THE HIGHWAYS AGENCY TD 36/93

THE SCOTTISH OFFICE DEVELOPMENT DEPARTMENT

THE WELSH OFFICE
Y SWYDDFA GYMREIG

THE DEPARTMENT OF THE ENVIRONMENT
FOR NORTHERN IRELAND

Subways for Pedestrians and Pedal Cyclists Layout and Dimensions

Summary: This Standard gives layout and dimensional requirements for the planning and design of subways for the exclusive use of pedestrians and for the combined use of pedestrians and pedal cyclists. Guidance is also included on headroom and width requirements for subways incorporating bridleways, surface finishes, lighting, drainage, handrailing, markings and signs.

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PART 1

TD 36/93

SUBWAYS FOR PEDESTRIANS AND PEDAL CYCLISTS LAYOUT AND DIMENSIONS

Contents

Chapter

1. INTRODUCTION

General

1.1 This Standard updates and supersedes TD 2/78, "Pedestrian Subways: Layout and Dimensions" and TD 3/79, "Combined Pedestrian and Cycle Subways: Layout and Dimensions". Both those Standards are hereby withdrawn.

1.2 Principal changes to those previous Standards and new concepts introduced in this Standard are:

a. Alternative cross-sections both wider than normal and narrower than normal are introduced to increase the number of options available.

b. Personal security aspects have been given greater prominence.

c. Features that are helpful to elderly people, disabled people, and visually impaired people, as well as to people with prams and pushchairs have been updated.

d. Helical stairs and ramps built around central voids are included as an alternative to straight stairs and ramps for sites where the space is restricted.

Scope

1.3 This document gives the requirements for geometric alignments and cross-sections of subways, access ramps and stairs for use by pedestrians and access ramps for use by cyclists. The headroom and width requirements for equestrians are also given. There will be situations where constraints could prevent the desirable subway standards being achieved. In such situations a subway built to the minimum dimensions may be preferable to not providing a grade separated crossing.

1.4 This document does not give specification requirements for the construction of subways, nor for any elements or materials of which they are constructed.

Implementation

1.5 This Standard should be used forthwith on all schemes for the construction and improvement of trunk roads, including motorways, currently being prepared provided that, in the opinion of the Overseeing Department, this would not result in significant additional expense or delay progress. Design Organisations should confirm its application to particular schemes with the Overseeing Department.

2. FACTORS AFFECTING SUBWAY PROVISION AND CHOICE OF CROSS-SECTION

General

2.1 There are a large number of factors affecting the choice whether to provide a subway, and if so the type of cross-section. For this reason it is preferable that each case is considered on its merits having regard to the particular local situation. The following factors have been found to be significant in the consideration process:

- Volume of pedestrian traffic;
- Volume of cycle traffic;
- Whether the access route is to a school, playground or other local amenity;
- Type of road to be crossed and its total width;
- Speed of vehicles on the road and the volume of traffic including the proportion of heavy goods vehicles;
- Location, convenience and safety of alternative routes for pedestrians and cyclists;
- Use by children, elderly people, visually impaired people and disabled people including wheelchair users, and people with prams and pushchairs;
- Environmental aspects;
- Other aspects particularly relevant to the local situation;
- Cost of subway;
- Effects of changes in local land use over the next 15 years including any prospective recreational routes for pedestrians and cyclists.

Siting of Subway

2.2 The line of the subway and its accesses should preferably be close to the main line of travel for the majority of subway users in order to maximise the use of the facility. The subway should be kept as short as possible. Where the number of pedestrians is very large an option might be to raise the level of the road to reduce the height and length of pedestrian access stairs and ramps.

2.3 Buried services may affect the siting of a subway if these cannot be re-routed economically and without significant disruption to highway users.

