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THE DESIGN OF PEDESTRIAN CROSSINGS

LOCAL TRANSPORT NOTE 2/95

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All enquiries on the general applicability of this Local Transport Note should be directed, in England to the appropriate Regional Government Office of the Department of Transport, in Wales to the Welsh Office, Highways Directorate, Phase I, Government Buildings, Ty Glas Road, Cardiff, in Scotland to the Scottish Office, Industry Department, Roads Directorate, New St Andrews House, Edinburgh, or in Northern Ireland to The Department of the Environment for Northern Ireland, Roads Service Headquarters, Clarence Court, 10-18 Adelaide Street, Belfast, BT2 8GB. Enquiries about authorisation for non-prescribed crossings should be made to the above offices.

ABSTRACT

This note recommends the practices to be followed when planning, designing and installing at-grade pedestrian crossings. It describes all types of crossings, including shared facilities with cyclists, other than those at signalled junctions.

PUBLICATIONS SUPERSEDED

Departmental Advice Note TA 52 and Standard TD 28 (DMRB Vol.8, Section 5).

CONTENTS

1 INTRODUCTION

Reference to 'pedestrians' in this document should be read to include pedal cyclists and equestrians. However, it should be remembered that only pedestrians may use Pedestrian Crossings.

1.1 This note recommends the practices to be followed when planning, designing and installing at-grade pedestrian crossings. It describes all types of crossings, including shared facilities with cyclists, other than those at signalled junctions.

1.2 This note replaces the recommendations for the design of pedestrian crossings contained in Departmental Standard TD 28 and Departmental Advice Note TA 52.

1.3 Advice is given on the design of pedestrian crossings in general and the operation of signal-controlled (Pelican, Puffin or Toucan) crossings in particular.

1.4 This publication complements the Statutory Instruments which set out the Regulations controlling the use of Zebra, Pelican, Puffin and Toucan Crossings and the Regulations for traffic signs.

1.5 Statutory Instruments

For Northern Ireland see section 11 REFERENCES.

- The 'Zebra' Pedestrian Crossing Regulations 1971[1].
- The 'Pelican' Pedestrian Crossings Regulations and General Directions 1987[2]
- The 'Puffin' Pedestrian Crossings Regulations[3]. (in preparation - authorisation is required in the interim) - not available in Northern Ireland.
- The Traffic Signs Regulations and General Directions l994[4] for 'Toucan' Crossings - (authorisation required at present) - not available in Northern Ireland.

1.6 All signal-controlled crossings must use Approved equipment. The technical requirements are contained in technical specification TR 0l41[5] the latest issue of which will incorporate Pelican crossing requirements currently specified in MCE 0125, and Puffin and Toucan.

1.7 The Assessment of Pedestrian Crossings[6] sets out a method for deciding the need for providing a stand-alone crossing at an at-grade site and the options available.

When planning improved pedestrian facilities it is important to understand where pedestrians may wish to cross. Consideration should be given to established and possible new pedestrian routes. These are often referred to as 'desire lines'.

2 GENERAL REQUIREMENTS

This section contains advice on the design of pedestrian crossings generally. Advice which is specific to one type of crossing is presented in the appropriate section.

2.1 Proximity of Junctions

2.1.1 Approach to a Side Road

2.1.1.1 Crossings should be located away from conflict points at uncontrolled junctions. This will give drivers an adequate opportunity to appreciate the existence of a crossing and to brake safely. The 'safe' distance will depend on the geometry of the junction and type of side road. However, a minimum distance of 20 metres is suggested for a signalled-controlled crossing and an absolute minimum of 5 metres for a Zebra crossing. It is suggested that the distance be measured from the position of a driver waiting at the give-way line of the side road. Where it is impossible to obtain a 'safe' distance, consider banning turning movements towards the crossing or make the side road one way away from the junction.

2.1.2 Minor Road Approach

2.1.2.1 Crossings on a minor road should not be sited very close to a 'GIVE WAY' or 'STOP' line. Generally the nearer the crossing is to the major road the greater will be the distance to be crossed. Drivers of vehicles turning into the minor road need time to judge the situation and space in which to stop.

If there is a strategic network for pedestrian routes this should be referred to before final decisions are made

2.1.2.2 There should be sufficient distance between the crossing and the priority marking for at least one waiting vehicle; the optimum will depend on the volume of turning vehicles. Care should be taken to ensure that drivers do not mistake a vehicular green signal on the signal-controlled crossing as a priority signal over traffic on the major road.

