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Transport Infrastructure Ireland

TII Publications

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Design Criteria for Footbridges

DN-STR-03005
July 2004

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inside cover pages, the documents contain the same information as previously within the NRA or RPA systems, including historical references such as those contained within NRA DMRB and NRA MCDRW.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

TII Publication Title	<i>Design Criteria for Footbridges</i>
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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NRA MCDRW prior to the launch of TII Publications, the NRA document reference used previously is listed above under 'historical reference'. The TII Publication Number also shown above now supersedes this historical reference. All historical references within this document are deemed to be replaced by the TII Publication Number. For the equivalent TII Publication Number for all other historical references contained within this document, please refer to the TII Publications website.

NRA ADDENDUM TO

BD 29/04

DESIGN CRITERIA FOR FOOTBRIDGES

Standard BD 29/04 – Design Criteria for Footbridges – is applicable in Ireland with the following amendments:

GENERAL

1. This Standard provides specification requirements for use in public purchasing contracts. It does not lay down legislation requirements for products and materials used in road construction in Ireland.
2. This Standard should be used forthwith for all schemes for the construction and/or improvement of footbridges. The Standard should be applied to the design of schemes already being prepared unless, in the opinion of the National Roads Authority, application would result in significant additional expense or delay progress. In such cases, Design Organisations should confirm the non-application of this Standard to particular schemes with the National Roads Authority.
3. At several locations:
 - For: “Departmental Standard”
Read: “NRA Standard”;
 - For: “BD...”
Read: “NRA BD...”
 - For: “BS....”
Read: “UK BS....”
 - For: “Overseeing Organisation”
Read: “National Roads Authority”;
 - For: “Technical Memorandum BE 5”
Read: “NRA BD 52 (DMRB 2.3.3)”;
 - For: “Trunk Roads”
Read: “National Roads”.
 - For: “Technical Approval Authority (TAA)”;
Read: “National Roads Authority (NRA)”.
 - For: “Design Manual for Roads and Bridges (DMRB)”;
Read: “National Roads Authority Design Manual for Roads and Bridges (NRA DMRB)”.

SPECIFIC

Chapter 3 – Layout

- 3.1 Page 3/1, Paragraph 31. Remove Mandatory Box and add the words “...unless otherwise agreed with the National Roads Authority”
- 3.2 Page 3/2, Paragraph 3.8, line 13:
For: “...Highways Agency...”
Read: “...UK Highways Agency...”
- 3.2 Page 3/2, Paragraph 3.15, line 11:
For: “...from Sense and Accessibility...”
Read: “...from UK Countryside Agency Publications document Sense and Accessibility...”
- 3.3 Page 3/3, Paragraph 3.20, line 5:
After the words “...consulting the...” add the words “...National Roads Authority and the...”
- 3.4 Page 3/3, Paragraph 3.21, lines 1 to 16:
Delete lines 1 to 16 and replace with:
“Footbridges sited in National Heritage Areas, in areas of landscape, conservation areas, close to buildings of architectural or historic interest or in high density urban areas may need special consideration. The form and appearance of such footbridges should be discussed at an early stage with the National Roads Authority, the local Road Authority and the local planning authority. The appearance of footbridges shall follow the advice given in the UK HA publication “The....”

Chapter 4 – Bridge Supports

- 4.1 Page 4/1, Paragraph 4.1, line 3:
Delete the word “...Departmental...” and insert the words “...National Roads Authority...”

Chapter 5 – Design Standards

- 5.1 Page 5/1, Paragraph 5.1, line 3:
Delete the word “...Departmental...” and insert the words “...National Roads Authority...”

- 5.2 Page 5/1, Paragraph 5.1, line 3:
For: “BS 5400: Part 2 as implemented by Departmental Standards.”
Read: “BS 5400: Part 2 as implemented by NRA BD 37 (DMRB 1.3).”

Chapter 6 – Dimensional Standards

- 6.1 Page 6/1, Paragraph 6.1, line 2:
For: “..Departmental Standard TD 27...”
Read: “... NRA Standard TD 27...”
- Delete “For example... Land Drainage Authority”
and replace with “For Example, the vertical and horizontal clearances to rivers and water courses in Ireland shall be agreed with the appropriate public body, such as Waterways Ireland, the OPW, or The Regional Fisheries Board”
- 6.2 Page 6/1, Paragraph 6.6, last sentence:
For: “Inclusive Mobility (Ref.8)”
Read: “UK D of T document Inclusive Mobility (Ref.8)”
- 6.3 Page 6/2, Paragraph 6.15
Remove reference to “650mm” and replace with “1300mm”.

Chapter 7 – Parapets

- 7.1 Page 7.1, Paragraph 7.1
Remove the words “Parapets shall conform to the current requirements of the Overseeing Organisation given in the IRRRS or,....” and replace with “Parapets shall conform to the current requirements of NRA BD52 or,....”.
- 7.2 Page 7/1, Paragraph 7.6, line 4:
For: “Inclusive Mobility (Ref.8)”
Read: “UK D of T document Inclusive Mobility (Ref.8)”

Chapter 8 – Enclosed Footbridges and Clearance Gauge

- 8.1 Page 8/1, Paragraph 8.1, line 9:

Delete the sentence commencing “The National Institute of Mental...”

Chapter 10 – Walkway Surfaces

- 10.1 Page 10/1, Paragraph 10.3:
Delete Paragraph 10.3.
- 10.2 Page 10/1, Paragraph 10.4:
For: “...Maintaining Agent...”
Read: “...National Roads Authority...”