Types of Subway

2.4 Subways may be designed for use by pedestrians only or by both pedestrians and cyclists. Subways for joint usage should normally be segregated, and preferably by level difference, however an unsegregated shared surface for both pedestrians and cyclists may be suitable in certain situations. Additional headroom may be required where bridleways pass through subways.

Personal Security Aspects

2.5 Wide approaches, subway alignments with good through visibility, and good lighting, all within the view of passing pedestrians and passing traffic, will help to minimise pedestrians' fears for their personal safety. Subways and their accesses should be designed to avoid places of concealment in the interests of personal security.

2.6 Vandalism can be a major problem in urban and peri-urban subways. Attractiveness and good design are important factors in developing the use of a subway. It has been found that frequent cleaning and maintenance to preserve appearance are vital in this respect, particularly in the early life of the subway. Finishes should be of high standards, good in appearance and easy to maintain throughout the life of the subway.

2.7 Physical barriers may be necessary in some locations to prevent cars and motorcycles being driven into subways or subway approaches.

3. CROSS-SECTION OF SUBWAYS FOR PEDESTRIANS ONLY

3.1 Three types of pedestrian subway cross-section may be used:

a. a **wide section**, suitable for those situations where a subway forms an extension to a footpath system not less than 5.0m in width carrying large numbers of pedestrians or where for aesthetic reasons the normal section is not considered to be suitable,

b. a **normal section**, suitable for the majority of situations,

c. a **narrow section**, for situations with small numbers of pedestrians where the normal section could not be justified on cost grounds.

3.2 If circular or other shaped sections are proposed, they should circumscribe the rectangular sections with dimensions not less than the minimum laid down in this Standard.

3.3 The minimum height and width of subways for pedestrians only are given in Table 1.

3.4 Sight distance of 4.0m or more should be provided at corners and changes of direction. For calculation purposes, pedestrians can be assumed to be 0.4m away from an adjacent vertical wall. The visibility envelope should extend from a height of 1.5m representative of an adult to 0.6m for a child. Inside corners rounded off to a radius of 4.6m will meet this criteria.

Table 1

Minimum dimensions for pedestrian-only subways

TYPE OF SUBWAY	LENGTH OF SUBWAY (m)	HEIGHT (m)	WIDTH (m)
Wide	-	2.6	5.0
Normal	< 23	2.3	3.0
	≥ 23	2.6	3.3
Narrow	-	2.3	2.3

4. CROSS-SECTION OF SUBWAYS FOR COMBINED USE

General

4.1 Pedestrians and cyclists can share the use of a single subway and associated ramps. For combined use to be successful the existing travel lines and those expected in the future should be investigated for both pedestrians and cyclists. Short diversions of one mode may be necessary to encourage the other mode to use the dual facility.

4.2 Guidance given on non-rectangular cross-sections in paragraph 3.2 is also applicable to this section.

Segregated Subways

4.3 The width for pedestrians should be segregated from the width for cyclists, preferably by level difference, as shown in Fig 1. Alternatively, segregation can be achieved by means of guardrailing which would serve as physical barrier to separate the footpath users from cycle track users. Where these measures are not suitable, a raised dividing line and tactile paving should be provided to assist visually impaired people.

4.4 The minimum dimensions for cross-sections are given in Table 2.

4.5 A typical cross-section of a subway to serve pedestrians and cyclists using the minimum internal dimensions for a segregated subway 20m long is given in Fig 1. The safety margin of 0.5m between the cycle track and subway wall may be haunched to deter pedestrians.

4.6 Stopping sight distances for cyclists given in Table 3 should be provided within the subway and on the approaches. These are illustrated in Fig 2. These distances are applicable to design speeds of 10 km/h or less on sharp curves and straights with staggered barriers, and 25 km/h or less on large radii and straights. The design speeds are not significantly affected by gradient. For layout purposes, the line of sight of a cyclist should be taken from a point 1.5m high, and at least 0.6m away from the edge of the cycle track. The design of subway walls, wingwalls, associated ancillary earthworks and landscape works should take account of these visibility requirements.

