Chapter 22 Pedestrians

22.1 Introduction

Walking is an indispensable part of the transport system in every urban area. Over 80% of trips under one mile long are made on foot and the proportion is even greater for shorter distances. Even among journeys over a mile, 10% are on foot, although this represents only 2.4% of the distance travelled. In total, about one-third of trips in urban areas are made entirely on foot (although this depends crucially on how 'a trip' is defined). For education and shopping trips, walking represents over 20% and 10% respectively for journeys over a mile, with higher proportions for shorter journeys. Everyone needs to walk – for work, shopping, education or leisure. For those with a choice of mode, more could be done to encourage people to choose to walk. Among the factors which favour walking are its cheapness, its healthiness and its flexibility.

In urban areas, people should be able to walk in reasonable comfort and safety, as walking is an essential part of a wide variety of activities. People walk in order to get to specific destinations but walking–around is also an integral part of shopping, leisure or sight–seeing. Indeed, the freedom with which a person can walk about and look around is a useful guide to the civilised quality of an urban area (Buchanan *et al*, 1963).

It is vital to the environmental quality of urban areas to provide a high standard of pedestrian facilities, recognising the vulnerability of all pedestrians and the special needs of the young, the elderly and people with disabilities (DOT, 1997) [Sa].

22.2 Vulnerability of Pedestrians

Pedestrians are particularly susceptible to risks posed by other road–users, although individuals may under– or over–estimate the actual level of risk in any given situation. However, the perception of risk influences many social activities and, in extreme cases, even community relationships and identity. The mobility of vulnerable groups, including children and the elderly, is especially affected by the perceived risk from traffic volume and speed. However, this perception is well grounded in the high proportion of pedestrian accidents that result in death or injury (see Chapter 16) and the injurious effect on health of the emissions from vehicle exhausts (see Chapter 17).

22.3 Strategies to Provide for Walking

In many urban areas, the needs of vehicular traffic have taken precedence over the needs of pedestrians and it appears that the needs of pedestrians have not been given the attention they deserve. This is not only inefficient but also results in a poor environment. A complete transportation strategy would include the development and maintenance of a comprehensive, safe, well–signed and well–lit network of pedestrian routes, providing easy access to major attractions.

The development of a robust urban transportation strategy must include an analysis of pedestrian needs. The resulting plan should provide a balance between the requirements of private vehicles, public transport, pedestrians and cyclists. Edinburgh, for example, has established specific targets for an increase in walking compared with other modes of transport. Policies now recognise the vulnerability of pedestrians and the need to discriminate in their favour (Davies, 1992). Analysis should determine the nature and preferred routes of walking trips. For example, pedestrians when shopping exhibit a more random and diverse pattern of movements and, therefore, need more space than pedestrians walking between a public transport interchange and, say, an office complex, who are likely to seek the shortest and quickest route.

The level of pedestrian activity is a useful measure of the vitality and commercial viability of a town. Counts should be taken at different locations, both within a town centre and elsewhere in the urban area, and at different times of the day and evening. The counts should be taken in the same locations at the same time each year to monitor trends, especially in retail activity. Surveys of this kind are used to assess the impact of activities, such as special promotions in the town centre and the opening of new retail centres, both within and outside the urban area and to provide a rationale for a footway improvement strategy.

Pedestrians are concerned about the condition of footways and footpaths, including unevenness, raised edges, slipperiness, broken paving slabs, gaps and poor quality repairs (May *et al*, 1991). There is a demonstrable need for a comprehensive strategy for

inspection and maintenance of footways and other pedestrian facilities. All pedestrian areas should be inspected on a regular basis and a record made of any footway or footpath in a condition worse than a pre-determined threshold standard. The strategy should allow for a maintenance response which balances the efficient use of resources and preserves acceptably safe surfaces. Generally, pedestrians seem to prefer elemental paving to blacktop and prefer sand or brick colours. The strategy should identify materials which are both economical and appropriate to the location and use of the pavement.

22.4 Developing Pedestrian Networks

Pedestrian networks should be planned carefully and implemented incrementally. They should be related to cycling (Chapter 23) and should be incorporated with town centre strategies (Chapter 12). Walking is both the slowest and most flexible form of transport but may, nevertheless, be the quickest means of making short trips. In order to decide which parts of a pedestrian network require improvement, the designer needs to have a clear understanding of the patterns of pedestrian activity. However, pedestrians, unlike vehicles, do not confine themselves to specific routes but rather follow the shortest and most direct path between their origin and destination. Surveys can be undertaken by a variety of techniques, using interviews, filming and observations. Generally, a combination of survey techniques should be used so as to cross-validate data.

The National Travel Survey (NTS) indicates a significant reduction in the distance walked by children aged 5 to 15 between 1975/76 and 1989/91. One of the factors involved is the trend towards taking children to school by car and the under-lying reasons for this need to be understood. Of especial importance are the perceived hazards of walking in urban areas. Designers should plan safer networks of walking routes for everyone but routes to and from schools should be given priority.

Footways and footpaths should be aligned as directly as possible between the main trip origins and destinations. Pedestrians prefer to see the place to which they are heading. Whilst gentle curves will probably be followed by pedestrians, sharp curves will not be followed readily unless physical barriers deter the taking of short-cuts. All pedestrian footways and footpaths should have a minimum width of 1800 mm but should be wider wherever possible.