2.1.3 Approach to a Roundabout

2.1.3.1 When crossings are needed on the approaches to a roundabout, special care is needed in the siting. The use of different types of facility at the game junction is not recommended as this could lead to confusion. Where a crossing must be provided within the junction layout, a Zebra crossing is preferred; it avoids any ambiguity as to priority that a signal-controlled crossing can create for the driver approaching the roundabout Give Way line. If a signal-controlled crossing is provided, it should preferably be of the staggered type to avoid excessive delays at the exit points blocking circulation. The pedestrian desire line, vehicle speeds, visibility, pedestrian/vehicle flows, size of roundabout, and length of crossing/road width should be considered when deciding the optimum location. Crossings away from flared entries are preferable as the carriageway widths are less and the vehicular traffic movements are simpler. It may be necessary in urban areas, where large numbers of pedestrians are present, to provide guard rails or other means of deterring pedestrians to prevent indiscriminate crossing of the carriageway.

2.1.4 Junction with a Yellow Box Marking

2.1.4.1 Where a pedestrian crossing is provided near to a junction with a yellow box marking, the location of the crossing must be chosen to ensure that the zig-zag markings do not overlap the yellow box markings. Note the Regulations allow for the overall length of the zig-zag markings to be varied.

2.1.5 Traffic Signal Controlled Junction

2.1.5.1 The decision to use a signal controlled crossing is often made because of the close proximity to a traffic signalled junction. Neither Zebra crossings nor refuges are suitable as there is a conflict of control methods. Even with a signal-controlled crossing care should be taken to ensure that queues do not build back from one installation to block the other. See the section 5.4 ‘Linking with other Signalling Systems’.

2.2 School Crossing Patrols

2.2.1 If there is an existing school crossing within 100 metres then a mutually convenient site should be found to accommodate both the patrol and other pedestrians. It may he necessary to install a greater number of guard rail sections to achieve a suitably safe site.

2.2.2 Where a School Crossing Patrol is located at a signal-controlled crossing the operator should be given appropriate instructions for the specific equipment in use.

Additional signal heads may be employed at a signal-controlled crossing where this will improve driver awareness

2.3 Visibility

2.3.1 Minimum distances for drivers’ visibility of crossings are set out in Table 1.

2.3.2 Pedestrians must be able to see and be seen by approaching traffic. Visibility should not be obscured or restricted by, for example, parked vehicles, trees or street furniture. If it is not possible to site the crossing elsewhere consideration must be given to either removing/resiting the obstacle or, if the carriageway is sufficiently wide, to building out the kerb-line to provide enhanced sight lines. Particular care should be taken when drawing up the layout for a new crossing. For example, the controller should not be in a position that obstructs the intervisibility between pedestrians and approaching vehicles. The designer is responsible for anticipating not only the problems for maintenance but also the particular visibility problems for wheelchair users and children. If visibility is restricted by parked/loading vehicles, it may be necessary to make a Traffic Regulation Order or impose the maximum waiting and loading restrictions in the appropriate Crossing Regulations.

Built out kerb to improve the sight lines.

2.3.3 Where there is an alignment problem, vehicles queueing back from a crossing can be a hazard. The expected queue length should, therefore, be estimated so that an adequate safety distance can be achieved in the design.

2.4 Crossing Width

2.4.1 The minimum width (between the two rows of studs) for a Zebra, Pelican or Puffin pedestrian crossing is 2.4 metres. If the crossing is of the Toucan type, or is used by a substantial number of cyclists on foot, the minimum width should ideally be 4 metres. However, narrower widths, down to 3 metres, have been successfully tried at some sites. Where pedestrian flows over 600 per hour are encountered wider crossings should be used. Regulations allow for the crossing width at a Zebra crossing to be increased to 5 metres and to 10.1 metres with the authorisation of the Secretary of State. Regulations allow Pelican crossings to have a maximum width of 10 metres. There are no regulations defining the width at a refuge island. However, 2 metres is considered a reasonable minimum to allow for two wheelchairs to pass each other. The use of wide crossings also may help prevent overcrowding of narrow footways.

The introduction of guardrail may require footways to be improved to maintain adequate width.