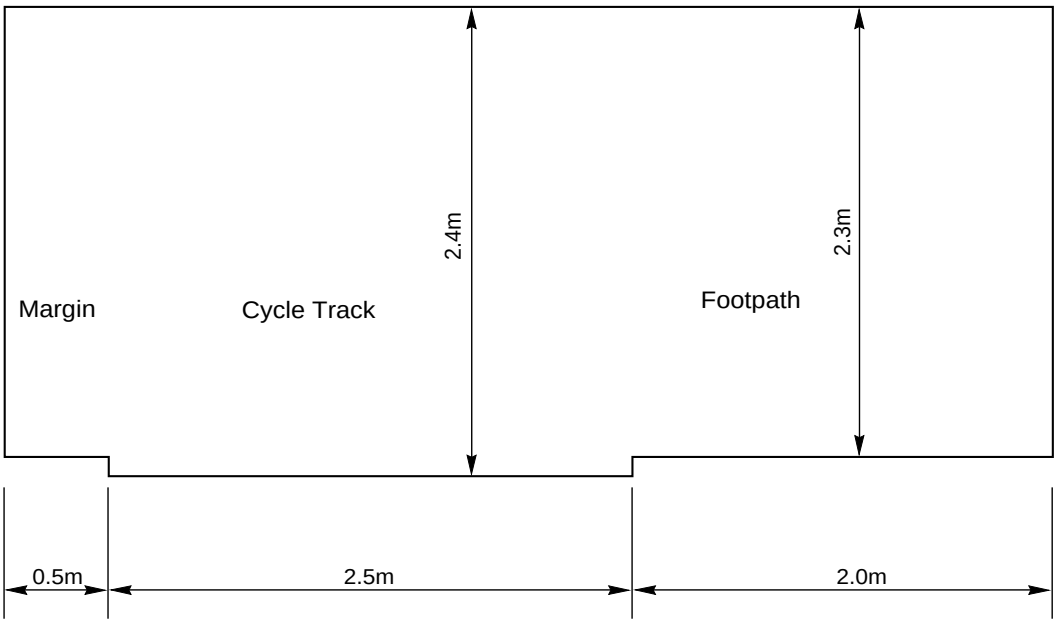


Figure 1 A cross-section of a typical segregated subway for combined use

Table 2

Minimum dimensions for segregated subways for pedestrians and cyclists

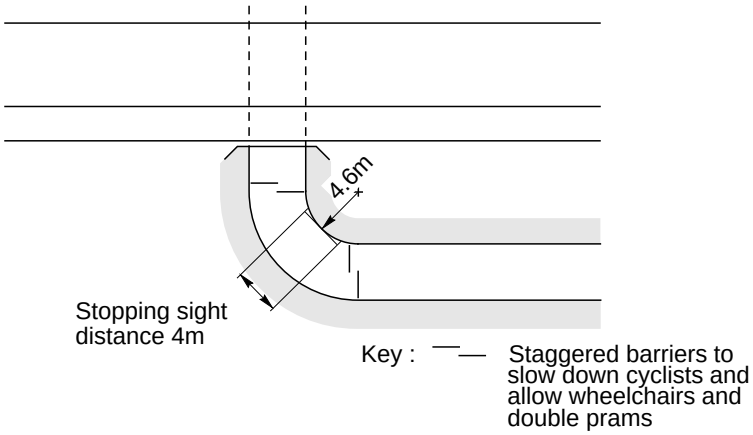
SUBWAY LENGTH (m)	HEIGHT (m)		WIDTH (m)		
	Cycle track	Footpath	Margin between subway wall and cycle track	Cycle track	Footpath
< 23	2.4	2.3	0.5	2.5	2.0
≥ 23	2.7	2.6			