Chapter 12 – Requirements for Combined Use by Pedestrians and Cyclists or Equestrians

- 12.1 Page 12/1, Paragraph 12.1, line 4
For: “...Highways Agency...”
Read: “...UK Highways Agency...”
- 12.2 Page 12/1, Paragraph 12.3, line 4:
For: “...in Local Transport ...”
Read: “...in UK Local Transport...”
- 12.3 Page 12/1, Paragraph 12.3, line 6
Delete the last sentence, commencing “In Scotland, reference...”

Chapter 15 – Enquiries

- 15.1 Page 15/1, Chapter 15:
Delete text and replace with:
“All technical enquiries or comments on this Standard should be sent in writing to:

Head of Project Management and Engineering
National Roads Authority
St Martin’s House
Waterloo Road
Dublin 4”.



.....
E O’CONNOR
Head of Project Management and Engineering

**VOLUME 2 HIGHWAY STRUCTURES:
DESIGN
(SUBSTRUCTURES)
MATERIALS**

SECTION 2 SPECIAL STRUCTURES

PART 8

BD 29/04

DESIGN CRITERIA FOR FOOTBRIDGES

SUMMARY

This Standard specifies design criteria for footbridges for use by pedestrians, cyclists and equestrians.

INSTRUCTIONS FOR USE

1. Remove existing Contents pages for Volume 2.
2. Insert new Contents pages for Volume 2 dated August 2004.
3. Remove BD 29/03 from Volume 2, Section 2, Part 8 and archive as necessary.
4. Insert BD 29/04 in Volume 2, Section 2, Part 8.
5. Please archive this sheet as appropriate.

Note: A quarterly index with a full set of Volume Contents Pages is available separately from The Stationery Office Ltd.



THE HIGHWAYS AGENCY



SCOTTISH EXECUTIVE



Llywodraeth Cymru
Welsh Assembly Government

**WELSH ASSEMBLY GOVERNMENT
LLYWODRAETH CYNULLIAD CYMRU**



**THE DEPARTMENT FOR REGIONAL DEVELOPMENT
NORTHERN IRELAND**

Design Criteria for Footbridges

Summary: This Standard specifies design criteria for footbridges for use by pedestrians, cyclists and equestrians.

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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SECTION 2 SPECIAL STRUCTURES

PART 8

BD 29/04

DESIGN CRITERIA FOR FOOTBRIDGES

Contents

Chapter

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1. INTRODUCTION

General

1.1 This Standard deals mainly with geometric and user requirements. Other design aspects such as strength and properties of materials are covered by other documents within the DMRB Series.

1.2 This Standard supersedes standard BD 29/87 including those aspects of Technical Memorandum BE1/78 that relate to footbridges. It is to be used where appropriate in conjunction with the relevant Parts of BS 5400 as implemented by the Overseeing Organisation except where otherwise specified by this Standard.

1.3 The major changes to this document are as follows:

- a) Advice is given on considering all relevant factors before deciding the form and layout of the footbridge with a view to developing structures that encourage greater use and appreciation by the public.
- b) The provisions for users with visual or mobility impairment have been incorporated into the general provisions.
- c) Figures have been included to illustrate certain provisions/advice.
- d) Definitions of terms have been provided.

Implementation

1.4 This standard shall be used forthwith on all future road schemes for the construction, implementation, improvement and maintenance of trunk roads. It shall apply also to schemes currently in preparation provided that, in the opinion of the Overseeing Organisation, this will not result in significant additional expense or delay progress. Design Organisations shall confirm its application to particular schemes with the Overseeing Organisation.

Definitions

1.5 For the definition of the general highway terms used in this Standard such as “highway types” (trunk road, motorway etc) and “components of the highways” (carriageway, verge etc) refer to BS 6100; Subsection 2.4.1.

1.6 Particular terms used in this standard are defined as follows:

Desire Line	Line likely to be taken by pedestrians finding the shortest route between two points.
Goal orientated users	Users making a journey to reach a specific destination.
Recreational users	Users making a journey for leisure purposes.
Bridleway	Public right of way open to pedestrians, equestrians and cyclists.
Cyclist	A pedal cyclist.
Footway	Public right of way for pedestrian use only.
Cycle Lane	A separate part of the footway or footbridge for use by pedal cycles.

Mandatory Sections

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

Scope

1.8 This Standard specifies non-structural criteria for the design of footbridges for use by pedestrians, cyclists and equestrians, in urban and rural areas, which may be constructed of steel, aluminium alloy, reinforced or prestressed concrete, timber or other agreed materials.

1.9 Guidelines for the selection of other suitable forms of pedestrian crossings are outside the scope of this Standard. However, an Advice Note 'Provisions for Non Motorised Users' is under preparation by the Environment Group of the Highways Agency, and this will contain advice on the selection of appropriate NMU crossings.

2. GENERAL PRINCIPLES

General

2.1 This section describes the principles to be followed when designing footbridges for new and improved all-purpose trunk roads and motorways. The underlying principle is that the designer is given the maximum flexibility to develop footbridge designs that will meet the stated objectives of the Overseeing Organisation.

2.2 The designer should balance the full range of considerations such as modes of users, safety, aesthetics, environmental impact, cost, robustness, sustainability, buildability, operation and maintenance. Where there are options for alignment, layout and structural form, the selection process should include due consideration of these factors and any other relevant design constraint.

2.3 Footbridges can be more prone to various forms of damage, misuse and vandalism by users than road bridges and this shall be taken into account in the design and agreed with the Overseeing Organisation. See in particular paragraphs 2.4 and 8.1 below. Consideration should be given by the Designer to assessing any existing patterns or likelihood of vandalism at the location. Relevant authorities such as the local police may be consulted if necessary.

2.4 Materials of high scrap value may not be suitable for components vulnerable to removal. In locations with a high risk of unauthorised removal of parts, appropriate fixing details should be specified. Materials vulnerable to fire damage, or to graffiti that is difficult to remove, may in some situations be inappropriate.

