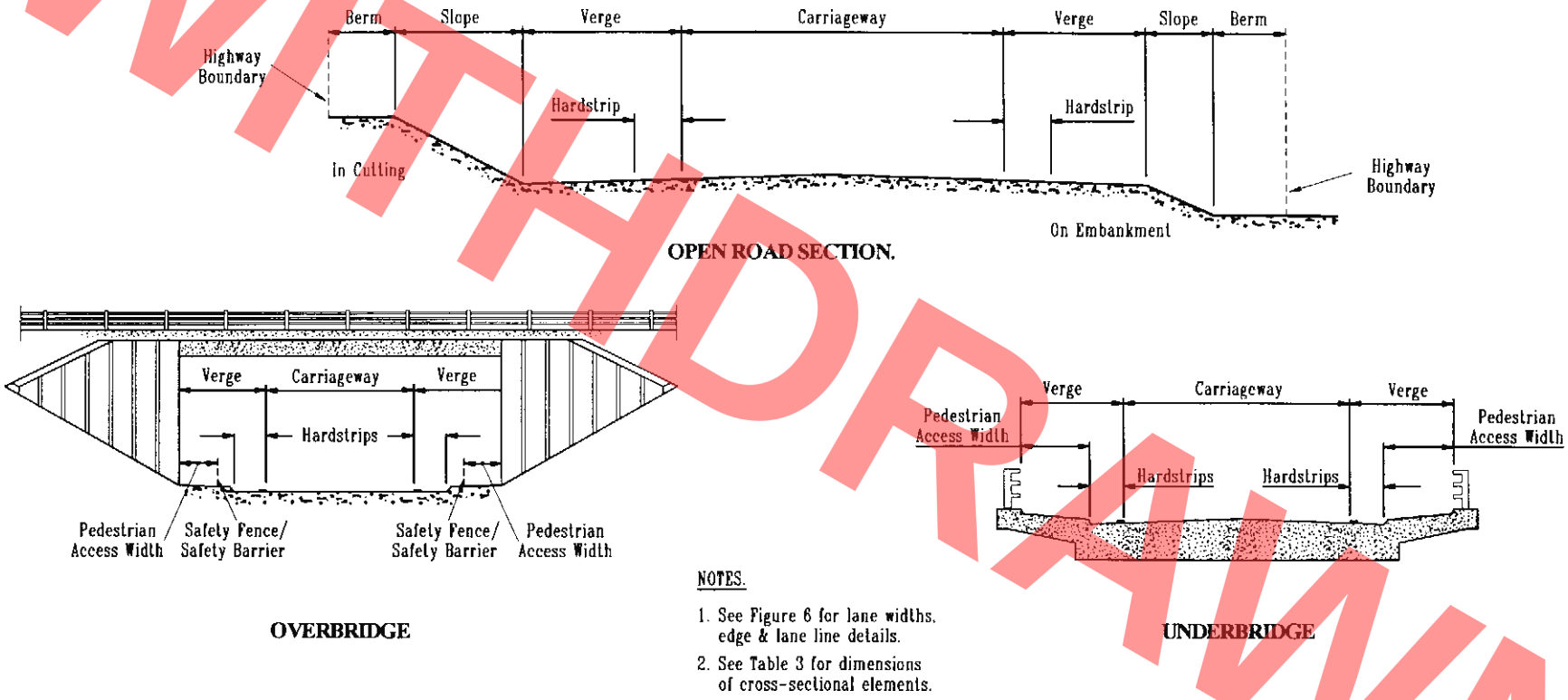

NOTES.