Most pedestrian journeys begin and end in buildings or transport interchanges. The relationship between the entrances to buildings and the pedestrian network is of particular significance. Changes in level should be avoided but, where a difference in level is inevitable, the needs of people with impaired mobility must be considered. Bridges, high level walkways and subways should be avoided, unless they relate naturally to the main entrances of nearby buildings.

The quality of a street scene is particularly important to pedestrians. Routes should be planned so as to allow both close and distant views of features of interest. The boundary to the footway should be of a consistently high quality. Hard and soft landscaping should be provided and maintained. Pedestrians enjoy animated and lively street scenes and the presence of a modest flow of vehicles (say, up to 500 vehs/h) is generally acceptable where pedestrian flows are light.

Pedestrians tend to be concerned about personal security. Routes should be developed that will be used by reasonably substantial and predictable flows of people. Corners and angles of buildings or structures, where individuals might not be visible to others, should be avoided where possible.

Local authorities are responsible for the naming and numbering of streets and for ensuring that these are properly displayed. A clear and consistent system of street name plates should be adopted. Key pedestrian destinations, and the quickest route to them, should be signed by a carefully devised area-wide system. Several authorities have adopted a particular style, such as finger-post signs with gold lettering embossed on a black background.

22.5 Dropped Crossings

Dropped crossings may be provided either:

- ❑ to allow vehicles to gain access across footways into buildings or onto land; or
- ❑ to assist pedestrians, especially those with mobility impairment, including those with prams or push–chairs, when crossing a carriageway.

The former should be kept to an absolute minimum and their provision and construction should be controlled by the Highway Authority. In some circumstances, planning permission may be necessary. There may be a vertical face of up to 25 mm to the upstand of a dropped kerb at a vehicle crossover, to ensure that surface water is retained on the carriageway. A problem with dropped crossings is that they can encourage cyclists to opt to use the

Photograph 22.1: A Toucan crossing with an L–shaped tactile area.

footway and, to avoid this, specific provision for cyclists should be made wherever possible (see Chapter 23).

At locations where significant numbers of pedestrians are likely to want to cross a carriageway, the kerbs should be dropped to facilitate crossing with prams or pushchairs and by people in wheelchairs. There should be no vertical face on the upstand of a dropped kerb at a pedestrian crossing so that wheelchair users are not delayed in regaining the footway. The gradient of ramps at all crossing places where kerbs are dropped should not be greater than eight per cent (1:12) but a gradient of five per cent (1:20) is preferred.

Care should be taken to assist people with visual impairment at appropriate crossing points and reference should be made to the most recent DOT guidance. Tactile surfaces should be used to identify the presence of a dropped kerb (DOT 1991a). Only 'modified blister paving' should be used, comprising rows of flat–topped 'domes' 5 mm (± 0.5 mm) high. It should be noted that DOT advice on tactile surfaces is being reviewed and the DOT Mobility Unit should be contacted to ascertain the latest position.

The layout and colour of the surface will depend on the type of crossing. Full details can be obtained from the Department of Transport's Mobility Unit (see Section 22.14).

Two examples of layouts are:

- ❑ an 'L' shaped area (see Photograph 22.1), leading pedestrians to the push–button box at a Toucan crossing; and
- ❑ a 'T' shaped area (see Photograph 22.2), which leads pedestrians to the centre of the crossing.

Crossing places at side–roads should ideally be located beyond the tangent point of the kerb radius. The raised kerb radius should be continued to give positive guidance to drivers turning at the junction and should enable pedestrians with visual

Photograph 22.2: An example of a Pelican crossing with a T–shaped tactile area and guard railing. Courtesy: David Nicholls.

impairment to locate the straight section of dropped kerb. If it is either impractical, due to footway width, or undesirable, since pedestrians might not be seen by drivers, to locate the crossing with dropped kerb in the side–road, the crossing point will have to be located on the pedestrians' line of travel. At all locations, the crossing point on one side of the road should be directly opposite that on the other side.

Consideration should be given to waiting restrictions where vehicles habitually park across dropped kerb crossing places. Where restrictions are not justified, an advisory white line carriageway marking, parallel with the dropped kerb, might be effective.

22.6 Pedestrian Refuges

Refuge islands are a relatively inexpensive method of improving crossing facilities for pedestrians. The width of the island is important. Whilst current standards allow an absolute minimum width of 1.2 m, this is inadequate for more than occasional individual pedestrians. The effective area,and hence the standing capacity, of the refuge should be related to its actual use at peak periods of pedestrian flows. Where people with pushchairs or in wheelchairs are likely to cross, the island should be at least 2.0m wide.

The residual carriageway width should be sufficient to allow vehicles to pass without tracking too close to pedestrians waiting on the refuge. Special consideration should be given to the needs of cyclists, with special provision made if necessary. Greater lane–widths should be allowed on bends and particular care should be taken where refuge islands are incorporated into traffic–calming measures, such as flat–topped road humps.

Refuge islands are usually formed by kerbs or prefabricated steel, 'D'–shaped in plan. The width of the crossing for pedestrians should be similar on both footways and on the refuge island. Dropped kerbs, to carriageway level at the island, should be provided (see Section 22.10 for further details) and tactile paving may also be appropriate (the DOT's Mobility Unit can advise) [Sc].