Provision of Footbridges

2.5 One of the purposes of footbridges is to facilitate and encourage walking and cycling whilst ensuring safety for all road users. The type of crossing provided should therefore be such as to encourage people to use it, taking account of likely pedestrian flows and movements, and to encourage people to regard walking or cycling as an acceptable mode of transport. Such matters should be considered in liaison with the Overseeing Organisation.

2.6 Criteria to be considered in relation to use by visually or mobility-impaired persons are incorporated into the following sections of this standard. These criteria are of benefit to many types of users with impaired mobility e.g. older people, people with prams, those with walking difficulties, heavily-laden shoppers etc.

2.7 It is important to determine the user groups of the bridge and their main purpose before deciding on its location. For goal-orientated use, location on the desire line is usually the highest priority. For recreational use, where possible, the new crossing should be located to add value to the recreational route, e.g. by reducing exposure to traffic, introducing new views or creating a new circular route.

3. LAYOUT

Location

3.1 Where a footbridge crosses a dual carriageway carrying traffic with permitted speeds in excess of 48 km/h, both carriageways shall be crossed with a single span to avoid the need for a support in the central reserve.

3.2 Where a separate footbridge is installed alongside a road bridge it should be detailed such as to deter attempts by persons to cross between. This may be effected by making the gap between the structures at least 2m wherever possible. Where this cannot be provided, adequate alternative safety precautions should be taken to minimise the risk of persons falling through the gap.

3.3 Where a separate footbridge is located close to a highway bridge such that an errant vehicle could impact the footbridge, consideration should be given by the Designer to the provision of a road restraint system on the approaches to the footbridge to contain appropriate vehicles within the highway.

3.4 The position of a footbridge should be chosen to maximise the use of the topography so as to avoid or minimise the need for stairs and ramps. See Figure 1.



Figure 1 (ref para. 3.4)

3.5 Where a paved approach to the ramp or stairs of a footbridge is located immediately adjacent to the carriageway, it should, as far as practicable, be sited in such a way that pedestrians walking towards the bridge face oncoming traffic.

3.6 When a road, other than a motorway, is in cutting or has other ground modelling which provide side slopes on one or both sides, these should be used as far

as is practicable to provide access to the footbridge by incorporating ramps in the side slopes. See Figure 2.

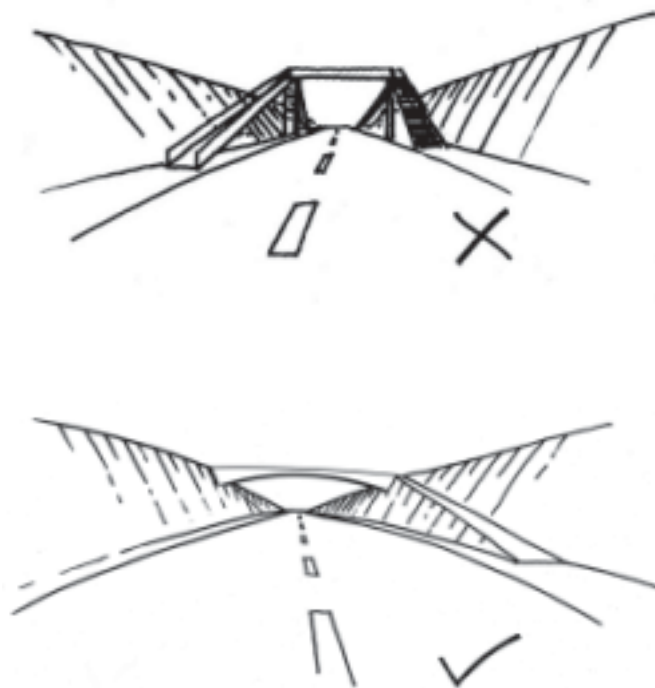


Figure 2 (ref para.3.6)

3.7 When the footbridge is in a cutting, particularly when visible on the skyline, the cutting slope should if possible extend at least up to deck level, using a false cutting if necessary. In such situations, where the footpath is within the cutting, the steps and ramps should be built into the face of the cutting. Alternatively, where the footpath is outside the cutting at original natural ground level, the access to the deck should be linked gradually into the footpath.

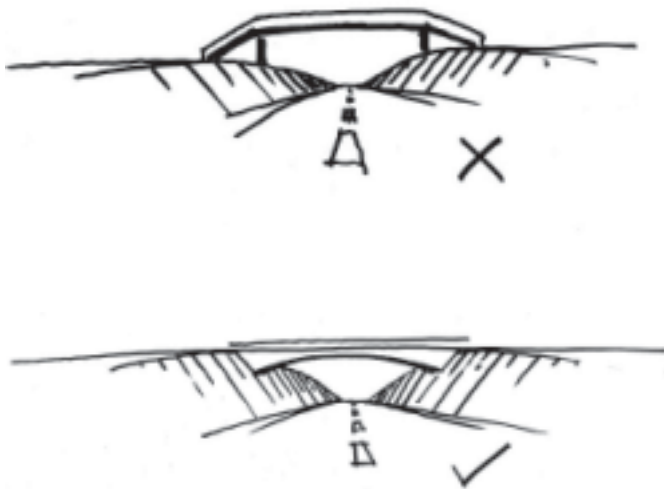


Figure 3 (ref para. 3.7)

3.8 Where a footbridge is installed to provide a crossing point for an existing rural footpath, any diversion of the footpath should commence as far from the carriageway or crossing point as is practicable to minimise the total route length and maintain the desire line to the footbridge. This will make the path more pleasant for users, provide better accessibility and help exploit the topography. However, rural footpaths frequently follow field boundaries and historic rights of way and care should be taken to avoid diversions that cut directly across fields. Further guidance on the diversion of existing Rights of Way can be found in Section 3 of the Highways Agency draft document “Provision for Non Motorised Users” (Ref. 4).

