THE HIGHWAYS AGENCY BD 29/87

THE SCOTTISH OFFICE DEVELOPMENT DEPARTMENT

THE WELSH OFFICE
Y SWYDDFA GYMREIG

THE DEPARTMENT OF THE ENVIRONMENT
FOR NORTHERN IRELAND

Design Criteria for Footbridges

Summary: This Departmental Standard specifies the Design Criteria for Footbridges.

Volume 2 home page

VOLUME 2 HIGHWAY STRUCTURES: DESIGN (SUBSTRUCTURES AND SPECIAL STRUCTURES), MATERIALS

SECTION 2 SPECIAL STRUCTURES

BD 29/87

DESIGN CRITERIA FOR FOOTBRIDGES

Contents

1. INTRODUCTION

1.1 This Departmental Standard supersedes those aspects of Technical Memorandum BE 1/78 which relate to footbridges. It is to be used where appropriate in conjunction with the relevant Parts of BS 5400 as implemented by the Department except where otherwise specified by this Standard.

2. SCOPE

2.1 This Departmental Standard specifies criteria for the design of pedestrian footbridges in urban and rural areas, which may be constructed of steel, aluminium alloy, reinforced or prestressed concrete or timber. The Standard gives also additional criteria for structures to be used by cyclists and horseriders. Enhanced criteria for people with disabilities are given in Section 14.

2.2 Guidelines for the selection of suitable forms of pedestrian crossings are outside the scope of this Standard. Information on this matter will be published in due course in a separate Advice Note.

3. GENERAL PRINCIPLES

3.1 Provision of Footbridges

3.1.1 During the planning stage of each road scheme consideration shall be given to the form of pedestrian crossing taking full account of the pedestrian flows and movements. A footbridge is the least suitable form of crossing for disabled people and should only be provided when other forms of crossings eg a crossing at grade, or a subway, are deemed to be unsuitable.

3.1.2 Many disabled people will not be able to use a footbridge unless the enhanced criteria of Section 14 are adopted. These criteria are also of benefit to many other types of users, e.g. the elderly, people with prams, heavily-laden shoppers etc. Therefore, in all cases, these enhanced criteria shall be adopted, as far as practicable. For each scheme, the provision for such users shall be agreed with local organisations for disabled people, the Technical Approval Authority and any other authorities concerned.

3.1.3 Provision of central supports for footbridges shall be assessed on the basis of safety, appearance and economics.

3.1.4 Where access to a footbridge is located immediately adjacent to the carriageway it should, as far as practicable, be sited in such a way that pedestrians walking down the access face on-coming traffic.

3.1.5 Consideration should be given to the provision of infill to parapets and step risers to protect the privacy of users and screening to protect the privacy of neighbouring dwellings.

3.1.6 Aluminium alloy should not be considered as a construction material at sites where vandalism or theft are likely.

3.2 Appearance

The appearance of a footbridge should be appropriate for its site. In urban areas consideration should be given to consulting the local planning authority about the appearance and location. Footbridges sited in Areas of Outstanding Natural Beauty, conservation areas, close to buildings of architectural or historic interest, or in high density urban areas are possible candidates for submission to the Royal Fine Art Commission and should be discussed at an early stage with the Technical Approval Authority.

3.3 Access

3.3.1 Access to a footbridge, using ramps or stairs, shall be as short and direct as possible, preferably on the line of the main pedestrian flow, avoiding long detours and unnecessary climbing.

3.3.2 Footbridges should be provided with both access ramps and stairs where this is practicable and can be justified by the number and type of users.

3.3.3 Plain ramped access is considered the most satisfactory for people in wheelchairs, those with walking difficulties and for pedestrians pushing prams. Footbridges with only access stairs cannot be used by people in wheelchairs and will be very difficult for many other users.

3.3.4 Pedestrians can be encouraged to use a footbridge by the provision of suitable pedestrian guard rails which prevent them from crossing the carriageway at road level.

3.3.5 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 should allow the passage of wheelchairs and prams and should be adequately marked in contrasting colour to reduce the risk of accidents, particularly to visually handicapped people.