1. See Figure 6 for lane widths, edge & lane line details.
2. See Table 3 for dimensions of cross-sectional elements.

FIGURE 10

CROSS SECTION ELEMENTS OF RURAL ALL-PURPOSE SINGLE CARRIAGEWAY ROADS

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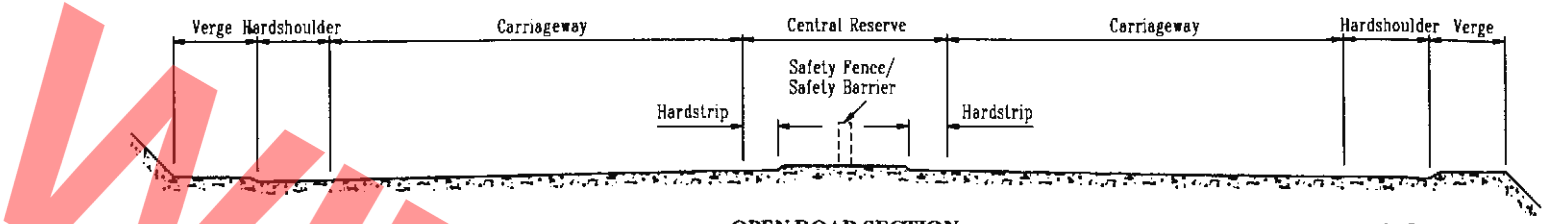
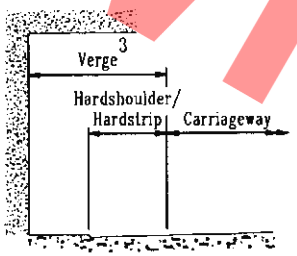
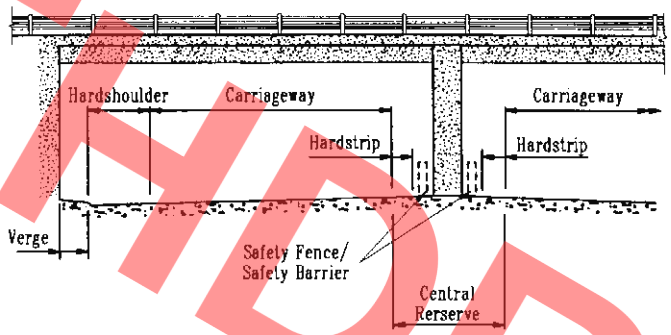


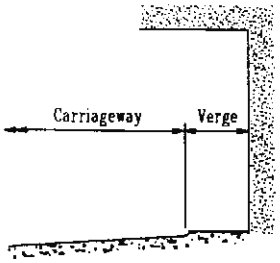
OPEN ROAD SECTION



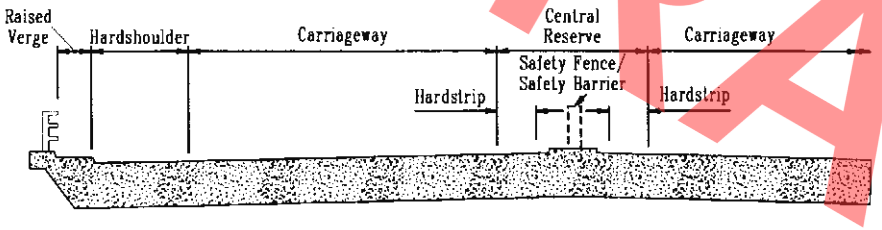
DETAIL FOR SLIP ROADS
(L.H SIDE)



OVERBRIDGE



DETAIL FOR SLIP ROADS
INTERCHANGE LINK AND LOOP ROADS
(R.H SIDE)



UNDERBRIDGE

NOTES.

1. See Figure 5 for lane widths, edge and lane line details.
2. See Table 2 for dimension of cross-sectional elements.
3. See note 4 Table 3.

FIGURE 11

CROSS SECTION ELEMENTS OF URBAN MOTORWAYS (Up to 85 kph Design Speed)

