1 Introduction

The Government is committed to comprehensive civil rights for disabled people. An integrated transport policy, which encompasses accessible public transport, public transport infrastructure and a barrier-free pedestrian environment is fundamentally important to delivering that commitment.

Part III of the Disability Discrimination Act 1995 (DDA) gives disabled people a right of access to goods, facilities, services and premises. These rights are being phased in over the period 1996 to 2004. Since 1996, it has been unlawful for service providers to treat disabled people less favourably than other people for a reason related to their disability.

Since October 1999 service providers have had to take reasonable steps to change practices, policies and procedures which make it impossible or unreasonably difficult for disabled people to use a service; to provide auxiliary aids or services which would make it easier for, or enable, disabled people to use a service; and to overcome physical features, which make it impossible or unreasonably difficult for disabled people to use a service, by providing the service by a reasonable alternative method. From October 2004, service providers may have to alter the physical features of premises if the service continues to be impossible or unreasonably difficult for disabled people to use.

These requirements apply to facilities and services in the pedestrian environment and in transport related infrastructure: bus stations and stops, airports and rail stations [1] for example. Transport vehicles are covered by separate provisions under Part V of the DDA.

There is already a range of advice, guidance and codes of practice drawn up to guide highway engineers and others in local authorities and the transport industries on the best ways to meet the needs of disabled people. The recently published British Standard (BS) 8300, Design of buildings and their approaches to meet the needs of disabled people Code of practice, for example, covers many aspects of good design for disabled people. Outside the United Kingdom (UK), many other countries have produced guides to good practice, as they too move towards attaining better access for disabled people. Relevant publications that were consulted during the preparation of this report are listed in the bibliography.

The introduction of legislation in this field requires a fresh look at what guidance already exists, whether it is up-to-date, consistent and comprehensive and whether there are overlaps and omissions. Ultimately the courts will determine whether a service provider is in breach of the new laws. These guidelines do not have any legal status and compliance with them should not be regarded as complying with the DDA, but they will provide guidance on established best practice in a general sense that relevant organizations can apply to their particular situation.

Although the main purpose of these guidelines is to provide good access for disabled people, designs that satisfy their requirements also meet the needs of many other people. Those who are travelling with small children or are carrying luggage or heavy shopping

will all benefit from an accessible environment, as will people with temporary mobility problems (e.g. a leg in plaster) and many older people. Thus, the overall objective of this guide is to provide inclusive design and through that achieve social inclusion.

One further point should be borne in mind when using this guide. Part V of the DDA enables regulations to be made concerning access onto and within buses, coaches, taxis and trains. The amount of space that is available, particularly in taxis and smaller buses, is quite restricted and because of this the dimensions required by the regulations, for example to accommodate a passenger in a wheelchair, are limited. Generally there is more space available in the built environment, and the guidelines in this report recognize that fact. People who wish to travel by public transport, particularly those who use a wheelchair, should take account of the amount of space available on buses, taxis and trains and should not be misled into believing that a wheelchair that can be used in the pedestrian environment will necessarily be usable on public transport vehicles. The Department for Transport (DfT) and the British Healthcare Trades Association (BHTA) have issued advice to wheelchair user on public transport in Get Wheelchair Wise which is available free of charge from the DfTs Mobility and Inclusion Unit.

There are solutions to the majority of access difficulties in existing buildings and in the pedestrian environment. Frequently the best options are not the most expensive nor the most disruptive. Access audits can provide detailed analysis of potential and actual problems and can be made based on plans for new buildings as well as by surveying existing ones. Where access audits are made, they must take account of the full range of requirements of disabled people, including those with sensory and cognitive impairments. Audits should be carried out by recognized, specialist auditors or consultants. Improvements to access in existing buildings may be made most economically as part of regular repair, maintenance, refurbishment and redecoration. Whenever work of this kind is to be undertaken, access provision should be reviewed to see how it can be improved.

Beyond specific opportunities like these, auditing problems of access should be part of the process of developing guidance, strategies and implementation programmes, which themselves should form part of Local Transport Plans, local bus and local walking strategies.

Where the area concerned is an historic environment, changes needed to improve accessibility should be made with sensitivity for site context. Early consultation with those responsible for managing the historic environment should ensure that any changes made do not detract from the appearance of the area.

The sequence of topics described in this guide generally follows that used by the Institution of Highways and Transportation (IHT) in their 1991 Revised Guidelines, Reducing Mobility Handicaps Towards a Barrier Free Environment. Thus it starts with the pedestrian and street environment and then goes on to deal with public transport buildings and infrastructure. At the start of the first section there is basic information on the space needed by people; walking, using wheelchairs, walking with sticks etc. Towards the end of the guide, there is a list of the sources of information used in its

preparation, subdivided by subject area. There is also a summary card listing the dimensions given in the text.

[1] The Strategic Rail Authority published a revised code of practice, Train and Station Services for Disabled Passengers in February 2002. That code should be used as the main reference document for disability provision in the rail environment.

2 Basic human factors information

2.1 Definitions

It is essential that design for people with mobility impairments should be to the highest possible standards. This requires knowledge of the capabilities of different types of person. This section provides information on the basic human requirements for ease of movement. In designing or modifying facilities the aim should be to be generous in the allocation of space.

The term disability is a broad one. It includes people with physical, sensory or mental impairment; at a conservative estimate between 12 and 13 per cent of the population have some degree of impairment. Many, though not all, face barriers to movement in the environment. This guide is intended to show how these barriers can be removed or at least reduced, but it does have a wider relevance because there are many other people not conventionally considered to have a disability who also encounter barriers to movement.

People with small children, people carrying heavy shopping or luggage, people with temporary accident injuries and older people can all benefit from good design of the pedestrian and transport environment. Without a barrier free environment, many of these people will be mobility impaired.

While it is true that there are many aspects of design in the pedestrian environment that are helpful to all or most disabled people (and many others as well) there are also some specific facilities needed by people with a particular kind of impairment.

Manual wheelchair users need sufficient space to be able to propel the chair without banging their elbows or knuckles on door frames or other obstacles. But someone who walks with sticks or crutches also needs more space than a non-disabled walker; so too does a long cane user or person carrying luggage, or a lot of shopping bags, or with small children. Thus providing adequate clear space on pavements, along passages in public buildings, through doorways etc, is of benefit to many people.

Similarly, visually impaired people need a good level of lighting in transport buildings and elsewhere and, if information such as a train or bus timetable is displayed, a print size that they can read easily. But almost everyone else benefits from good lighting, not least because it gives a greater sense of security, and practically everyone finds reading timetables easier if the print is clear and large.

These are just two examples of design requirements that are essential for people with a particular impairment but which have a much wider relevance.

More specific needs, however, can be just as important for people with certain types of impairment. For example, the rotating cone below the push button box on a controlled pedestrian crossing is essential if a deaf blind person is to know when the steady green man signal is lit.

This guide attempts to cover both those requirements that are general in nature and those that are more specific.

As noted at the start of this section, the term disability is a broad one. The DDA defines a person as having, a disability if he has a physical or mental impairment which has a substantial and long term adverse effect on his ability to carry out normal day-today activities.

There are various ways or models used to define disability, but in functional terms this guide is mainly concerned with the following:

Locomotion, which includes people who use wheelchairs and those who can walk but only with difficulty often using some form of aid such as a stick or walking frame. Approaching 70% of disabled people have locomotion difficulties: those with walking difficulties outnumber wheelchair users by about 10:1.

Seeing, which can be sub-divided into blind and partially sighted people. It is estimated by the Department for Work and Pensions (DWP) that there are almost two million people in Great Britain with a significant sight loss.

Hearing, which can also be sub-divided into those who are profoundly deaf and those with impaired hearing, ranging from severe to mild deafness. The Royal National Institute for Deaf People (RNID) estimates that there are over eight million deaf or hard of hearing people in the UK of whom approaching 700,000 are severely or profoundly deaf.

Reaching, stretching and dexterity, frequently the result of arthritis, which can make these movements painful and difficult, or of muscular dystrophy causing a loss of muscular strength, or of complaints of the nervous system.

Learning disability, making it hard to understand complicated information or to use complex machines (like some ticket machines).

It should be remembered that these categories are not mutually exclusive. Many disabled people, particularly older people, have more than one impairment. The following paragraphs give some basic information on the space needed by people when they are standing or moving. Of course there is a lot of variation in this, but if the dimensions

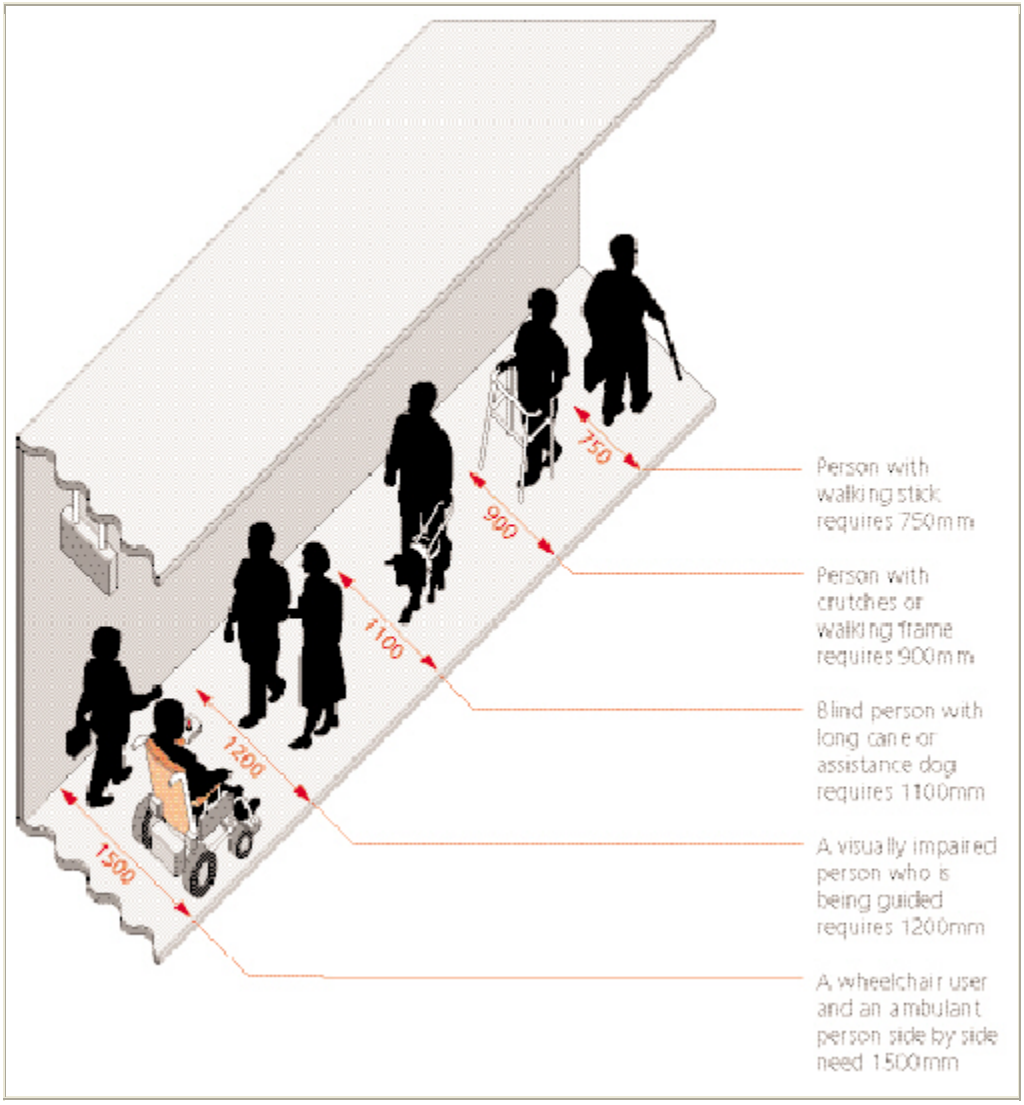
given below are used then the great majority of disabled people will be able to move around buildings and the environment much more easily.

2.2 Mobility impaired and visually impaired people

Someone who does not use a walking aid can manage to walk along a passage way less than **700mm** wide, but just using a walking stick requires greater width than this; a minimum of **750mm**. A person who uses two sticks or crutches, or a walking frame needs a minimum of **900mm**, a blind person using a long cane or with an assistance dog needs **1100mm**. A visually impaired person who is being guided needs a width of **1200mm**. A wheelchair user and an ambulant person side-by-side need **1500mm** width.

Unobstructed height above a pedestrian way is also important, especially for visually impaired people. Generally, this should be a minimum of **2300mm** except on sub-surface station platforms where it should be **3000mm**. Where a sign is suspended over a footway or pedestrian area, for example in a railway station a minimum clearance of **2100mm** is acceptable (**2300mm** on cycleways). Where trees overhang a footway it is advisable to cut them back to at least **3000mm** clear height to allow room for regrowth.

Mobility impaired and visually impaired people



2.3 Wheelchair users

Although a minority among disabled people, wheelchair users need quite a lot of space to move around comfortably and safely: usually more than mobility impaired people, although those who walk with two sticks can occupy a greater width than someone using a wheelchair.

A comprehensive set of measurements of wheelchair visitors to the Mobility Roadshow (1999) gave the figures for length and width summarized on the opposite page. The range of dimensions is considerable, particularly that for overall length. The greatest lengths are those of conventional wheelchair users with leg supports (maximum 1545mm, though this was the only measurement out of 745 of more than 1500mm) and electric scooters with a maximum of **1500mm**. Conventionally seated wheelchair users do not occupy more than approximately **1250mm**. However, if a wheelchair user has a personal assistant, their combined length will be typically **1750mm**.

The figures given for width, with a 95th percentile of slightly over **700mm** at maximum (for powered chairs), do not make allowance for the wheelchair users elbows and hands. The ISO standard for wheelchairs (ISO 7193) notes that to propel a wheelchair manually needs a clearance of not less than **50mm**, preferably **100mm**, on both sides.

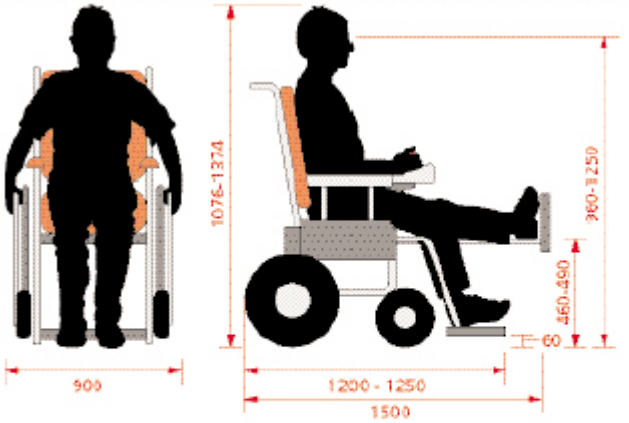
The Mobility Roadshow survey also measured the heights of wheelchair / users. The overall mean height for all types of wheelchair users was **1243mm**, with a 5th percentile of **1076mm**, 95th percentile of **1374mm** and a maximum of just over **1450mm**. As with overall length, scooter users gave slightly greater figures, with a mean height of **1340mm**, 5th and 95th percentiles of **1202mm** and **1438mm** respectively and a maximum of **1502mm**.

Other basic measurements which are of importance when considering design standards to accommodate wheelchair users are:

- Eye height, which is around **120-130mm** below seated height giving a 5th-95th percentile range for wheelchair users from **960mm** to **1250mm** (**1080mm** to **1315mm** for scooter users)
- Knee height, **500mm** to **690mm**
- Seat height, **460mm** to **490mm**
- Ankle height, manual wheelchair users **175mm** to **300mm**; electric wheelchair users **380mm** to **520mm**
- Height to bottom of foot support, **60mm** to **150mm**.

The ability of a person in a wheelchair to reach, sideways or forward, is also important and a number of guidelines give figures for this.

Wheelchair users



Note:

Requirements in transport regulations introduced under the Disability Discrimination Act 1995 are based on an occupied wheelchair 1200 x 700mm.

Wheelchairs that are larger than this can and should be catered for in the built environment, but it is not feasible to provide for larger wheelchairs on public transport.

Length of wheelchair and user (excluding children)

Chair type	Mean (mm)	Min (mm)	Max (mm)	Percentiles (mm)	
				5th	95th
Attendant propelled	1080	742	1318	928	1197
Electric wheelchair	1107	758	1549	949	1328
New style manual chair	1033	707	1256	846	1183
Older style manual chair	1108	862	1357	919	1267
Electric scooter	1187	971	1500	1000	1402
All chairs	**1085**	**707**	**1549**	**894**	**1273**

Width of wheelchair (excluding children)

Chair type	Mean (mm)	Min (mm)	Max (mm)	Percentiles (mm)	
				5th	95th
Attendant propelled	596	520	674	528	658
Electric wheelchair	635	521	755	552	706
New style manual chair	638	511	741	579	702
Older style manual chair	616	511	722	560	686
Electric scooter	607	501	695	529	685
All chairs	**627**	**501**	**755**	**558**	**695**

Source: A survey of occupied wheelchairs to determine their overall dimensions and weight: 1999 Survey by R E Stait, J Stone and T A Savill. Unpublished Project Report, Transport Research Laboratory.

The distance that an individual can reach varies with both the size of the person and the height to which they are reaching. Reach distance forms an arc based on the shoulder level of the wheelchair user and can be measured as easy or comfortable (reach without much movement of the torso) and maximum or extended (just possible with movement of the torso). Recent research done for the preparation of the new Code of Practice (BS 8300) gives figures for comfortable and extended reach ranges. These are shown in the table below. The Code of Practice, which gives further and more detailed guidance on reach ranges, should be consulted when designing anything which people will have to touch, push, turn etc.

Dimensions associated with comfortable and extended reach ranges

Person	Access	Reach angle	Height (H)		Depth (D)	
			Comfortable mm	Extended mm	Comfortable mm	Extended mm
Wheelchair user	Front	+ 70°	1,000	1,150	90	120
		horizontal	(750)	(750)	180	230
		- 24°	650	650	120	200
	Side	+ 70°	1,060	1,170	100	135
		horizontal	(750)	(750)	220	310
		- 24°	665	630	165	230
Ambulant Disabled	Front	+ 70°	1,500	1,625	200	250
		horizontal	(850)	(850)	280	400
		- 24°	750	700	180	310

Note 1 Dimensions have been rounded to the nearest 5 mm.

Note 2 Dimensions in brackets are for the horizontal reference plane.

Note 3 It is assumed that any kneehole allows full reach capabilities.

Note 4 Maximum heights are measured from the 70° line; minimum heights from the -24° line

Note 5 For some activities, the recommended dimensions in the standard are extended beyond those resulting from the research trials on the basis of accepted practice.

Source: BS 8300 Design of buildings and their approaches to meet the needs of disabled people – Code of Practice.

The height of the feature button, handle etc, - which the wheelchair user has to reach is also important. As a general rule any features that are intended for use by people in wheelchairs, such as push buttons, switches, coin slots etc, should be no less than **750mm** and no more than **1200mm** above ground level. By leaning forward or sideways it is possible for a wheelchair user to reach beyond this range US data suggests an absolute range for sideways reach height from 230mm to 1370mm but placing controls or other features towards the extremes of this range should be avoided if at all possible.

Forward reach measurements are also important. Some wheelchair users find it difficult or impossible to lean forward: if practicable the distance forward, measured at chest height, should be no more than **500mm**; **600mm** should be the absolute maximum.

Manoeuvring space is needed for a wheelchair to turn corners or turn around. Skilled users of manual wheelchairs can turn through 360°° in a space no more than **1500mm** x **1500mm**, but this is insufficient for larger chairs, particularly outdoor electric wheelchairs (turning circle **2420mm**), electric pavement vehicles (turning circle **4350mm**) and for wheelchair users with extended leg rests.

Within transport related buildings, the following dimensions should be taken as the minima acceptable:

- Right angle turn (along corridor) **1200mm** x **1200mm**
- 180° turn (within corridor) **1600mm (width) x 2000mm (length)**

Users of electric scooters and large electric chairs may need greater space than this for 180° turns, but the dimensions given (as minimum) will accommodate users of self-propelled wheelchairs and the majority of electrically powered wheelchairs.

2.4 Walking distances

Walking distances were researched in some detail in the late 1980s and, based on the findings from these studies, the following are recommended:

Impaired group	Recommended distance limit without a rest
Wheelchair users	150m
Visually impaired	150m
Mobility impaired using stick	50m
Mobility impaired without walking aid	100m

These figures are average measures; there is a lot of variation between individuals. Gradients, weather conditions, whether there are handrails etc, will also affect the distances people are able to walk. US regulations, for example, note that on distances over 100 feet (30m) disabled people are apt to rest frequently. These regulations suggest that to estimate travel times over longer distances allowance should be made for two minutes rest time every 30 metres.

Research based on a follow-up study to the London Area Travel Survey found that of all the people with a disability who were able to walk at all, approximately 30 per cent could manage no more than 50 metres without stopping or severe discomfort and a further 20 per cent could only manage between 50 and 200 metres.

2.5 Standing

Standing is difficult and painful for some disabled people, particularly those with arthritis, rheumatism and back problems. In the same study as that mentioned above, nine per cent of the survey respondents could only stand for less than a minute without discomfort, 24 per cent could manage between one and five minutes and a further 22 per cent could stand for up to ten minutes. The findings from this study emphasize the importance of providing plenty of appropriately placed and designed seating at places where people may have to wait and along pedestrian routes.

3 Footways, footpaths and pedestrian areas

The distinction between a footway and a footpath is that a footway (usually called the pavement) is the part of a highway adjacent to, or contiguous with, the carriageway on which there is a public right of way on foot. A footpath has no contiguous carriageway. Where reference is made to one, it can generally be regarded as applying to the other for design purposes.

3.1 Widths

A clear width of **2000mm** allows two wheelchairs to pass one another comfortably. This should be regarded as the minimum under normal circumstances. Where this is not possible because of physical constraints **1500mm** could be regarded as the minimum acceptable under most circumstances, giving sufficient space for a wheelchair user and a walker to pass one another. The absolute minimum, where there is an obstacle, should be **1000mm** clear space. The maximum length of restricted width should be **6 metres** (see also Section 8.3). If there are local restrictions or obstacles causing this sort of reduction in width they should be grouped in a logical and regular pattern to assist visually impaired people.

It is also recommended that there should be minimum widths of **3000mm** at bus stops and **3500mm** to **4500mm** by shops though it is recognized that available space will not always be sufficient to achieve these dimensions.

Where a cycle track runs alongside a footway or a footpath best practice is to physically segregate the two as advocated in Local Transport Note (LTN) 2/86 Shared Use by Cyclists and Pedestrians.

If this is not possible, appropriate tactile surfaces should be used to identify the cycle and pedestrian paths (see Section 4.5). The cycle track should be at least **1400mm** wide with the cycle symbol on the ground every 50 yards. The pedestrian part should meet the standards given earlier in this section and should be separated from the cycle track by a raised dividing line **150mm** wide and **12 to 20mm high**, with a **50mm** wide top face.

3.2 Gradients (see Section 8.4 for design of steps and ramps)

There is general agreement among guidelines from many countries that an 8 per cent (1 in 12) slope is the maximum that may be used; anything greater than this will cause difficulties for manual wheelchair users. Most guidelines also agree that 5 per cent (1 in 20) is preferred. (A ramp is generally defined as a pathway with a slope of more than 5 per cent). The effects of different gradients have been described in the Swedish publication Streets for Everybody as:

- **1%** (1 in 100) - is never an obstacle.
- **2%** (1 in 50) - can be managed by most people (and also provides good drainage).
- **2.5%** (1 in 40) - can be managed by many people.
- Steeper than **2.5%** - impossible for many manual wheelchair users.