Table 3

Stopping sight distances for cyclists

DESIGN SPEED (km/h)	MIN STOPPING SIGHT DISTANCE (m)	MIN RADIUS OF CURVATURE OF WALLS ADJACENT TO CYCLE TRACK (m)	MIN RADIUS OF CURVATURE OF WALLS ADJACENT TO FOOTPATH (m)
≤ 10	4.0	4.6	4.6
≤ 25	26.0	68.0	28.5

(i) Design speed ≤ 10 km/h



(ii) Design speed ≤ 25 km/h

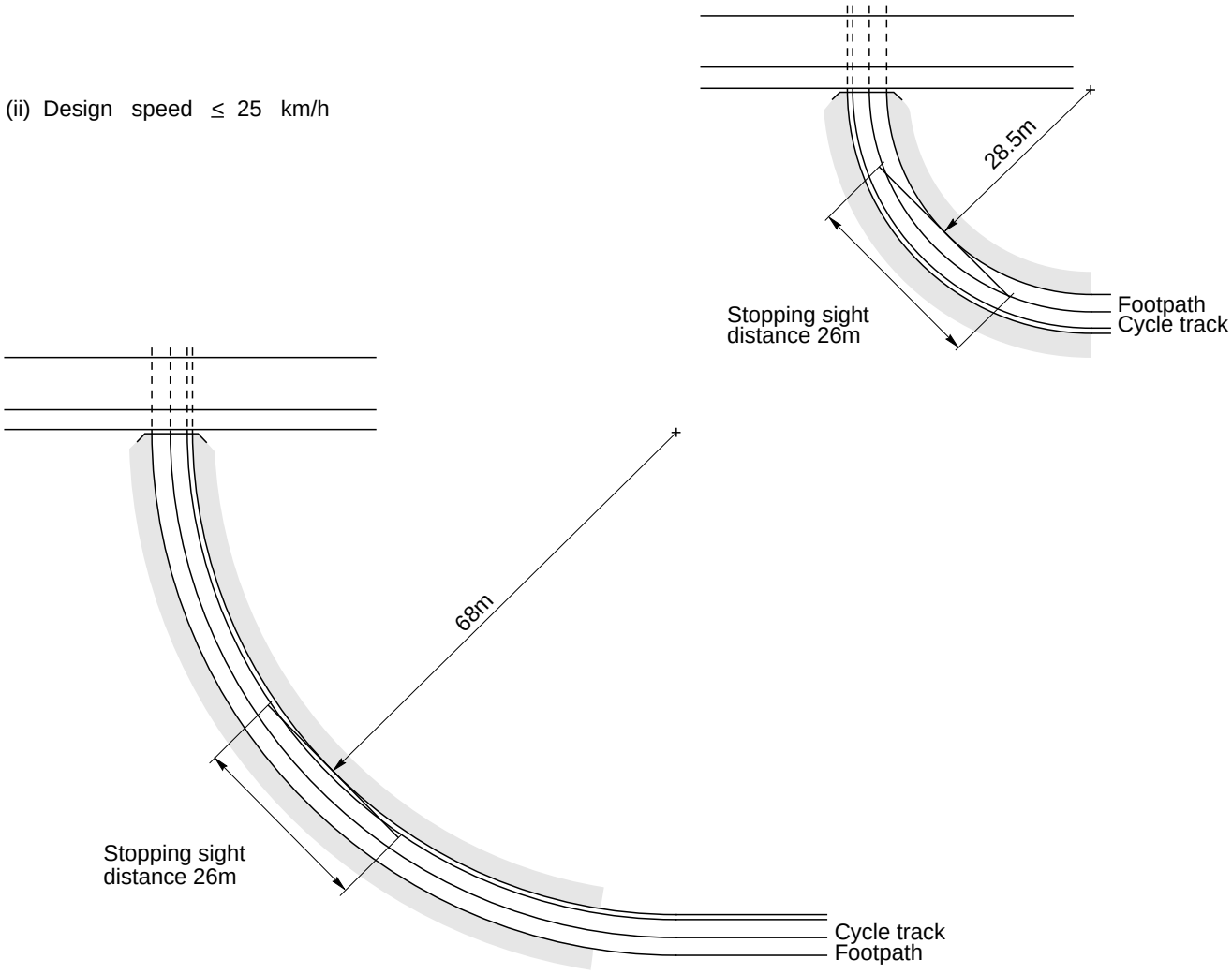


Figure 2 Stopping sight distances for cyclists

Unsegregated Subways

4.7 Where the total number of pedestrians and cyclists is small, an unsegregated subway may be acceptable, particularly for short subways with good through visibility.

4.8 The minimum dimensions for cross-sections are given in Table 4. At sites where space is restricted or where the total number of pedestrians and cyclists is very small, the subway width may be reduced to 3.0m.

4.9 An alternative where the number of cyclists is expected to be small is to provide a narrow pedestrian subway in accordance with Table 1. Suitable signs would be required to indicate that the cyclists should dismount before entering the subway and that no cycling is permitted within the subway. It would also be necessary to ensure that the cycle track is legally terminated either side of the subway.

Subways for Equestrian Use

4.10 Where bridleways are to be incorporated into subways, the minimum headroom should be 3.7m, except where suitable facilities for the riders to dismount and remount are provided, when the headroom may be reduced to 2.7m. Suitable signs should be erected to indicate that equestrians are required to dismount if the latter option is adopted. The minimum width of a subway for equestrian use should be 3.0m.

Table 4

Minimum dimensions for an unsegregated subway for pedestrians and cyclists

SUBWAY LENGTH (m)	HEIGHT (m)	WIDTH (m)
< 23	2.4	4.0
≥ 23	2.7	

5. ACCESS

General

5.1 Access to the subway may be via ramps or stairs which may be straight or helical. Consideration should be given to providing both ramps and stairs to suit able-bodied, cyclists, people with prams and pushchairs, those with heavy shopping or luggage, visually impaired people and disabled people including wheelchair users.