3.4 Layout

3.4.1 Where a footbridge crosses a dual carriageway carrying traffic with permitted speeds in excess of 48 km/h, preference shall be given to spanning both carriageways with a single span to avoid the need for a support in the central reserve. The main span of a footbridge should preferably be at right angle to the carriageway.

3.4.2 When a road, other than a motorway, is in cutting with side slopes on one or both sides, consideration should be given to providing access to the footbridge by incorporating ramps in the side slopes.

3.5 Clearances

3.5.1 The vertical and horizontal clearances to the carriageway shall be in accordance with Departmental Standard TD 27/86.

4. REQUIREMENTS FOR COMBINED USE BY PEDESTRIANS AND CYCLISTS OR HORSERIDERS

4.1 Footbridge to be used by pedestrians and cyclists

4.1.1 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.

4.1.2 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.

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

(a) 1.75m wide each when segregated by kerb

(b) 1.95m wide each when segregated by railings

(c) 1.20m wide footpath (or footway) and 1.50m wide cycle track when segregated by white line, colour contract or surface texture

(d) 2.00m wide for unsegregated facility.

4.1.4 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 Technical Memorandum BE5 for a standard 1.15m parapet. Where cyclists are physically segregated from pedestrian facilities the increased parapet height need be provided on the side of the cycle track only.

4.1.5 The segregated facility shall be marked by signs to diagram 625.3 in accordance with 'Traffic Signs (Amendment) Regulations 1982'. Cycle symbol markings to diagram 1057 shall be used on the cycle track.

4.1.6 Where ramps are permitted to be used by mounted cyclists they shall have a gradient not steeper than 1 to 20. Chicane barriers on long ramps may be provided to slow down mounted cyclists in such a way that the passage of perambulators and wheelchairs would not be restricted.

4.2 Footbridges to be used by pedestrians and horseriders

4.2.1 Where the crossing is part of a designated bridleway it shall be designed as a bridleway bridge in accordance with BD 14/82 and BE5.

4.2.2 Where the crossing is not part of a designated bridleway, consideration shall be given to providing mounting/dismounting blocks on the approaches to the bridge to enable horses to be led across. The parapet height shall be increased to 1.80m and be of a type specified for bridleway bridges.

5. PROTECTION OF SUPPORTS

5.1 Footbridge supports shall be designed in accordance with the current Departmental requirements. In addition supports which may be subject to collisions by errant vehicles shall be designed to resist collision loading. The collision loads given in BS 5400: Part 2 as implemented by the Department are currently under review. In the interim period the collision loading for footbridges shall be agreed with the Technical Approval Authority. In order to achieve the required impact resistance it may be necessary to encase or widen the support to form a concrete plinth extending to a height of at least 1.5m above the adjacent surface level. Where supports are to be located in a central reserve attention shall be given to the clearance requirements specified in Departmental Standard TD 19/85.

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

6. DESIGN STANDARDS

6.1 General

6.1.1 Steel and concrete footbridges shall be designed in accordance with the relevant Parts of BS 5400 as implemented by Departmental Standards.

6.1.2 Timber and aluminium footbridges shall be designed by the permissible stress methods and shall generally comply with the requirements of BS 5268 and CP 188 respectively. For timber footbridges where precise information on vibration is not available, the value of δ, the logarithmic decrement of decay of vibration due to structural damping, shall be taken as 0.04.

6.1.3 The loading and loading effects to be used for the design of timber and aluminium footbridges shall be the unfactored nominal values given in BS 5400: Part 2, as implemented by Departmental Standards.

6.2 Minimum thickness of metal sections

The minimum thickness of metal sections 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

6.3 Foundations

The foundation shall be designed in accordance with the requirements given in Clause 5 of the Departments Standard BD 30/87.

7. DIMENSIONAL STANDARDS

7.1 Width

7.1.1 The clear width of the bridge, ramps and stairs which shall be not less than 1.8m 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 over 1 to 20 gradient: 300mm of width per 14 persons per minute.

7.2 Bridge Structure

7.2.1 Where the bridge structure is such that the footway is curved in elevation, the slope of the footway shall at no point be steeper than 1 in 20, either on the bridge structure or on adjoining landings. The requirements of 7.3.1 (d) should however be taken into account.