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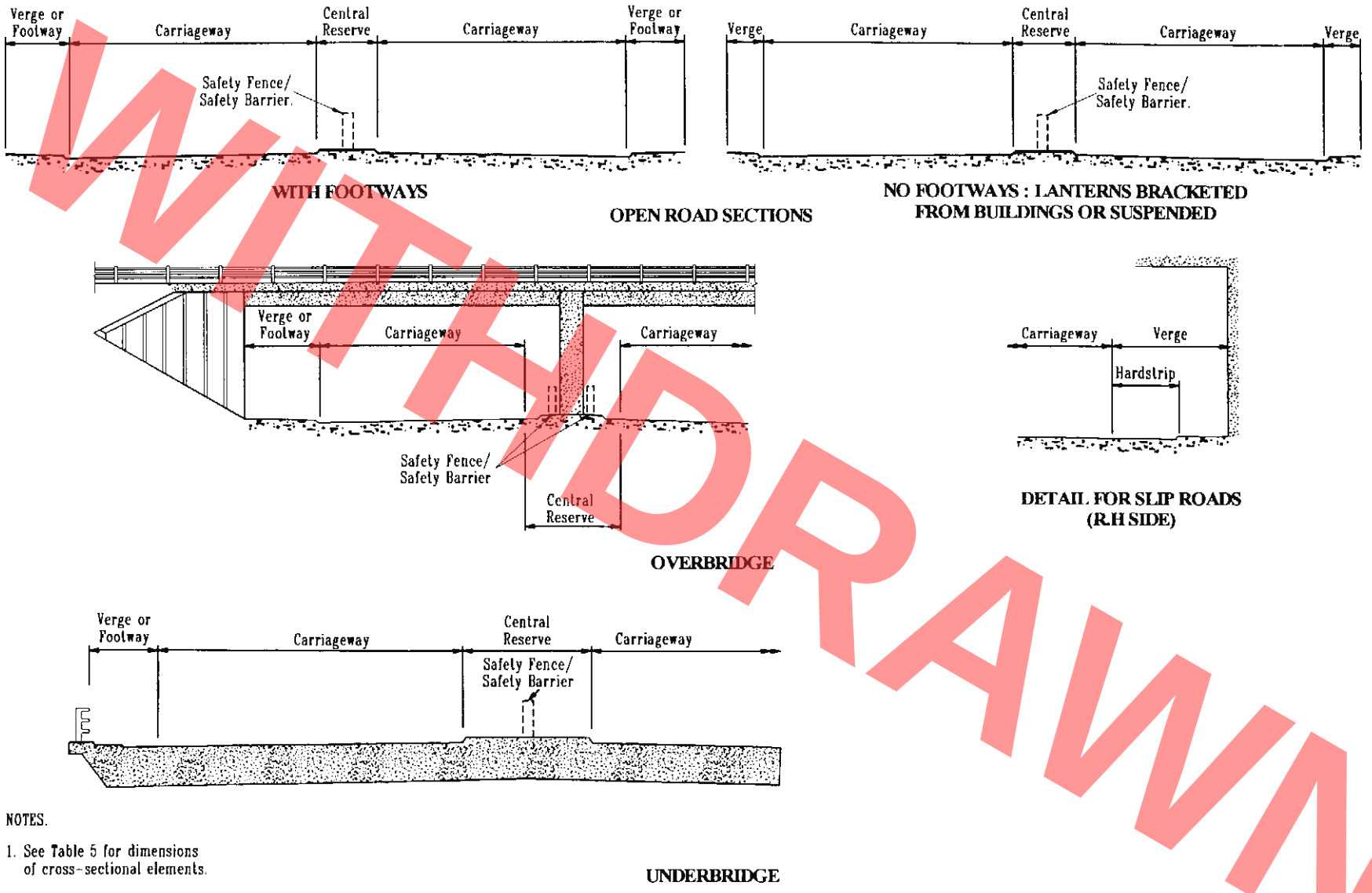

NOTES.

1. See Table 5 for dimensions of cross-sectional elements.

FIGURE 12

CROSS SECTION ELEMENTS OF URBAN ALL-PURPOSE DUAL CARRIAGEWAY ROADS

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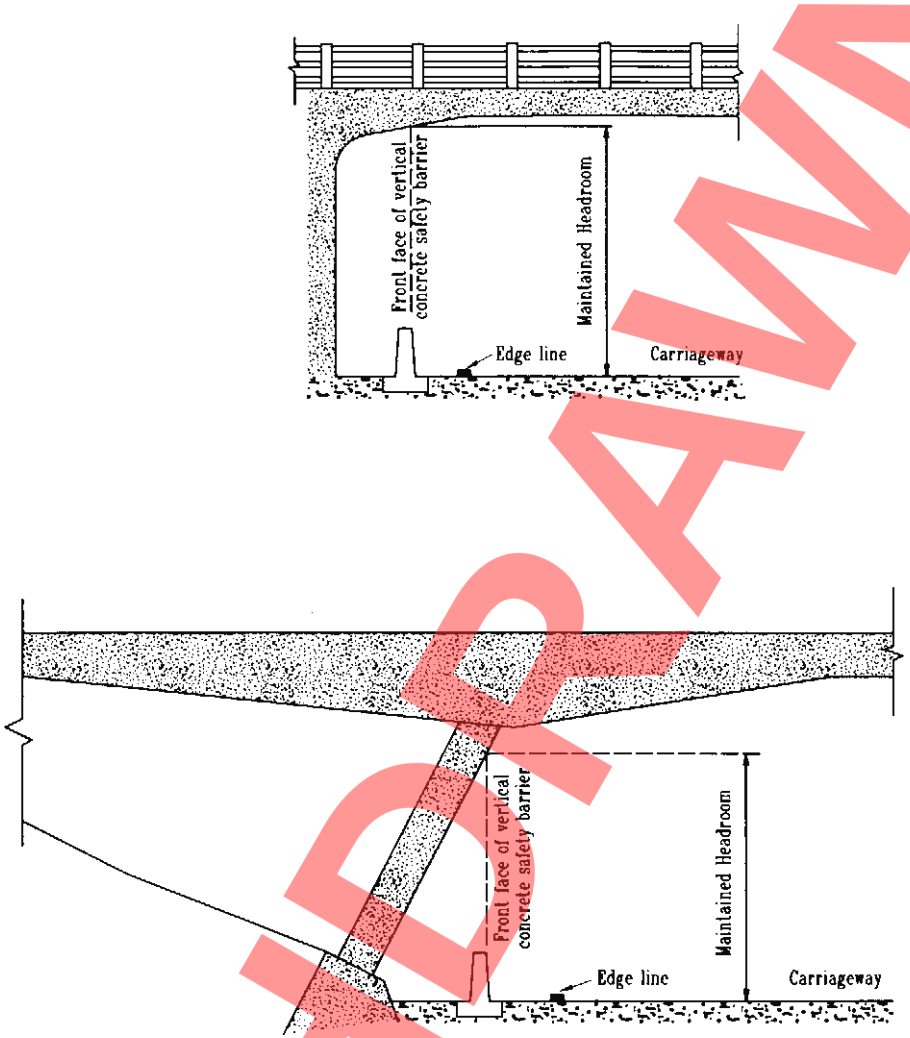