Refuges should be sited where a majority of pedestrians actually want to cross. If, for overriding safety reasons, this is not possible, then short lengths of pedestrian guard–railing should be installed to guide pedestrians to the provided crossing point. Refuges should not be sited where vehicle drivers' and pedestrians' views of each other are likely to be obstructed by parked vehicles. If there is no practical alternative site, the imposition of waiting restrictions should be considered. Care should be taken when siting refuges near bus stops.

The probability of traffic queues that would extend across the refuge should be examined. Pedestrians should not be faced with having to squeeze between queueing vehicles in order to use a refuge. The dangers are especially marked for vulnerable people and particularly those with impaired mobility.

Refuge islands should be marked by internally illuminated bollards (HMG, 1994) [NIa]. On roads not subject to a 30 miles/h limit, or where drivers may have difficulty in judging the presence or size of a refuge, supplementary lighting can be added to the island with illuminated 'KEEP LEFT' signs fixed to the lighting column (IPLE, 1982a).

22.7 At–Grade Pedestrian Crossings

A full pedestrian crossing may be justified where pedestrians experience significant delay or danger in crossing a road. Pedestrian crossing provision at signal–controlled junctions is discussed in Section 40.8. The Department of Transport now recommends the use of an explicit procedure, based on a site assessment record and an assessment framework (DOT, 1995a) [Sb]. The purpose of the procedure is to ensure that all relevant information is collected and that the grounds for decisions, and their consequences, are made clear.

The boundaries of the site assessment should extend approximately 50m on either side of the site of the intended pedestrian crossing. However, the exact length depends on the existence of side–roads and major entrances to buildings across the footway.

Factors which should be recorded are:

- ❑ carriageway and footway types and widths;
- ❑ the nature and form of any existing pedestrian crossing;
- ❑ existing road lighting standards;
- ❑ minimum visibility–distances for pedestrians and drivers;
- ❑ waiting and loading restrictions;
- ❑ public transport stopping points;
- ❑ locations of nearby junctions;
- ❑ other major pedestrian crossings or school crossing patrols;
- ❑ skid resistance of the carriageway(s);
- ❑ surroundings affecting pedestrian movement;
- ❑ flow and composition of pedestrians;
- ❑ average time taken and difficulty experienced in crossing the road;

- ❑ vehicular flow, composition and speed; and
- ❑ records of recent crashes and casualties in the vicinity.

The difficulty of crossing can be determined by one of three methods. These are: acceptable gap analysis; data–logger method; or by the judgement of an experienced engineer (DOT, 1995a) [Sb]. A *précis* of the information, recorded in the site assessment, is then included in the assessment framework. The assessment framework considers all reasonable pedestrian crossing options against the more important factors. The options should include refuge islands, Zebra crossings or signal–controlled crossings. Each of these should be compared with the 'do–nothing' option. The most likely factors to influence the decision are:

- ❑ pedestrians' current difficulty in crossing;
- ❑ local accident trends;
- ❑ vehicle–delays in the peak period;
- ❑ vehicle–speeds;
- ❑ local representations;
- ❑ installation costs; and
- ❑ the present value of operating costs.

The assessment framework should annotate clearly the effects of each option. Whilst the incidence of crashes and casualties is important, it is difficult to predict accurately the consequences of introducing a particular type of pedestrian crossing.

General Siting Requirements

Various requirements should be met in the siting of both uncontrolled and controlled pedestrian crossings (DOT, 1995b) [Sb]. They should be located well away from potential conflict points at uncontrolled road junctions. Drivers need adequate time to see and react to pedestrian crossings. Signalled–controlled crossings on a major road should be a minimum of 20m, and Zebras an absolute minimum of 5m, away from the give–way line on a side–road. Those on side–roads should be sited well away from the give–way line.

Photograph 22.3: A Pelican crossing with built–out kerb and guard–rail.

Special care should be taken in siting pedestrian crossings near roundabouts. Zebras are preferred but, if signal–controlled crossings are necessary, then a staggered island arrangement should be used. The detailed choice of site should have regard to the pedestrian desire–lines and flows, vehicle–speeds, visibility, vehicle–flows, size of the roundabout and the width of the crossing.

Drivers' ability to see pedestrians waiting to cross is crucial. Visibility must not be obscured by street furniture or parked vehicles. For 85 percentile speeds of 30 and 40 miles/h, the desirable minimum visibility is 65m and 100m respectively. One method of improving visibility is to build out the kerb (Photograph 22.3). Any equipment such as guardrailing, signal posts or control cabinets, must be sited with care, so as to achieve maximum visibility and not to cause difficulties for people with impaired mobility (see Section 22.10). Whilst there should be no surface water lying at a crossing point, gully gratings and any statutory utility boxes should all be sited away from the crossing or vice–versa. Similarly, crossings should not be sited immediately adjacent to bus stops but, if this is unavoidable, bus stops should always be beyond (ie downstream of) the crossing.

High skid–resistance surfacing should be laid on both vehicle approaches to the crossing. The length of the carriageway surfacing will depend on the approach speeds and collision potential of the site. Similarly, the need for advance warning signs depends on the 85 percentile speeds: 50 miles/h, or greater, for a signal–controlled crossing and 30 miles/h for a Zebra crossing.