5.2 Access ramps or stairs should normally be the same width as the subway; except when multiple ramps and stairs are connected to a single subway, they may be narrower.

5.3 The thresholds of all subway accesses, tops and bottoms of flights of stairs, should be provided with a system of tactile pavings to assist visually impaired people. For details, see Ref 21.

Access Ramps

General

5.4 Ramps should not be allowed to run into the subway beyond the threshold as there could be a risk of cyclists hitting the soffit of the subway.

5.5 Landings should be provided at changes of direction, and changes of gradient. Landings should be used, even on straight ramps, so that the total rise between landings is not greater than 3.5m. Landings should normally be the same width as the ramp, and 2.0m or more long measured along the centre line of the landing. All landings should be approximately horizontal, and adequately drained.

Pedestrian Ramps

5.6 Gradients of 5% or shallower are preferred for access ramps where significant numbers of disabled persons or heavily laden shoppers are expected to use the subway. In other situations gradients shallower than 8% are preferred, but gradients up to 10% are permitted for short lengths in exceptionally difficult sites. Stepped ramps may also be considered at exceptionally difficult sites although wheelchair users find stepped ramps difficult to negotiate.

Cycle Ramps

5.7 In order to limit cycling effort to reasonable levels and to discourage cyclists from high speeds, the gradient of the access ramps should preferably be shallower than 3%, and should not normally exceed 5%. If space is very restricted a gradient of up to 7% may be adopted. In steep ramps of this type, staggered barriers would be desirable to encourage cyclists to exercise greater care and slow down, particularly on downhill bends, until they clear the steep ramp. See paragraph 6.20 for barrier details.

5.8 An effective way of controlling the speed of cyclists to less than 10km/h at or near the threshold of subway entrances leading to steep approach ramps is to introduce staggered barriers as shown in Fig 2.