These figures may be regarded as a counsel of perfection as the terrain in many places imposes steeper gradients than 2.5 per cent, but the standard of 5 per cent should be borne in mind when designing new footpaths and pedestrian areas.

Steeper gradients than these can be managed by some wheelchair users, but only over very short distances (1000mm or less), for example on a ramp between a bus entrance and the pavement. Even over these short distances the maximum gradient used should be no more than **10 per cent (1 in 10)**. As a general rule, however, **8 per cent (1 in 12)** should be used as the absolute maximum. Not only is the physical effort of getting up a steeper gradient beyond many wheelchair users, but there is also a risk of the wheelchair toppling over.

Crossfall on footways and footpaths may be necessary to provide good drainage[2], but if too great, can make it difficult for wheelchair users. Recommendations contained in guidelines vary somewhat but, under normal circumstances, a figure of **2.5 per cent (1 in 40)** should be regarded as the maximum acceptable. Where possible, it is preferable to have a crossfall between **1** and **2 per cent**.

Variable crossfall, such as may be found when travelling along a street with vehicle cross-overs, can be irritating as it affects the steering of wheelchair users and can also cause problems for people with walking difficulties. Local authorities should take these problems into account when considering their policies on front garden parking in residential areas, which may result in the installation of cross-overs.

3.3 Fences and guardrails

If there is a steep slope or drop at the rear of the footway, precautions must be made to prevent wheelchair users running over the edge or blind or partially sighted people walking over it. Guardrails and barriers at the side of or across footways should be at least **1100mm high**; preferably **1200mm** measured from ground level.

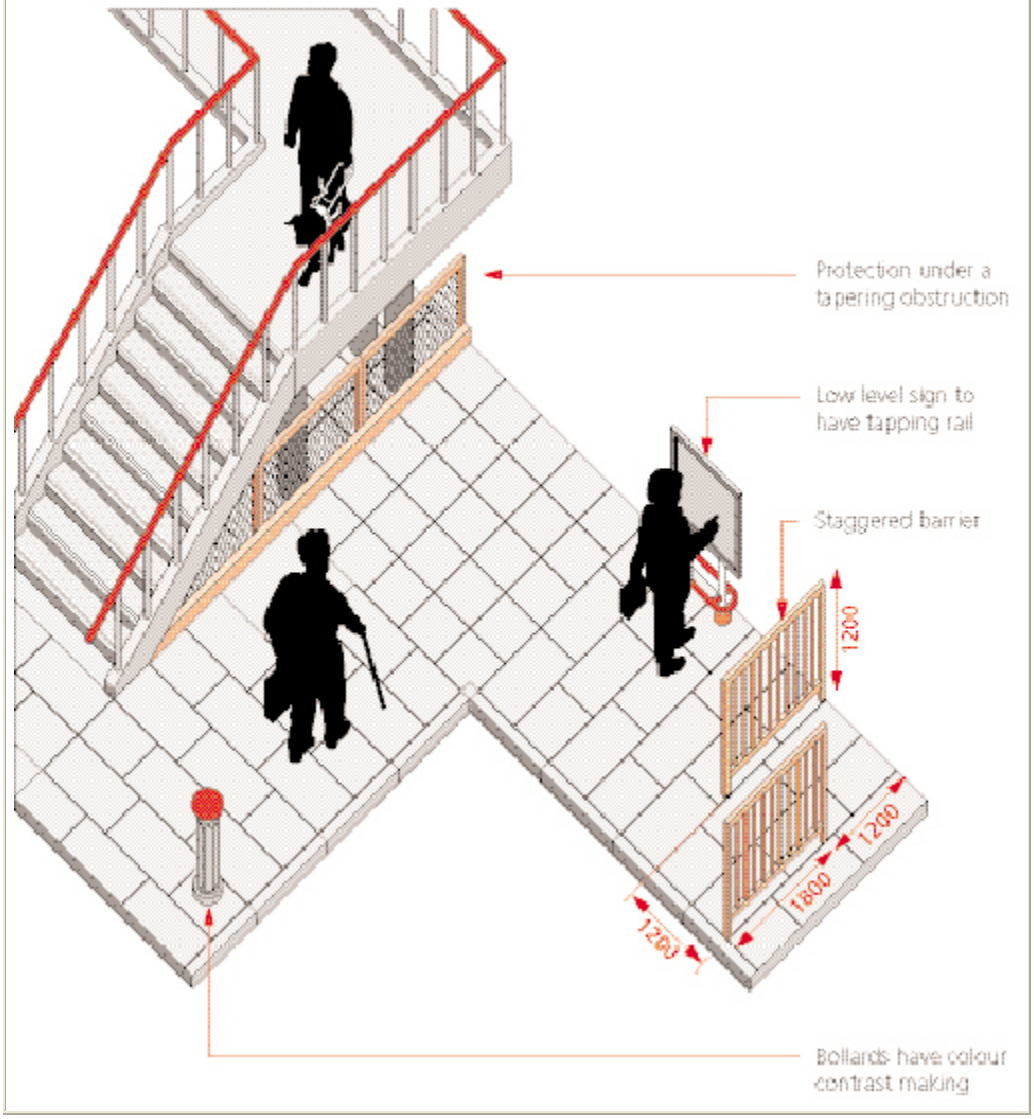
In common with other street furniture on or close by footways, guardrails should be clearly colour contrasted from their surroundings: simple galvanized railings are not acceptable. If, for reasons of economy, this type of railing has to be used it should at minimum have colour contrasted markings on it. These requirements also apply to rails around street works.

Guardrails should also be designed to prevent guide dogs from walking under the rails, but there should be sufficient openings between vertical members to ensure that children and wheelchair users can see, and be seen, through the railings. The top rail should have a smooth profile and, if intended to provide support, should be circular with a diameter of between **40** and **50mm**.

There should also be an upstand a minimum of **150mm** in height at the rear of the paved area, which can then act as a tapping rail for long cane users as well as a safeguard for wheelchair users.

BS 7818 includes more detailed information on this area.

Fences and guardrails



3.4 Seating

As mentioned in Sections 2.4 and 2.5, mobility impaired people need seating at reasonably frequent intervals. In commonly used pedestrian areas, and transport interchanges and stations, seats should be provided at intervals of no more **50 metres**. Wherever possible seats should also be provided at bus stops and shelters. Seating should be placed adjacent to, but not obstructing, the pedestrian route and should be picked out in contrasting colours to help people with visual impairment (the design of seating is described in Section 9.3).

3.5 Barriers on footways

Where it is necessary to provide staggered barriers across footways and footpaths in order to prevent conflict with other forms of traffic (for example at junctions with main roads) the barriers should be constructed of vertical bar sections **1200mm** high and colour contrasted with their surroundings. An offset between the two barriers of **1200mm** allows wheelchair users convenient passage but discourages the riding of bicycles. Requirements to give visibility through the railings, as mentioned in Section 3.3, also apply to barriers.

3.6 Ramps and steps

Detailed design guidelines for ramps and steps are given in Section 8.4. The recommended dimensions apply equally to the external as well as the internal environment.

3.7 Street furniture

Street furniture can cause problems for both wheelchair users and for people who are visually impaired. It is essential, taking account of heritage issues, to consider both the position of any furniture and the means of making it apparent to people with reduced vision.

Posts, poles, bollards etc should be positioned to leave at least the minimum footway widths given in Section 3.1. It helps visually impaired people if, within an area, the positioning of posts etc is consistent and away from general lines of movement. Thus lamps (and signs) should be mounted on walls or buildings whenever possible; if not, then placing them at the back of the footway as near the property line as possible is acceptable. In this position the maximum distance from the property line to the outer edge of the pole should be **275mm**. If they are placed on the road side of the footway, they should be at least **500mm** away from the edge of the carriageway, increased to **600mm** where there is severe camber or crossfall. If there is more than one pole, they should be at least **1000mm** apart.

Waste bins should be approximately **1300mm** in height, should continue down or close to ground level and should be of a rounded design. The bin opening should be about **1000mm** above ground level. Bins should be colour contrasted to their surroundings.

Bollards are recommended to be at least **1000mm** in height. The same minimum height **(1000mm)** applies to other freestanding objects such as raised flowerbeds, which should also be designed with rounded edges. Under no circumstances should adjacent bollards be linked with chain or rope as this is a hazard for blind and partially sighted people.

Low level signs supported on two vertical poles (eg city maps) should have a lower tapping rail or skirting between the posts to prevent blind pedestrians inadvertently walking between them and colliding with the sign. The rail or skirting should be **300-400mm** above ground level. The sign should not extend more than **150mm** beyond the supporting posts.

Colour contrasted bands (**150mm** deep) on poles and colour contrast on the tops of bollards will help partially sighted people, but the choice of colour for the overall post or bollard also affects visibility. Grey poles in particular are often problematic as they tend to blend into the general background. The incorporation of a light at the top of bollards is also an effective way of making them more easily seen.

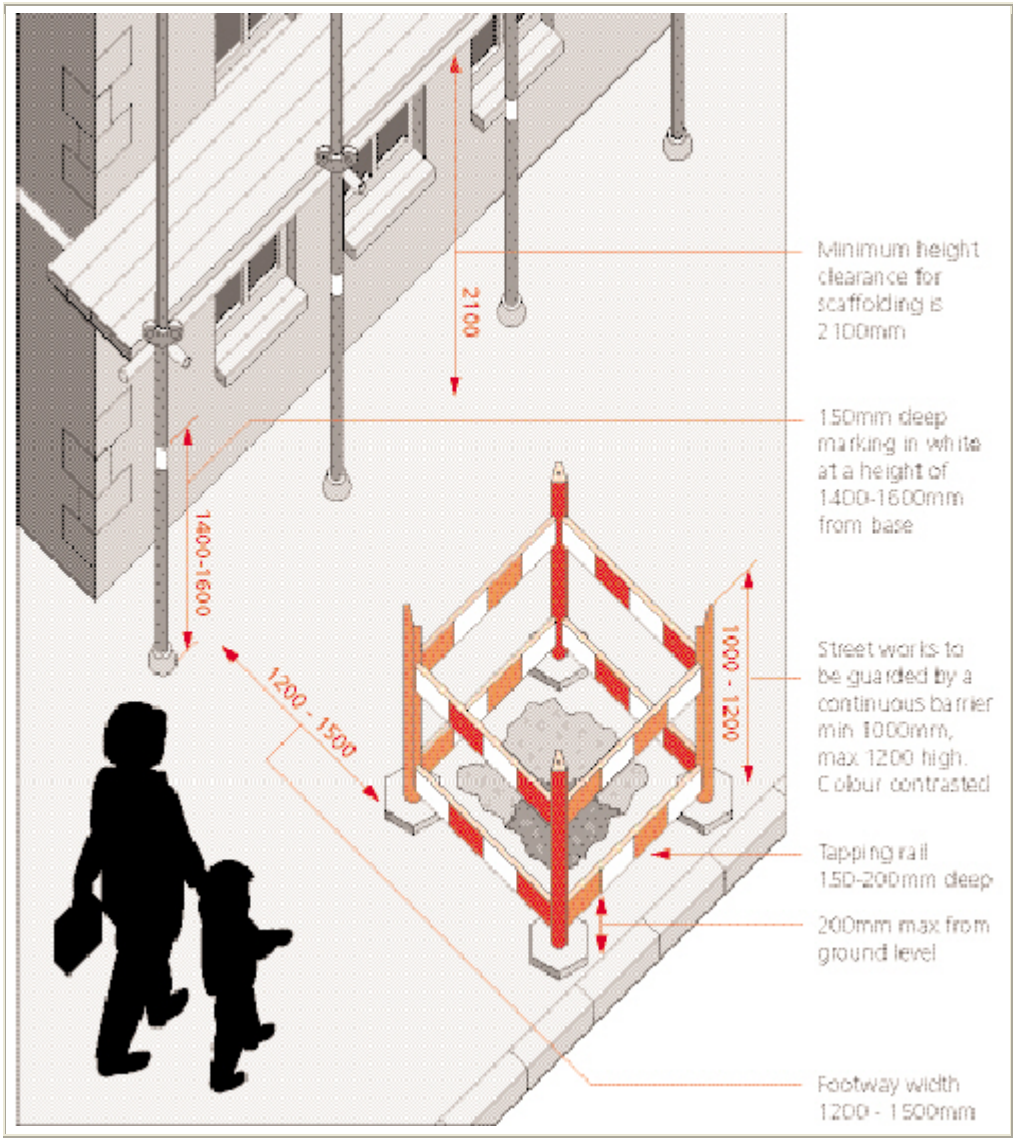
Overhead signs (and any other obstacles over a footway) should give the height clearances specified in Section 2.2 (**2100mm** minimum below suspended signs, **2300mm** otherwise).

Tapering obstructions are usually inside buildings, but can also be found in the outside environment, for example where there is a pedestrian bridge over a road. Any part below a stairway which is **2100mm** or less in height should be protected with a barrier to warn blind and partially sighted pedestrians. In some circumstances (where there is sufficient space) protection can be given by a warning surface which extends out from the obstacle. In this context it should be remembered that pedestrians take time to come to a halt. Finnish guidelines, for example, give a braking distance for pedestrians of 500mm and a reaction distance of 1400mm.

3.8 Street works

Street works not properly safeguarded pose a hazard for many disabled people and particularly blind and partially sighted pedestrians. Street works should be guarded for their full extent by a continuous barrier, minimum **1000mm** high, maximum **1200mm**, with a tapping rail (depth **150mm** to **200mm** with its bottom edge on the ground or up to a maximum height of **200mm** above the ground). The barriers must be placed so that they cannot be knocked over and should be reasonably rigid. The requirements for clear level footway space around roadworks including temporary footpaths should follow the standards given in Section 3.1. Illumination of the street works at night-time helps partially sighted people; audible warnings help blind people. Colour and tonal contrasting of the protective barriers is essential (see Section 3.9).

Streetworks



If the extent of the works means that pedestrians will have to use the carriage way, kerb ramps or raised footways should be provided to help wheelchair users.

Where scaffolding is erected on or over a footway, there must be adequate height clearance **(2100mm minimum)** and an absolute minimum footway width of **1200mm** in lightly populated areas, **1500mm** in busier areas. Enclosing the actual building works with a hoarding is the safest measure for blind, deafblind and partially sighted people.

The name and contact details of companies undertaking works should be clearly displayed so that any problems can be reported immediately (see Section 3.12 for street works affecting pedestrian crossings).

Building works within bus and rail stations, or in other transport facilities used by the public, should also be guarded in a manner similar to that described for street works.

3.9 Colour contrast

Many guidelines advocate the use of colour / tonal contrasted marking to identify street furniture, railing or boarding around street works, scaffolding, tactile paving surfaces and so on (it may not be appropriate to use such treatments in historic areas. Consultation with those responsible for these areas should take place at the earliest opportunity). The main purpose of using contrasted marking is to help partially sighted people avoid obstacles that they might walk into or trip over. The dimensions and placing of colour contrasted bands on poles and similar obstructions are a minimum depth of **150mm** placed with the lower edge of the band between **1400mm** and **1600mm** above ground level. Some guidelines advocate deeper bands (300mm) or more than one band (three dark, two light bands each 100mm deep), but the single band, minimum 150mm, is considered satisfactory by the Royal National Institute for the Blind (RNIB).

Colour contrast is also necessary on structures other than poles and guardrails, for example on glass doors and on bus shelters. The principles underlying colour and contrast have been researched in detail but, in summary, it is essential to ensure that the colours used contrast with their surroundings. Colours which appear to be different from one another in colour (chroma) can be very similar tonally (eg green and brown) and therefore do not give sufficient contrast. Contrast is the difference in reflectivity between two surfaces.

An easy way of judging whether there is good contrast is to take a black and white photograph of the scene or a photocopy of a colour photograph. A good contrast will show up black and white, poor contrast will show up as grey. Further detailed information on the use of colour and contrast can be found in A design guide for the use of colour and contrast (see Section 5 of the Bibliography).

3.10 Surfaces (see Section 4 for tactile paving surfaces)

Uneven surfaces, gaps between paving slabs etc whether within or outside buildings can cause problems for people using sticks and crutches, visually impaired cane users and wheelchair users. Joints between flags and pavers should not be less than **2mm** and not more than **5mm** wide. For pedestrian-only footways, flags can be laid with wider joints **(6-10mm)** filled with compacted mortar. Maximum deviation of the footway surface under a **1 metre** straight edge should not exceed **3mm**. New cobbled surfaces are unlikely to be appropriate and, even in historic environments, alternatives should be sought.

Covers and gratings can also cause problems and may be mistaken by blind people as a tactile surface. It is recommended that the maximum size of openings should be **13mm** and if openings are elongated they should be placed at right angles to the predominant direction of travel. It is also recommended that the spaces should not be more than **150mm** long. Wherever possible gully covers and drainage slots should be positioned as far as possible from main pedestrian flows. Inspection chamber covers and service inspection chambers should be flush with the surface.

Surfaces should be firm, slip-resistant (dry friction between 35 and 45) in wet and dry conditions and should not be made of reflective material. Dished channels (for drainage) should not be incorporated within pedestrian routes.

When small paving bricks (paviours) are used, care should be taken to ensure that they are evenly laid; any unevenness can cause problems for some wheelchair users and some visually impaired cane users. For obvious reasons cobblestones should not be used. As noted earlier in Section 3.2, crossfalls should not exceed **2.5 per cent (1 in 40)**.

3.11 Other obstructions

Apart from roadworks and scaffolding, there are many other sometimes temporary obstructions that can cause problems for disabled people, particularly those with visual impairments. A-frame advertisement boards placed outside shops, ladders, over-hanging tree branches, dustbins, vehicles and bicycles parked on pavements are all potential hazards.

Wherever feasible obstructions of this kind should be kept to a minimum and should not encroach on the clear space (horizontal and vertical) needed to provide safe passage for pedestrians. Any floor mounted signs and displays should only be within the shop curtilage. If temporary obstructions have to be placed on a pedestrian route ladders, for example, used when redecorating a shop front the minimum clear passageway given in Section 3.1 should be maintained and the obstructing equipment should be clearly marked with colour contrasting tape or similar. Other temporary structures such as street market stalls and pavement café tables should be placed so as to leave clear pedestrian routes. Consideration could be given to the approach used in the Netherlands in pedestrian areas, where two colours (or textures) are used to help people detect between where obstacles are allowed and the clear path through the development.

3.12 Road crossings

Road crossings are dealt with in detail in a number of Traffic Advisory Leaflets (TALs) and guidance documents produced by the DfT.

These include:

- Audible and tactile signals at pelican crossings (TAL 4/91)
- Audible and tactile signals at signal controlled junctions (TAL 5/91)
- The Design of Pedestrian Crossings (LTN 2/95)
- Guidance on the use of Tactile Paving Surfaces (DfT, 1998).

The method for assessing whether or not a crossing is required, and if so what type of crossing, is given in LTN 1/95. The considerations include whether there is any hospital, sheltered housing or workshop for disabled people with an entrance within 100 metres of the crossing and the composition of the pedestrians including people with impairments.

The timings given for the Green Walking Figure are, for Pelican crossings, from four seconds (for crossings up to 7.5 metres in length) up to seven seconds for crossings over 12.5 metres. The period can be extended by two seconds if there is considerable use by disabled pedestrians. Similar figures apply to Toucan crossings. There is a further time allowance on each type of crossing which advises pedestrians not to start crossing but allows time for those already on the crossing to get to the other side.

The allowance of six seconds for a 7.5 metre crossing compares with a need for about 12 seconds, however the extendable periods on Toucan and Puffin crossings and the Flashing Green Man on Pelican crossings are long enough to give disabled people sufficient time to complete their crossing. New Puffin crossings with detectors enable people to cross in their own time, which is of benefit to people with mobility impairments.

Section 2.7 of The Design of Pedestrian Crossings (LTN 2/95) sets out the facilities required for disabled pedestrians, including provision of dropped kerbs, tactile paving, audible and tactile signals.

At controlled crossings the control unit should be located close to the tactile surface (see Section 4), with the centre of the button between **1000mm** and **1100mm** above the footway level. The post on which the unit is mounted should be clearly marked with a contrasting band of colour **140mm** to **160mm** in depth with the lower edge **1400mm** to **1600mm** above footway level. Where a tactile indicator (a rotating knurled cone) for the steady green man phase is used, it should be placed on the right hand side of the bottom of the push button unit, extending **20mm** down (±1mm) and with a diameter of **15mm** (±1mm). Tactile indicators should not be considered as a substitute for audible signals as they are required by different people, although some will benefit from both. A large diameter raised push button which can be activated by a closed fist will be most easily used by pedestrians who have mobility impairments. It should have an illuminated LED surround or be colour contrasted for increased conspicuity. The United States Access Board recommends 50mm diameter buttons and a maximum pressure to activate of 22.2N. It should be noted that push button units used in Great Britain must first be approved by Traffic Control and Lighting in Bristol.

Where centre refuge islands are provided they can be an absolute minimum of **1200mm** in width (LTN 2/95) but to cater for wheelchair users they should be at least **1500mm** and preferably **2000mm**. If the island is at the centre of a staggered crossing there should be a minimum clear width (between guard rails) of **2000mm**: sufficient to allow two wheelchair users to pass one another.

Clearly marked pedestrian crossing areas should be provided in bus stations where people cross the bus lanes to get from one platform to another, with signing for buses to give way. As a general matter of policy authorities should give the pedestrian priority.

The appropriate tactile paving surfaces should be installed at all controlled and uncontrolled pedestrian crossings. Details of these surfaces are given in Section 4 of this Guide.