Zebra Crossings

Zebra crossings have the advantage of relatively low cost but must be installed only where they are the most appropriate type of crossing (HMG, 1990) [NIb]. To exercise priority over traffic, pedestrians have actually to be on the Zebra crossing markings. This form of crossing is not ideal, therefore, where traffic speeds or volumes are high. Zebra crossings may also be unsuitable where pedestrian flows are so high that pedestrians are likely to dominate the crossing and cause long delays to vehicular traffic.

Road markings and details of studs and materials are set out in the Traffic Signs Manual (DOT, 1991c). Zebra crossings are characterised by flashing amber globes, the construction and performance of which are given in BS.873. Zig–zag markings are laid on both the approaches and the exits to the crossing and

on both sides of any central refuge island. Zig–zags ban waiting or parking, prohibit vehicles from overtaking each other and warn pedestrians of the increased risk of crossing in the zig–zag area.

Whilst it is inadvisable to install Zebra crossings in the vicinity of speed humps, they can be installed on flat–topped road humps (DOT, 1991b) [Sc]. This provides a pedestrian crossing of the carriageway at footway level but drivers must be given adequate warning of the arrangement. Where the width of the carriageway exceeds 11.0 m, a refuge island should be constructed and must include two flashing amber beacons.

After dark, the safe and satisfactory functioning of pedestrian crossings relies on the approaching drivers' ability to see pedestrians clearly. Roads with significant numbers of pedestrians should be lit in accordance with BS5489 (BSI, 1992). This should normally provide sufficient illumination for a pedestrian crossing. However, it is essential to inspect the site after dark and to assess the lighting, in the context of the street and the traffic speed, especially in shopping streets where there may be other lighting that affects visibility. If there is still difficulty in seeing pedestrians waiting at the kerb or on the crossing, supplementary lighting can be installed. A number of new lighting techniques have been assessed, as reported by the Institution of Lighting Engineers in 1997. If supplementary lighting is installed, it should be positioned with care so as not to cause glare to drivers or pedestrians. The use of vandal–resistant lanterns, mounted at least 3m above the ground but not obscuring the beacon globes, is recommended (DOT, 1995b) [Sb]. Experienced lighting engineers should be involved in the design of illumination at all pedestrian crossings.

Photograph 22.4: A Puffin crossing with an L–shaped tactile area, dropped kerbs and guardrailing.

Signal–Controlled Crossings

The incorporation of pedestrian facilities at signal–controlled traffic junctions is dealt with in Chapter 40.

There are currently three types of independent signal–controlled pedestrian crossings: Pelicans; Puffins; and Toucans. The operational cycles and timings for Pelicans, Puffins and Toucans are set by the Department of Transport (DOT, 1995b) [Sb]. Briefly, the differences between the three are that:

- ❑ 'Pelicans' (Photograph 22.3) use far–side pedestrian signal heads with a green–man aspect, are demanded by a pedestrian push–button and have a fixed duration of flashing amber to traffic, concurrent with flashing green to pedestrians (HMG 1987) [NIc];
- ❑ 'Puffins' (Photograph 22.4) use near–side pedestrian signal heads, with an extendable all–red crossing period which is demanded by both kerbside and on–crossing pedestrian detectors (to cancel demands which are no longer required) (DOT, 1993c); and
- ❑ 'Toucans' (Photograph 22.1) use far–side pedestrian and cycle signal heads and the same on–crossing detection as the Puffin and are used by both pedestrians and cyclists (DOT, 1993a). These are likely to be replaced, as the standard form of Toucan crossing, with a near–side mounted signal similar to Puffin pedestrian crossings.

The general siting requirements are the same for all three. The Puffin has been developed, using kerbside and on–crossing detectors, to provide an efficient crossing with advantages to both drivers and pedestrians. The Toucan provides a crossing for cyclists and pedestrians. Cyclists are not permitted to use Zebra, Pelican and Puffin crossings.

All signal–controlled crossings must use approved equipment and must comply with current regulations regarding position and mounting height of the signal–heads and road–markings (DOT, 1981a and 1981b). Drivers, either when approaching or waiting at the stop–line, must be able to see at least one signal–head clearly. As one signal may be masked by parked vehicles or other obstructions, it is normal to align at least two signals to be seen on each approach. At most pedestrian crossings, these objectives can normally be achieved with one primary and one secondary signal, the latter mounted at either the centre or the off–side of the road. The use of 'primary' visors (which are cut away) on the secondary signal heads is normally recommended, to improve the visibility of the signal from the stop–line. However, if the road is particularly wide or the approach alignment is poor, it may be necessary to install additional signals. In appropriate

circumstances, tall posts or even overhead mounting can be used. On roads with an 85 percentile speed of more than 35 miles/h, additional primary signals should be provided. Whatever layout is chosen, access for maintenance should be a key consideration and trees and other vegetation should be trimmed to keep sight–lines clear. The pedestrian push–button boxes should be mounted so that the push–button is between 1.0m and 1.1m above the ground and on the right–hand side from a pedestrian's view (see Section 22.10 for details of the requirements for people with impaired mobility). For Toucan crossings, push–buttons are provided on both the left and right sides, whilst at any crossing that horse–riders may use, the mounting height will have to be chosen accordingly. For Puffin crossings, the box should be mounted to the right of the pedestrian and at the kerb–edge nearest to the approaching traffic. This may mean that additional boxes are needed for staggered crossings.