Straight Access Stairs

5.9 The dimensions for access stairs are given in Table 7.

5.10 The headroom between any ceiling and stair measured vertically should not be less than the height of the subway.

5.11 Stair flights should normally comprise no more than 20 steps between landings. The landings should normally be the same width as the stair, and preferably 1.8m deep, or a minimum of 1.2m depth in restricted sites. There should not be more than 3 successive flights without a change of direction of 30 degrees or more at a landing. All landings should be approximately horizontal, and adequately drained.

5.12 Stair flights limited to 9 steps are preferred where significant numbers of disabled persons are expected to use the stairs.

5.13 Stair pitch should be uniform for a subway system, with steps of equal rise.

5.14 Nosings on the stairs should be rounded to a 6mm radius without overhang, and should be colour contrasted from the rest of the step.

5.15 The stair elements; rise, going, nosing and pitch are illustrated in Fig. 3.

Table 7 Dimensions for straight stairs

RISE r (mm)			GOING g (mm)			PITCH (degrees)	
Min	Max	Optimum	Min	Max	Optimum	Max	Optimum
100	150	130	280	350	300	33	27

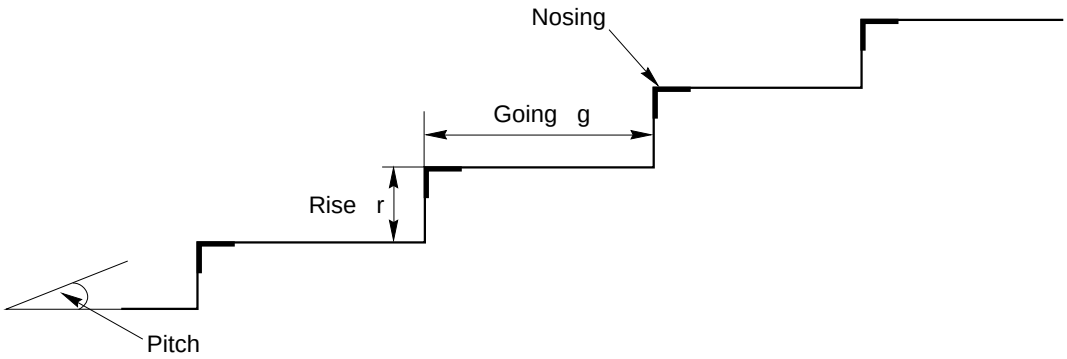


Fig. 3 Stair elements

Helical Access Stairs

5.16 At sites where space is restricted helical stairs may offer a useful alternative to straight stairs.

5.17 The dimensions for helical stairs are given in Table 8.

5.18 The requirements for straight stairs in paragraphs 5.10 to 5.14 also apply to helical stairs.

5.19 If structural columns are used adjacent to the central void, they should be slender so as not to create places of concealment.

Table 8 Dimensions for helical stairs

RISE r (mm)	**GOING g (mm)**			**2r+g**	
	Min inner going	Min centre going	Max outer going	Min	Max
150 to 190	150	250	450	480	800

6. CONSTRUCTION DETAILS

Surface Finishes

Walls

6.1 The walls are the most conspicuous and vulnerable areas and their finishes will affect the whole character of the subway. Some finishes are difficult to keep clean and have poor quality of light reflection. Important considerations in the selection and specification of finishes are their resistance to vandalism and the ease with which any graffiti can be removed.

6.2 For these reasons, porous open surfaced materials such as facing bricks and exposed aggregate finishes are best avoided. Mosaics and other hard impervious surfaced materials have performed well in the past. They are reasonably graffiti-proof and easy to clean.

6.3 In situ structural concrete and precast concrete are more prone to graffiti; but this can be discouraged by the application of suitable plastic paints to make walls impervious and easier to clean.

6.4 Bold designs with bright multiple colours in irregular or random patterns, and murals with themes suggested by children can help to create an atmosphere that the subway is well-used and therefore safer. This has also been found to deter vandalism.