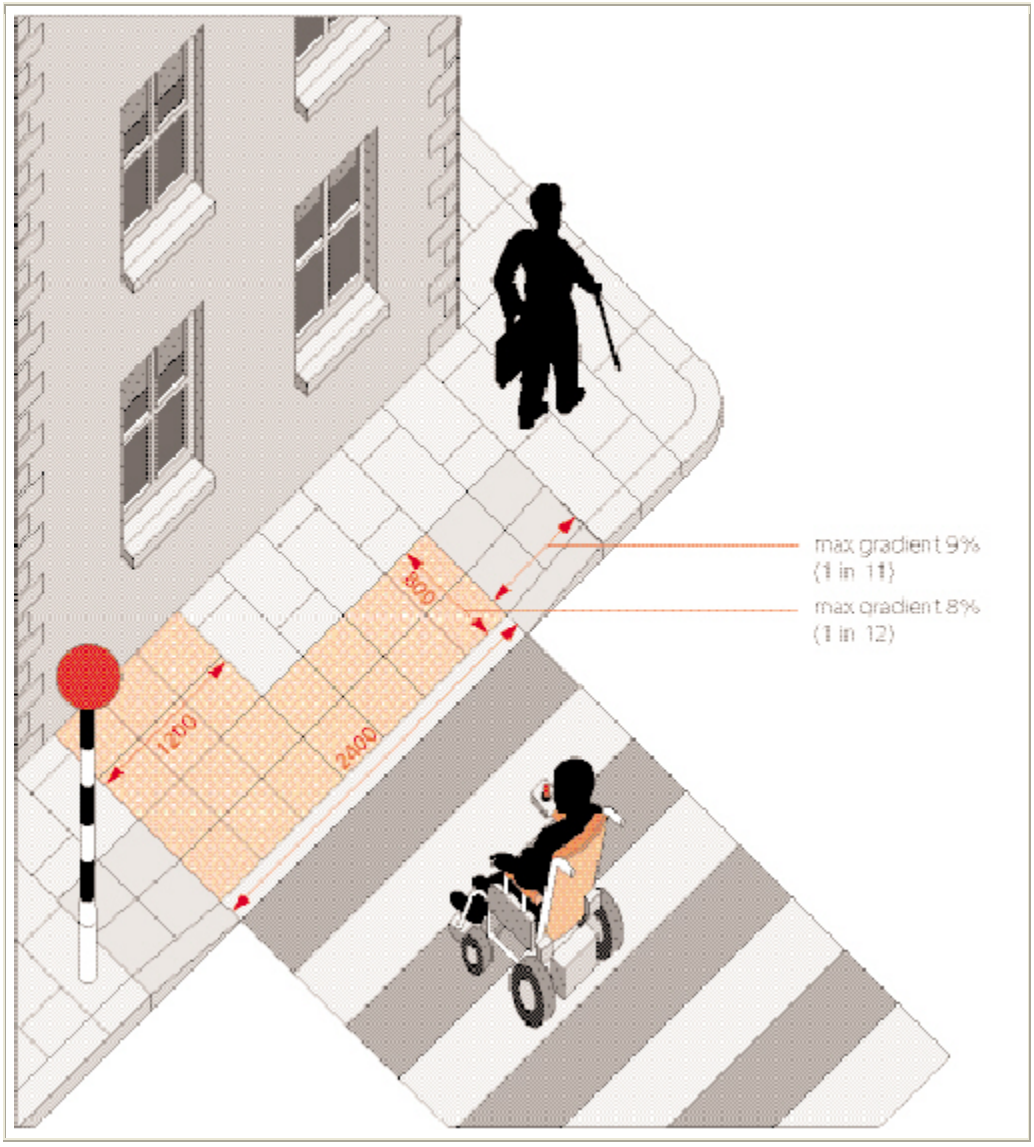
If street works mean that a pedestrian crossing cannot be used, the following should be done:

- put barriers across pedestrian accesses to the crossing.
- use signs showing Zebra, Pelican etc crossing not in use. Place them so that they face pedestrians on both sides of the road.
- extinguish or cover Zebra crossing globes, switch off the lights on Pelican, Puffin or Toucan crossings.

3.13 Dropped kerbs and raised crossings

Level or flush access is essential for the majority of wheelchair users. Such access, either by dropped kerb or raised road crossing must be provided at all Zebra and controlled crossings and at other places side roads, access points to parking areas etc used by pedestrians. On longer side roads and residential roads dropped kerbs should, where possible, be provided every 100 metres to avoid the need for wheelchair users to make lengthy detours to cross the road having given due consideration to desire lines for pedestrians and intervisability.

Dropped kerbs and raised crossings (Example of layout at zebra crossing)



Wherever possible the dropped kerb should be flush with the carriageway (maximum 6mm rounded bullnose if really essential) and have a maximum gradient of **8 per cent (1 in 12)** on the direct approach; **9 per cent (1 in 11)** on the flared sides. The minimum width of the flush area should be **1200mm** (up to **3000mm** where there are heavy pedestrian flows) though **1000mm** is acceptable adjacent to car parking reserved for disabled users. Where a dropped kerb is provided at a controlled road crossing it should be the same width as the crossing itself (minimum **2400mm**). At the foot of the dropped kerb, the camber of the road should be no more than **5 per cent (1 in 20)** for a wheelbase distance (approximately 600mm) away from the kerb line. This avoids the wheelchair front wheels or footrest being caught by an opposing upslope.

If the width of the footway is sufficient there should be a level area, **900mm** minimum width, along the rear side to allow easy passage for wheelchair users who are not crossing the road.

It is essential that the dropped kerb be indicated by the appropriate tactile surface (see Section 4) and, again with the interests of visually-impaired people in mind, the kerb should not be on the radius of a road junction at an uncontrolled junction. If the radius is large it may be necessary for the dropped kerb to be within it, but it should be located so as to give as close as possible to a right-angled crossing of the side road.

If level access is provided by a raised road crossing, the raised area should be at least **2400mm** in width and should be level with the footway.

An H marking should be applied to dropped crossings (at uncontrolled crossings) to indicate to motorists that there is a crossing present and not to park there (see diagram 1026.1 in Traffic Signs Regulations and General Directions (TSRGD)).

[2] As an alternative to crossfall, pervious surfaces which absorb rain may be used in some circumstances.

4 Tactile paving surfaces

Following extensive research, DfT and the Scottish Executive jointly published guidance on the use of tactile paving surfaces (Guidance on the use of Tactile Paving Surfaces). The following paragraphs summarize the guidance given, but designers should consult the document itself and follow the guidance given. In addition, BS 7997 established the construction standards for these materials in concrete, clay and stone.

Whenever a footway or other area used by pedestrians is being constructed, repaired or renewed, consideration should be given to incorporating any appropriate tactile surfaces.

4.1 Pedestrian crossing points

Type of surface: parallel rows of flat-topped blisters **5mm** (±0.5mm) high, **25mm** in diameter, pitch **64-67mm**.

Colour: red at controlled crossings; buff or any other colour that contrasts with the surroundings **except red** at uncontrolled crossings.

Application: at controlled and uncontrolled crossing points where the footway and carriageway are level with one another.

Layout - controlled crossings: where the dropped kerb at the controlled crossing is in the direct line of travel, the tactile surface should be laid to a depth of 1200mm. At all other controlled crossings a depth of 800mm should be provided. The surface should be laid to the full width of the dropped kerb.

The back edge of the section of tactile surface which extends across the dropped kerb should be at right angles to the direction of the crossing. Where the back edge is not

parallel to the kerb (ie the crossing itself is not at right angles to the kerb) the tactile surface should not be less than **800mm** in depth at any point.

At controlled crossings only, a stem of the surface **1200mm** wide should extend back from the tactile surface adjacent to the push button control box or the zebra pole and should be in line with the direction of travel across the road.

Layout uncontrolled crossings: for crossings at or close to road junctions, the blister surface should extend across the full width of the dropped kerb, with a depth of **400mm** where the crossing is inset (ie not in the direct line of pedestrian travel) or **1200mm** where it is in the direct line. As with the surface at controlled crossings, the back edge should be at right angles to the direction of crossing.

When the dropped kerb is inset (into the side road) it should not be located on the radius but set about **1000mm** in from the end of the radius.

Where there is an uncontrolled crossing away from a junction, the blister surface should be laid to a depth of **800mm**.

The DfT publication provides a series of illustrative diagrams of the layout for blistered surfaces at a range of different crossings and pedestrian islands. These should be used in the circumstances shown.

There is no suggestion (by DfT) that highway authorities should set out to reconfigure existing installations. It would be useful, however, to take the opportunity to review existing sites in the course of maintenance or other major works, with a view to bringing them into line with the guidance.

4.2 Hazard warning surface

Type of surface: corduroy, consisting of rounded bars. The bars are **6mm** (± 0.5mm) high, **20mm** wide and spaced, centre to centre at **50mm**.

Colour: the surface should contrast with the surrounding area but **should not be red**.

Application: at the top and bottom of steps, at the foot of a ramp to an on-street Light Rapid Transit (LRT) platform (but not other ramps), a level crossing, where people could walk inadvertently onto a platform at a railway station and where a footway joins a shared route (cycle/pedestrian).

It should be noted that the surface is **not** recommended for raised bus stops.

Layout: the surface should be laid so that the bars run transversely across the direction of pedestrian travel and should extend across the full width plus **400mm** each side of stairs at top and bottom, across the full width of the ramp (at the foot of the ramp only), across

the full width of the footway at level crossings and the full width of pedestrian entry to unprotected railway station platforms.

The recommended depths of the corduroy surface are:

Steps (top and bottom)	- in direct line of travel	800mm
	- otherwise	400mm
Ramps (foot only)		800mm
Level crossings	- where there is a barrier	400mm
	- no barrier	800mm
Entrance to unprotected railway station platform		800mm

Surfaces laid to warn of steps should start **400mm** away from the nosing of the first step.

4.3 Off-street platform edge warning

Type of surface: offset rows of flat-topped domes **5mm** (± 0.5mm) high, spaced **66.5mm** apart, centre to centre.

Colour: should contrast with the surrounding area but **should not be red**.

Application: should be used at all off-street rail platforms, including heavy rail, light rail and underground (but **not at on-street platforms**).

Layout: the surface should be laid parallel to the edge of the platform, with a depth of **400mm** and set back from the edge by between **500mm** and **700mm**. The surface should extend the full length of the platform. (The platform edge itself should still be marked with a white line).

4.4 On-street platform edge warning

Type of surface: rows of lozenge shapes, **6mm** (± 0.5mm) high with rounded edges so as not to be a trip hazard and **150mm** by **83mm** in size.

Colour: normally buff coloured but can be any colour, **other than red**, which contrasts with the surrounding surface.

Application: at all on-street LRT platform edges.

Layout: the surface should be laid immediately behind the platform edge coping stone, no closer than **500mm** from the edge and for the full length of the platform including any approach ramps. The surface should be laid to a depth of **400mm**.

Note that a tram stop is regarded as being on-street where: the tramway is in a street environment, or where the ability for pedestrians to cross and/or walk, without restriction, along or alongside the infrastructure, exists. (This definition has been agreed with the Railway Inspectorate).

4.5 Segregated shared cycle track/footway surface and centre delineator strip

Types of surface: the start of the pedestrian part of the shared surface is a ladder pattern consisting of raised flat-topped bars each **5mm** (± 0.5mm) high, **30mm** wide and spaced **70mm** apart. These bars are laid at right angles to the direction of travel.

the start of the cyclists part of the shared surface has exactly the same raised bars but laid parallel to the direction of travel.

the centre delineator strip should be **12-20mm** high (preferably 20mm), **150mm** wide with sloping sides and a flat top 50mm wide. The strip should be finished in white.

Colour: no specific recommendations are made for the colours of the surfaces other than the requirement that the centre delineator be white. However, the use of different coloured surfaces and different materials, eg bitumen and concrete, on the different sides of the route can provide a helpful cue to partially sighted people.

Application: to be used on any segregated shared route where the pedestrian side is not physically separated from the cyclist side, for example by a difference in level.

Layout: the tactile surfaces should be laid at the beginning and end of the shared segregated route, at regular intervals along the route and at any junctions with other pedestrian or cyclist routes.

The surfaces should be **2400mm** long, across the full width of the footway and cycle track.

The delineator strip should run the entire length of the route except at crossing points and places where another cycle track crosses the pedestrian footway to join the route.

A cycle symbol marking (in accordance with diagram 1057 of TSRGD) should be provided on the appropriate side at all entry/exit points, and at any junctions with footways or other shared routes. This should be repeated at every **50 metres** along the cycle way.

As with other warning surfaces, the DfT publication gives illustrations of the ways in which various layouts should be treated. Schemes in historic environments can create particular aesthetic problems and should be carried out sensitively.

In general, shared use facilities should be regarded as a last resort; every effort should be made to keep cyclists and pedestrians fully separated. Where shared facilities are

unavoidable at least the minimum width for the footway should be maintained as detailed in Section 3.1.

4.6 Guidance path surface

Type of surface: a series of raised, flat-topped bars running in the direction of pedestrian travel. The bars are **5.5mm** (± 0.5mm) high, **35mm** wide and are spaced **45mm** apart.

Colour: contrasting to the surrounding area, but **should not be red**.

Application: the surface is recommended for use in pedestrian precincts where the traditional guidance given by a standard footway between the property line and carriageway does not exist, where pedestrians need guidance around obstacles, where visually impaired people need to find a specific location and possibly in transport terminals.

The layout of the guidance path will be determined by the specific location in which it is placed, but the path should be **800mm** wide (with unobstructed space on each side also at least **800mm** wide) as straight as possible and, in busy shopping centres, with a minimum **2000mm** of unobstructed space between the path and the property line.

Where there is a right angle turn, the surface should be installed so that the bars run transversely across the path for **1200mm** before the bend in both directions; the same applies to T junctions in the path. For bends other than right angles, the bars should be turned to follow the direction of travel.

When considering putting in guidance paths care should be taken to make sure that the layout of the pathways is not too complicated, otherwise they may cause confusion rather than assisting blind people. Local consultation on the proposed layout should be held to avoid any risk of confusion.

4.7 Information surface

Type of surface: this does not have a raised profile but is made of a material that is slightly softer underfoot than conventional paving materials, for example neoprene rubber or similar elastomeric compound.

Colour: it should contrast in colour and tone to the surrounding area.

Application: the surface can be used to draw attention to facilities such as bus stops, help points, telephone kiosks, post-box, tactile or talking information board, entrances to civic amenities, cash dispensers, etc. Within transport terminals it can be used to indicate ticket offices, help points, waiting rooms and toilets.

Layout: the surface of the material should be level with the surrounding area. A space of **400mm** should be allowed between the facility and the start of the surface, the surface

itself should be at least **800mm** wide or the full width of the facility, whichever is the greater. The only exception to this is where the facility is an entrance or window (eg for a ticket office) when the surface should be no wider than the facility itself.

As with the guidance surface, local consultation with blind and partially sighted people should be carried out to ensure that the layout of any surfaces does not cause confusion.

5 Car parking 5.1 General provision

Provision should be made for car parking spaces for disabled motorists (Blue (formerly Orange) Badge holders) wherever conventional parking spaces are provided. In off-street car parks operated by a Local Authority and in car parks offered for public use by private companies, spaces for Blue Badge holders should be provided as close as possible, preferably within **50 metres** of the facilities served by the car park with level or ramped (preferred gradient 5 per cent) access, and under cover if possible.

In open parking areas, designated parking spaces should be located on firm and level ground. The surface of designated parking spaces should be even and stable, with any variation of surface profile not exceeding **± 5mm** (eg between paving, surface features or different surfaces).

Where the provision of designated parking spaces close to the building is not possible, a setting-down point for disabled passengers should be provided on firm and level ground, close to the principal entrance to the building. The surface of the pavement or footpath alongside a setting-down point should be level with the carriageway at this point. Tactile indication of this type of setting-down point is necessary to enable people with impaired vision to determine whether they are on the pavement or the carriageway.

In multi-storey car parks the spaces should be on the level or levels at which there is pedestrian access or, if this is not possible, near to a lift usable by wheelchair users.

Where car parks serve a general area rather than a specific facility, consideration should be given to providing a Shopmobility service [3] for disabled motorists between the car park and the area served by it. This type of service, of which there are many examples, can also be helpful for older and disabled people who travel to a town centre by Dial-a-Ride or similar accessible bus services. A good location for a Shopmobility scheme office would be in close proximity to a large car park and set down/pick up points for local Dial-a-Ride, Community Transport bus services and local public transport.

Spaces reserved for use by disabled motorists should be monitored for abuse, with reminder notices or other appropriate action taken if cars are wrongly parked.

Where park-and-ride facilities are available, the advance signing should include information on whether or not the facility is served by wheelchair accessible buses.

5.2 Recommended spaces for disabled motorists parking

The recommended proportions of spaces [4] for Blue Badge holders are:

(i) For car parks associated with existing employment premises: 2% of the total car park capacity, with a minimum of one space.

Spaces for disabled employees **must be additional** to those recommended above; reservations could be ensured, for example, by marking a space with a registration number.

(ii) For car parks associated with new employment premises: 5% of the total parking capacity should be designated (to include both employees and visitors).

(iii) For car parks associated with shopping areas, leisure or recreational facilities, and places open to the general public: A minimum of one space for each employee who is a disabled motorist, plus 6% of the total capacity for visiting disabled motorists.

The numbers of designated spaces may need to be greater at hotels and sports stadia that specialize in accommodating groups of disabled people.

At railway stations, the Strategic Rail Authority (SRA) [5] recommends the following:

- Fewer than 20 spaces, a minimum of **1** reserved space
- 20 to 60 spaces, a minimum of **2** reserved spaces
- 61 to 200 spaces, **6%** of capacity, with a minimum of 3 reserved spaces
- Over 200 spaces, **4%** of capacity, plus **4** reserved spaces

An additional space should also be provided for any railway employee who is a disabled motorist.

5.3 Bay design

DfT Traffic Advisory Leaflet 5/95 gives detailed advice on the provision and design of parking for disabled car users, as does BS 8300, "Design of buildings and their approaches to meet the needs of disabled people Code of practice".

On-street parking parallel to the kerb: within the marked parking space, a clear rectangular space should be provided which is a minimum of **6600mm** long by **2700mm** wide (preferably **3600mm**). The extra width allows for an access zone on kerb or street side.

On-street parking at an angle to the kerb: the parking space should be a minimum of **4200mm** long by **3600mm** wide.

It is recommended that kerbside parking bays should be sited where road gradient and camber are reasonably level, eg **1:50**. A road with a steep camber causes difficulties for wheelchair users who have a side lift in their vehicle.

Where designated bays on-street are at a different level from the adjacent pavement, dropped kerbs should be provided for wheelchair users, with appropriate tactile marking.

It should be remembered that parking vehicles partly on the pavement is one of the main causes of concern to blind and visually impaired people, deafblind and partially sighted people in the pedestrian environment. Every effort should be made to ensure that it does not occur or that, if it does, appropriate enforcement action is taken.

Off-street parking: bays should be a minimum of **4800mm** long by **2400mm** wide with additional space:

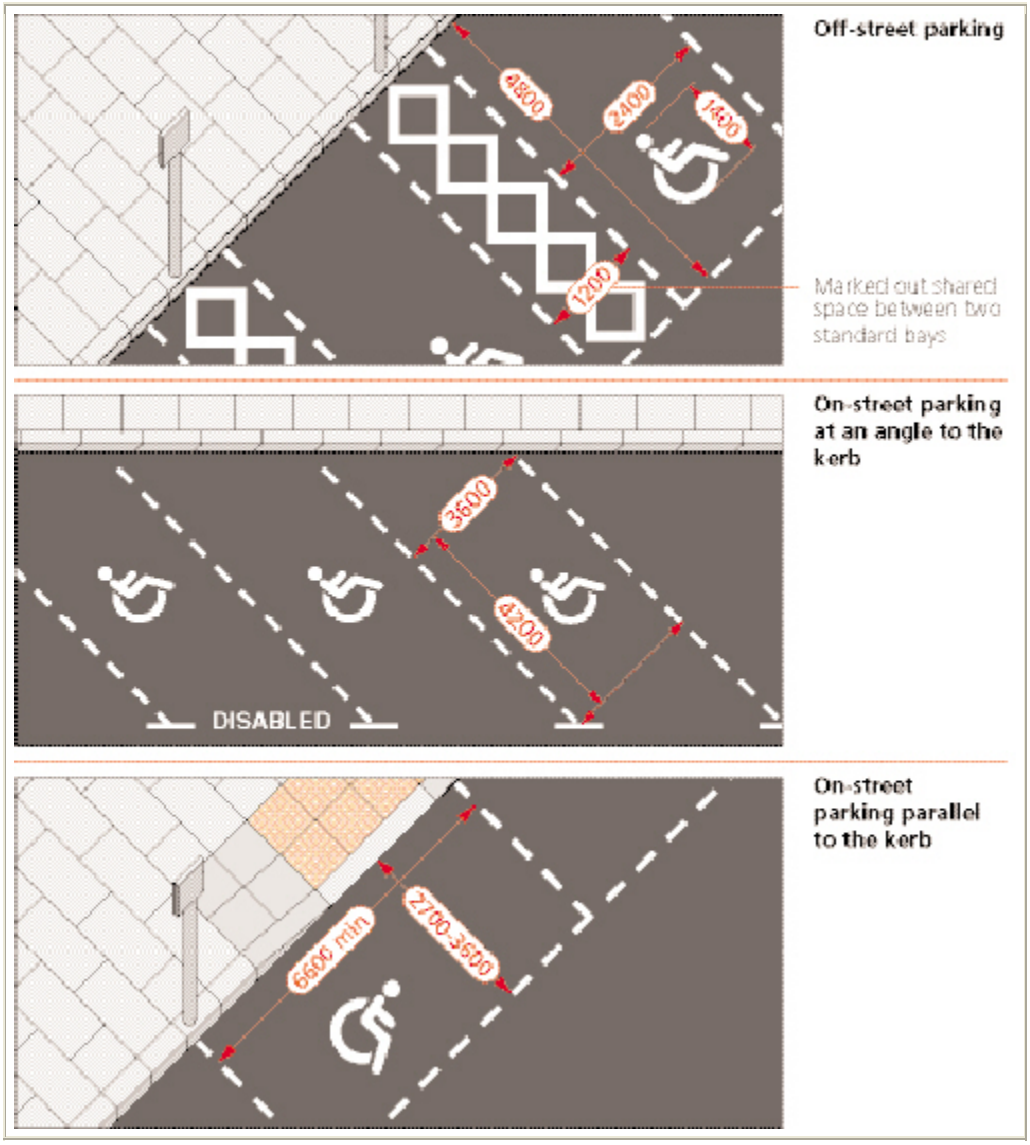
1 Where bays are parallel to the access aisle and access is available from the side an extra length of at least **1800mm**, or,

2 Where bays are perpendicular to the access aisle, an additional width of at least **1200mm** along each side. Where bays are adjacent the same **1200mm** space can serve both sides. There should also be a **1200mm** wide safety zone at the vehicle access end of each bay to provide boot access or for use of a rear hoist.

5.4 Bay marking and signing

On-street bays should be indicated by signs in accordance with TSRGD; road markings must also confirm to TSRGD. Each bay should have a raised sign at the head of the bay to ensure that if snow or fallen leaves obscure the road markings, the purpose of the bay is still apparent.

Bay Design



In off-street parks, bays should be marked with yellow lines and a yellow wheelchair symbol within the parking space. A sign or, if appropriate, signs should be provided at the entrance to the car park to direct disabled motorists to designated parking spaces which, if the car park is not under cover, should also have raised signs at the head of the reserved bays.

Signs inside the car park should show the most convenient way to the facilities served by the park, with an approximate distance to those facilities.

Where the car park is provided for a specific facility and where there are staff available, an emergency / assistance point could be located adjacent to the area reserved for disabled car users.

5.5 Parking control equipment

In many places Blue Badge holders do not have to pay for parking, but in some they do. Where this is so, the design of pay and display machines, parking meters etc, should conform to the standards given in Section 9.1. Signs should make it very clear that Blue Badge holders are required to pay.

BS 8300 states that ticket dispensers and slots for coins or cards that need to be operated from a wheelchair should not be less than **750mm** and not more than **1200mm** high. Any variable message displays or control instructions should be centred on **1500mm** above ground level. Keypads on those parking machines which require registration numbers to be typed in, should be no more than **1200mm** high.

Access to the ticket machine should take account of the space at foot level needed by a wheelchair user and should not be placed on plinths, or, if a plinth is necessary, it should not extend out beyond the face of the equipment. To allow wheelchair users to manoeuvre in front of the machine, there should be a clear space of **1850 x 2100mm**.

Barrier control units (for coin or card entry and ticket issue) should be between **1000mm** and **1300mm** above ground, with instruction plates placed at the lower end of the range (**1000mm** to **1600mm** above ground) required by BS 6571.