7.3 Stairs

7.3.1 Access stairs to footbridges shall comply with the dimensional and safety requirements of BS 5395 for 'public' stairs, except as amended below:

(a) the number of steps in a single flight shall not be more than 20

(b) a maximum of three successive flights may be used without a significant change in direction (30° or more) provided each flight comprises not more than 12 steps

(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 shall be not less than 300mm.

7.3.2 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 shall not exceed 50mm

(b) the ratio of the open area to the total area of the riser shall be not more than 0.4.

7.4 Ramps

7.4.1 Plain ramps

7.4.1.1 Ideally ramps shall not be steeper than 1 in 20 but in some circumstances eg. limitations of space this may be unachievable. In such cases steeper ramps may be used but in no case steeper than 1 in 12.

7.4.1.2 Where the ramp slope is steeper than 1 in 20, for safety reasons there should normally be a significant change of direction (30° or more) at intermediate landings. Successive sloping ramps in one line should only be used where 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.

7.4.2 Spiral ramps

Spiral ramps shall comply with the requirements for plain ramps but the gradient must be less than 1 in 20. 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 shall be 5.5m for plain ramps.

7.4.3 Landings

Where the total rise of a ramp exceeds 3.5m, horizontal landings shall be provided at equal intervals along the length of the ramp in order that the rise of any ramp section does not exceed 3.5m. However, landings need not be provided for spiral ramps or elsewhere where the ramp gradient is flatter than 1 in 20. The length of the landings shall not be less than 2m measured on the centre line of the ramp.

8. PARAPETS

8.1 All bridge spans, ramps and stairs shall be provided with parapets. Except where covered by 4, 8.3 and 10, parapets shall conform to the requirements specified in Technical Memorandum BE 5 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 and spiral ramps the height of the upstand shall be not less than 25mm and not more than 50mm.

8.2 In areas of high prevailing winds or where the headroom under a footbridge for pedestrian use only is greater than 10m, the height of the parapet may be increased to 1.30m with the agreement of the Technical Approval Authority.

8.3 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 Technical Memorandum BE 5. The climbability aspect requires particular attention where diagonal members or members at intermediate heights are employed.

9. HANDRAILS

9.1 Handrails shall be provided on both sides of stairs, ramps and ramp approaches. Handrails shall be designed in accordance with BS 5810. 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 840mm or more than 1.00m, measured vertically above the line joining the noses of the stairs or above the line of the ramps as appropriate.

9.2 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.

10. ENCLOSED WALKWAYS

10.1 Where it is considered that there is a high risk of objects being dropped or thrown from the footbridge, consideration should be given to full or partial enclosure of the crossing and its ramps or stairs. The need for such provision shall be agreed with the Technical Approval Authority. Normally mesh infill will be suitable but if solid panels are specified they should be translucent with provision made for cleaning. The design of the enclosure shall be such that unauthorised access to the sides or the roof is prevented.

10.2 Consideration should be given to enclosing footbridges when they are on sites exposed to very adverse weather, ie high winds and above average rainfall, 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 Technical Approval Authority.

10.3 The minimum headroom inside the enclosure shall be 2.30m.

11. DRAINAGE

11.1 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 to allow water to run off.

11.2 With the exception of stair treads, water should not be allowed to discharge of spill over the edge of 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.

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

12. WALKWAY SURFACES

12.1 The decks, stairs and ramps of footbridges shall be waterproofed.

12.2 Waterproofing may be applied separately or as a combined layer with the surfacing.

12.3 Where a separately applied bituminous surfacing is considered appropriate on a concrete footbridge then a suitable waterproofing system selected from the list given in Series 2000 of the Department's Specification for Highway Works may be used. In such a case the minimum thickness of the applied bituminous surfacing shall be 25mm and shall incorporate slip resistance dressing.