6.5 Mosaics and tiles on external arrises are vulnerable to damage. They should be inset and stopped at least 0.10m short of these arrises and another material used for the arrises. Hard cement mortar or structural concrete, treated with plastic paint are suitable materials.

6.6 Mosaics or tiles will not, however, be satisfactory for those subways where the risk of structural vandalism is anticipated; consideration should be given to the use of a suitable robust finish such as structural concrete coated with graffiti-proof paint.

Floors Ramps and Stairs

6.7 Finishes may be subjected to all weather conditions and to salting and gritting in winter. They should have an adequate and durable slip resistance both when wet and when dry. The same advice should be followed for footpaths, cycle tracks, access stairs and access ramps.

6.8 It is recommended that the coefficient of friction between the dry surface and rubber, leather or composition soled shoes should not be less than 0.6, and when wet this coefficient of friction should not reduce to less than 0.4. A guide to the slip resistance of floor finishes is given in BS 5395: Part 1.

Ceilings

6.9 Concrete soffits should be treated to maximise the amount of light reflection. Finishes known to have been successful include plastic paint with a matt white finish, Tyrolean and cement sprays.

6.10 Suspended ceilings should not be used.

Lighting

6.11 Daylight penetration into the subway entrances should be utilised wherever possible, with surface finishes chosen to enhance daylight illumination.

6.12 Artificial lighting should always be provided for use in the hours of darkness both inside the subway and on the subway approaches. Continuous use of lighting, in the daytime also, will encourage subway use in many cases.

6.13 The levels of illumination given in BS 5489: Part 9 are recommended for subways, stairs and ramps in rural and urban areas. Further information is contained in Ref 20.

6.14 Vandal-proof lighting systems should generally be used. Luminaires recessed into the ceiling or into the tops of walls have been successful in the past although surface mounted corner light fittings should be satisfactory in most situations provided they do not unduly encroach into the minimum cross-section required by this standard.

Drainage

6.15 The floors of pedestrian subways should be cambered with transverse slopes of about 3% and shallow channels on each side. For segregated subways the drainage should be at the edge or edges of the cycle track. It is preferable for the subway to slope longitudinally at a gradient of not less than 0.7%.

6.16 The drainage system should be large enough to deal with the water and detritus entering the subway from the ramps and stairs. The specification and siting of gulley gratings and channel gratings should be carefully considered in the interests of women with stiletto heeled shoes and cyclists with narrow tyred wheels. Lockable or hinged gratings are recommended in situations where vandalism or theft is a problem. Adequate provision should be made for the cleaning and maintenance of gulleys and drains.

Handrailing

6.17 Handrails should be provided on both sides of stairs and ramps. Central handrails may be advisable where the width of stairs or ramps exceeds 3.0m.

6.18 To assist elderly people and disabled people, the handrailing height should be 1.0m above the level surface, 0.9m above a ramp and 0.85m above the nose of a step.

6.19 People with frail or arthritic hands have difficulty in gripping objects. The most comfortable sections for handrails are round sections between 45mm and 50mm in diameter and there should be a gap of 45mm between the rail and the wall, see Fig 4.

6.20 Where used, bollards and metal railings should be between 1.0m and 1.2m high. The mininum access gaps between these barriers should be 1.2m wide for the passage of wheelchairs and double prams. To assist the visually impaired, the tops of these barriers should be applied with colour contrasting paints.