Irrespective of the particular type of charging system used, it helps disabled motorists if they are informed before entering the car park what sort of system is used or if there is no charge. It is also essential that the maximum acceptable height of vehicle is shown on the approach to the car park. Some disabled motorists use vans or high-top cars, others use cars with their wheelchair stowed on top of the vehicle, so height can be critical. It is recommended that the minimum vertical clearance, from carriageway to designated parking bays should be **2600mm**. This height is sufficient for a car carrying a wheelchair on its roof and for the wheelchair to be positioned vertically during the hoisting process.

If it is not possible to maintain this height along the route to the designated bays, information to that effect, specifying what the minimum clearance is, must be displayed prominently so that the driver of a higher vehicle has time to avoid entering the car park. At the same point, directions to a suitable alternative parking area must be displayed.

[3] Shopmobility services are now found in many town centres and can provide wheelchairs and personal assistance for disabled people when they travel round the centre.

[4] See Parking for Disabled People TAL 5/95, DfT.

[5] See Train and Station Services for Disabled Passengers, Strategic Rail Authority, 2002.

6 Bus stops

The advent of low floor buses will improve access for disabled people, but full benefit will only be attained if bus stops are also designed to meet their needs.

Section 2.4 showed that the distances some disabled people are able to walk are quite short. In residential areas bus stops should be located ideally so that nobody in the neighbourhood is required to walk more than **400 metres** from their home. The spacing of bus stops should, where possible, take account of gradients on the footpaths within the vicinity of the stop. A suggested standard is to reduce the maximum walk distance (400 metres) to a bus stop by **10 metres** for every **1 metre** rise or fall. Regular bus services designed particularly with elderly and disabled people in mind, such as the Swedish Service Routes have bus stops at more frequent intervals, typically every **200 metres**. This figure is in accord with research that shows that for disabled people, bus use falls off sharply if the distance is more than **200 metres** (**250 metres** for able-bodied people). Where there are places that will be used by disabled people, such as residential care homes, day centres etc, bus stops should be sited as close as possible and should have a pedestrian crossing (with dropped kerb) in reasonable proximity. On single carriageway roads it is normal practice to stagger bus stops in opposing directions so that buses stop tail-totail and move away from each other. The stagger should be a minimum of **40 metres** and may have a pedestrian crossing in-between. As a matter of general policy, highway authorities should ensure that dropped kerbs are provided wherever there is a need to do so, so that wheelchair users can get to stops.

Routes, or sections of routes that do not have fixed bus stops that is they are operated on a hail and ride basis should be clearly defined in timetables, on route maps and preferably by some indication on the streets concerned such as signs at eye level on street furniture. If signs of this kind are used, they should include embossed lettering so that they can be read by blind and visually impaired people.

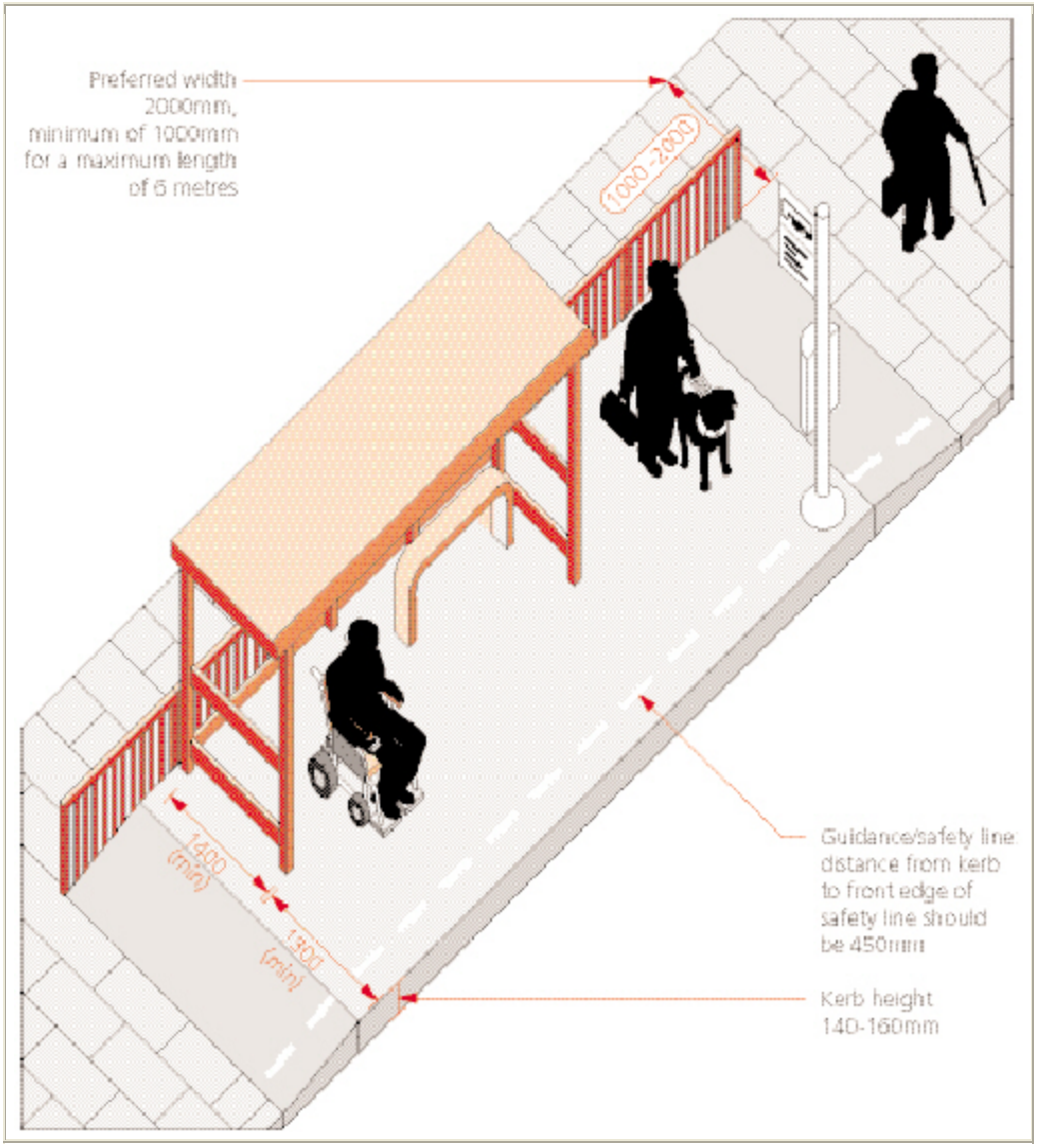
The improvement of bus stops and the introduction of low-floor wheelchair-accessible buses should be, as they already are in some places, the subject of partnership agreements between local authorities and bus operators. Joint initiatives should ensure that benefits for passengers, including those who are disabled, are maximized.

Whenever maintenance work is carried out highway authorities should take the opportunity to lift kerbs and provide a raised bus boarding area (see Section 6.1.1).

6.1 Bus stop overall design

Many bus stops have to be placed in locations where pavement space is limited but, where space permits, the following guidelines are suggested.

Bus stop overall design



6.1.1 Raised bus boarding area

A raised bus boarding area assists passengers boarding / leaving the vehicle and may enable some wheelchair users to board directly without using a ramp.

There are two conventional types of bus boarder: full width and half width. A full width boarder juts out into the carriageway far enough for the bus to avoid parked vehicles, that is by approximately **1800mm**.

The length of the boarder will depend on the type of bus using the stop and whether or not a shelter is provided. For a conventional single entry / exit bus where there is no shelter a length of **3000mm** is recommended. For buses with two doors, the recommended minimum length of the boarder is **9000mm**.

A half width boarder, which juts out by between **500mm** and **1500mm**, is a compromise design that can be used where a full width boarder would unduly delay other traffic or place the bus in or too close to the opposing traffic stream. A further alternative is an angled boarder: wedge shaped from up to **2000mm** into the carriageway and tapering back to the original kerb line over the length of the bus stop cage. This design is similar to the shallow saw tooth layout used in some bus stations.

Standard kerb heights range from **125mm** to **140mm**; above this it is recommended that specialized bus stop kerbs should be used (eg Marshalls, Charcon, Lafarge Redland) which can give heights up to 220mm. Recent research by Greater Manchester Passenger Transport Executive suggests that a height of **160mm** will give the best compromise between ease of access and reduced damage to the bus.

A higher kerb may be appropriate where there is a segregated bus system or at places where the vehicle is guided into the stop.

Where a raised bus boarding area is provided, care should be taken to keep the transition gradients to acceptable levels (**1 in 20** preferably, **1 in 12** maximum). Tactile warning surfaces (Section 4) should **not** be used on raised bus boarders.

Bus boarders should be carefully designed and built, particularly in relation to drainage. If a raised boarding area is simply added onto the existing kerbline with gullies still in place, the gullies may cause problems for disabled passengers as well as potentially obstructing a bus shelters foundations.

6.1.2 Shelters

Shelters should be provided where there is space to do so. From the point of view of disabled passengers, particularly wheelchair users, the best location for a shelter is opposite the boarding point. Because of space constraints this may not be possible; an alternative is to place the shelter downstream, leaving 2000mm length of clear boarding / alighting area. In locations not exposed to severe weather, a cantilever bus shelter with one end panel offers good accessibility and some weather protection. Where the end panel is used for advertising, it should be at the downstream end of the shelter so that people can see the bus approaching. In more exposed locations enclosed shelters should be provided, if there is space to do so.

For reasons of personal security the bus shelter should be made mainly of transparent material and well lit at night, though use of other materials may be more appropriate in rural areas. Where glass or transparent walls are used they should have a tonally contrasting band at least **150mm** wide at a height of **1400mm** to **1600mm** from the ground. A second, lower band may be put at **900mm** to **1000mm** above ground level.

There should be sufficient space either to the rear of the shelter, or in front of it if the shelter has to be placed at the back of the pavement, to allow easy pedestrian movement. Where shelters are provided in newly built areas there should be a clear obstacle free

footway width of at least **2000mm**, preferable **3000mm**. These dimensions should also be used where practical, when improvement work on highways is being carried out.

However, it is recognized that at many existing stops it is not possible to achieve these standards. It was noted in Section 3.1 that, where there are physical constraints, a clear footway width of **1500mm** is acceptable, with an absolute minimum of **1000mm** over a limited distance (for example, that occupied by the shelter provided it is not more than 6 metres long).

The Public Service Vehicles Accessibility Regulations 2000 state that the maximum acceptable angle of a bus boarding ramp shall be 7° (12 per cent or 1 in 8) from a bus step height of 250mm down to a reference kerb height of 125mm. This means a minimum ramp length of 1000mm. To allow adequate manoeuvring space for a wheelchair user the unobstructed boarding area at the stop onto which the ramp is lowered should be **2000mm** by **2000mm**. Where an open-fronted passenger shelter is used, part of this boarding area may extend into the sheltered area. This layout, with the canopy of the shelter 1400mm in depth requires a total footway width of, ideally **4700mm**, absolute minimum **3700mm**.

If the shelter is placed down stream of the bus boarding area, with its closed side to the carriageway, the total footway width required can be reduced to **4000mm**, absolute minimum **3000mm**.

It is also suggested that a **100mm** yellow line be provided on the footway, offset **450mm** from the kerb (to the outer edge of the line) at bus stops, replicating that used on railway platforms. This will provide guidance to bus drivers and indicate to passengers that they should keep away from the kerb-edge.

Where a fully enclosed shelter is used allowance must be made for manoeuvring space for wheelchair users both into and within the shelter. It is recommended that shelters of this type should be 2000mm in depth and with a minimum of 1500mm clear footway space between the rear of the shelter and the inner edge (or heel) of the footway to allow the wheelchair user space to turn into the shelter entrance. However, as with the other types of shelter, the clear footway to the rear should be 2000mm if possible giving a total footway width of 4600mm. If the enclosed shelter is placed at rather than downstream of the bus boarding area the exit from the shelter onto the bus boarding area should be 2000mm wide, with the shelter itself set back from the kerb edge by a minimum of 1000mm.

6.1.3 Bus stop flags

Bus stop flags should be fixed as low as possible while remaining visible above road traffic, pedestrians and any other nearby obstacles. The bottom of the flag should not be less than **2500mm** above ground. The minimum size for the flag given in TSRGD is 300mm wide by 250mm high, but it is recommended that a larger size, **450mm** wide by **400mm** high should be used if possible. Bus route numbers on the flag should be at least

50mm high. A US demonstration project found that a limited amount of information was more effective than a substantial amount, which tended to lead to confusion. That research suggested just

- Route number / name
- Pictograph of a bus
- Special messages
- Telephone number for information

Direction of travel, Towards (name of next town / principal destination) helps travellers who are not familiar with the area.

In the future it is possible that there will be automatic onbus announcements made as the bus approaches each stop. With this in mind, it would be helpful if the name / location of the bus stop could be included either on the flag or in a prominent position on the bus shelter.

Where there are a lot of different routes using one stop it may be better to keep these off the flag and put them on the time table display, but they must be shown in one or the other place.

Bus stop signs should be positioned so as to be visible to passengers inside the vehicle so that they can verify where they are. A raised capital letter B about 20mm high at a height of 1000mm from the ground fitted to the bus stop pole or other structure at the bus stop will assist blind people. The clearance between a bus stop pole and the kerb edge should be **600mm** (500mm minimum). Coloured bands should be applied to the bus stop pole to enhance visibility, in accordance with the dimensions given in Section 3.9. As with bus shelters, bus stops should be well lit with sufficient illumination to enable reading. A good level of lighting will also improve personal security.

6.1.4 Seating

Seating should be provided where possible (see Section 9.3). Shelters should incorporate a bench, platform or horizontal rails to rest against at a height of about **580mm**. Any seating should be painted or self-coloured in a contrasting colour and, if not undercover, should be designed so that rainwater does not collect on it. Where seating is provided in a shelter, sufficient clear space should be left for use by a wheelchair passenger.

6.2 Timetable information

Timetable information should be provided at as many bus stops as is feasible. Timetable and information displays should be located between **900mm** and **1800mm** in height. Information that is of particular relevance to wheelchair users should be put at the bottom of the display and any important information should not be more than **1700mm** above ground. If surrounding street lighting is not adequate, additional lighting should be provided at the stop itself.

The information provided should include at minimum details of the route(s), destination(s) and departure times. Full timetables and route diagrams are helpful to passengers unfamiliar with the service(s) and are essential for longer routes or less regular services. Details of other stopping places in the vicinity and routes servicing them will avoid confusion where routes cross or there is more than one stopping place. Lettered bus stops, as used in London and elsewhere, should be used where stops are split between different routes at complex junctions or picking-up points, with maps of the stop locations, letters and route numbers displayed at each stop. Where bus stops are lettered, the letter should be shown on the bus stop flag as well as on the timetable display. The information provided on this display should also include directions to and distance of the nearest public telephone, with the display itself including the bus operating companys telephone number and textphone number. The maps of bus stop locations should also show where public telephones are, including any textphones, separately identified.

Where space permits, new designs of panel bus stops provide more space for information. These types of bus stop poles are more frequently found in other parts of Europe and are usually 400mm to 500mm wide with a width of up to about 350mm available for information.

Visual displays of expected arrival times of buses at stops, destinations served and any delays are helpful for all passengers but particularly so for deaf and hard of hearing people. Where real-time information of this type is provided, the screen should be shielded from direct sunlight (see also Section 10.1.6). Voice activated information systems will assist people with visual impairments and learning difficulties.

The increasing number of low-floor buses coming into operation and the implementation of the DDA regulations mean that vehicles are much more accessible than previously, but the benefits of low floor entry are negated if the bus cannot draw up close to the kerb. As recommended by the Disabled Persons Transport Advisory Committee (DPTAC) all bus stops should have a 24-hour clearway marking and the ban on parking should be enforced.

7 Taxi ranks

At present over 80 Licensing Authorities have introduced mandatory orders requiring some or all of the taxis within their area to be wheelchair accessible. Regulations under consideration for implementation under the DDA will require further wheelchair accessible taxis to be provided.

Wherever feasible to do so, taxi ranks should be provided adjacent to railway, bus and coach stations, and all major attractors such as retail areas. If possible, ranks should be located close to the facility being served and should have clear signs within the facility showing where they are. Ranks should be sited so that passengers board or alight onto the footway from the nearside of the taxi. The width of unobstructed footway should be sufficient to allow the deployment of wheelchair ramps (up to **1620mm**) and adequate manoeuvring space for the wheelchair user. The suggested total width is **4040mm**. A

dropped kerb or raised road crossing should be provided close to the rank if passengers need to cross a street to get to or from the taxis.

The ranks themselves should be clearly signed and should have seating close by. If the rank does not have taxis regularly standing at certain times, the sign should state what these times are and give telephone number(s) for calling a taxi. Embossed information of this type would assist blind and partially sighted people.

8 Access to and within transport-related buildings 8.1 Location of bus, rail and interchange stations

Although this guide is primarily concerned with the design and dimensions of specific features in the built environment, it is worthwhile mentioning the wider principles that should determine the location and general layout of transport facilities. Public transport can seldom provide through door-to-door services, so many journeys will involve passengers transferring from one mode to another or, at the very least having to walk from a station to their final destination.

Ideally interchanges and bus/coach stations should be located at, or immediately adjacent to the other transport services and to local shops and passenger destinations. The table in Section 2.4 illustrates the comparatively short distances disabled people can manage without undue discomfort. Thus a centrally located bus station on a less than ideal site may be preferable to a superb interchange that many potential passengers find difficult or impossible to reach.

The size and layout of interchanges and bus stations will be dictated by the frequency and pattern of services, but it is important to use as compact a layout as possible, so minimizing walk distances. A two-level station, provided there is good access between the levels, may be better than an extensive single-level site. A compact layout with passenger facilities concentrated in one area will also be easier to supervise and reduce any fear felt by passengers who might otherwise have to wait in quiet, isolated areas.

Completely new railway stations are infrequently built, those that are are often Parkway stations towards the outskirts of urban areas. It is essential at these stations that provision is made immediately by the station for interchange from road-based transport: buses and taxis as well as private cars. This requirement applies as much to existing railway stations. The provision of set down/pickup points for private cars should include specific provision for disabled car users, who should have priority over other car users if space is limited.

Where passengers are moving between road and rail services, or between different bus services within a station, conflicts between pedestrians and moving (road) vehicles should be kept to a minimum. There are a number of different basic layouts for bus stations including oblique-angled bays, saw-tooth bays, L, U or horseshoe layouts and island layouts. The design adopted will depend among other things on the dimensions of the site available and the numbers of buses using it, but layouts with buses stopping

around a central island site require all passengers to cross the path of buses or negotiate a change of level. For this reason central island stations are not recommended, though they can be very compact, therefore useful where space is limited and careful design and management can reduce the risk of passenger/vehicle accidents.

Oblique angled bus bays mean that the bus has to reverse back out of the bay which can be a hazard though careful attention to railing off the reversing area from any adjacent pedestrian areas can reduce this. Wherever passengers do need to cross the path of buses, fixed crossing points, very clearly marked with level access and priority for pedestrians are essential.

As rail and bus stations may be approached by a variety of means: pedestrian, by car (parked or drop off) paratransit service etc, the pathways leading to the station entrance should be accessible from all of these approaches. As stated in the US Accessibility Handbook: Regardless of which means passengers use to get to the station, approaches have to be accessible and minimize the distance to an accessible entrance.

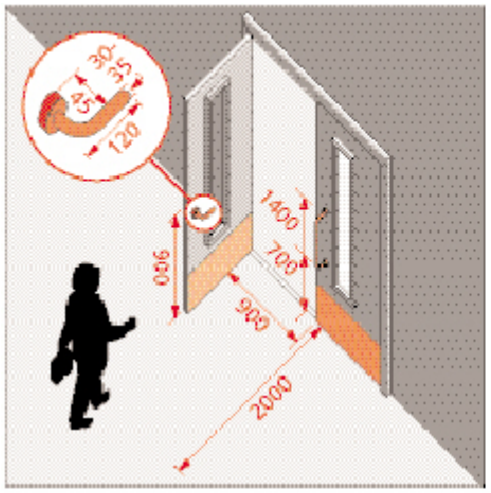
It is important that disabled passengers should be able to find accessible entrances easily, thus there should be clear signs to indicate where the accessible entrance is and to direct people to it from any other entrances that may not be fully accessible. Entrances should be in contrasting colours to their building.

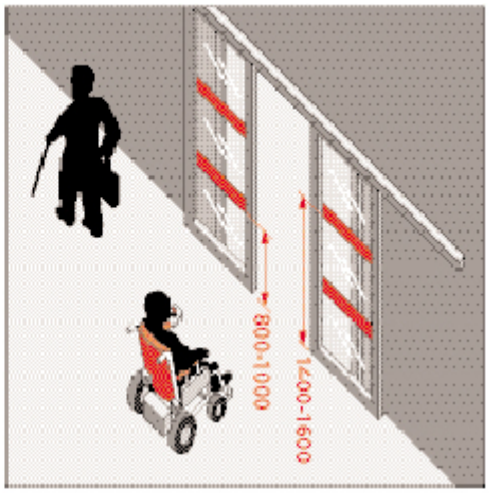
Clear signage throughout transport sites and buildings is important for everyone, particularly deaf and hard of hearing people.

8.2 Entrances and doors

The physical location of transport infrastructure bus, railway stations etc varies greatly; at ground level, below ground, above, single or multi-level. The basic principles in designing access, however, remain the same whatever the specific physical characteristics of the building. A single step at the entrance to a building or a kerb without a ramp in the road outside can make the most carefully designed terminal inaccessible to some disabled people.

Recommended dimensions for doorways





Clear width when open	1200mm
(minimum acceptable	900mm)
Width of leaf in double leaf door	900mm
(minimum acceptable	800mm)
Clear, level space before/after door	2000mm
(minimum acceptable	1500mm)
Clear, level space between doors in series	1340 + width of doors opening into space

Door handle	lever height	900mm
	lever length	120mm min
	vertical "pull to open" bar	from 700 to 1400mm above floor level
Diameter of lever or bar		30-35mm
Clearance of lever or bar from door surface		45mm

If possible entrances to stations should not have doors, but this is not always feasible, for example for reasons of security or to retain heat within the building. Where there are doors they should be automatic, linked either to a weight sensor or to sensors mounted above the door; manual doors are very difficult for people in wheelchairs to manage. Revolving doors are not well suited to many people, including disabled people, but if they are installed, an alternative hinged or sliding door must be provided.

The clear width of the door(s) once open should preferably be **1200mm**; **900mm** is the minimum acceptable. Where double leaf doors are installed each leaf should be **900mm** wide, with 800mm as a minimum. Space immediately before and after a door is also important to allow for people to stand clear if the door opens towards them and for wheelchair users to manoeuvre. At the very least there should be a clear, level space of **1500mm** on both sides of the doorway; preferably more than this. Where there are two doors in series there should be a minimum space between of **1340mm** plus the width of any door swinging into this space. If a space of **2000mm** can be achieved, it makes manoeuvring in a wheelchair much easier.

The door handle should be of the lever type, which is easier for people with any weakness in their hands to manipulate, and if horizontal should be at a height of **900mm** and with a minimum length of **120mm**. If the door has a vertical bar rather than a lever handle, this should stretch from **700** to **1400mm** above floor level.

The diameter of the door handle or bar is recommended as **30mm** to **35mm**. As with any rails, there should be sufficient space between the inner side of the handle or rail and the surface of the door to avoid people catching their knuckles on the door. The recommended gap is **45mm**.