3.9 In order to avoid discouraging walking, as far as is practicable, rural footpaths should not be diverted to run beside unscreened, busy roads.

Access

3.10 Access to the deck of a footbridge should be provided by both ramps and stairs wherever practicable, unless ramps alone would provide the most direct route to the deck, in which case the stairs may be omitted. Access by stairs alone should only be considered in exceptional circumstances in consultation with the Overseeing Organisation and local access and disability groups. Access shall be as short and direct as practicable and follow the desire line of the main pedestrian flow wherever possible, avoiding long detours and unnecessary climbing.

3.11 Ramp geometry should be as simple as is practical, ideally following directly the desire line. Straight ramps with 180-degree turns or multiple levels should be avoided where possible. Spiral ramps can be very effective, with larger radii generally being more visually pleasing. However, the absence of landings in spiral ramps may lead to them being more difficult or even impossible to negotiate for mobility-impaired users, particularly wheelchair users. This should be taken into account in any decision on ramp layout.

3.12 Access to footbridges with combined cycle or equestrian use shall not be by stairs only.

3.13 Access stairs and ramps are often the most noticeable and environmentally damaging elements of a pedestrian bridge and should be minimised where possible. Where practicable, steps and ramps should be built into the contours of the landscape.

3.14 Pedestrians can be encouraged to use a footbridge, rather than crossing at grade, by the provision of suitable pedestrian guardrails or appropriate planting which prevent them from crossing the carriageway at road level.

3.15 Where access to a footbridge is such that a motor vehicle could be driven onto the structure, the access shall be restricted by spaced bollards or a system of staggered horizontal rails. The method of restriction adopted shall be appropriate to its environmental setting and shall allow the passage of wheelchairs and prams. Restrictions should be adequately marked in contrasting colour to reduce the risk of accidents, particularly to visually impaired persons. Further information can be obtained from Sense and Accessibility (Ref. 5), and the Sustrans information sheet Access Controls (Ref. 6).

3.16 Existing hedgerows or tree lines should be utilized as effectively as possible to minimise the visual impact of the steps and ramps. Where there are no trees in the area of the footbridge, landscaping with trees should be considered, especially in flat country. See Figure 4. Any proposed planting should be discussed if necessary with a landscape architect and should take into account the effect on any future maintenance liabilities for the structure. Planting schemes should be designed to avoid creating an enclosed area which might cause anxiety or a risk to users' personal security, or which may eventually cause trip or slip hazards to users from root and branch growth or falling foliage and berries.



Figure 4 (ref para. 3.16)

3.17 Where possible, the lower sections of ramps should be built on embankments that merge with the existing contours. Where necessary, sufficient land should be acquired to facilitate this. This detail will also help to prevent the accumulation of rubbish in inaccessible or confined spaces beneath the ramp.

3.18 Where stairs are provided, they should also be detailed such that the accumulation of rubbish in inaccessible or confined spaces beneath them is avoided.

3.19 There should be no concealed areas or recesses on the bridge that may cause bridge users to become concerned about their personal security while crossing.

Appearance

3.20 The appearance of a footbridge should be appropriate for its site. It should be aesthetically pleasing, enhance the environment and encourage people to use the bridge. In urban areas consideration should be given by the Designer to consulting the local planning authority about the appearance and location.

3.21 Footbridges which may have a significant visual impact on their local environment, or which may be situated in areas requiring special consideration such as Conservation Areas, Areas of Outstanding Natural Beauty, Heritage sites etc, are possible candidates for submission to the Commission for Architecture and the Built Environment (CABE). (The relevant bodies for Scotland and Wales are the Royal Fine Arts Commission for Scotland and the Design Commission for Wales. In Northern Ireland please consult the Overseeing Organisation.) The need for consultation with these bodies shall be discussed at an early stage with the Overseeing Organisation. The appearance of footbridges shall follow the advice given in the HA publication "The Appearance of Bridges and Other Highway Structures" (Ref. 7) particularly chapter 12, and the more general advice in BA 41 (DMRB 1.3.11) "The Design and Appearance of Bridges".

3.22 The long spans and relatively light loads of footbridges should be exploited and expressed in their appearance. Where the guidance in BA 41 (DMRB 1.3.11) is being followed to produce a family of bridges along a road with an occasional substantially different bridge to provide variation and respond to the topography, it is often appropriate to use a footbridge as the dramatic contrast. In this situation bolder, contrasting forms of structure could be considered, with the agreement of the TAA to give it drama. Whether the form is simple or more complex it should be expressed with clarity, simplicity and elegance.

3.23 The appearance of the footbridge, from all viewpoints, should be considered. The overall proportions of the bridge in elevation should be designed to satisfy the road users or distant observer. The approaches, the handrailing, the detailing and close-up effects should be designed to satisfy those who will appreciate the bridge at close quarters and at a slower pace. The highest standard of detailing is required. See Figure 5.



Figure 5 (ref para. 3.23)

3.24 Visual clarity of the structure and all of its elements is essential. To this end the mounting of signs or signal equipment on the bridge structure or in its immediate environment, which create an impression of clutter, should be avoided. Where the provision of gantry signs in close proximity to a footbridge is unavoidable their interaction should be taken into account from the earliest stages of design. Because the plane of the sign is fixed relative to the road alignment, the line of the footbridge should follow this to avoid awkward clashes in angle.

4. BRIDGE SUPPORTS

4.1 Footbridge supports and foundations shall be designed in accordance with the current Departmental requirements, in particular BD 37 (DMRB 1.3.14) for loading and BD 60 (DMRB 1.3.5) for collision loading.