12.4 Where approved proprietary concrete bridge deck waterproofing systems overlain by bituminous surfacings are considered uneconomic and unsuitable for use on footbridges, alternative waterproofing systems may be used subject to the approval of the Technical Approval Authority. Such waterproofing systems shall provide adequate resistance to water penetration and indentation, and shall not be adversely affected by chloride ions or sunlight. The efficiency of the waterproofing system and its tensile bond with the deck shall be demonstrated to the approval of the Technical Approval Authority by test and/or by service history.

12.5 The surfacing of railways on all footbridges, when new, shall have a slip resistant finish which has a skid resistance against rubber, leather or composition sole material of not less than 65 units under wet conditions. The slip resistant finish shall have an effective life of at least five years and shall retain a skid resistance of not less than 45 units under wet conditions throughout this period. The slip resistance of surfacings should be checked by the portable skid resistance pendulum tester developed by the Transport and Road Research Laboratory.

A suitable in situ finish may be obtained by oversprinkling the surface with calcined bauxite flints with a particle size in the range of 0.17–0.50mm or other materials with similar grading and slip resistance.

12.6 Where a waterproofing system listed in the Department's Specification is to be used, the class of finish to a concrete surface shall be as defined in the Department's Specification for Highway Works. The class of finish to receive any other waterproofing system shall be as recommended by the manufacturer and subject to the approval of the Technical Approval Authority.

12.7 Joint gaps in walkway surfaces in excess of 12mm in width shall have cover plates. All joints shall be sealed or caulked. Cover plates shall be set flush with the top of surfacing to prevent tripping.

13. LIGHTING

13.1 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.

13.2 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 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. Parapet members shall not be used as cable ducts.

14. PROVISION FOR PEOPLE WITH DISABILITIES

14.1 Many disabled people will not be able to use a footbridge if the following enhanced criteria are not adopted.

14.2 Enhanced criteria:-

Standard criteria	Enhanced criteria
3.3.2 Provision of ramps and stairs	Both plain ramps and stairs shall be provided.
7.1.1 Minimum clear width	The clear width of footbridge, ramps and stairs shall not be less than 2.0m.
7.3.1 (e) Maximum rise of steps in stairs	The dimension of step risers in stairs shall not be more than 125mm.
7.4.3 Provision of landings	Horizontal landings shall be provided on all ramps where the gradient equals or is steeper than 1 in 20 at intervals of not more than 10m along their lengths.

15. REFERENCES

1 - Technical Memorandum (Bridges) No BE 5: Fourth Revision - The Design of Highway Bridge Parapets:

2 - Departmental Standard TD 19/85 - Safety Fences and Barriers.

3 - Departmental Standard TD 27/86 - Cross Sections and Headroom.

4 - Departmental Standard BD 14/82 - Loads for Highway Bridges - Use of BS 5400: Part 2: 1978.

5 - Departmental Standard BD 30/87 - Backfilled Retaining Walls and Bridge Abutments.

6 - BS 5268 - Structural use of timber.

7 - BS 5395: Part 1: 1977 - Code of Practice for the Design of Straight Stairs.

8 - BS 5400 - Steel, concrete and composite bridges.

9 - BS 5489: Part 6: 1967 (1980) - Lighting for bridges and elevated roads.

10 - BS 5810: 1979 - Code of Practice for access for the disabled to buildings.

11 - CP 118: 1969 - Code of Practice for the Structural use of Aluminium.

12 - Local Transport Note 2/86 - Shared use by Cyclists and Pedestrians - August 1986, HMSO.

13 - Traffic Signs (Amendment) Regulations - 1982. Statutory Instrument 1982, No 1879 - December 1982, HMSO.

14 - Department of Transport - Specification for Highway Works August 1986, HMSO.

16. ENQUIRIES

Technical enquiries arising from the application of this Departmental Standard to a particular project should be addressed to the appropriate Technical Approval Authority.

General Technical enquiries or comments should be sent in writing to:

Head of Bridges Engineering Division
Department of Transport
St Christopher House
Southwark Street
LONDON
SE1 0TE

Quoting reference:
BE 21/5/041

Orders for copies of this Departmental Standard should be accompanied by the remittance shown on the cover and addressed to:

DoE/DTp Publications Sales Unit
Building One
Victoria Road
South Ruislip
Middlesex HA4 0NZ

Telephone No: 01 - 841 3425