Doors should be fitted with a kick plate, **400mm** in depth at the bottom of the door and, where they are made of glass or other translucent material, should have contrast colour banding in accordance with the standards given in Section 3.9 or a logo or other decorative symbol with minimum dimensions **150mm** by **150mm** set at eye level. The contrasting feature should be repeated at a lower level of between **800mm** and **1000mm** above floor level. However, clear glass doors can be a hazard for visually impaired people and use of this material should be avoided if possible, except to provide a viewing panel, which should extend from adult eye level down to **500mm** from the floor. Glass used in a door must be safety glass.

Automatic sliding doors are recommended in preference to manually operated doors and should remain open for a minimum of **six** seconds, preferably **nine** seconds, and should not open faster than **three** seconds to back check. Many automatic doors incorporate a time delay device whereby the doors close automatically after a prescribed time lapse. Such doors can be hazardous to wheelchair users and some people with walking difficulties.

The operation of automatic doors can be triggered by a sensing device or by foot or hand pressure, pendant switch or push button. The most suitable operating device is mat contact, where doors are held open for as long as the area on either side is occupied. Mats must be sensitive to pressure exerted unevenly (for example by crutch users) and to light pressure (for example exerted by an assistance dog). Where doors are operated by photoelectric cells a Z layout of light beams ensures that doors remain open if traffic moves slowly. Pressure required to stop doors closing should not be more than **66.6N (15lbf)**. In the event of a power failure it must be possible to move the door freely by hand. If the doors are controlled by a push button it is recommended that the button be located **800mm** from floor level and a similar distance from the side of the door with appropriate luminance and colour contrast.

If manual doors are used, it must be possible to open them with minimal effort: some people with severe disabilities cannot exert a force even as low as 13.3N (3lbf). Australian standards sub-divide the action of opening a door into three movements with different acceptable levels of force for each:

- To initially open the door: **19.5N**
- To swing the door: **6N**
- To hold the door open between 60 degrees and 90 degrees: **7.5N**.

However, the Strategic Rail Authority recommends an opening force of **15N**, which is preferred to the Australian standard of 19.5N.

Thresholds should be level, but if this is not possible, the maximum acceptable threshold rise is **10mm**. Any rise of more than **5mm** should have a bevelled edge.

Doors should have tonal contrast with the wall around them and door handles should contrast with the doors, to help visually impaired people. Doormats should be flush with the floor finish. Rubber backed mats, placed on top of the existing floor finish can ruck and present a trip hazard, and should not be used. Coir dirt mats and mats with directional weave are not recommended, as they can impede access for people with walking difficulties and people using wheelchairs.

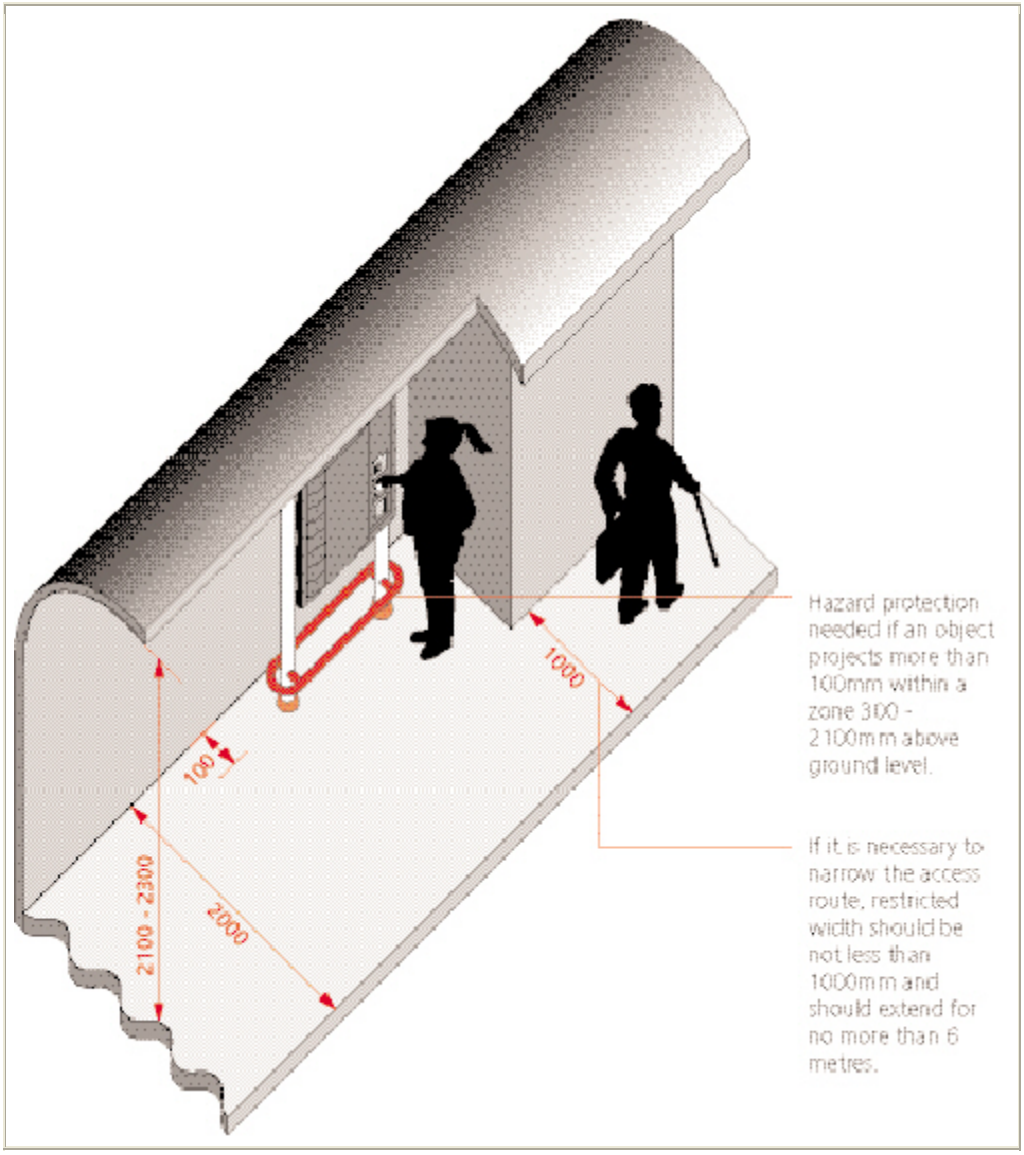
There should be a lighting transition zone immediately within the entrance door to enable adjustment from a bright outdoors to a more dimly lit interior or vice versa.

If there is a canopy at an entrance, care should be taken to ensure that the supporting structure is either incorporated into the building fabric, positioned on a verge or clearly marked at eye level **(1400-1600mm)** with contrasting banding **150mm** in depth.

8.3 Access within transport sites and buildings : passageways

The width of space required for wheelchair users, people with assistance dogs etc was given earlier in Sections 2.2 and 2.3: the minimum width for a two-way corridor should be **2000mm**. Where an access route is predominantly less than **1800mm** wide, passing places should be provided to allow two wheelchair users to pass each other. A passing place should be a minimum of **2000mm** long by a minimum of **1800mm** wide and located within direct sight of another, or at a maximum distance of **50 metres** from another, whichever is the closer.

Access within transport sites and building: passageways



Where it is necessary to introduce occasional narrowing of the access route, the restricted width should not be less than 1000mm and should extend for no more than 6 metres.

The American guidelines use the concept of an accessible route; their regulations state that:

At least one accessible route within the boundary of the site shall be provided from public transportation stops, accessible parking, and accessible passenger loading zones and public streets or sidewalks to the accessible building they serve. The accessible route shall, to the maximum extent feasible, coincide with the route for the general public. At least one accessible route shall connect accessible buildings, facilities elements, and spaces that are on the same site. (Federal Register/Vol 56, No 173)

The same source also says that accessible routes servicing any accessible space or element shall also serve as a means of egress in emergencies or connect to an accessible area of rescue assistance.

An access route should have a clear height of not less than **2300mm** (**2100mm** absolute minimum). Isolated objects that cause an occasional narrowing of the access route, but which project not more than **100mm** from their base into the access route, do not need hazard protection. However, if an object projects more than **100mm** within a zone between **300** and **2100mm** above ground level then hazard protection should be provided. If the base of the projection is less than **300mm** above ground level, no hazard protection is needed.

Well-designed corridors help every user to find their way through a building. People with visual impairments generally navigate by focussing mainly on the floor up to 1500mm ahead of travel. Floor finishes are therefore instrumental in helping visual impaired people to find their way. They should incorporate landmarks which may be one or a combination of features, such as visible clues, tactile indicators, sounds etc. For example, different materials, texture changes and raised symbols could indicate that stairs are being approached, there is a junction opposite etc. Such changes and symbols should be consistent throughout the building.

The end wall of a corridor should be highlighted by, for example, good colour and tone contrast between the wall and floor and a change in lighting. Glare problems caused by windows positioned at the end of corridors or passageways can be reduced by using tinted glass, anti-glare treatment or blinds. As a general rule, walls should have light, non-reflective surfaces and should be in a colour which contrasts with the floor, so that the boundary of the floor is clearly visible.

8.3.1Travelators / moving walkways

Where there are substantial distances to be traversed within terminals, travelators help a lot of people, but they should always have a parallel walkway. For some people, particularly older people who are a little unsteady, stepping onto a moving walkway is not a comfortable experience. Where travelators are provided, the direction of travel should be shown clearly and the footway at both ends should be marked by colour contrast and a change in floor finish. The travelator must be well lit, particularly at its entrance and exit. Moving handrails should be rounded in section, in a colour which contrasts with the background and should extend approximately **700mm** beyond the beginning of the walkway. The recommended width for a travelator is **1500mm** with a minimum height clearance of **2300mm**. The side panels of the travelator channel should be finished in a non-reflective surface; back illuminated side panels can be very disorientating.

The speed of movement of the travelator should be kept low: **0.5m/second** is recommended (**0.75m/second** maximum). The surface should be non-slip and there should be clearly visible emergency stop switches that can be reached and operated by

disabled people. An audible warning at the beginning and prior to the end of the travelator is essential for visually impaired people.

Travelators should have a minimum unobstructed level run-off at each end of **6 metres**. The maximum gradient for a travelator should be **5 per cent (1 in 20)**.

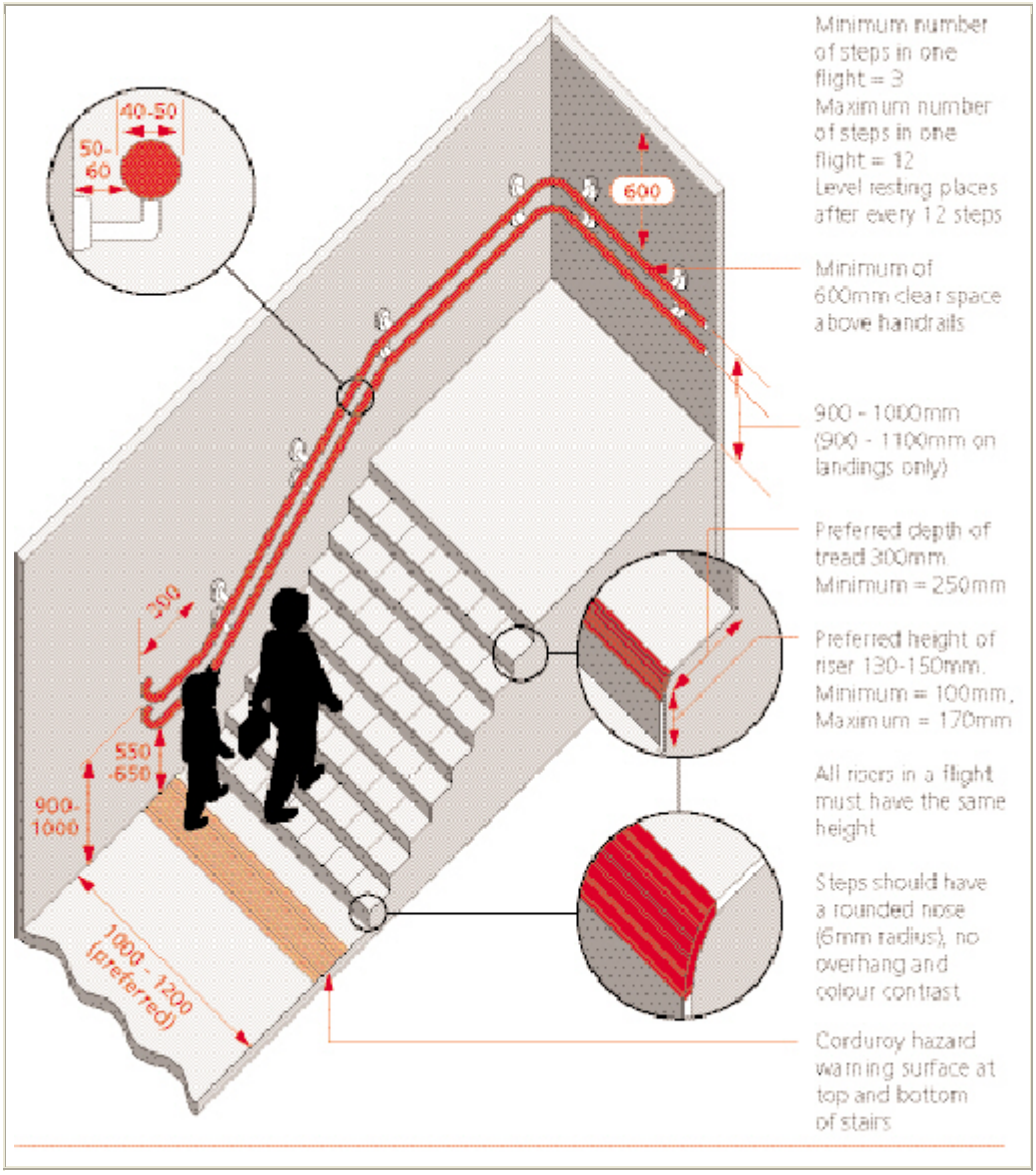
8.4 Changes in level [6]

Even a single step will prevent access for the great majority of wheelchair users (and be a trip hazard for others), so alternatives must be provided; either ramps or lifts. However, the design of steps and stairs themselves is important. Good design can greatly assist ambulant disabled people and those with visual impairment.

8.4.1 Steps and stairs

A considerable amount of research on dimensions and design of steps and stairs was carried out in the 1970s and 1980s and there is reasonable consistency between the dimensions given in various national guidelines. A riser height of **150mm** can be managed by most people; a little more than this is possible if there are well designed handrails but **170mm** should be regarded as the maximum in normal circumstances. Steps with very shallow risers can cause problems and should be avoided; **100mm** is the absolute minimum.

Steps and stairs



Tread depth or going should be **300mm** deep (approximately the length of a size 9 shoe), never less than **250mm** and the nose of the step should be rounded (**6mm** radius) without any overhang. People with walking difficulties often pull their feet up the face of the riser; any overhang will catch their foot.

Common criteria from several guidelines are that all steps in a flight must have the same dimensions, that open tread staircases are to be avoided, as are curved or spiral staircases and that there should be tactile warning surfaces at the foot and head of the stairs (see Section 4). Stairs should be well lit (minimum **200 lux**, see Section 11) and surfaced with a slip resistant material. Colour contrast on the step noses is essential for visually impaired people and should extend across the full width of each tread, **55mm** deep on both tread and riser.

People with walking difficulties cannot manage long flights of steps. The maximum number of risers in a flight should be **12**, with resting places between successive flights. Resting places should be at least **1200mm** long, preferably **1800mm**, and across the full width of the stairway. The minimum number of steps in a flight should be **three**; fewer than this is less safe.

Stairs should have a minimum clear width between handrails of **1000mm**, preferably **1200mm** which is sufficient for a disabled person and companion. Handrails should be provided on both sides (see Section 8.4.3) and, where stairways have a clear width of more than **1800mm**, a centre handrail should also be provided[7]. Stairs of this width are needed where there is concurrent two-way movement. Stairs that lead to a platform, on which people will be carrying luggage, should be **3000mm** wide (with centre handrails).

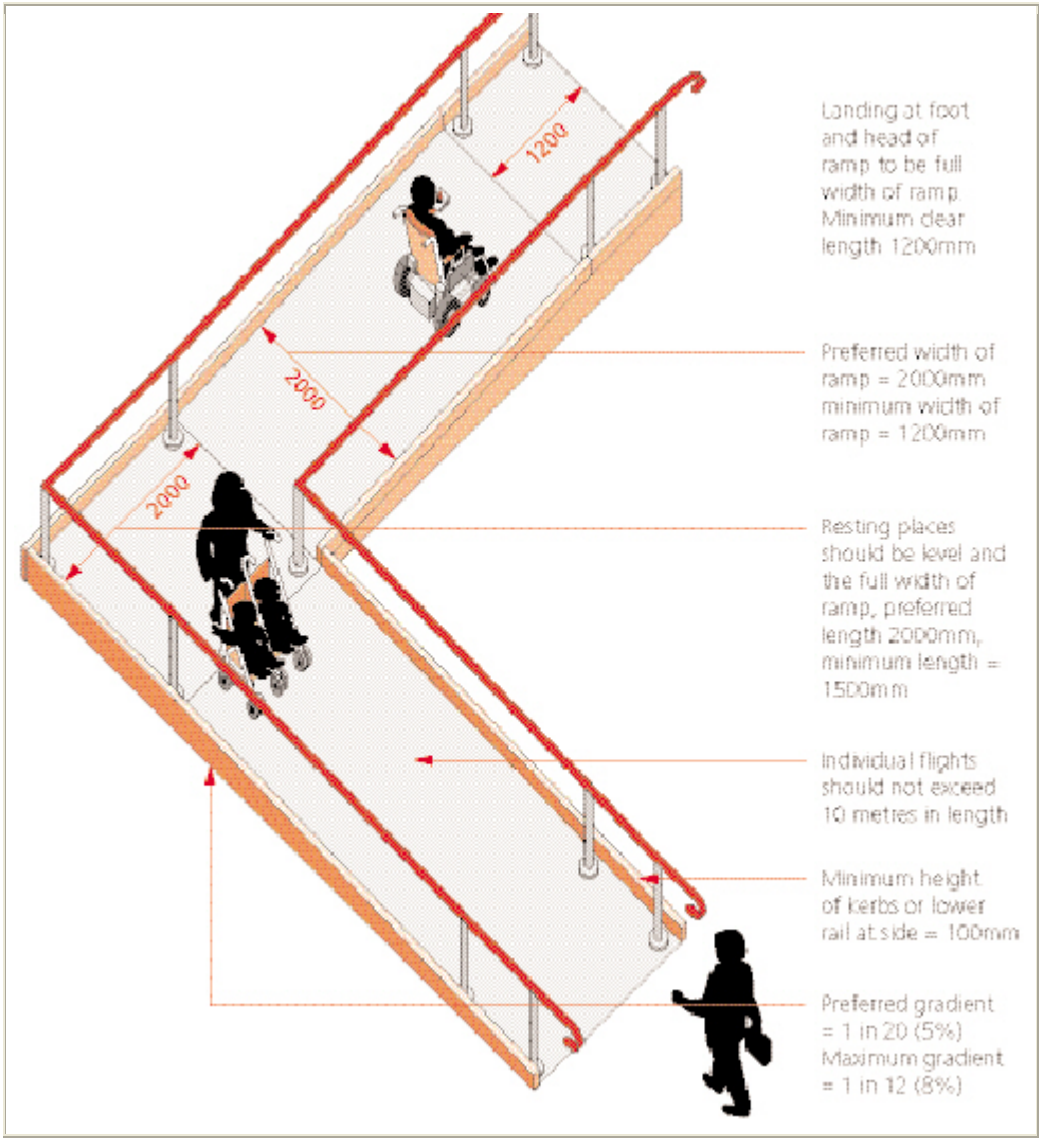
As mentioned in Section 3.7, means should be provided to limit the risk of people colliding with the underside of freestanding stairs or ramps at any point where the clear height is less than **2100mm**. The appropriate hazard warning surface should also be provided at the top and bottom of steps (as detailed in Section 4.2).

There should be unobstructed landing space at the top and bottom of each flight of stairs of a length at least equal to the unobstructed width of the stairway.

8.4.2 Ramps

In many places ramps (defined as a gradient of more than 1 in 20) will provide the alternative access to stairs for wheelchair users. Where the change in level is no more than **200mm** a ramp may be used without alternative steps.

Ramps



As described in Section 3.2, most guidelines specify **5 per cent (1 in 20)** as the preferred gradient and **8 per cent (1 in 12)** as the absolute maximum acceptable. There is a relationship between the length of a ramp and the gradient that people can manage; the longer the ramp the less severe the gradient that is feasible. One possible approach to this is, where a lengthy ramp is necessary, to design more frequent landings and lesser slopes for each successive segment.

BS 8300 states that a ramped approach should have the lowest practical gradient and should be within the limits shown in the table below.

Going of a flight	Maximum gradient	Maximum rise
Not exceeding 2m	1:12	167mm
Not exceeding 5m	1:15	333mm
Not exceeding 10m	1:20	500mm

A slightly steeper gradient of **1 in 10** is acceptable over very short distances, for example a ramp covering a distance of **600mm**. Gradients steeper than 1 in 10 are not only physically difficult to manage but may cause the wheelchair to overbalance.

If more than one flight is needed, there must be rest places between the flights. These should be level if under cover (**1 in 50** gradient if outside to drain surface water) should be at least **1500mm** long and the full width of the ramp. The landings at the foot and head of a ramp should be at least **1200mm** long, clear of any obstruction such as door swing and, again, should be the full width of the ramp.

The minimum surface width of a ramp should be **1200mm**, but as with stairways, two-way movement requires more space preferably **2000mm** (minimum **1800mm**).

Handrails should be provided on each side, with a minimum clear width rail to rail of **1000mm**. Where this unobstructed width exceeds **2000mm**, a central, continuous handrail may be used as an alternative to a handrail on each side.

The sides of a ramp should be protected by a raised solid kerb at least **100mm** in height. Australian standards also state that if the kerb height exceeds **75mm** there must be no slot or gap greater than **20mm** in the range of **75mm** to **150mm**. This is done to avoid the possibility of the footplate of a wheelchair riding over the kerb or becoming trapped. These standards also require the ramp-side face of the kerb to be flush with, or no more than **100mm** away from the ramp-side face of the handrail.

Transition between level and inclined parts of the ramp should be sufficiently rounded to ensure that a wheelchair user does not get caught by the foot supports. There is rarely a need for cross fall on a ramp. If drainage is thought likely to be a problem, the use of a pervious surface should be considered.

Physically fitting a ramp into the available space can be a problem if a lift cannot be made available. South Yorkshire Passenger Transport Executive has calculated that a ramp needed to give an over-rail clearance of 4.8 metres above platform level would require some 76 metres in length at 1 in 12 or 126 metres at 1 in 20, both measurements allowing for rest points. It is not clear how practicable ramps of this length would be for wheelchair users. Many manual wheelchair users would probably not be able to manage these distances unaided, though what constitutes a reasonable maximum length is not known; this is an area where further research is needed. The report of the European COST 335 project on Passengers Accessibility of Heavy Rail Systems states that ramps should never be longer than **132 metres** in total and preferably no longer than **50 metres**. The preferred figure (50 metres) means that ramps should not be used to bridge between platforms. No individual flight of a ramp should have a length of more than **10 metres** or rise more than **500mm**.