Markings and Signs

6.21 Advice on the signing, including marking, for subways is contained in the references in Chapter 7 of this Standard.

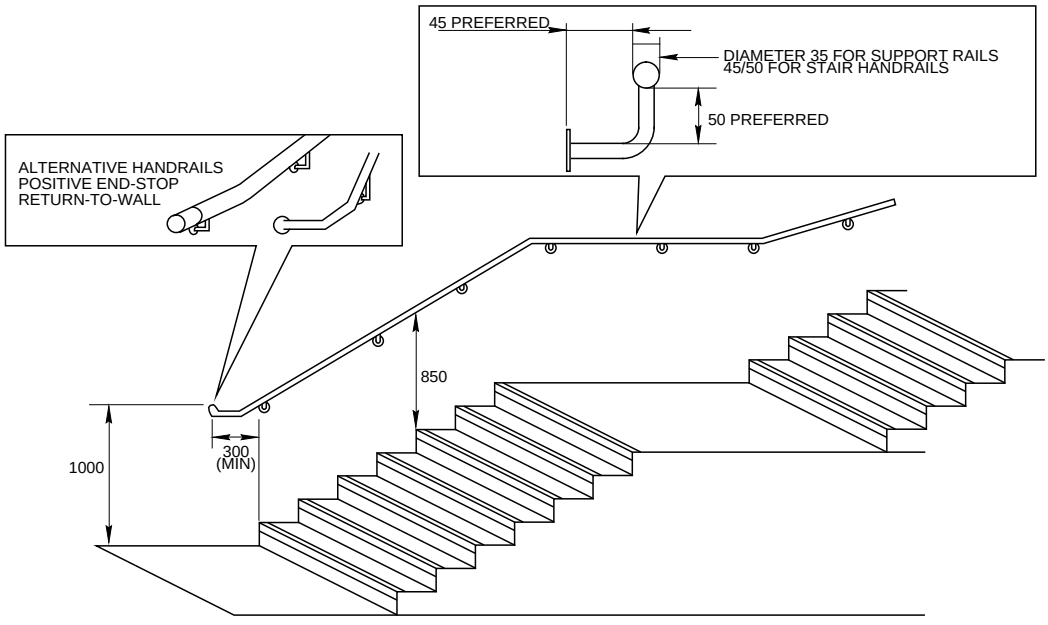


Figure 4 Handrailing details

7. REFERENCES

The following documents provide useful background information relevant to subway layout and dimensions:

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12. Traffic Advisory Leaflet 4/90: Tactile Markings for Segregated Shared Use by Cyclists and Pedestrians. (Traffic Advisory Unit).

13. Traffic Signs Regulations and General Directions 1981 and all amendments.

14. Traffic Signs Manual - Chapters 1, 3, 4, 5 and 14.

15. BS 5395: Part 1: Code of practice for the design of straight stairs.

16. BS 5395: Part 2: Code of practice for the design of helical and spiral stairs.

17. BS 5810: Code of practice for access for the disabled to buildings.

18. BS 6180: Code of practice for protective barriers in and about buildings.

19. BS 5489: Part 9: Code of practice for lighting for urban centres and public amenity areas.

20. Technical Report, TR13: Lighting of Pedestrian Subways (1990) Institution of Lighting Engineers, Lennox House, 9, Lawford Road, Rugby CV21 2DZ.

21. M Williams, Tactile markings for the guidance of visually handicapped pedestrians (TRL).

8. ENQUIRIES

All technical enquiries or comments on this Standard should be sent in writing as appropriate to:-

Chief Highway Engineer
The Department of Transport
St Christopher House
Southwark Street
London SE1 OTE

T A ROCHESTER
Chief Highway Engineer

The Deputy Chief Engineer
The Scottish Office Industry Department
Roads Directorate
New St Andrew's House
Edinburgh EH1 3TG

J INNES
Deputy Chief Engineer

The Director of Highways
Welsh Office
Y Swyddfa Gymreig
Government Buildings
Ty Glas Road
Llanishen
Cardiff CF4 5PL

K J THOMAS
Director of Highways

Chief Engineer - Roads Service
Dept. of the Environment for
Northern Ireland
Commonwealth House
Castle Street
Belfast BT1 1GU

W J McCOUBREY
Chief Engineer - Roads Service

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