4.2 Where footbridge sub-structures are sited on Railway or Waterway property, the appropriate Authority's requirements shall be satisfied.

4.3 For new bridges over existing roads, the foundations shall be designed to cause the minimum delay to traffic during construction.

5. DESIGN STANDARDS

General

5.1 Steel and concrete footbridges shall be designed in accordance with the relevant Parts of BS 5400 as implemented by Departmental Standards or where implemented, by the relevant European Code.

5.2 The loading and loading effects to be used for the design of timber and aluminium footbridges shall be those given in BD 37 (DMRB 1.3.14) and BD 60 (DMRB 1.3.5) for collision loading. For timber structures, where permissible stress methods of design are used, the unworked nominal values shall be applied.

5.3 Timber and aluminium footbridges shall generally comply with the requirements of BS 5268 and BS 8118 respectively or where implemented, by the relevant European Code.

Vibration and Dynamic Response

5.4 Due consideration shall be given by the Designer to the susceptibility of any footbridge to vibrations induced by pedestrians and by other bridge users. Particular consideration shall be given to the possibility that vandals may deliberately attempt to excite the structure into motion or that the passage of large numbers of people may unintentionally do so. All footbridges shall satisfy the vibration serviceability requirements set out in BD 37 (DMRB 1.3.14) Appendix B5.5. Designers should be aware that footbridges having modes of oscillation with frequencies less than 5Hz involving vertical motions of the deck, and/or less than 1.5Hz involving horizontal motions of the deck, are particularly susceptible to unacceptably large oscillations caused by the passage of large groups of people who may unconsciously or deliberately synchronise their walking patterns. Such oscillations can present a hazard to pedestrians on the structure and can risk damaging the structure itself. The possibility of the synchronisation of a large number of people to vertical motions should

particularly be considered. For any footbridge having modal frequencies below these limits consideration should be given by the Designer, in agreement with the Overseeing Organisation, to any requirements needed for carrying out appropriate dynamic testing in order to verify that the footbridge is suitable for entry into service, and to the provisions needed for the future installation if required of vibration reduction devices such as dampers. Criteria for accepting or rejecting a design on the basis of its expected dynamics shall be agreed with the Overseeing Organisation.

Minimum Thickness of Metal Sections

5.5 The minimum thickness of metal structural elements shall be as follows:

Steel plates and sections other than hollow sections	6mm
Steel hollow sections effectively sealed by welding	5mm
Aluminium alloy plates and sections	4mm

6. DIMENSIONAL STANDARDS

Clearances

6.1 The vertical clearances to the carriageway shall be in accordance with Departmental Standard TD 27 (DMRB 6.1.2). The vertical and horizontal clearances to railways, canals and watercourses shall be agreed with the Appropriate Authority. For example, the vertical and horizontal clearances to rivers and watercourses in England shall be agreed with the Environment Agency and the Land Drainage Authority.

6.2 The horizontal clearance from the edge of the carriageway to the bridge supports shall be a minimum of 4.5m unless otherwise agreed with the Overseeing Organisation. Where a clearance of 4.5m or greater cannot be achieved, the bridge supports shall be designed for collision loading to BD 60 (DMRB 1.3.5) and/or provided with appropriate road restraint systems.

Width

6.3 The clear width of the bridge, ramps and stairs, which shall be not less than 2m, shall be derived on the following basis to meet the peak pedestrian flows:

- a) On the level or up to 1 in 20 gradient: 300mm of width per 20 persons per minute.
- b) On steps or ramps steeper than 1 in 20 gradient: 300mm of width per 14 persons per minute.
- c) For shared use with cyclists and equestrians the requirements contained in Section 12 shall also be complied with.

Gradients on Bridge Structure

6.4 Where the bridge structure incorporates an inclined deck, the slope requirements regarding plain ramps shall apply. However, the requirements regarding spacing of landings on ramps may not be practical across a deck structure and for this reason the deck slope should normally be no steeper than

1 in 20. Where a deck is steeper than 1 in 20 the requirements regarding landings may be waived across the deck in agreement with the Overseeing Organisation, having given due regard to the likely mobility levels of the bridge users in consultation with the local access and disability groups.

6.5 Normally, gradients on the deck shall be no steeper than those adopted for the access ramps. However, where the deck form incorporates a varying slope (e.g. suspension, trafficked arch, stressed ribbon etc.), this requirement may be relaxed over localised lengths of the deck by agreement with the Overseeing Organisation, having given due regard to the likely mobility levels of the bridge users in consultation with the local access and disability groups.

Stairs

6.6 Access stairs to footbridges shall comply with the dimensional and safety requirements of BS 5395 for 'public' stairs, except as amended below (see also Figure 6):

- (a) The number of risers in a single flight shall not be more than 13.
- (b) A maximum of three successive flights may be used in line, provided any adjacent flights provide a change in direction of at least 30 degrees.
- (c) The risers and treads of each step in a flight of stairs shall be uniform.
- (d) Risers shall not be variable in height over their width.
- (e) The riser shall be not more than 150mm.
- (f) The tread width shall be not less than 300mm and not greater than 350mm.
- (g) Landing lengths shall be not less than 2m measured along the centre line of the stairs, or not less than the width of the stairs, whichever is the greater.

Further guidance can be obtained from Inclusive Mobility (Ref. 8).

6.7 Completely open risers shall not be used. Stairs may, however, have perforated risers, in which case the openings shall meet the following requirements:

- (a) The principal dimensions of the perforation shall not exceed 50mm.
- (b) The ratio of the open area to the total area of the riser shall be not greater than 0.4.

6.10 Where the ramp is steeper than 1 in 20, for safety reasons there should normally be a significant change either of direction (30 deg or more) or in horizontal alignment (e.g. offset by at least one ramp width), at least at every 3.5m rise of the ramp at an intermediate landing.