Where railway stations are being refurbished provision of lifts should be considered where the alternative would be a long ramp. However, it would be unrealistic to expect that lifts will always be provided so, in spite of their drawbacks, lengthy ramps are likely

to remain the only way of providing access for wheelchair users in some places. Where a long ramp is unavoidable, stairs should also be provided; some people prefer to climb a shorter staircase (properly designed) than a very much longer ramp.

The hazard warning tactile surface should be used at the foot of ramps to on-street LRT platforms, but should not be used at other ramps. Ramp surfaces must be slip resistant and non-reflective. A colour and tone contrasting V shaped marking on the ramp surface is helpful, with the apex of the V at the top of the ramp or ramp section.

If portable or temporary ramps have to be used to give access to an existing building where space is limited, they should be positioned and their presence identified so that they do not constitute a hazard to passers-by. These ramps should have a surface width of at least **800mm**, a drainable, slip-resistant surface and upstands to prevent wheelchair tyres veering off the edge.

8.4.3 Handrails

Handrails should be provided on both sides of stairways and ramps and down the centre of stairs when their unobstructed width (ie between handrails) exceeds **1800mm** (see Section 8.4.1). The recommended height to the top of the principal handrail is between **900mm** and **1000mm** above the pitchline of the steps or above the surface of the ramp. On landings the top of the handrail should be between **900mm** and **1100mm** from the surface.

Handrails should continue beyond the end of the ramp slope or end of the stairs by a (minimum) distance of **300mm** and should either return to the wall or down to the floor or have a minimum rounded downturn of **100mm**.

Second, lower handrails for children and people of restricted growth are helpful and should be at heights of between **550mm** and **650mm**.

The handrail itself should be smooth and comfortable to use by people with arthritic hands that is they should not be too small in diameter. Circular handrails should have a diameter between **40mm** and **50mm**; if not circular the handrail should be a maximum of **50mm** wide by **38mm** deep with rounded edges (radius of at least **15mm**).

There should be a clear space between the handrail and any adjacent wall of at least **50mm**, preferably **60mm**. Handrails should be supported centrally on the underside so there is no obstruction to the passage of the hand along the rail. There should also be a minimum of **600mm** clear space above the handrail.

Colour / tonal contrasted handrails are essential to assist partially sighted users.

8.4.4 Escalators

The maximum speed recommended for escalators is **0.75m per second**, but lower speeds (down to **0.5m per second**) may be preferable where levels of passenger use are not so great. The recommended angle of inclination is **30°** to **35°**.

The recommended minimum width is **580mm** and the maximum **1100mm**. Step heights are specified as a maximum of **240mm** or **210mm** if the escalator would be used as an emergency exit when stationary. Tread surface should be a matt, non-reflective finish.

The moving handhold should be between **900** and **1100mm** above step nosing and, as with handrails on stairs, extend a minimum of **300mm** beyond the ends of the escalator. It should be clearly colour contrasted and should move synchronously with the escalator.

Clear space on the approach to an escalator used in heavily trafficked places should be **10 metres** or more. The direction of travel should be clearly indicated (top and bottom) and the steps should form level areas at top and bottom of the escalator of at least **2000mm** and **1600mm** respectively (falls on boarding or leaving are the most common type of accident on escalators). An audible warning at the beginning and just before the end of the escalator is essential for visually impaired people.

Good lighting is also important, with a minimum of **50 lux** and there should be a minimum vertical clear height above the escalator of **2300mm**. Step edge marking in a contrasting colour is also required on the tread only (**55mm** deep) and there should be a noticeable change in lighting at the bottom and top of the escalator.

It should be borne in mind that escalators are difficult for some ambulant disabled people to use and cannot be used at all by people in wheelchairs or with assistance dogs. As a general rule, where there are substantial changes in level, a lift should be provided and should be clearly signed as an alternative to the escalator.

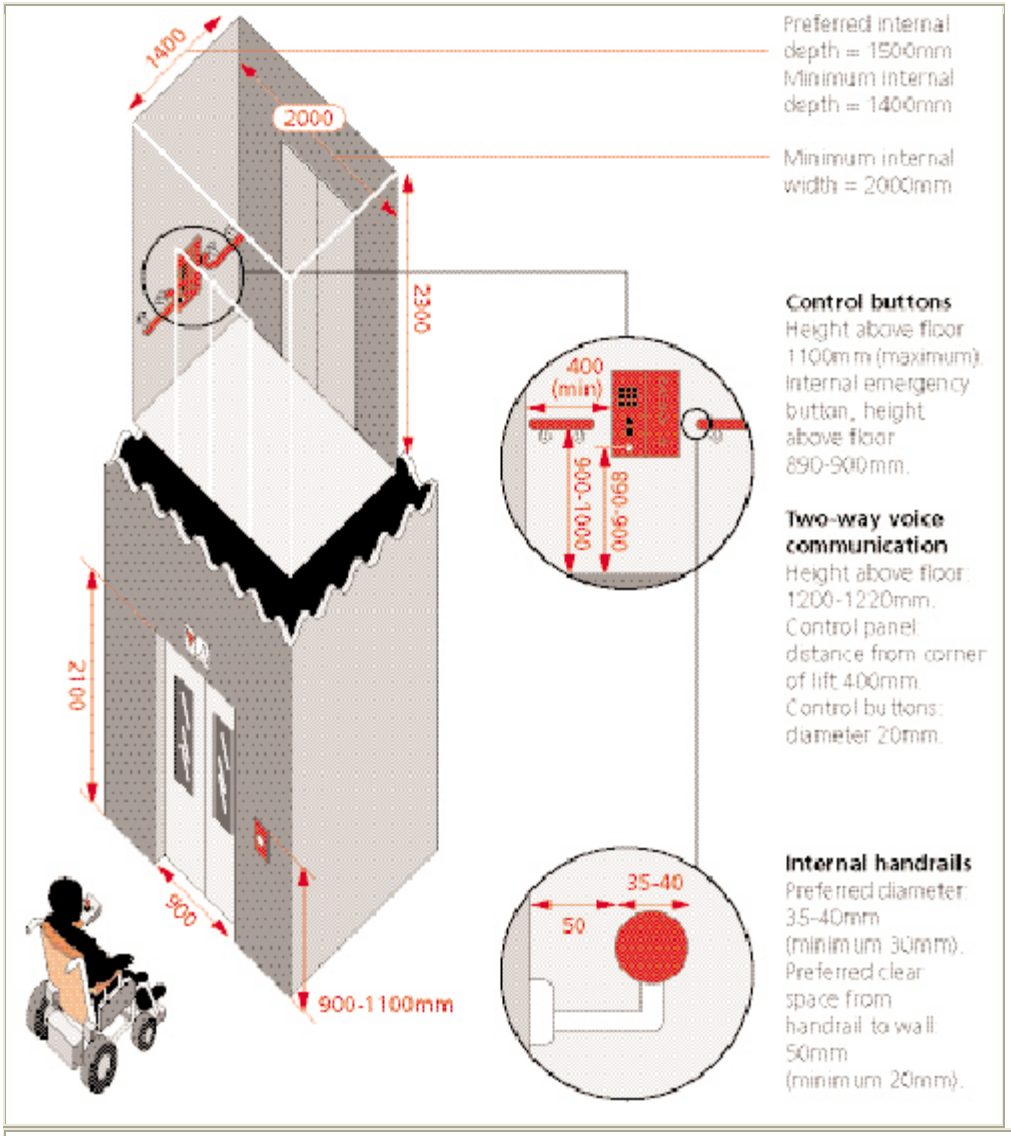
8.4.5 Lifts

Lifts are essential for wheelchair users and for some people who have walking difficulties when there is a substantial change in levels. They should be provided in preference to very long ramps. Finding the lift location can be a problem for blind, deafblind and partially sighted people. Lift locations should be clearly sign posted from the main pedestrian route and recognizable through design and location.

Ideally the internal dimensions of a lift should be big enough to enable a wheelchair user to turn round and come out facing forwards, but space constraints, particularly where a lift is put into an existing building may dictate less than an ideal size.

The draft European Lift Standard (April 2000) defines minimum internal dimensions measured between the structural lift car walls (see table, below). Any decorative finishes of a wall must not exceed 15mm in thickness.

Lifts



Minimum car dimensions for lifts with a single or two opposite entrances

Type of lift	Minimum car dimensions	Accessibility level	Remarks
1	1000mm wide x 1250mm deep	This lift car accommodates one wheelchair user	Provides access for manual and powered wheelchairs used in indoor environments
2	1100mm wide x 1400mm deep	This lift car accommodates one wheelchair user and one accompanying person	Provides access for manual wheelchairs and powered wheelchairs that are capable of negotiating some outdoor obstacles
3	2000mm wide x 1400mm deep	This lift car accommodates one wheelchair user and several other passengers. It also allows a wheelchair to be rotated	Provides access for manual wheelchairs and powered wheelchairs that are used in the outdoors. The car provides sufficient turning space for persons using class A and B wheelchairs or walking aids (walking frames, roller frames etc)

It should be noted that these are **minimum** dimensions. The depth of lift required by a wheelchair user with an elevated leg rest may be more than the dimensions given; a minimum of **1500mm** is suggested. This depth also makes turning a wheelchair round easier. Lifts provided in the pedestrian and transport environment should be large enough for a person to accompany the wheelchair user. The increasing numbers of scooters used in the outside environment also argue for using larger dimensions wherever possible than those given in the table. Where it is possible to fit them, walk through lifts (ie with doors on opposite sides) are preferable to single door lifts.

If a tip-up seat is provided it should not impede the normal use of the lift when in its folded position and it should be colour contrasted. The seat should have the following dimensions:

- seat height from floor **500mm ± 20mm**
- depth **300 400mm**
- width **400 500mm**
- ability to support a mass of **100kg**.

Handrails should be provided on the (non-opening) sides of the lift cabin at a height between **900mm** and **1000mm** and should contrast in colour with the interior of the lift. The dimensions of the handrails should meet those specified in Section 8.4.3 where possible, but lack of space may dictate a reduced standard. However, the handrail should not be less than **30mm** in diameter and should have at least **35mm** clear space between rail and wall. The handrail should not continue across the control panel in order to avoid

obstructing it. The ends of handrails should be closed and turned in to minimize the risk of injury.

The clear width of the doorway into the lift should be **900mm**, which allows for wheelchair users elbow space. The minimum clear height of the doorway should be **2100mm**, with **2300mm** inside the lift cabin.

Control buttons used to call a lift should be positioned between **900mm** and **1100mm** above floor level. They should not be positioned closer than **400mm** to an internal corner or other obstruction; if they are a wheelchair user many find it difficult to reach them. The call buttons should have symbols in relief to enable tactile reading. Call buttons should also contrast in colour and luminance with the surrounding face plate; the face plate should contrast with the wall on which it is mounted.

Similar measurements apply to control buttons inside the lift, but there are some additional features. Emergency buttons (with an embossed tactile legend) should be placed at the bottom of the control panel, not less than **890-900mm** above the floor and twoway voice communication should be at a height of **1200-1220mm**. If communication is via a handset, it should have a minimum length of cord of **735mm**. However, a push and talk facility is superior to a handset and cord and is more resistant to vandalism. As an aid to people with impaired hearing, the communication system should have an acoustic coupler and a volume control. There should be a yellow illuminated pictogram to indicate that the alarm has been activated and a green illuminated pictogram to indicate that the emergency call/alarm has been registered. Simple written information explaining emergency procedures should be provided for deaf people. The audible signal (voice communication) should have a sound level adjustable between **30dBA** and **55dBA**. The control panel should be at least **400mm** away from the corner of the lift cabin and there should be no fittings or objects between the panel and the floor which extend out more than **100mm** from the wall. Where the lift has centreopening doors, the control panel should be located on the right hand side when entering the cabin. With side opening doors, it should be on the closing side. Whichever side they are on, control panels should be on the flank wall of the lift rather than the front wall.

Outside the lift door there should be sufficient space for a wheelchair user to manoeuvre into place and to wait without obstructing the passage of other people. A clear landing **1500x1500mm** is the minimum. If this floor area is finished in a different colour from its surrounding area it will help visually impaired people to locate the lift.

Control buttons both within and outside the lift should be **20mm** in diameter and should protrude from the wall or lift cabin side. They should be at least **10mm** apart. Control panels should include instructions in Braille and in relief: the latter should use characters raised **1mm** from the surface and at least **15mm** in size. The force needed to press the buttons should be between **2.5N** and **5N**. The buttons should contrast with their surrounding area, either by internal illumination or colour contrast on or around the button.

Visual and audible announcements should be provided both in and outside the lift, the audible announcements having a sound level of between **30dBA** and **55dBA** adjustable to suit the site conditions. An audible signal on the landing should indicate when the doors are opening. An illuminated indicator arrow giving advance information on the direction the lift is going should be placed above or near the doors in a visible position. The height of the arrows should be at least **40mm**. The visual information display inside the lift should be positioned just above head height, to ensure a clear sight line when the lift car is full (**1800-1900mm** above floor finish) and should have minimum dimensions of **60mm x 50mm**.

The display could be digital or segmented LED or an appropriate alternative. A yellow or light green on black display is preferred to red on black as it is easier to read.

Lift doors should be open long enough to allow people who can only move slowly to get in and out without being caught by the doors. A minimum of **3 seconds** is acceptable, but a usual dwell time of **5 seconds** before the doors begin to close after they are fully open is preferable. The control system should allow for the door dwell time to be adjustable up to **20 seconds**: the means of adjustment should not be accessible to users.

The door re-activating mechanism should be photo-eye or infrared not pressure sensitive door edges. Sensors should be positioned at low level (around **125mm** above floor finish) to ensure that the sensor will be triggered by an assistance animal, and at around **700mm** to **800mm** above floor finish. It is also recommended that a **5 second** notification time should be given that the lift is answering a landing call.

The lift doors should be in a clear colour/tonal contrast with the surrounding wall and control buttons inside and outside the lift should contrast with the control panel. A clear contrast between the lift walls and floor will assist visually-impaired people. Lift floors should have a non-slip finish. Placing a mirror on the rear wall of the lift will enable wheelchair users to see floor indicators located over the entrance. In lifts where a wheelchair passenger cannot turn around, a mirror or other device should be installed to enable a wheelchair user to observe obstacles when moving backwards out of the cabin. Where wall mirrors are installed care should be taken to avoid creating optical confusion for users with impaired vision. Where glass is used it must be safety glass, but in general it is better to have internal walls with a non-reflective, matt finish.

Interior lighting should provide a level of illumination of minimum **100 lux** at floor level uniformly distributed, avoiding the use of spotlights or downlighters.

The stopping accuracy of a lift is important because, if inaccurate, it could prevent a wheelchair user accessing the lift or trip an ambulant user. The maximum vertical distance should be **10mm** and any horizontal gap should be kept to **20mm** or less.

There should be an obvious way of showing an intending user if the lift is not working. An emergency call system inside the lift is essential and, should it be used, there must be

a swift response. There should also be an external communication system on all lift landings to enable communication with a central controller should a lift not be in service.

Passenger lifts that are provided to evacuate disabled people in an emergency must have an independent power supply and meet the relevant recommendations of BS 5588.

8.4.6 Footbridges, tunnels and underpasses

While it is preferable to have at grade crossings wherever it is safe and feasible, there are places where a bridge or underpass has to be provided.

The design of road- and rail-related footbridges, tunnels and underpasses is largely governed by the good practice standards on stairs, ramps and handrails given earlier in this Section.

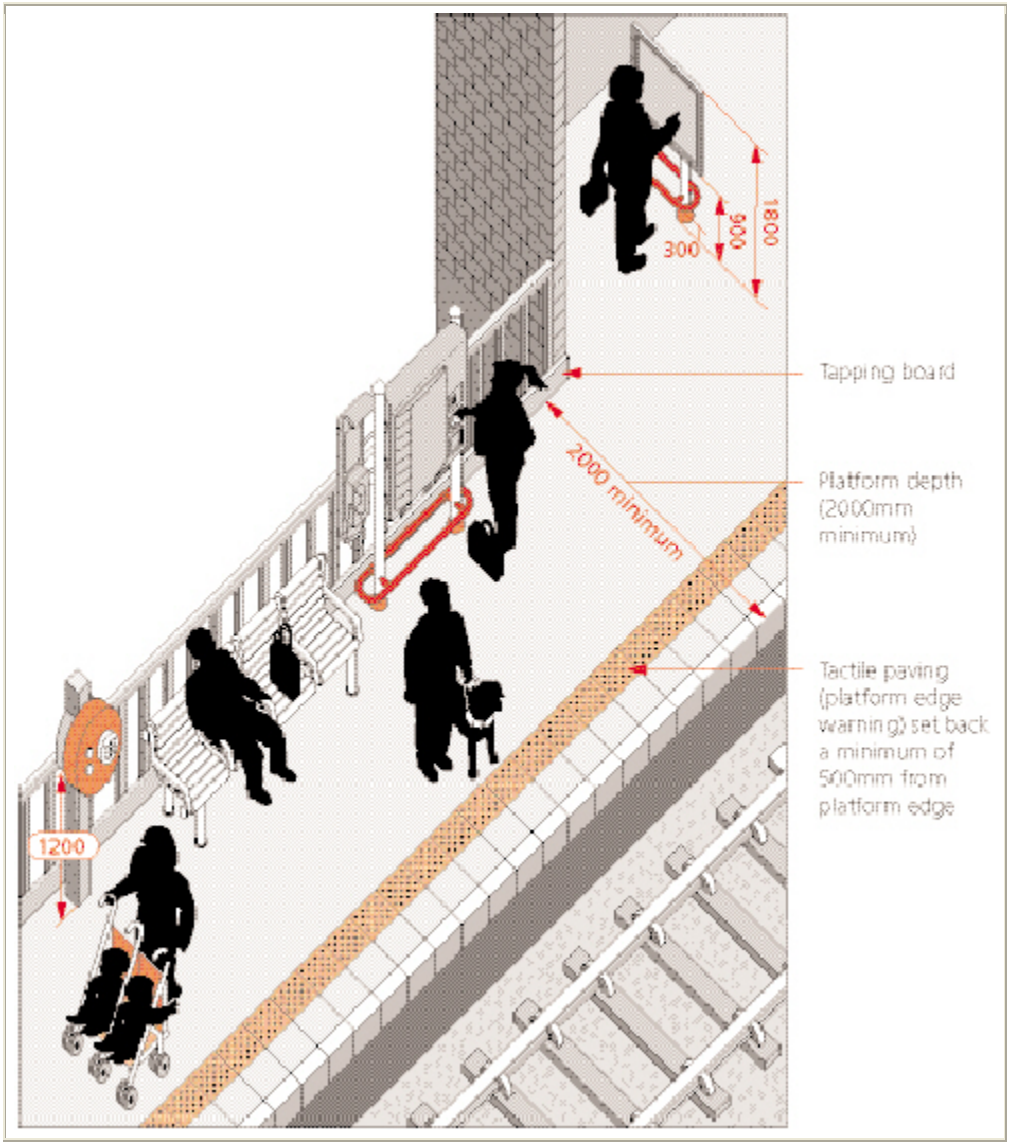
It is worth remembering that the headroom to be accommodated on an underpass is usually less than that required for a footbridge, so the length of ramp and stairway will also be less.

Where underpasses are provided the approach to them should be as wide as possible to give an open aspect and sense of security. It is recommended that the width of the underpass itself should be at least **4.8 metres** and have a clear headroom of **3 metres**. Within the underpass, handrails set at **1000mm** above the walking surface should be provided on both sides. There should be a clear view from one end to the other and a good level of lighting, at least **50 lux**. CCTV cameras placed in tunnels will enhance security and should be located so as to provide full coverage. Notices to the effect that CCTV is in operation should deter vandals and provide a measure of comfort to pedestrians.

8.4.7 Platforms: rail services

Passenger platforms should be built on a straight section of track so that the gap between platform and rail carriage is minimized. If they have to be on a curve, it is recommended that the smallest radius of curvature should be **600 metres**, and that if possible at least part of the platform should be on a straight section of track. Inevitably there is sometimes a balance to be made between locating a station on a straight section of track and locating it where it is most easily accessible, while economic and engineering factors also have to be taken into consideration. Where a station is on a curve, announcements should be made (as on London Underground) to alert passengers to the gap between platform and carriage.

Platform: rail services



The width of platform is influenced by the (maximum) number of passengers using it, but should have a minimum of **2000mm** clear space in addition to the width of the safety zone(s) and a further **1000mm** for service traffic.

The surface of platforms should comply with all aspects of good practice associated with flooring: even, slip resistant and non-reflective. Any crossfalls needed for drainage purposes should slope down from the front edge to the rear edge of the platform. Drainage gullies should if possible be avoided on platforms as they can cause problems for wheelchair users. Where they have to be provided they should be covered.

The appropriate tactile surface should be used to warn of the platform edge (see Section 4) and there should be a white line 100mm wide at the edge of the platform. If a guidance tactile surface is used along the platform, it should be **800mm** wide (Section 4.6) and should be located on the safe side of the platform safety area, eg behind the yellow line

1000mm from the platform edge on those platforms where trains pass faster than 165km/hour.

Any equipment such as vending machines should be placed clear of the unobstructed space along the platform and should be marked by contrasting colour and tone. Information signs should include a tapping rail between supporting posts to aid identification of the hazard by long cane users. Columns and other projections into the passenger circulation area should be avoided if at all possible; if not they should be highlighted using contrasting colour/tone. At least one Help Point (for information and use in an emergency) should be provided on each platform with controls (raised push buttons) and communication link at a height that can be reached by wheelchair users (around **1200mm**). Wherever possible the Help Point should provide both visual and audible communication. Similarly any audible announcements such as delays or changes of platforms should be provided visually as well, as should any emergency announcements.

The height of rail station platforms is normally 915mm, which does not give level boarding onto trains. However, the kinetic envelope required by a moving train (particularly freight) means that any increase in platform height would have to be offset by an increase in the horizontal distance between train and platform edge. Thus access to heavy rail trains for wheelchair passengers will continue to require a mobile ramp or on-train lift. Modern light rail systems are normally built with platforms that provide level boarding; if there is a gap a ramp has to be carried on the vehicle.

8.4.8 Platforms: rail services off-street

Where the rear of the rail platform is open there must be a raised kerb or kicking board in addition to rails or fencing. Such a kerb may be used as a tapping rail by long cane users; for this purpose the bottom edge of the board should be not more than **200mm** above ground level and should have a depth of **150mm**.

The DfT recommended tactile warning surface (see Section 4) should be laid between **500mm** and **700mm** back from the platform edge and should have a depth of **400mm** along the entire length of the platform. In addition to this, the edge of the platform should be marked with a **100mm** wide white line to assist partially sighted people.

Other potential hazards for visually impaired people, for example flights of steps, should be marked by a colour and tactile change in the platform surface.

The surface of platforms should comply with all aspects of good practice associated with flooring: even, nonreflective and slip resistant. Cross-falls required for drainage purposes should be no greater than **1:40** and must slope away from the platform edge.

Where there is a larger than usual gap between the railway carriage and the platform a clear mind the gap warning painted along the edge of the platform is of benefit to deaf and hard of hearing people.

8.4.9 Platforms: rail services on-street

The height of on-street LRT platforms will be dictated by the floor height of the rolling stock used. Modern low-floor LRT designs are such that the platforms need be no more than **350mm** high to give level access into the train. Although the height of the platform above road level may be relatively small, it should still be marked with the appropriate tactile warning surface and a white strip along the edge of the platform.