FIGURE 13

EXAMPLE OF SAFETY BARRIER AT EXISTING STRUCTURES WITH RESTRICTED HEADROOM

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5.7 The headroom to be provided at a structure on a "high load route" shall be as given in Table 8.

5.8 The headroom standards for pedestrian subways and combined pedestrian/cycle subways are contained in **TD 36 (DMRB 6.3.1)**. Guidance on the headroom requirement for equestrian usage is contained in **TA 57 (DMRB 6.3)**.

5.9 When existing roads are being improved the cost implication of complying with paragraph 5.6 may be significant. In these cases, installation of a vertical concrete safety barrier as referred to in paragraph 5.6(e) should be considered. The Overseeing Organisation may be consulted for advice.

Compensation for Vertical Sag Curvature and Deflection

5.10 Where the road passing underneath a structure is on a sag curve, the headrooms in Table 8 shall be increased in accordance with Table 9. The sag radius is measured along the carriageway over a 25m chord.

5.11 Allowances shall be made for the deflection of structures. The minimum headroom shall be maintained for the serviceability limit state under the action of load combination 1 specified in **BD 37 (DMRB 1.3)**

Utilities Companies and Other Authorities Apparatus

5.12 Greater headroom than that determined from Paragraphs 5.1 to 5.11 may be required by a Utility Company, or other Authority. Any increase in the headroom dimension shall be agreed with the Overseeing Organisation.

TABLE 9:
SAG RADIUS COMPENSATION

Sag Radius (m)	Additional Clearance (mm)
1000	80
1200	70
1500	55
2000	45
3000	25
6000	15
>6000	Nil

5. HEADROOM AT STRUCTURES

General

5.1 Dimensional Standards are given in Table 8 for "new construction headroom" and "maintained headroom" at overbridges, and at other structures over a highway.

TABLE 8:
STANDARD HEADROOM AT STRUCTURES

Type of structure	New Construction Headroom (m)	Maintained Headroom (m)
Overbridges	5.30	5.03
Footbridges and Sign/Signal Gantries	5.7	5.41
Free Standing Temporary Structures	N/A	5.41[1]
All Permanent Structures over High Load Routes[2]	6.45	6.18[1]

Notes:

1) For Free Standing Temporary Structures and also for a Temporary Structure attached to a Permanent Structure refer also to Paragraph 2.5.4 of the **Traffic Signs Manual, Chapter 8**.

2) Not applicable in Scotland and Northern Ireland.

5.2 The headroom provision at underbridges shall be agreed with the relevant Highway, Railway or Water Authority. (Road, Rail, Navigation or River Authority in Scotland).

5.3 The headrooms given are the minimum; where it is economical and/or environmentally acceptable, greater headroom should be provided.

5.4 The requirements of this standard are not applicable to road tunnels.

Dimensional Requirements

5.5 Headroom shall be measured at right-angles to the surfaces of the carriageway, hardshoulder, hardstrip, verge or central reserve, at the point where it is a minimum.

5.6 The relevant standard headroom in Table 8 shall be provided:

(a) Over the paved carriageway, hardshoulder or hardstrip;

(b) Over the full verge width, except where (e) applies;

(c) Over the central reserve of a dual carriageway, except where (e) applies;

(d) Between the carriageway and the pier or abutment face where such a support is located within 4.5m of the edge of the carriageway [for the purpose of this clause only, the definition of a carriageway given in **BD 37 (DMRB 1.3)** is applicable], except where (e) applies;

(e) Up to the traffic face of a vertical concrete safety barrier, when installed at an existing structure (see Figure 13).