6.11 For ramps of gradient steeper than 1 in 20, successive sloping ramps in one line may be used in agreement with the Overseeing Organisation where either no other arrangement of ramps is possible on the site or where it provides more encouragement to pedestrians to use the footbridge by shortening the walking distance.

6.12 The footway, cycleway or equestrian approaches to the footbridge or ramps shall not, for the purpose of design to this Standard, be regarded as part of the footbridge structure.

Spiral and Curved Ramps

6.13 The effective gradient for spiral and curved ramps shall comply with the requirements for plain ramps. The effective gradient and governing dimensions shall be measured 900mm from the edge of the walkway surface on the inside of the curve. The minimum inside radius of walkway surfaces for curved and spiral ramps shall be 5.5m.

Landings

6.14 For straight or spiral ramps of gradient 1 in 20, landings shall be provided at equal intervals of maximum rise 2.5m. For gradients flatter than 1 in 20, intermediate landings are not required.

6.15 For straight ramps of gradient steeper than 1 in 20, horizontal landings shall be provided at intervals producing a rise of no more than 650mm between landings.

6.16 The length of a landing shall not be less than 2m measured for straight ramps on the centreline of the ramp or for spiral ramps circumferentially at 900mm from the walkway edge on the inside of the curve.

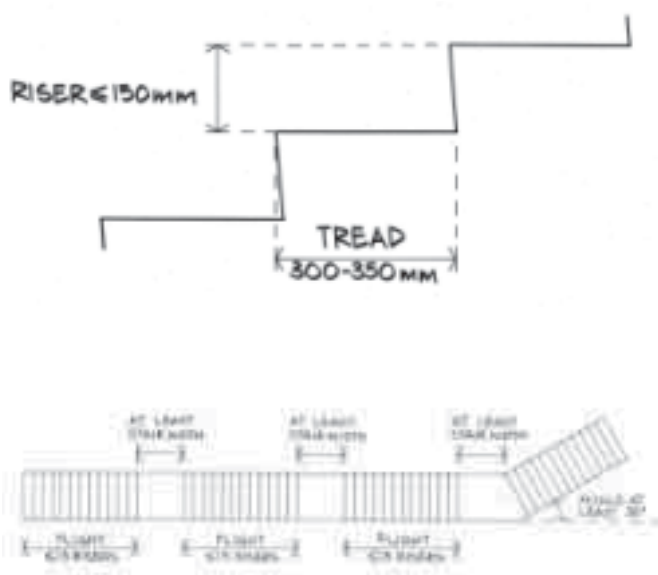


Figure 6 (ref para. 6.6)

6.8 Consideration should be given by the Designer to the provision of solid infill panels to parapets and step risers to protect the privacy of users and screening to protect the privacy of neighbouring dwellings.

Ramps

Plain Ramps

6.9 Ramps for pedestrians, cyclists and equestrians shall not be steeper than 1 in 20 unless agreed otherwise with the Overseeing Organisation. For reasons of keeping the access on the desire line, or to avoid long diversions, or to avoid damage to the environment, or for reasons of limitations of space, a steeper ramp may be used, preferably no steeper than 1 in 15. However, no ramp shall be steeper than 1 in 12.

7. PARAPETS

7.1 All bridge spans, ramps and stairs shall be provided with parapets. Parapets shall conform to the current requirements of the Overseeing Organisation given in the IRRRS or, when implemented, by EN1317 Part 6, and the following:

- (a) No upstand is required under the parapet on stairs.
- (b) Where the parapet is provided with a bottom rail, the clearance from the rail to the nose of the stairs shall be not less than 50mm and not greater than 100mm.
- (c) The height of the parapet shall be measured vertically above the line joining the noses of the stairs.
- (d) For plain or spiral ramps the height of the upstand shall be not less than 25mm and not more than 50mm.
- (e) If glass is used it shall be laminated. A rigorous risk assessment shall be undertaken during the selection of the glazing system. It shall be demonstrated that the panels, if damaged in service, would retain sufficient post fracture strength to remain in place within its fixings on the structure. Shards created during the shattering of the outer plies shall be large enough to be retained by the laminating materials.

7.2 In areas of high prevailing winds or where a footbridge is designed for pedestrian use only, and the headroom under the bridge is greater than 10m, the height of the parapet may be increased to 1.30m with the agreement of the Overseeing Organisation. Alternatively, an enclosed form of superstructure should be considered – see Section 8.

7.3 Where structural members of a footbridge serve as a parapet, the height of the parapet, the infilling of open areas, the upstand at the edge of the walkway surface and the climbability of any part shall be in accordance with requirements of 7.1. The climbability aspect requires particular attention where diagonal members at intermediate heights are employed.

Handrails

7.4 Handrails shall be provided on both sides of stairs, ramps and to decks with a gradient steeper than 1 in 20. Handrails shall be designed in accordance with BS 8300. Additional central handrails need only be provided where the width of the stairs or ramps exceeds 3m. Handrails may either be fixed to the parapet or be self-standing. The height of the handrail shall be not less than 900mm or more than 1000mm, measured vertically above the line joining the noses of the stairs or above the line of the ramps as appropriate.

7.5 Handrails of circular section should preferably have a diameter of 40 – 50mm and if within an enclosure should have a clearance from any part of the frame of 50 – 60mm. Those of non-circular section should preferably be 50mm wide by 38mm deep with rounded edges.

7.6 Handrails should be of a contrasting colour to the parapet to which it is attached, to aid those with visual impairment. Further guidance on provision of handrailings can be found in Inclusive Mobility (Ref. 8).

7.7 The handrail and its fixings shall be designed to resist a uniformly distributed load of 700 N/m applied separately in the horizontal and vertical directions in such a way that the system is designed for the most severe effects. This loading is not additional to the loading for parapets.