Access from pavement to the platform should be by shallow ramp and protection must be given if the rear of the platform is open (see Section 3.3).

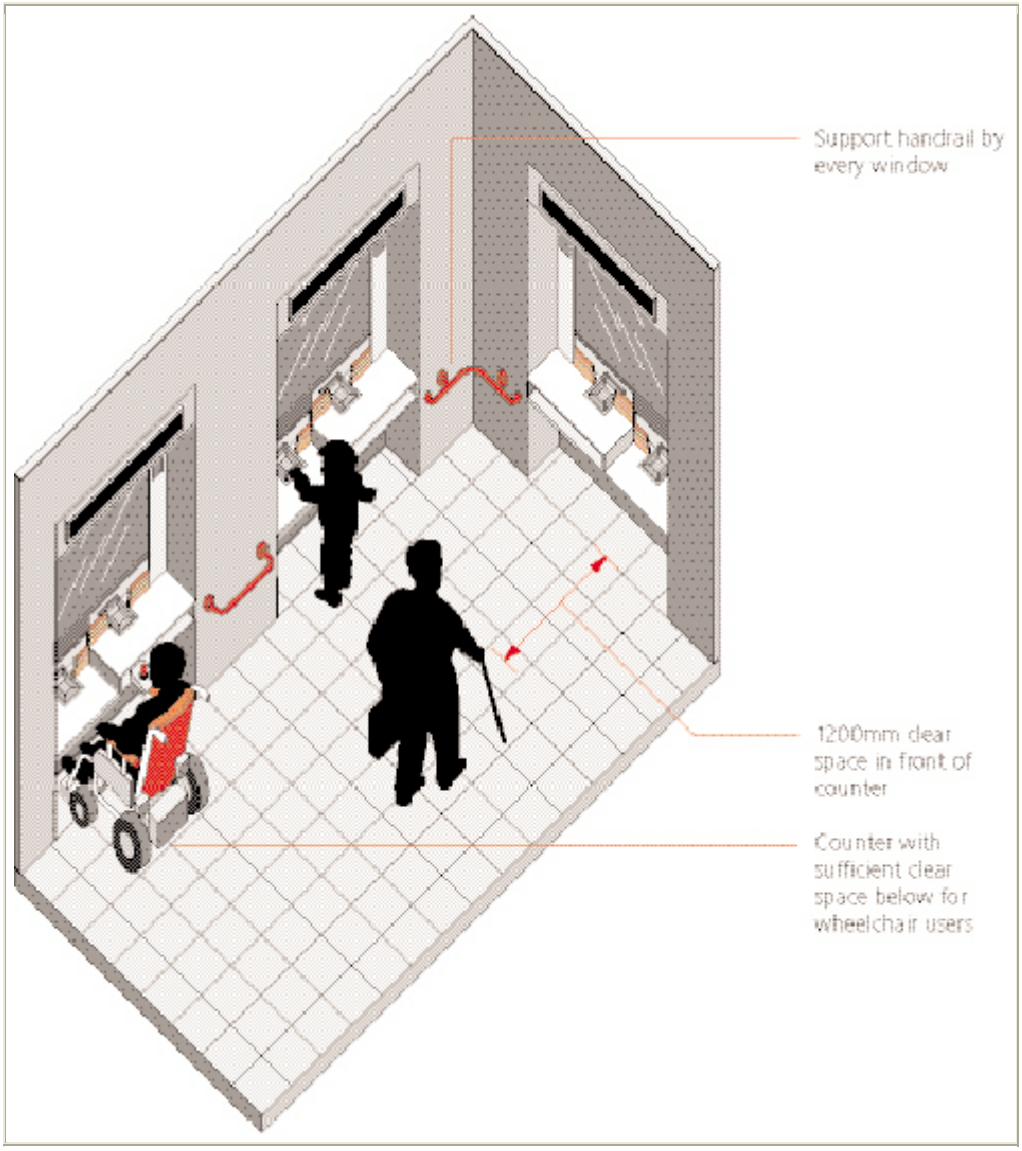
[6] It should be noted that stairs, ramps and lifts may form part of an escape route in the event of an emergency. Specific requirements are contained in Fire precautions in the design, construction and use of buildings. Code of Practice for means of escape for disabled people BS 5588 part 8 (1988).

[7] Note that this recommendation precludes the use of stairs with a clear width between 1800mm and 2000mm.

9 Transport buildings: Facilities 9.1 Ticketing and information

Service counters at ticket and information offices are conventionally designed for standing passengers and have a height of about 1050mm 1100mm: too high for passengers in wheelchairs or people of restricted growth. A service counter should be provided to meet their requirements, with a height of **760mm**. There should be sufficient clear knee space below the counter for a wheelchair users to come right up to the counter. It is recommended that this space should be **750mm** high by **500mm** deep and at least **900mm** wide. There should be a clear space at least **1200mm** wide in front of the counter. A support handrail should be provided at the side of each ticket office window.

Ticketing and information



The design of the counter top is also important. Some counters have a large radius curve on the top leading edge and when a customer sweeps the change or ticket into their hand it falls to the floor. A slight upstand at the front edge of the counter facilitates picking up small items. The design of the counter top should also reduce glare and reflection from lighting both natural and artificial.

Service counters should have induction loops for people who use hearing aids (with the appropriate sign displayed). The intercom unit should be mounted at a height of **1100mm** from the floor this height being chosen so that there is no visual barrier between the employee in the ticket office and the passenger.

Where there is a glass screen partition, consideration should be given to installing a voice transfer system. This is potentially of benefit to all hearing aid users (including those with

a t-switch) as well as hearing impaired people who do not normally rely on a hearing aid for communication.

Glass screens should be non-reflective so that a person who relies on lip-reading or facial gestures can see the staff member. Where information centres have textphones these should be well located with easy access to the staff member.

Cash tills should display amounts due for payment on tickets so that they can be easily seen by the ticket purchaser.

Wherever possible, ticket and information offices should be in a quiet area, well separated from the noise of the concourse.

Remembering that some ambulant disabled people find standing for even a few minutes difficult and painful, handrails which passengers can lean on should be provided in the queueing area.

Many rail systems are becoming closed with barriers at entry and exit points. Standard designs of barriers are not accessible to wheelchair users and are difficult for other disabled people. At each ticket barrier, the availability of assistance for mobility-impaired travellers should be clearly signed, as should an alternative, accessible route through the ticket checking and collection area.

Automatic ticket vending machines are becoming an increasingly common feature of transport systems. Probably the two most important aspects of the design of these machines are simple operation and all interactive parts of the machine within reach of wheelchair users. The maximum height of any interactive element should be **1200mm** and the minimum **750mm**. The operational features of ticket vending machines should be straightforward three or four step procedures. For example, ticket machines on the Manchester Metrolink System have such a system: select destination zone, select ticket type, pay fare and collect ticket and change. The places into which the ticket and change are issued should be large enough for people with manual dexterity impairment to be able to retrieve them without difficulty ie the size of the hand.

Instructions should be very clearly set out minimum type size **16 point**, with a mix of upper and lower cases and unambiguous illustrations. Printing and illustrations should be colour contrasted to their background. Consideration should be given to providing a Braille version of any instructions. Push buttons should be **20mm** in diameter and slightly protruding. There should be a good level of lighting around the machine; **200 lux** is recommended for the interactive parts and there should be sufficient clear space in front of the machine to allow wheelchair users to manoeuvre (**1850mm x 2100mm**). Ticket machines should not be placed on plinths that extend beyond the face of the machine.

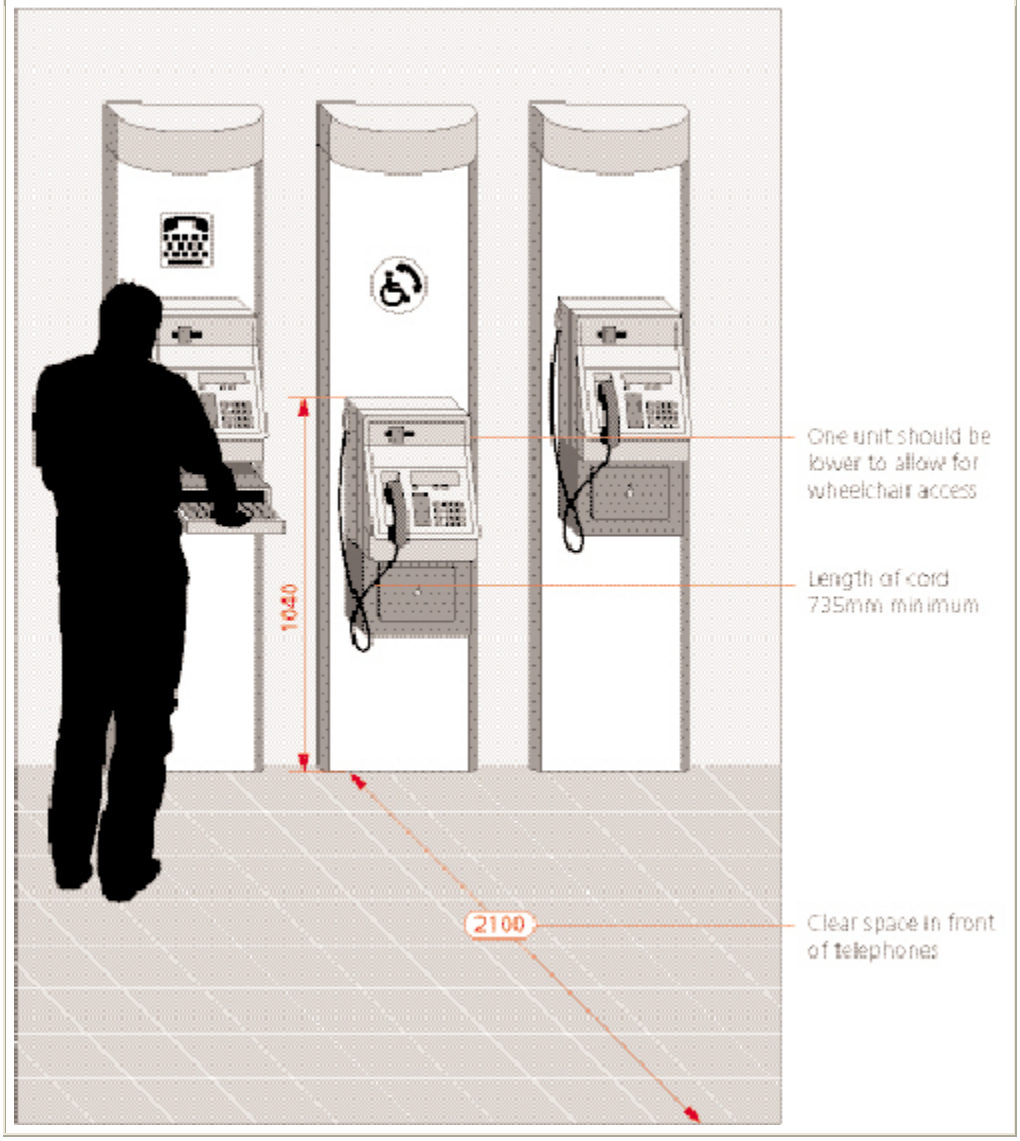
Having staff available who can help disabled people, who find using ticket machines difficult or even impossible, would be of benefit, but where this is not possible the

operational system of the service (rail, tram etc) should not penalize disabled people unable to use automatic machines.

9.2 Telephones

Some telephones, including text payphones, should be positioned **260mm** lower than the standard height (ie at **1040mm** to the top of the unit instead of **1300mm**). A new kiosk has been designed with the receiver, keypad etc at a height that is suitable for both standing and wheelchair users. On the keypad, the numeral 5 should always have a clear tactile marking. At transport facilities (airports, major rail stations, motorway service stations) text payphones should be provided. Clear signage to show the existence of text payphones should be provided. (see also Section 4.7: tactile information surface may be used to show where telephones are located).

Telephones

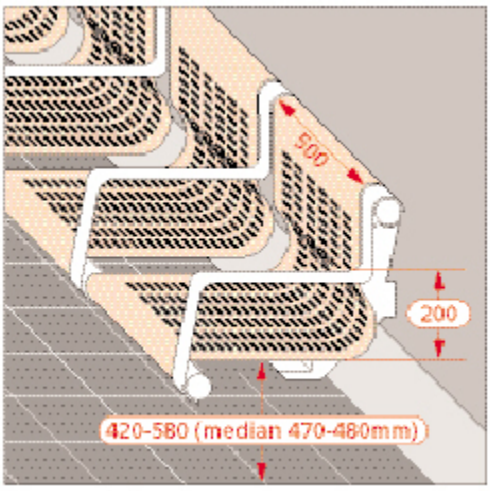


New public payphones are equipped with an inductive coupler and many have an adjustable volume control for incoming speech. Canadian guidelines recommend that the adjustment should cover from **12 decibels** to **18 decibels** above the noise level of the surroundings. The cord of the telephone should be at least **735mm** long to bring it within comfortable reach of a wheelchair user. There should be a clear space in front of the telephone of **1850 x 2100mm** to allow either forward or parallel approach by a wheelchair user. The design of any kiosk should ensure that there is no overhang that would present a danger to blind, deafblind and partially sighted people.

9.3 Seating and waiting areas

Use of public transport usually involves waiting, so provision of seating is important. Guidance on conventional seat heights varies over the range of **420- 580mm**, with a median height around **470-480mm**. Merseyside PTE uses a seat design which provides two seat heights at **489mm** and **584mm**, thus meeting the requirements of most people. Armrests are helpful for some people and should be placed about **200mm** above seat level. Seats placed in a row either should all have armrests or no armrests; a mixture within a single row can cause difficulties for visually impaired people. Seat widths are recommended to be a minimum of **500mm**.

Seating and waiting areas



Conventional seats

Although conventional seating to the dimensions given above will meet the needs of most disabled people, there are some who find perch-type seating, against which people half lean and half sit, easier to use. There may also be constraints on the amount of space available for seating, in which case fold down seats may be appropriate. Perch-type seating is recommended to be at a height of **700mm** and fold down seating at **550mm** to **600mm**. If space permits it is helpful for people of restricted growth (and children) if there are some seats at a lower level than the standard height. Also, in designing the layout of the seats, space should be left for wheelchair users to sit with their companions.

For outdoor seating it is vital that rain water is not allowed to collect on any part of the seat; wire top or wire-mesh seats are an obvious way of preventing this. Seats should be made of vandal resistant easy clean material. As mentioned in Section 3.4, seating should colour contrast with its surrounding area and should not obstruct pedestrian flows.

The need for seating is not limited to transport terminals; it also applies to the pedestrian environment as a whole (see Section 3.4).

Where audible announcements are made in seating/ waiting or refreshment areas, they should also be provided visually for the benefit of deaf and hard of hearing people.

9.4 Waiting and refreshment rooms

Waiting and refreshment rooms should make provision for the needs of disabled travellers. Doorways must provide level access and have, preferably, automatic doors or ones which are capable of being opened easily (see Section 8.2).

Priority seating for older and disabled people should be clearly identified. Where tables are provided they should make provision for use by wheelchair users, with legroom below the table **700-730mm** in height, **600mm** (minimum) wide and **500mm** (minimum) deep.

The tops of tables to be used by customers in wheelchairs should be no more than **750mm** in height. The height of accessible counters should conform with the dimensions given in Section 9.1.

Gangways between tables should be a minimum of **1300mm** wide to allow for the passage of wheelchair users and people with assistance dogs, though a narrower width of **900mm** may be acceptable in circumstances where space is very limited.

Colour contrasted seating and tables will assist visually impaired people, as will a contrast between wall and floor.

US regulations specify the numbers of wheelchair spaces in public places with fixed seating as one space where there are 4 to 25 fixed seats, two spaces where there are 26 to 50 fixed seats, four spaces (minimum) above this. Australian guidelines require a minimum of two spaces, above this five per cent of capacity.

Waiting areas should be equipped with help buttons and visual / audio information points.

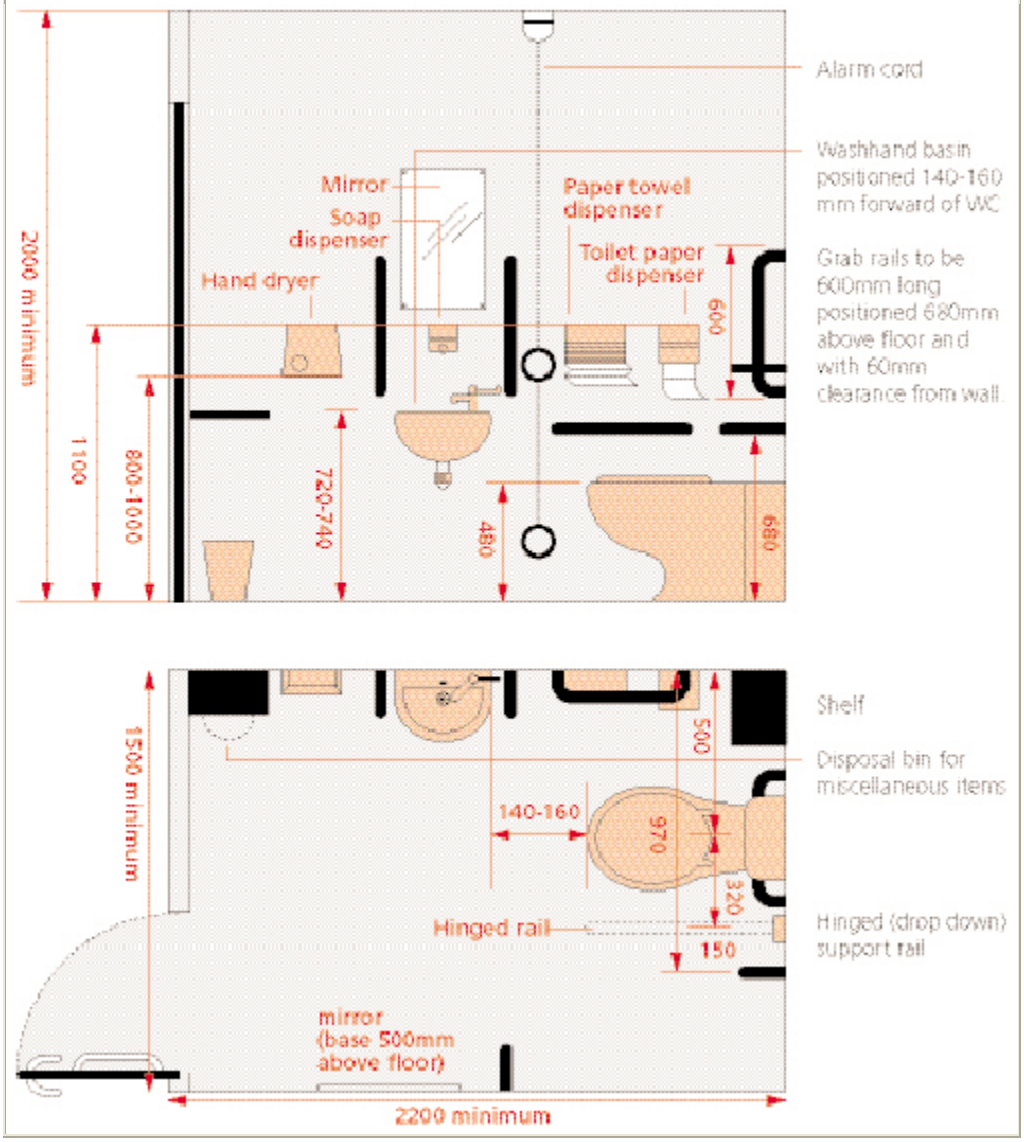
9.5 Luggage facilities

Where left luggage facilities are provided, they should be accessible to wheelchair users. Lockers of different sizes must be placed at heights appropriate to the range of passengers who wish to use them.

9.6 Toilets [8]

Toilets should be no less available for disabled people than for non-disabled people. It is recommended that they should be designated as unisex, not integrated with male and female toilets. Providing unisex toilets allows use by the many disabled people accompanied by a carer or partner of the opposite sex. Accessible toilets should have a raised tactile sign **180mm x 100mm**.

Toilets



Toilet doors should have a clear minimum opening width of **925mm** and be fitted with L or D shaped handles on the outside of the door at a height of **1040mm** above floor level. A horizontal closing bar should be fixed to the inside face of an outward opening door and the lock should be large and easy to operate.

The overall size of the toilet cubicle depends on whether it has a corner WC or a central (or peninsular) WC. A central WC allows the user to transfer from right or left on to the toilet or from the front and needs overall dimensions of **2800mm** width by **2200mm** length. A corner layout, which allows transfer from either left or right, requires less space: **1500mm** width by **2200mm** length.

Where more than one WC is provided the opportunity should be taken to provide both left-handed and righthanded transfer layouts, with the handing indicated by a touch legible pictogram. The overall dimensions quoted in this paragraph are sufficient to allow a wheelchair user to turn around.

In a corner WC layout, the WC centre line should be **500mm** from the side wall on which the wash basin is fixed. The basin should be within reach; placed **140mm** to **160mm** forward of the WC. The height of the WC should be **480mm** and the rim of the wash basin **720mm** to **740mm** above the floor. If a separate wash basin is provided for ambulant disabled people, the wash basin by the lavatory can be at a lower level. The toilet paper, soap dispenser and towel/hand drier should be within reach of a person seated on the lavatory. The wash basin should have a lever operated mixer tap on the side closest to the WC. A flushing lever attached to the WC cistern is preferable to a chain pull, and should be positioned on the transfer side of the pan where a corner layout is used.

It should be noted that a peninsular layout does not allow hand washing when seated on the lavatory, unless a pivoting design of washing basin is used. A single WC with a peninsular layout should not be seen as a substitute for two separate lavatories with handed corner layouts, but as an additional facility.

A hinged (drop down) support rail should be provided on the transfer side of a corner WC, set at a height of **680mm** and **320mm** from the centre line of the WC pan. Peninsular layouts need a hinged handrail on both sides. In corner layouts there should be fixed support rails, one set horizontally **680mm** above the floor on the wall at the side of the WC and two vertical rails set either side of the wash basin, **600mm** long with the bottom end of each rail **800mm** above floor level. If the WC cistern is a duct or at high level a horizontal grab rail should be fitted behind the WC. All rails should be **35mm** in diameter, with a good grip when wet, and the fixed rails should have **60mm** clearance from the wall.

Accessories such as dispensers for soap, toilet paper and paper towels should be suitable for single-handed use and positioned with their lower edge between **800mm** and **1000mm** from floor level. A mirror should be placed immediately over the wash basin, with a second longer mirror located away from the basin. This mirror should be at least **1000mm** tall with the bottom edge **600mm** above the floor (**500mm** in a corner layout where the viewing distance is more limited). A coat hook should be provided at a level that can be reached by a wheelchair user (**1050mm** above floor level) as well as one set at a more conventional height.

A colostomy changing shelf should be provided to the side of the WC pan (at a height of **950mm**) and a lower shelf (**700mm** above floor level) can be provided by the wash basin but away from the wheelchair manoeuvring space.

An emergency alarm or call for assistance cord, in a contrasting colour to its surrounding should be provided. The cord should be positioned to hang between the WC and wash basin and should reach almost to the floor level, passing through wall mounted guides for ease of control. Two large pull handles (**50mm diameter**) should be attached to the cord one at between **800mm** and **1000mm** and the other at **100mm** above floor level so that assistance can be summoned from the seated position or from floor level if someone has fallen. It is recommended that the alarm reset switch be positioned inside the cubicle.