2.5 Guard Railing

2.5.1 Many accidents at pedestrian crossings occur on the approach to the crossing. The provision of guard railing at such positions should be considered. Guard railing may also provide useful guidance for blind and partially sighted pedestrians.

2.5.2 Guard railing manufactured to British Standard (BS) 3049[7] should be used. Intervisibility is important and should be a major factor in deciding whether guard railing should be provided, the physical layout of the railing and its specific type.

2.5.3 The effectiveness of guard railing is lessened if gaps have to be left for access for vehicles and the loading/unloading of goods. Where possible, crossings should be sited to avoid the necessity for such gaps.

An example of bad site layout.

2.5.4 Guard railing, at signal controlled crossings, should start at the signal post but not encroach past the push button position.

2.6 Crossing Approach Surfaces for Footways and Carriageways

2.6.1 Crossings should be installed so that adjacent drainage collects surface water from the crossing area. Care should be taken to ensure that, even after remedial surface treatment, excess water does not collect at the crossing point. Dropped kerbs must always be provided across the crossing width and the section of footway between the lowered kerb-line and the adjacent footway should be ramped with a slope having a desired gradient of 1 in 20 but not steeper than 1 in 12. Tactile paving should be installed across the dropped kerb and in a strip stretching back to the building line. (See 2.7 ‘Facilities for Disabled Pedestrians’.)

2.6.2 Both the carriageway and footway crossing areas should be free of surface obstructions such as cable drawpits, access covers to underground services, gratings and gullies. Street furniture, such as supply pillars should not be placed within the tactile paving area. As far as possible such items should be sited in an area not used by pedestrians.

2.6.3 It is recommended that high skid resistance surfaces be provided on the carriageway approaches to pedestrian crossings. Guidance on the choice of Polished Stone Value and Aggregate Abrasion Value for the aggregates exposed on the surface of flexible roads is given in publication HD28[8]. The specification for the application of the flexible surfacing material is the 900 Series of the Specification for Highway Works[9].

2.6.4 Consider both the approach speed and accident record when determining the length over which high skid resistance surfacing should be applied.

If the main area of footway is the same colour as the recommended tactile surface, a band of lighter/ darker coloured bricks/ blocks can be used, as an edging, to provide contrast.

2.7 Facilities for Disabled Pedestrians

2.7.1 The needs of disabled pedestrians should be considered when designing the layout of crossings. If these are well provided then a better crossing will probably result for all users.

2.7.2 Dropped kerbs provide easy access for wheelchair users and people with walking difficulties. Care should be exercised, therefore, when laying the kerbs which form the crossing boundary. To ensure the safety of blind and partially sighted people at these sites it is important to provide tactile paving to the recommended layouts in Disability Unit Circular DUl/91 [SOID 2/1994][10].

2.7.3 The ramped section, leading to the crossing and the immediate approaches, should be indicated by contrasting coloured tactile surfaces. Recommendations for the design and use of tactile pavement are also detailed in Circular No. DU 1/91 [SOID 2/1994][10].

2.7.4 At signal-controlled crossings audible signals or bleepers in the form of a pulsed tone and/or tactile signals are normally used during the green figure or "invitation to cross" period. The signals are intended for the benefit of blind or partially sighted pedestrians although they can also be helpful to others.

2.7.5 In residential areas objections to audible signals may be encountered. It is important that the audible unit is adjusted to suit the local conditions. There can be particular annoyance at night. A time switch may be incorporated to enable the sound to be reduced in level, or, if appropriate, switched off.

2.7.6 At adjacent sites, such as at a staggered crossing, there is a risk that the signal at one crossing may be heard and mistaken for another and so the standard audible signal must not be used. An alternative which is suitable for use at staggered crossings is the facility known as 'bleep and sweep'. The tone produced by the unit has been specially designed to be distinctive and the audible range has been restricted. By monitoring the ambient level of traffic noise the unit adjusts the level of the audible tone to that which is loud enough to be heard only near the crossing in use.

2.7.7 If audible signals cannot be used then tactile signals should always be provided. These are small cones mounted beneath the push button box which rotate when the steady green figure is shown. Reference should be made to local mobility officers/representative groups. If there are local people with vision and hearing difficulties, tactile signals are strongly recommended. Also if audible signals are to be switched off at night, then tactile signals should be considered.