8. ENCLOSED FOOTBRIDGES AND CLEARANCE GAUGE

8.1 Where it is considered that there is a high risk of objects being dropped or thrown from the footbridge, or if there is a high risk of persons jumping onto the carriageway, consideration shall be given by the Designer to full or partial enclosure of the crossing and its ramps or stairs, where these are over the highway. The need for such provision shall be agreed with the Overseeing Organisation. The National Institute of Mental Health can help identify problem areas, in pursuance of the National Suicide Strategy for England (Ref. 9). The design of an enclosure shall be such that unauthorised access to the sides or the roof is prevented.

8.2 Consideration should be given by the Designer to enclosing footbridges when they are on sites exposed to very adverse weather, e.g. high winds, or where they are of such a height above the road that pedestrians may feel insecure. The need for such provision shall be agreed with the Overseeing Organisation.

8.3 Where bridge enclosures are proposed, aerodynamic effects shall be considered. Wind tunnel testing may be required and guidance is given in BD 49 (DMRB 1.3.3). Requirements shall be agreed with the Overseeing Organisation.

8.4 Normally, fine unclimbable stainless steel mesh infill will be suitable as cladding to the enclosure frame but if solid panels are specified they should be transparent with provision made for cleaning. Depending on the particular site problems, high parapets with an inward canted top or full enclosure may be required. Flush glazing outside the face of the structure is an acceptable form for enclosure walls and arched mesh roofs are an acceptable form for preventing roof access. Particular care in detailing is required to prevent access at the end of main spans where the bridge is over a cutting. Enclosures shall comply with the parapet requirements of 7.1.

8.5 The minimum headroom inside the enclosure shall be as follows:

Pedestrian only	2.3m
Pedestrian and Cyclist	2.4m
Equestrian (dismounting provisions in accordance with 12.14)	2.7m
Equestrian (mounted)	3.7m

8.6 A vertical clearance envelope shall be maintained at all locations on decks, stairs and ramps whether open or enclosed appropriate to the respective user groups. No part of any structural items such as cable stays, enclosure frames etc, or any signing or other attachments, shall intrude into the envelope. The clearance envelope shall be formed by a vertical line flush with the innermost surface of each parapet, fence or handrail, and a horizontal line complying with the height requirements given in 8.5. Where shared facilities exist, the height shall be the greatest height of the respective users.

9. DRAINAGE

9.1 Provision shall be made for the drainage of water from the footbridge and its roof in the case of enclosed footbridges. All walkway surfaces, steps, ramps and roof shall have adequate falls and suitable detailing to allow water to run off.

9.2 With the exception of stair treads and perforated decks, water should not be allowed to discharge or spill from the structure on to the carriageway or footpaths or to stain exposed surfaces, but shall be carried away either to a drainage system or to a soakaway.

9.3 Positive drainage of bearing shelves shall be provided beneath all deck movement joints.

10. WALKWAY SURFACES

10.1 It is intended to establish an Approval/Registration System for materials and systems to provide appropriate fitness for purpose for surfacing for various user types, and until this is in place the fitness for purpose of the combined substrate/surfacing system for the respective user type shall be agreed with the Overseeing Organisation as an Aspect Not Covered by Standards. This should address such requirements as corrosion resistance, resistance to slip, environmental deterioration, durability, and additionally for equestrian use, noise attenuation.

10.2 On the traversed areas of decks, stairs and ramps, the upper substrate surfaces shall be waterproofed or otherwise protected against deterioration from surface contaminants, and the surfacing shall be fit for purpose with respect to the user type.

10.3 The minimum slip resistance of traversed areas shall be equivalent to a mean corrected Pendulum Test Value of 45 units using a standard skid resistance pendulum test (prEN 13036-4).

10.4 The Designer, or for existing structures the Maintaining Agent, shall ensure that the Maintenance Manual for the structure states the installation date and minimum expected life from the surfacing or surfacing/waterproofing system.

10.5 Exposed gaps in walkway surfaces shall not be in excess of 12mm in width. Cover plates to gaps and joints shall be set flush with the top of the surfacing to prevent tripping, and the upper surfaces shall be suitably profiled or treated to reduce the likelihood of slippage.

11. LIGHTING

11.1 Footbridges shall be illuminated if they are located in areas where public lighting is provided and any lighting shall conform with the requirements of BS 5489: Part 6. Lighting systems, fixings and connections shall be robust and tamper proof.

11.2 Footbridges shall normally be illuminated by means of existing road or footway lighting augmented, if necessary, by additional ground level mounted lighting columns and lanterns. Where this is impracticable, for instance in the case of a covered walkway, the footbridge shall be illuminated by parapet lighting fittings or lighting columns mounted on the bridge structure, using fixings incorporated in the bridge design. All components of lighting systems, their fittings and connections shall be robust and tamper proof. Parapet members shall not be used as cable ducts.

12. REQUIREMENTS FOR COMBINED USE BY PEDESTRIANS AND CYCLISTS OR EQUESTRIANS

12.1 For guidance on the layout and surfacing of Non Motorised User (NMU) provision to the footbridge approaches beyond the ramp and stair ends, see Highways Agency draft Guidance Note “Provision for Non Motorised Users” (Ref. 4). For additional information on tactile surfacing for combined use situations see “Guidance on the use of tactile paving surfaces” (Ref. 12).

Footbridge Designed for Combined Use by Pedestrians and Cyclists

12.2 Shared facilities may be segregated or unsegregated. The form of segregation on the structure as determined locally shall be compatible with the segregation on the approaches. Where practical, and where agreed with the Overseeing Organisation, differing surface textures on segregated footways to aid visually impaired users may be continued across the structure.