The emergency alarm cord should be clearly labelled as such, and should trigger audible and visual signals outside the cubicle and in a reception point or area which is staffed. The cubicle door should allow for opening from the outside in an emergency.

Urinals should include one stall with a lower rim (maximum **430mm** from the floor), for use by people of restricted growth and children. At this urinal there should be a vertical rail on both sides to assist people who only have the use of one or other side of their body. A similar rail should be provided at the side of at least one standard height urinal.

If a urinal is intended for wheelchair users, the rim height should be **380mm** from the floor and should project at least **360mm** from the wall face. A tapering urinal, possible extending more than **360mm** from the wall to avoid contact with pipework, would allow closer access without the wheelchair touching the wall. An unobstructed space not less than **900mm** wide by **1400mm** deep should be provided in front of the urinal to allow access by a wheelchair user.

Shiny surfaces are confusing for visually impaired people and should be avoided for wall, floor, door etc finishes. Matt and mid-sheen finishes are likely to realize the full benefit of colour differentiation. There should be a good level of colour / tonal contrast between floor and walls, between door and walls and between the toilet, washbasin and other fittings and their surroundings.

9.7 Provision for assistance dogs

A secure area should be provided close to station buildings with a step-free access route. The dog relief area should be at least **3 metres x 4 metres** with a **1200mm** high secure fence. The entrance gate to the enclosed area should have a simple to operate and secure catch. The surface area should be concrete with a smooth finish to assist cleaning and a slight fall, say 3.5 per cent, to assist drainage. A waste bin, with a supply of plastic bags, should be placed close to the entrance. A sign saying For assistance dogs only should be displayed.

[8] BS 8300 Design of buildings and their approaches to meet the needs of disabled people Code of practice contains guidance for designing toilets and the measurements given in

this section are largely based as those given in that publication. See also design standards given in Part M of the Building Regulations 1991 (Access and Facilities for disabled people) and in Part T of the Technical Standards (Scotland) Regulations 1990.

10 Signage and information

Signs and information must be in forms that can be used by disabled people. It is particularly important to take account of the needs of visually impaired and hard of hearing people and to make information as simple and easily understood as possible. Simplicity helps everyone but particularly people with learning disabilities. The placing of signs is also important: reasonably close to, but not impeding passenger circulation areas.

Signage has a very important role to play. It should encompass all the facilities within the area, particularly any services or facilities for disabled people such as accessible toilets, accessible buses, Shopmobility services etc, and should also say how far it is to each facility mentioned. Given the limited distances that some ambulant disabled people can manage, it is essential for them to know how far away the facility or service is located. All stations and terminals should have clocks which display the time in large digital characters. Rail and most bus timetables use a 24-hour format, so this format should also be used for clocks.

Signage is also very important in relation to emergencies. Exit routes to be used in an emergency must be clearly signed; essential for deaf and hard of hearing people who may not be able to hear emergency announcements. Visual information systems used for emergencies should have flashing warning lights to alert deaf and hard of hearing people.

A considerable amount of research has been undertaken on the design of signage and printed material. The general principles are summarized in the following sub-sections.

10.1 Signage 10.1.1 Size of letters

Size of letters should be related to the distance from which the sign will usually be read.

Various research studies have produced a range of preferred size of letters in relation to distance and degree of visual impairment. As a general rule it is suggested that the letter height should be at least 1% of the distance at which the message will usually be read, subject to a minimum height of 22mm. If space permits, letter height should be greater than the one per cent rule. US guidelines, for example, specify a minimum (capital) letter height of 75mm for overhead signs and a general ratio of text height to reading distance of 1:60 or approximately 1.7 per cent. This size is stated to be acceptable to people with low vision (20/200).

The Sign Design Guide (see Bibliography) recommends the following character sizes:

- Long distance reading, for example at building entrances, a minimum size of **150mm**.
- Medium range reading, for example direction signs in corridors, a size of **50-100mm**.
- Close up reading, for example wall mounted information signs, a size of **15-25mm**.

The Guide also contains a graph showing the relationship between character size and reading distance. For someone with 6/60 vision registered as partially sighted the character size : reading distance ratio is approximately **1:27** or **3.75 per cent**. Thus at a distance of four metres, character size would need to be 150mm; at six metres it would be 225mm.

10.1.2 Size of symbols

Research by TransVision for Transport Canada produced the table shown below relating viewing distance to symbol size. The size is actual for any square symbol, nominal for symbols using a circular or triangular shape. Symbols can have the advantage of simplicity and greater clarity but should not be used unless it is known that they will be understood by passengers and staff.

Viewing Distance and Symbol Size

Viewing distance	Symbol size
3-6m	40mm
6-9m	60mm
9-12m	80mm
12-15m	100mm
15-18m	120mm
18-24m	160mm
24-30m	200mm
30-36m	240mm
36-48m	320mm
38-60m	400mm
60-72m	480mm
72-90m	600mm

10.1.3 Typefaces

Considerable research has been carried out into legibility of different typefaces. The general recommendations are that letters and numbers should:

- be Sans Serif;
- use lower case lettering, which is more readily distinguishable than uppercase (capital) lettering;

- use Arabic numbers;
- have a width to height ratio of between **3:5** and **1:1**;
- have a stroke width to height ratio between **1:5** and **1:10**, preferably in the band **1:6** and **1:8**;
- character spacing the horizontal spacing between characters should be **25 to 50%** of characters width and **75 to 100%** between words; and
- vertical spacing between lines should be at least **50%** of character height.

Examples of appropriate typefaces for signs include New Johnston (used by London Underground) Rail Alphabet (designed for British Rail), Futura, Folio, Helvetica, Standard, Airport and DfT Transport Heavy and Medium (expressly designed for clarity for traffic signs).

10.1.4 Colour contrast

It is essential that characters on signs should contrast with the background of the sign. Apart from signs that are internally lit, dark text on a light background is preferable: eg black or dark blue on a white background though there may be occasions when light lettering on a dark background is preferable.

Signs should have a matt finish, not a shiny one, and should be well and evenly lit with uniform lighting over the surface of the sign of between **100** and **300 lux**.

The sign board colour should contrast with its background as this will assist with visibility and readability. The table below, reproduced from the Merseyside Code of Practice, shows appropriate colour relationships.

Schedule of Colour Contrast for Signs

Background	Sign board	Legend
Red brick or dark stone	White	Black, dark green or dark blue
Light brick or light stone	Black / dark	White or yellow
Whitewashed walls	Black / dark	White or yellow
Green vegetation	White	Black, dark green or dark blue
Back-lit Sign	Black	White or yellow

10.1.5 Positioning of signs

The optimum viewing angles for signs mounted on walls or other vertical surfaces are **± 30°** in the vertical plane (from eye level) and up to **20°** either side of a **90°** line to the sign in the horizontal plane.

In practice, it may not be possible to achieve the height implied by the optimum viewing angle because of obstruction from other passers-by, where for example the content of the sign is directional information that needs to be seen from a distance. Wall-mounted signs that contain detailed information; timetables, maps or diagrams, should be centered around **1400mm** from the ground, with the bottom edge not less than **900mm** above ground and the top edge up to **1800mm** above ground.

Consideration should be given to duplicating detailed signs and instructions, especially safety notices, at high and low levels, i.e. at **1600 1700mm** and at **1000 1100mm** to allow convenient close viewing by wheelchair users.

Where a sign may be temporarily obscured, eg by a crowd, it should be placed at a height of not less than **2000mm**. Where a directional or information sign is suspended over a pedestrian area there should be preferably **2300mm** clear space below the bottom edge of the sign, (**2100mm** minimum).

10.1.6 Variable message signs (VMS)

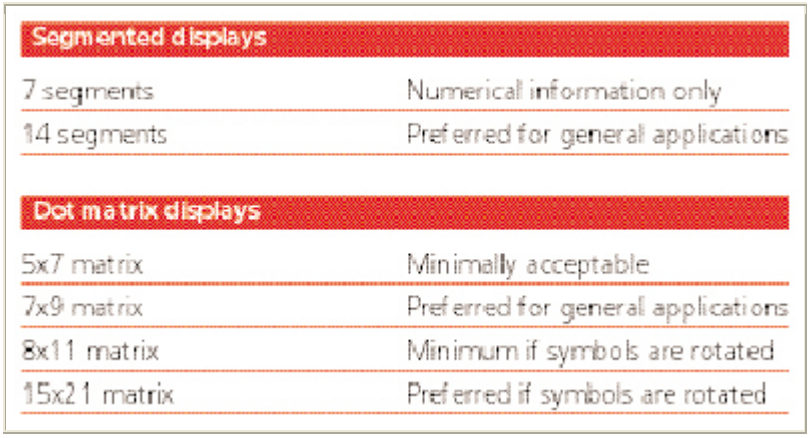
Signs of this kind have been used for many years in transport terminals, but their use has extended in more recent times to other locations such as bus stops and Underground stations.

The increased use of VMS has been accompanied by the development of guidelines, notably in North America. The recommendations include:

Reading rate: there is a wide range in individual reading rates from around 125 words per minute up to 500 to 600. The average is about 250 words per minute. Where messages are scrolled or changed (as in split-flap or flip-disk displays) each message should be held for a fixed time of **10 seconds** sufficient time for someone with relatively poor reading ability to read about 20 words. This is also sufficient time for a synthesized speech message to be made.

Electronic characters: can be formed by segments or dots. Increasing the number of dots or segments improves character readability. The recommendations are:

Segmented displays



Segmented displays	
7 segments	Numerical information only
14 segments	Preferred for general applications
Dot matrix displays	
5x7 matrix	Minimally acceptable
7x9 matrix	Preferred for general applications
8x11 matrix	Minimum if symbols are rotated
15x21 matrix	Preferred if symbols are rotated

Colours: must take into account colour deficiencies, thus red/green combination should be avoided.

Height of characters is recommended as equal to the distance between the viewer and the screen divided by 137.5. Thus if viewed from **2 metres**, the character height would be approximately **14.5mm**, at **10 metres** it would be about **73mm**.

Variable message signs outside buildings should be shielded from direct sunlight. Care should be taken to ensure that VMS information is accurate and up-to-date.

10.1.7 Tactile signs

Characters, whether letters or pictograms, should be embossed, not engraved, and should be raised from the surface of the sign by between **1mm** and **1.5mm**. The stroke width should be between **1.5mm** and **2mm** and the height of each character should be at least **15mm**. The letter spacing should be increased by between **20-30 per cent**, depending on the selected font, and word spacing should be increased by 25 per cent. The edges of embossed characters should be slightly rounded to avoid sharp edges and the typeface should be sans serif.

Where Braille is used, grade one Braille is permissible for single words but for signs with more than one word, contracted Braille must be used. Most blind and visually impaired people do not read Braille, so embossed signs will be more generally useful.

10.1.8 Audible information

Audible announcements are helpful to most people but particularly to those with visual impairment. It is essential that there is a significant difference between the level of background noise (ambient noise) and the level of the signal or announcement. The higher the signal to noise ratio (the difference in decibels (dB) between signal and ambient) the better for communication. People with hearing impairment require at least a **+5dB S/N** ratio. In environments that are noisy, any spoken information should be repeated at least once.

Audible alarm systems should operate at least **15dB** over the prevailing sound level, with a maximum of **120dB**.

10.1.9 Timetables [9]

Timetables and other information which people will read from a short distance should:

- use a simple sans serif mixed-case typeface;
- print size of 16 point (if there is sufficient space);
- good contrast between print and background, eg black on white or black on yellow;
- matt finish paper, not glossy;
- and if appropriate, distinguish clearly between weekday and weekend services.

In some cases the amount of timetable information that has to be displayed will mean that use of 16 point print size would make the displays too large, so a smaller size will have to be used. The other requirements listed above would still apply.

Where text is used it should be left-aligned type with a ragged right-hand margin; this is easier to read than justified type. Although a word or two in capitals should not present any difficulties, capitals should be avoided in continuous text.

Timetables placed outside, for example at bus stops, should if possible be sheltered from the rain; water on the glass over the timetable distorts the text and makes it difficult to read. All bus stops should be provided with timetable frames located between **900mm** and **1800mm** above ground level.

Timetable panels, of the type found in railway stations, should be placed adjacent to the main flow of passenger circulation, and at right angles to the direction of the flow. Placing should allow passengers to stand directly in front of the panel without impeding the main circulation flow. The recommended dimensions for the panels are: bottom **900mm** above ground, top **1800mm**, width **800mm** to **1100mm**. If there is an opening between the bottom of the panel and the ground, a skirting **300mm** minimum in height should be placed below the panel to guide people who use a long cane or stick around the panel.

[9] This subsection is concerned with timetable displays. Guidance on good practice for books and leaflets is given in Legibility of Timetables Books and Leaflets produced by DPTAC.

11 Lighting

Good lighting in the transport and pedestrian environment is important from several points of view personal security, safety, the ability to see signs and instructions.

People with visual impairments require clarity from a lighting system. Reflection, glare, shadows and large variations in lighting levels generate visual confusion and, in some cases, discomfort.

- Reflection can be minimized with the careful use of non-reflective finishes on internal surfaces.
- Glare can be reduced by the thoughtful positioning of lights out of the line of vision. Glare from daylight can be reduced with adjustable blinds on windows.
- Shadows can mask hazards. They can be avoided by increasing the level of ambient light and ensuring spotlights are not used on their own.
- Feature lighting, such as downlighters should be located where they will not cause shadows to fall across peoples faces making lip reading difficult.
- Large variations in lighting levels requiring swift reactions from the eye should be avoided. Any change in lighting levels should be gradual.

Lighting often fulfils secondary functions, for example, giving directional guidance along a corridor illuminated by a series of lamps mounted longtitudinally on the ceiling or highlighting potential hazards such as stairs. Recommendations for carriageway and footway lighting levels are given by BS 5489, the Code of Practice for Road Lighting. Different parts of the Code relate to different types of area to be lit. Part 2 refers, for example, to lighting for traffic routes and Part 3 to lighting for subsidiary roads and associated pedestrian areas.

Part 3 of the Code recommends maintained average illuminance figures varying from 3.5 to 10 Lux, depending on the road lighting category. This includes for public use, crime risk and traffic use. For other areas, the following recommendations for minimum acceptable illuminance levels are drawn from a number of sources, including British, Australian and Canadian guidelines. They represent minimum acceptable levels.

Entrances to buildings	150 lux
Passages and walkways	150 lux
Steps and stairs, at tread level	200 lux
Ramps, at top and bottom	200 lux
Station platforms and forecourts	50 lux
Underpasses	50 lux
Directional signage	200 lux
Maps and displays, text panels	200 lux
Counter tops	250 lux
Telephones	200 lux
Control panels (eg on lifts)	100 lux
Ticket and other interactive machines	
- interactive area	200 lux
- background level (around machine)	50 lux
Lifts, internal minimum (uniformly distributed)	100 lux
Lifts, landing area	200 lux
Accessible toilets	100 lux

It should be remembered that good levels of lighting will be of benefit to everyone who uses transport and pedestrian facilities. Bright, well-lit premises will encourage the use of public transport and lighting that eliminates dark areas or corners will give a greater feeling of security to passengers. Wherever possible, buildings should be designed to make maximum use of natural lighting, though care should be taken to minimize glare and strong reflections off surfaces.

12 Access in the countryside

Although this guide is mainly concerned with accessibility in the urban environment, access to the countryside is also important. Those who are involved in the design, planning and provision of access to the countryside should consult the British Telecom (BT) Countryside for All Standards and Guidelines (1997).

Many of the dimensions recommended in the BT Guidelines are similar to those given in this report. The following paragraphs summarize the key recommendations.

To allow for two-way pedestrian traffic paths should be at least **2000mm** wide with a clear visual distinction between the path surface and the ground next to it. If the path width has to be less than **1500mm**, passing places (minimum **1500mm** wide by **2000mm** long) should be provided every **50 metres**.

Where there are gates on a path, there should be clear space **2000mm** long, with **300mm** extra width adjacent to the latch side, on the side of the path into which the gate opens.

Where there are changes in level both steps and ramps should be provided, but if there is insufficient space for both provide a ramp. (The BT Guidelines give detailed recommendations for maximum ramp lengths and gradients in different countryside settings).

All accessible path surfaces should be compact, firm, stable, non-slip and obstacle free. Suitable materials include concrete, bitumen macadam, stone, timber, brick/paving and grass. Sand, loose gravel, woodchips and cobbles should not be used.

Bridges and boardwalks should have a minimum clear width between handrails or edging boards of **1200mm** for one-way traffic and **2000mm** for two-way traffic. At the start of a boardwalk the lip should not be more than 5mm high and gaps between boards (laid at right angles to the directions of pedestrians flow) should not be more than **12mm** wide. All boardwalks and bridges should have edge protection at least **75mm** high and also handrails.

The recommendations for the design of steps are similar to those given earlier in Section 8.4 of this report and include advice to avoid single steps, to use colour contrasting for step noses and to provide handrails.

Viewing points should, wherever possible, be accessible to everyone including wheelchair users. The provision of seating or resting places is important, as is ensuring that any information or interpretation points do not obscure the view for wheelchair users. If telescopes are provided they should have a variable height control and there should be knee space between the telescope and the ground to give wheelchair users access. Safety barriers should be provided where necessary and should take account of the viewing height of wheelchair users, though safety considerations are paramount.

Detailed advice on the design of gates and stiles, including a type of stile that can be used by people unable to climb over traditional stiles, is given in the BT Guidelines.

Seats and perches should be placed or regular intervals along paths in the countryside. They should be located no more than **100 metres** apart and should be set back from the main route by at least **600mm** to allow the free passage of through traffic. Surfaced resting places at least **900mm** square should be provided next to seats so that wheelchair users can sit next to family and friends.

Sheltered information and interpretation boards are helpful for visitors and can double up as shelter from the weather. They should be accessible to all visitors and, where possible, incorporate seats or perches under the shelter. The roof of the shelter should not just cover the information board, but also people who are reading it and the roof should be at least **2100mm** from the ground so that it is not a hazard for blind or partially sighted people. The BT Guidelines also include advice on signage and way marking, car parking and the provision of facilities including toilets and telephones.

13 Consultation, training and management 13.1 Consultation and participation

As will be apparent from the information contained in this report, planning and developing an accessible environment is quite a complex process.

Consultation, at an early stage, with local groups representing disabled people will help in the process of planning and implementing accessible buildings and other infrastructure. It should be remembered that disability covers a very wide spectrum of people with different needs, so consultation should involve people who use wheelchairs, who are ambulant disabled, people with partial sight and others who are blind, people with impaired hearing and people with cognitive impairment.

Consultation with these people and of local authority access officers by planners, engineers, architects, surveyors and transport providers will provide a better understanding of the mobility requirements of disabled people and avoid the cost of rectifying mistakes retrospectively.

Following on from consultation, the direct involvement of disabled people participation in the development and testing of accessible features will be of value in again ensuring that what is provided does meet disabled peoples needs.

Beyond local groups, there are national organizations, such as DPTAC, the RNIB the RNID and The Royal Association for Disability and Rehabilitation (RADAR), that can provide advice on the design of buildings and facilities. The DfTs Mobility and Inclusion Unit can give advice both on specific aspects of designing for accessibility and on appropriate national organizations concerned with disability (see Useful Addresses for further details).

13.2 Disability awareness training

Brief reference was made in Section 2.1 to the definitions or models of disability. The Social Model of Disability views disability as something which is imposed on people with impairments whatever the nature of those impairments by the way society places barriers to equality.

This guide is mainly concerned with designs that will remove these barriers, but disability awareness training is also essential if disabled people are to have equality of access and mobility.

Obviously it is most important that staff who come into contact with the public should have this training, but equally those who deal with designing, planning and managing facilities and services should also have a good knowledge of the needs of their disabled customers and users.

Senior managers need to understand the implications of the DDA on policy and procedures, planning, investment and strategy to ensure:

- Investment opportunities are not wasted.

- Investment helps meet the requirements of the DDA.
- The guidance and standards set out in this document are built into routine maintenance and construction projects to avoid making mistakes that may be expensive to rectify and to help ensure compliance with the DDA.
- All policies, practices and procedures at every location used by the public comply with the DDA.

Staff who are in regular contact with the public need to have awareness of how to serve a disabled person without discrimination and how to mitigate the effects of inaccessible premises, vehicles and services etc, in compliance with the DDA. All staff need to be able to think on their feet in unexpected situations or in an emergency.

Some transport operators and other organizations have produced training programmes on disability awareness which can be used by other organizations. Training in disability awareness should form part of both induction training and refresher or promotion courses for staff. Disabled people should be involved in the design of training programmes as well as their delivery where possible.

Training should be tailored to the particular job function, but in general programmes should include (as appropriate):

- barriers faced by disabled people, including attitude, environment and organization;
- principles of access audits;
- suggestions for removing barriers faced by disabled people;
- information on the range of disabilities, including hidden disabilities;
- the skills needed for assisting disabled travellers;
- communication and interpersonal skills for dealing with disabled people, particularly those with a hearing impairment;
- and general awareness of the DDA.

For those who are involved at a professional level and who wish to learn in more depth about designing access into the environment, short courses and modular degree courses are becoming available. Advice on courses of this kind may be obtained from DPTAC.

Give the far-reaching nature of the DDA, it would be sensible for any organization that is involved with transport and its associated environment, to make sure that it has staff who are well-trained and knowledgeable about access for disabled people.

13.3 Management

Much of the future improvement to access in the transport environment will take place as part of maintenance, repair and modernization of transport fabric, rather than when brand new facilities are built. Continuing maintenance programmes give the opportunity to make improvements in access at lower cost and with less disruption than if the

improvements are made separately. For example, relaying a footway may provide the opportunity to clear some of the clutter often found in the pedestrian environment.

This is not to say that specific improvements to access should never be made unless they are part of larger works; there will be occasions when it will be essential to carry out improvements outside normal work programmes. However, there are obvious advantages in incorporating access improvements into planned work programmes wherever possible. Staff, particularly engineering and maintenance, should be made aware of the importance of doing this.

Further emphasis to developing programmes for improving access in the environment is given in Guidance on Full Local Transport Plans, published in March 2000 by DfT. Paragraphs 301 to 304 in Part II of this document set out the disability issues that should be taken into account when preparing local transport plans (LTPs) and include the statement that, Local authorities and transport operators will have to consider the needs of disabled people from the start to the finish of their journey. This section also makes the point that, getting the design of the pedestrian environment and public transport infrastructure right is just as important as ensuring that disabled people can get on and off vehicles.

It is also Government policy to encourage walking by making it easier, more pleasant and safer. In the advice to local authorities Encouraging walking (DfT, March 2000) the point is made that improvements to the pedestrian environment must take account of the full range of people who will use them, including people using wheelchairs and walking aids, people with sight or hearing impairments and people with all levels of fitness and ability.

Thus there is a clear responsibility placed on local authorities to plan and implement improved access for disabled people.

13.4 Publicity for improvements in accessibility

When access to an existing facility or service is improved, or when a new fully accessible facility is built, disabled people who may use and benefit from the improvements should be made aware of them. The methods used to bring improvements to the attention of disabled people will vary depending on the type and scale of the changes made, but may include direct correspondence with local organizations of disabled people, announcements in the local press or on local radio, leaflets and advertising. Hiding the light of an improvement in access under a bushel of nonpublicity helps no-one.

Apart from the need to inform people about changes in accessibility, there is a more general requirement to make sure that people are aware of the level of access at stations and other transport infrastructure. This information should be available in a variety of formats so that, for example, blind as well as sighted people can obtain the information.