The choice of site and layout of any refuge island should allow sufficient space for the expected numbers of pedestrians waiting to cross the carriageway, whilst still allowing sufficient space for those passing by. Wherever a refuge is provided, a staggered crossing arrangement, with two independent crossings over each half of the carriageway, must be installed. A staggered refuge layout is optional where the carriageway is between 11m and 15m wide, but is essential for carriageways greater than 15m wide. The layout of the stagger should be such that pedestrians on the island are facing on–coming traffic. If this orientation is impossible, then a straight crossing is recommended. Staggered crossings are also not recommended for one–way streets. If necessary, additional advisory signs should be used to aid pedestrians but formal authorisation for their use is required. Staggered crossings should have an absolute minimum of three metres between crossing limits and, due to the need to install guardrails on both sides of the refuge island, the island should be a minimum three metres width overall. It is important to ensure that there is sufficient capacity on the island for all pedestrians likely to accumulate there. Dropped kerbs and tactile pavings should be provided, subject to current DOT advice.

At most crossings, approaching vehicles should be detected by either inductive loops or microwave sensors. However, vehicle actuation may not be necessary where the pedestrian crossing is linked to other adjacent traffic signals or is part of an urban traffic control scheme. In a 30 miles/h limit or where the 85 percentile speed is less than 35 miles/h, fixed–time operation is an option. In such circumstances, a pedestrian pushing the button will actuate the operational cycle, which will normally commence with a 20– to 30–second vehicle–precedence stage. At a busy crossing, this period could be extended, so that vehicle delays are minimised. The 'steady green–man' time should take into account the overall kerb–to–kerb distance that pedestrians have to walk.

Before installation, it is essential to consult with the police and to give notice to the public. The Secretary of State must also be formally notified [NId]. The new crossing should be well publicised and the Road Safety Officer should offer instruction to any local schools or old persons' homes. Leaflets to aid people's understanding of Puffin and Toucan crossings are available (DOT, 1993a and b).

School Crossing Patrols

Children are particularly vulnerable when crossing roads. Indeed, there is some evidence to suggest that drivers are less likely to give way to children than to adults at pedestrian crossings [NIe]. The appropriate local authority can, with police agreement, operate a school crossing patrol. The Road Traffic Regulation Act 1984 (HMG, 1984) defines the nature and limitations of such patrols [NIf]. The decision to provide school patrols rests with the Local Authority and they should develop consistent assessment procedures for vetting requests for patrols. These should include such matters as:

- ❑ traffic volumes, composition and speed;
- ❑ main routes to and from school;
- ❑ the complexity of adjacent junctions;
- ❑ the volume and average age of child pedestrians;
- ❑ the availability of safe waiting places;
- ❑ sight lines and visibility distances;
- ❑ street lighting and signing; and
- ❑ traffic fumes.

The sites themselves should be safe to operate and should be justified by these criteria. Consultation with all interested parties is essential. Once a positive decision has been made, adequate publicity information should be given to potential users, who should also be advised that responsibility for the safety of their children remains with parents.

Careful selection and appropriate training in the operation of patrols is essential, particularly if there is a signal–controlled crossing at the site. Advanced warning signs should be erected using the standard red triangle 'Children' symbol, with a supplementary 'Patrol' plate. Flashing amber warning lights should be added when the 85 percentile speed of vehicles is over 35 miles/h or where the forward visibility of drivers to the patrol is less than 100 m.

22.8 Grade–Separation

In urban areas, pedestrians are particularly at risk

when crossing roads with heavy traffic flows. For this reason alone, pedestrians are safer when physically separated from traffic. However, pedestrians are often concerned about their own security and sometimes resent the inconvenience of longer routes or apparently unnecessary steps or slopes. Grade–separation should look natural, in terms of topography and the manner in which it fits into the grain of the surrounding built environment. In many town and city centres, separation can be achieved by removing traffic from certain streets (see Section 22.9). However, pedestrians inevitably have to cross major urban roads. In these situations, designers should investigate the feasibility of separating pedestrians from road traffic vertically. Grade–separation which is confined within the highway is often inconvenient for pedestrians. A safe segregated road crossing should not involve a much longer walk, exposed to the elements, and create any anxiety for personal security. Successful grade–separation, either by footbridges or subways, gives pedestrians the feeling of remaining on the level and on their natural desire–line, whilst vehicles undergo the changes in grade and level.

Footbridges

The design and layout of footbridges should accommodate the likely pedestrian flows and movements and should cater for the needs of people with disabilities and people with prams or pushchairs (DOT, 1987a). The widths and layout have to be varied if they are also to be used by cyclists or equestrians (DOT, 1986) [Sb]. It is important to ensure that vehicles cannot gain access to footbridges, without restricting access for people in wheelchairs or children in prams or pushchairs.

The width of a footbridge should not be less than 1.8m. A minimum of 2.0m is appropriate where cyclists and pedestrians are not separated. Parapets should be at least 1.15m high but increased to 1.4m if cyclists are expected to use the bridge. In locations exposed to wind and weather, it might be desirable to cover the footbridge and, in these circumstances, the minimum internal headroom should be 2.3m. Similarly, where objects might be thrown onto the carriageway below, or where the bridge is unusually high above the carriageway, high parapets of unbreakable transparent material might be appropriate.