2.7.8 All the above devices, whether audible or tactile, must conform to TR 0141[5] including the requirements for lamp monitoring. Traffic Advisory Leaflet 4/91[11] gives further information.

2.7.9 An embossed 'Z' on the beacon post is being trialled to help blind pedestrians recognize Zebra crossings. This may be introduced as an option in the future.

2.8 Lighting

2.8.1 It should be remembered that pedestrian crossings are often used at night as well as during the day. It is necessary to ensure that the crossing can readily be seen against the background of other lights and signs.

2.8.2 Good road lighting will reduce the majority of the problems related to extraneous light sources. An experienced lighting engineer should ensure that the level recommended in the appropriate part of BS 5489[12] is used at all pedestrian crossing sites. BS 5489 also gives details of lighting column positions and spacings, in relation to crossings. Reference should also be made to the current version of Technical Report No. 12, 'Lighting of Pedestrian Crossings'[13].

2.8.3 At night drivers may not be able to see pedestrians waiting to cross unless the road lighting is to the standard recommended above. If there is still doubt about the visibility of pedestrians then supplementary lighting can be provided to illuminate the crossing.

2.8.4 If supplementary lighting is employed it must be designed to prevent glare to drivers which could hide or "veil" pedestrians standing behind it, thus defeating the objective of its installation. The pedestrian approach (at least the area covered by the tactile paving surface) and the carriageway crossing area must be illuminated to a uniform level.

2.8.5 Supplementary lighting units appear to be especially susceptible to vandalism and should be checked regularly to see that they are aligned and operating correctly. It is essential that all units are operating correctly to ensure that uniform lighting of the crossing is achieved.

2.9 Signing

2.9.1 Where a signal-controlled crossing is sited on a road where the speed limit or 85 percentile speed on any approach is 50 m.p.h. or greater, advance warning signs to diagram 543, Traffic Signs Regulations and General Directions l994[4] should always be used.

Diagram 543

2.9.2 Where a Zebra crossing is sited on a road where the speed limit or 85 percentile speed on any approach is greater than 30 m.p.h., advance warning signs to diagram 544, Traffic Signs Regulations and General Directions 1994[4], are recommended.

2.9.3 On roads where the 85 percentile speed is lower, advance warning signs should only be erected where visibility of the crossing is impaired. The siting details for warning signs are given in the Traffic Signs Manual, Chapter 4, Table A[14].

Note: This advice on the placement of signs modifies that given in the Traffic Signs Manual, Chapter 4.

Diagram 544

2.9.4 Where a School Crossing Patrol is operating at a Zebra or signal-controlled crossing, the relevant Regulations and Traffic Signs Manual, Chapter 4 should be referred to.

2.9.5 Examples of zig-zag markings are given (or will be given in the case of Puffin Crossings) in the relevant Regulations. It is not possible to cover all layouts that will be experienced and the designer will need to make individual decisions within the Regulations and the spirit of the examples given. It should be remembered that restrictions imposed by zig-zag markings apply to laybys as well as the main carriageway. Any part of an affected layby, used by general traffic, should be hatched or physically infilled to prevent ambiguity.

2.10 Provision for Bus Stops

2.10.1 A pedestrian crossing may be sited near a bus stop. Close coordination should be maintained between the highway authority, the police and the bus operator during the planning process to ensure that stopped buses do not obscure the vision of pedestrians or drivers. Generally a bus stop is better sited on the exit side.

2.11 Street Furniture

2.11.1 Adequate clearance is required between the kerb edge and the closest part of any street furniture. A minimum of 0.5 metre is recommended but this should be increased in cases where the road camber or speed of vehicles necessitates. Particular care is needed at refuge islands on bends or where vehicles may be turning.

3 PEDESTRIAN REFUGE ISLANDS

3.1 Refuge islands are a relatively inexpensive method of improving crossing facilities for pedestrians.

3.2 Where they are to be provided it is essential they are large enough. An absolute minimum of 1.2 metres width is needed but the standing area for pedestrians must be sufficient for the location. Near a school, for example, large numbers of children and parents with prams and pushchairs may need to be accommodated.

3.3 The carriageway width at the crossing should be sufficient to prevent vehicles passing too close to the refuge or the footway as this can be intimidating for pedestrians. Consider also the needs of cyclists who could be overtaken alongside a refuge. A single carriageway approach width of 4 to 4.5 metres adjacent to a refuge is recommended although refuges have been

A clear conflict: a refuge intended for pedestrians but unsuitable kerbing opposite.