12.3 Where the crossing is part of a pedestrian and cycle route, specific provision shall be made in accordance with the guidance on shared use by cyclists and pedestrians contained in Local Transport Note 2/86 (Ref. 10) or any current update of that document. In Scotland, reference shall be made to ‘Cycling by Design’ (Ref. 13).

12.4 The minimum widths for a footpath (or footway) and a cycle track on a bridge and ramps shall be:

	Pedestrian Path	Cycle Path	Total Width
When segregated by kerb not less than 50mm high	1.75m	1.75m	3.5m
When segregated by railings not less than 900mm high	1.95m	1.95m	3.9m
When segregated by a white line, colour contrast or surface texture	1.5m	1.5m	3.0m
Unsegregated	-	-	2.0m

12.5 On footbridges with cycle facilities the minimum height of a parapet shall be 1.40m. Design criteria and details for this parapet shall be as specified in 7.1 above, but where cyclists are physically segregated from pedestrian facilities the increased parapet height need only be provided on the cycle track side of the bridge.

12.6 Whether ramps are segregated or not, for long ramps, consideration should be given by the Designer to providing chicane barriers to slow down mounted cyclists. This should be done in such a way that the passage of perambulators and wheelchairs or mobility and visually impaired users would not be hindered, and should preferably be located on level landings especially where ramp slopes are steeper than 1 in 20.

Footbridge Designed for Combined Use by Pedestrians and Equestrians

12.7 Where a crossing is designated for equestrian use, it shall be designed in accordance with BD 37 (DMRB 1.3.14) and 7.1 above. All crossings catering for equestrians shall be designed for combined pedestrian/equestrian use.

12.8 The minimum width of a footbridge for combined pedestrian/equestrian use shall be 3.5m.

12.9 Where the crossing is not part of a designated bridleway, consideration should be given by the Designer to providing mounting/dismounting blocks on the approaches to the bridge to enable horses to be led across.

12.10 In pursuance of 12.7 above, where agreed with the Overseeing Organisation the use of solid infill panels higher than the minimum requirement defined in the documents referred to in 7.1 above may be permitted in order to reduce the risk of horses being startled by traffic on the carriageway below. Due account shall be taken of the effects of this on aesthetics and potential loss of utility to other users.

12.11 Wherever possible the bridge should be aligned such that all user types can see the entire length of the structure from the approaches and, where practical, suitably sized equestrian waiting areas should be provided off the structure to allow users the option to cross when the deck is clear.

12.12 The upper face of cover plates to expansion joints at deck level shall be provided with a suitable slip resistant coating.

12.13 Suitable signage shall be erected on the approaches to the footbridge to warn other users of the potential presence of horses, requesting cyclists to take particular care or give way to equestrians.

12.14 Where the minimum headroom on the structure is not designed for mounted use in accordance with 8.5, mounting/dismounting blocks shall be provided and suitable signs erected to indicate that equestrians should dismount.

12.15 Where the deck is constructed of steel or timber or any other material where the sound made while crossing the bridge could alarm the horses, warning notices to this effect shall be erected. Alternatively, suitable noise attenuation measures, for example special surfacing, may be agreed with the Overseeing Organisation.

13. REFERENCES

1. British Standards: BSI
BS 5400: Code of Practice for the Design of Steel, concrete and composite bridges
BS 6100: Subsection 2.4.1. Glossary of Building and Civil Engineering Terms, Highway Engineering
BS 5268: Structural use of timber
BS 8118: Structural use of aluminium
BS 5395: Part 1: Code of Practice for the Design of Straight Stairs
BS 8300: Design of buildings and their Approaches to meet the needs of disabled people - Code of Practice
BS 5489: Part 6: Lighting for bridges and elevated roads
BS 5395: Part 1: Code of Practice for the Design of Straight Stairs
2. Design Manual for Roads and Bridges (DMRB): TSO
BD 37 Loads for Highway Bridges (DMRB 1.3.14)
BD 60 The Design of Highway Bridges for Vehicle Collision Loads (DMRB 1.3.5)
BD 74 Foundations (DMRB 2.1.8)
BD 30 Backfilled Retaining Walls and Bridge Abutments (DMRB 2.1.5)
BD 49 Design Rules for Aerodynamic Effects on Bridges (DMRB 1.3.3)
BA 41 The Design and Appearance of Bridges (DMRB 1.3.11)
TD 27 Cross Sections and Headroom (DMRB 6.1.2)
Technical Memorandum BE1/78
3. Manual of Contract Documents for Highways Works (MCHW): TSO
Specification of Highways Works. (MCHW)
4. Draft Guidance Note on Non-Motorised Users, Highways Agency
5. Sense and Accessibility, Countryside Agency Publications, 2000
6. Sustrans Information Sheet FF22 – Access Controls, Sustrans 1998
7. The Appearance of Bridges and Other Highway Structures, Highways Agency, 1996
8. Inclusive Mobility, Department for Transport, London, 2000
9. National Suicide Prevention Strategy, Department of Health, London 2002
10. Local Transport Note 2/86 – Shared use by Cyclists and Pedestrians – August 1986, HMSO
11. Interim Requirements for Road Restraint Systems (IRRRS)
12. Guidance on the Use of Tactile Paving Surfaces. Department for Transport (1998)
13. Cycling by Design: A Consultation Paper – December 1999, Scottish Executive

14. FURTHER READING

Traffic Signs (Amendment) Regulations:1982. Statutory Instrument 1982, No 1879 – December 1982, HMSO

DETR Traffic Advisory Leaflet 3/00; Walking Bibliography

DETR Traffic Advisory Leaflet 4/00; Cycling Bibliography

Highways Report HR6 – Equestrian Use of Trunk Road Structures, Transport Research Laboratory, 2002

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