The appearance of a bridge is important to both pedestrians and to vehicle occupants passing beneath. It can be fabricated from steel, reinforced or pre–stressed concrete, timber or aluminium alloy, although this last material is not recommended where vandalism or theft is prevalent. On aesthetic matters, the advice of the Royal Fine Arts Commission should be sought. The appearance of a bridge, especially when crossing a dual–carriageway, is enhanced by having no central support. If one is necessary, then it will need to be protected from possible collision impacts of vehicles. The design should also incorporate drainage, have waterproofed and non–slip surfaces and be well–lit. The lighting should relate to that of the approaches and ground–level mounted columns, columns on the bridge itself or parapet fittings can be used.

The approach to the bridge should be by ramps of a gradient no greater than five percent but stairs should also be incorporated with horizontal landings at regular intervals. The accesses should be as short and direct as possible and should follow the main pedestrian desire–lines. All ramps and stairs should be provided with handrails on both sides and appropriate provision made for people with impaired mobility (see Section 22.10).

Subways

Whereas complete separation of pedestrians from vehicular traffic should eliminate the risk of pedestrian casualties, some people have an aversion to going 'underground'. Wherever grade– separation, by way of a subway, is considered, the layout and design should promote the illusion that the highway has been elevated to cross the natural pedestrian route. The desired effect can be achieved by wide approaches, good 'through' visibility and the maximum possible subway width. A feeling of personal security will be fostered if the subway is in constant view of other people and if there are no places where a felon might be concealed. Great care should be given to the detailed specification of wall and ceiling finishes. Materials should be used which are designed to reflect light, deaden sound, be vandal–resistant and yet be easy to clean and maintain. Vehicles should not be able to enter a subway other than for maintenance and servicing. The aim is to produce a welcoming and pleasant environment.

Factors to consider in justifying the construction of a subway include:

- ❑ the pedestrian and cycle flows likely to use the facility;
- ❑ the use by children, and other vulnerable people, who might experience difficulty or excessive risk in crossing the highway at grade;
- ❑ the type and width of the road to be crossed;
- ❑ vehicle speeds, flow and the proportion of heavy goods vehicles; and
- ❑ the capital cost and present value of future maintenance costs.

The predictions of potential use should have particular regard to:

- ❑ whether or not the subway would form an access route to a school, play area or other amenity;
- ❑ the location, convenience and safety of alternative routes which pedestrians might take; and
- ❑ any likely changes in land–use in the vicinity over the next 15 years.

The subway should be sited as close to the major desire–lines of potential users as practicable and should be as short as possible. Its construction should preferably involve elevating the carriageway, although existing underground services may be too costly to divert.

Whilst the objective of good design is to provide generous dimensions, excessive costs and other practical difficulties may limit the available options (DOT, 1993d). Nevertheless, at all changes in direction, there should be adequate sight distances. This can be achieved by corners of 4.6m minimum radius. However, if cycles share the subway with pedestrians, different criteria will apply (see Chapter 23).

Subways should be well lit, in recognition of users' concerns about underground passages and fear of crime. Lighting should be incorporated at the early stages of design (IPLE, 1982b) and should aim to achieve:

- ❑ a bright appearance of the interior of the subway, to encourage confident use and to discourage abuse;
- ❑ a high level of lighting on stairs, ramps and approaches, for pedestrians' safety;
- ❑ avoidance of deep shadows;
- ❑ luminaires resistant to attack by vandals;
- ❑ ease of maintenance with reliable, long lamp–life;
- ❑ good colour rendering of surfaces, to give a sense of spaciousness; and
- ❑ emergency lighting in the event of failure of the mains power supply.

The visual problem when approaching a subway is to see sufficiently far into it, whilst there is daylight outside, yet achieving the reverse effect after dark. One way to achieve this is to use higher levels of illumination for, say, the first 6 metres. After dark, this initial 'threshold' lighting level could be reduced to match that of the exterior lighting.

22.9 Pedestrian Priority Areas

The pedestrian environment in an existing street can be improved in many ways. Most techniques involve the restriction of traffic using the street but do not necessarily offer pedestrians legal priority over any residual vehicles (DOT, 1987b) [Sb]. Such improvements are most applicable to streets incorporating leisure activities, where the pattern of pedestrian movements tends to be random.

The value of pedestrianisation schemes in improving the attractiveness and commercial success of town centres has been demonstrated widely, especially for retail shopping streets specialising in comparison rather than convenience goods (see Chapter 12). The prime quantifiable benefits come from reductions in accidents and pollution. Studies show that most schemes improve retail turnover but sometimes not during an initial one– or two–year period. 'Fringe' shops and convenience stores can suffer a net loss of trade (IHT, 1989b and ICE, 1993).

The quality of the design of schemes can have a marked effect on their success. Imaginative designs that create a distinct sense of place and avoid uniformity can enhance the vitality of town and city centres. The opportunities afforded by area–wide refurbishment and redevelopment of centres are generally best seized by schemes with mixed land–uses that include the addition of more homes and community facilities. For real success, pedestrianised areas should not become deserted in the evenings. Where this may happen, consideration could be given to allowing vehicles to enter and park in such areas outside the normal working day.