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6. REFERENCES

1 **DESIGN MANUAL FOR ROADS AND BRIDGES (DMRB) : HMSO**

a. **TD 36 (DMRB 6.3.1) -** Subways for Pedestrians and Pedal Cyclists : Layout and Dimensions.

b. **BD 29 (DMRB 2.2) -** Design Criteria for Footbridges.

c. **TA 57 (DMRB 6.3) -** Roadside Features.

d. **TD 22 (DMRB 6.2.1) -** Layout of Grade Separated Junctions

e. **BD 2 (DMRB 1.1) -** Technical Approval of Highway Structures on Motorways and other Trunk Roads - Part III - Procedures for Tunnels.

f. **HA 55 to HA 63 (DMRB 10.1.1 to DMRB 10.3.1) -** The Good Roads Guide.

g. **HA 67 (DMRB 10.4.1) -** The Wildflower Handbook.

h. **HA 59 (DMRB 10.1.5) -** Nature Conservation.

i. **TA 56 (DMRB 8.2) -** Hazardous Cattle Crossing : use of Flashing Amber Lights.

j. **HA 37 (DMRB 4.2) -** Hydraulic Design of Road Edge Surface Water Channels.

k. **HA 39 (DMRB 4.2) -** Edge of Pavement Details.

l. **TA 26 (DMRB 6.3) -** Withdrawal of Motorway Design Memorandum.

m. **BD 51 (DMRB 2.2.4) -** Design Criteria for Portal and Cantilevers Sign/Signal Gantries.

n. **BD 26 (DMRB 2.2.1) -** Design of Lighting Columns.

o. **TD 30 (DMRB 8.3) -** Design of Road Lighting for All Purpose Trunk Roads.

p. **TD 34 (DMRB 8.3) -** Design of Road Lighting for Motorway Trunk Roads.

q. **HD 20 (DMRB 9.3.1) -** Loop Detectors for Motorways.

r. **(DMRB 9, 9a & 9b) -** Network Traffic Control and Communications.

s. **BD 52 (DMRB 2.3.5) -** The Design of Highway Bridge Parapets.

t. **BA 48 (DMRB 2.2.2) -** Pedestrian Protection at Headwalls, Wing Walls and Retaining Walls.

u. **TA 66 (DMRB 6.3.2) -** Police Observation Platforms on Motorways.

v. **TSM -** Traffic Signs Manual. Chapter 8

w. **HA 44 (DMRB 4.1.1) -** Earthworks : Design and Preparation of Contract Documents.

x. **TA 18 (DMRB 6.2) -** Junction Layout for Control by Traffic Signals.

y. **TD 19 (DMRB 2.2) -** Safety Fencing and Barriers.

z. **TD 32 (DMRB 2.2.3) -** Wire Rope Safety Fence.

aa. **TD 9 (DMRB 6.1.1) -** Highway Link Design.

bb. **TD 42 (DMRB 6.2.6) -** Geometric Design of Major/Minor Junctions.

cc. **BD 37 (DMRB 1.3) -** Loads for Highway Bridges.

dd. **(DMRB 11) -** Environmental Assessment.

2 MANUAL OF CONTRACT DOCUMENTS FOR HIGHWAY WORKS: HMSO

a. **Highway Construction Details (MCHW 3.1)** Carriageway and Other Details.

3 BRITISH STANDARDS

a. **BS 6100 Subsection 2.4.1** - The British Standard Glossary of Building and Civil Engineering Terms - Part 2 Civil Engineering, Section 2.4 Highway, Railway and Airport Engineering. British Standards Institute.

b. **BS 5489 Part 1.** Guide to the General Principles British Standard Institute.

c. **BS 5649 Parts 1-7/EN40 Lighting Columns.** British Standard Institute.

d. **BS 6779 Highway Parapets for Bridges and other Structures -**

Part 1 Specification for Vehicle Containment Parapets of Metal Construction : Parapets for Vehicle Containment on Highways. British Standards Institute.

Part 2 Specification for Parapets of Concrete Construction : British Standards Institute.

Part 3 Specifications for Vehicles Containment Parapets for combined metal and concrete construction.

e. **BS 3049 : Specification : Pedestrian Guard Rails (Metal).** British Standards Institute.

4 MISCELLANEOUS

a. **Roads and Traffic in Urban Areas (RTUA)**: HMSO.

b. **Circular Roads No 61/72 :** Routes for Heavy and High Abnormal Loads : DOE. (Not applicable in Scotland).