There are two statutory means of improving the pedestrian environment in an existing street. The Road Traffic Regulation Act 1984 (HMG, 1984) permits the closure of roads to traffic but generally for no more than eight hours in any 24–hour period [NIg]. Subject to consultation with the public and police, the highway closure Order may be permanent. However, the facility for traffic to use the carriageway outside the times of closure must remain. Apart from variations to the surface treatment, only limited changes can be made. The Road Traffic Regulation Act 1994 also allows for closures to be made on an experimental basis (see Section 13.2) [NIh].

Frontagers to the street are entitled to compensation if they are adversely affected by the removal of vehicular rights of access [NIi]. Because the rights–of–way for vehicles are removed permanently, the width, surface and layout of the street can be changed. However, reasonable access to underground services should be maintained. The emergency services must be consulted on their needs for access to frontage premises and to the street itself.

The conception and design of any scheme to restrict or remove vehicles from existing streets requires care and sensitivity by the designer. Special consideration should be given to whether or not to exclude buses, so as to ensure continued ease of access to the street and to the buildings in it. Whilst proposals may generally be welcomed, especially in busy shopping areas, the changes may also have an adverse impact on certain businesses. Full and early consultation on proposals is essential. Among those who should be involved from the outset are the police, businesses based within the vehicle restriction area, transport firms who deliver there and groups representing local residents and people with impaired mobility. Adequate access has to be maintained for goods deliveries and especially for the collection of cash from banks, building societies and large shops. There may well need to be compromises between the conflicting wishes of different interest groups.

Special consideration must be given to public transport operators, especially if any bus routes have to be diverted. In any scheme, access by bus should remain at least as good as that from the nearest car park. Taxi operators may object to potential loss of trade and longer journey– lengths for their customers, so taxi stands should be located so as to minimise inconvenience. If cyclists are excluded from the street, then the impact of their displacement to alternative routes should be assessed. People with impaired mobility can be assisted by a 'Shopmobility' scheme, which involves the free loan of wheelchairs, sometimes with power assistance, from reserved parking areas close–by. Whereas all vehicles, except those relating to emergency services, statutory undertakers, street cleansing, funerals and security carriers, would normally be prohibited from using the street or area, it is possible to offer exceptions (see Section 13.2).

If vehicles are permitted to enter the street, the design of the scheme should be such as to maintain a clear distinction between footways and carriageways. Signing of the restrictions must be clear. A comprehensive review of pedestrian direction signs should be undertaken to ensure that people can continue to find the most convenient route to all major facilities. Similarly, local traffic direction signs may well need to be amended, so as to minimise drivers' confusion, particularly for those unfamiliar with the area.

Any scheme should be carefully monitored and necessary adjustments or improvements made. Assessments should be made of the effects on pedestrians, vehicle movements and parking. The difficulties and dangers for pedestrians crossing roads to which traffic may have been diverted should be monitored and appropriate remedial measures implemented.

22.10 Facilities for People with Disabilities

A significant proportion of people who live in urban areas have some degree of impaired mobility. To help them to achieve a reasonable quality of life, their needs must be understood and accommodated. The advice and assistance of such people who actually live in the area should be sought before changes are made to the layout of pedestrian facilities, especially pedestrian crossings (TRL, 1991).

The use of dropped kerbs and tactile surfaces at pedestrian crossings has been described in Section 22.5. Where a cycletrack runs alongside a footway or a footpath, an appropriate method of delineation should be used (DOT, 1990) [Sa]. One option is to use a tactile surface to enable blind and partially sighted people to position themselves on the correct side of such a shared route. Advice on this can be obtained from the DOT's Mobility Unit (see Section 22.14).

Blind or partially–sighted people can usually follow kerb lines or the facades of buildings. However, they can experience particular problems in finding their way in pedestrianised streets or urban squares. Different surface textures can provide a valuable aid. Alternatively, 'directional guidance' paving with a series of flat–topped, round–ended ribs can be used to provide a guide. The paving is laid with the ribs indicating the direction of travel (TRL, 1992). Further advice on this can be obtained from the DOT's Mobility Unit (see Section 22.14). In conservation and other historic areas, it is often difficult to meet the needs of people with physical disabilities or with visual impairment and the advice of the Civic Trust and English Heritage should be sought.

Maintenance works in urban areas should be undertaken with particular regard to people with disabilities. Special care should be taken wherever maintenance works interfere with facilities provided for such people. The New Roads and Street Works Act (HMG, 1991) requires that facilities provided for people with disabilities, such as tactile surfaces, are reinstated in full by public utilities after street works have been undertaken [Nij].

Street furniture, including street–lighting columns and barriers, can prove a real hazard to people with disabilities (IHT, 1989a). Street furniture should be carefully positioned so as not to be on the natural

routes taken by blind or partially–sighted people. The presence of necessary street furniture can be marked by a surround of granite setts or an obstruction–warning material, which has a soft or springy feel.

Changes in level should avoid the use of steps wherever possible. If steps are unavoidable, the top and bottom of flights of steps should have warning surfaces of 'corduroy paving' and step–cages should be painted white or another contrasting colour. The stairs should be divided by handrails into flights not wider than 1800mm. There should be a maximum of 16 risers in any flight, with landings at top and bottom. Generally, ramps are preferred. A maximum gradient of five per cent should be provided. Where this is impracticable then the gradient should be no greater than eight percent, with level rest–areas.

Signal–controlled crossings remain one of the biggest issues of concern, especially to elderly people with disabilities. The Traffic Signs Regulations and General Directions 1994 (HMG, 1994) [NIa] require that all tactile or audible signals provided to assist visually impaired people at pedestrian crossings must be of a type approved by the Secretary of State for Transport [NIk]. Two types of audible signal are available. The standard unit, located in the pedestrian push–button box, produces a series of bleeps when activated and can be used at crossings of single carriageways. It should not be used in the vicinity of another crossing or on a staggered crossing of a dual–carriageway, in case there is confusion about which crossing has been activated. At staggered crossings, the alternative audible signal should be used. Known as 'bleep–and–sweep', it emits a distinctive sound of four beeps followed by a rising tone. The volume can initially be adjusted manually but is then automatically adjusted to the ambient background noise level, so as to be heard by someone close to the loudspeaker but not by anyone waiting at the other crossing. The audible signal, in both cases, operates while the steady green–man pedestrian signal is lit (DOT, 1995b) [Sb].

The standard tactile signal consists of a small rotating cone protruding from underneath the push–button box. Although tactile signals are not generally so useful to people with visual impairment as audible signals, they are essential to pedestrians who also have impaired hearing and are also helpful where audible signals are not provided or are switched off at night. Great care should be exercised in siting audible or tactile signals. The equipment must not be capable of activation if the red lights to traffic fail. Push–button boxes must be easily accessible to pedestrians waiting to cross and there should be a clear path without obstructions, such as guard–rails. If the sound of the audible signal is likely to cause a nuisance to nearby residents, then either the sound output can be reduced or a time–switch incorporated to cut out the sound altogether at night.

Puffin crossings can provide assurance to pedestrians with disabilities, and especially to the elderly, that they have time to cross. Not only do Puffins incorporate pedestrian detection at the kerb–side but also infra–red detectors to extend the red time to vehicles, if a pedestrian is still crossing the road when the flashing green ends.

Possibilities for helping visually–impaired people to distinguish the type of crossing include a design of push–button box of a controlled crossing which emits a continuous low–pitch ticking sound, and a raised letter Z attached to Zebra crossing poles.

22.11 Guard–Rails

The installation of pedestrian guardrails should be considered only where there are real risks of accidents should pedestrians walk onto the carriageway. Guardrails are intrusive and unsightly. Their purpose is to restrict people's freedom of movement. This will be resented unless their installation is self–evidently necessary. The use of guardrails should be avoided unless there is no practical alternative in terms of pedestrian safety.

Guardrails are a continuous safety fence placed on the footway with sufficient clearance (500 mm minimum) from the kerb–face (BSI, 1976). They therefore narrow the footway, which causes a reduction in footway capacity and this should be considered before installation. There should be no gaps, through which a small child could squeeze, at any breaks in the guardrailing, such as at trees, signs or similar obstructions. Guardrails should comply with BS.3049 and can be either painted or anodized. Several proprietary makes are available and careful selection of a type which is both easily erected and repaired is worthwhile. Decoration of guardrails can help to relieve their inherent monotony. The ability of drivers to see pedestrians crossing at the end of a length of guardrailing should be checked carefully. Special guardrailing that provides increased visibility is available.

Where guardrail is installed in streets with retail or commercial premises that do not have rear service facilities, real difficulties can be experienced in loading or unloading goods. It is possible to install gates in the guardrail but these should be located with extreme care and nominated frontagers should

accept responsibility for their closure. A gate left open, after the servicing of premises has been completed, can cause a real hazard to pedestrians and can negate the benefits of the guardrailing.

22.12 Personal Security

Whilst the fear of personal crime is out of proportion to its reality, nevertheless the risks should be considered carefully in the layout and design of urban public areas. Statistics show that most street crimes, including physical assault and abuse, are the work of opportunists when circumstances appear to be in their favour. Indeed, surveys of such acts after dark indicate that young men are far more likely to be attacked than women. In a few areas, however, women are more vulnerable. Evidence of anxiety can be seen in the way many women avoid using subways during the hours of darkness. Experience in the UK and abroad relates such anxiety, and the opportunity for crime, to those locations which are not 'watched' naturally by the community. To combat the problem, the priority should be to create conditions where there is always a mix of different ages and groups of people and where the physical layout does not include places where threatening groups can gather. A good urban design produces natural surveillance of public places and streets from adjacent buildings.

Studies in America indicate that streets taken over by heavy flows of traffic tend to lose their community activity and hence the incidental surveillance of the footways. On the other hand, traffic–free areas without adequate levels of activity can also promote anxiety in pedestrians. Indeed, many private shopping precincts are locked to the public outside opening hours. The feeling of being watched can be enhanced in two ways. Good lighting is a significant deterrent to crime and enhances a feeling of personal security. Also, an increasing number of local authorities, working in close conjunction with the relevant police authorities, are installing closed circuit television (CCTV). From a central control room, operators are able to see, at any time of the day or night, whole street–scenes, car parks or other public areas. Modern high–definition cameras are able to focus–in on fine details, such as individual people's faces or vehicles' number plates. In the event of any unsocial or potentially criminal activity being recorded, the police are advised and the video–tape may be accepted, later, in evidence.

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