Good lighting will ensure clear visibility for approaching drivers. To enhance this, or if there is a problem with vertical alignment, a central marker beacon is sometimes used. Care should be taken that the beacon column does not obstruct pedestrians.

used successfully with narrower widths. If the refuge island is not on a straight stretch of carriageway, the width either side of the refuge may need to be greater.

3.4 The width of the crossing should be maintained across the full carriageway. This should include the refuge island which will have either openings or dropped kerbs. Under no circumstances should a pedestrian be encouraged to cross with dropped kerbs on one footway only to find a lesser provision on the refuge or the other footway. See also Disability Unit Circular DU 1/91 [SOID 2/1994][10].

3.5 Pedestrians can be tempted to cross near or in the 'shadow' of the refuge. This can be potentially dangerous. In these cases, if the refuge cannot be located where there is a clear desire line, measures such as guard railing should be considered.

3.6 Vehicles parking adjacent to the refuge may reduce intervisibility or block the free flow of vehicular traffic. If considered a problem then waiting and loading restrictions may need to be imposed. For the same reason care should be taken if the refuge is to be near a bus stop.

3.7 If a refuge is to be on the approach to a junction the existence and extent of the average vehicle queue should be recorded. Queueing vehicles can block access to a refuge resulting in the pedestrian having the choice of either crossing through the queue or away from the refuge. The positioning of the refuge is, therefore, important. For disabled pedestrians the dangers are accentuated.

4 ZEBRA CROSSINGS

4.1 Road markings and details of studs and materials are given in the Traffic Signs Manual, Chapter 5[15]. Dimensions for road markings and studs are given in the 'Zebra' Pedestrian Crossing Regulations 1971[1].

4.2 Flashing rates, the photometric performance of globes and construction and electrical requirements are set out in BS 873[16].

Street furniture and a well established tree obstructing the approach to a Zebra crossing.

4.3 The Highways (Road Humps) Regulations 1990 do permit the use of a road hump in connection with a Zebra crossing, though not in the Zebra zig-zag area, provided that the location of the road hump would conform to the other requirements of the regulations. Where these requirements can be met there is some advantage in providing a road hump, as vehicle speed will be slower on the approach, and pedestrians can cross the carriageway at the same level as the footway.

4.4 Refuge islands can be used with Zebra crossings (but see the section on signal-controlled crossings).

4.5 As with refuges and signal-controlled crossings, it is important to keep the approaches to the Zebra crossing clear. Trees and street furniture are a hazard for pedestrians, especially those with disabilities.

5 SIGNAL-CONTROLLED CROSSINGS

Where mast arm signals are employed, structural approval of the mast arm will be required. Departmental Standard BD 2[23] refers.

This chapter gives general advice regarding the design of signal controlled pedestrian and Toucan crossings. This Note does not expressly cover the design of pedestrian facilities at junctions although many of the comments are applicable.

5.1 Installation

5.1.1 The minimum requirements for positioning and the restrictions on the mounting height for signals are contained in the relevant Regulations (see Introduction).

5.1.2 Departmental Advice Notes TA 13[18] and TA 14[19] provide recommendations for good working practice on all roads.

5.1.3 Staggered crossings are considered as two separate crossings. For electrical safety during maintenance, a post on the central refuge must have equipment for only one crossing mounted on it.

5.1.4 Accessibility for maintenance of crossings is important. Although written primarily for use on trunk roads, the requirements for maintenance are detailed in Departmental Standards TD 24[20], TD 25[21] and TD 26[22].

5.1.5 Drivers must have a clear view of at least one signal head on approaching, and when stationary at, the stop line. Where the view of the vehicular signals is reduced by the vertical or horizontal alignment of the road or other situations such as masking of signals in heavy traffic conditions or by overhanging trees, the conspicuity should be enhanced. This can be done, for example, by the provision of additional secondary heads, tall posts, building out kerb-lines if the carriageway width is sufficient or installing signals over the carriageway. Such overhead signals should be considered as supplementary to and not replacements for those listed as minimum in the relevant Regulations. If the overhead signal option is to be considered the problems of maintenance should be taken into account.

5.1.6 To assist partially sighted pedestrians, posts may have one white or yellow band as detailed in the appropriate General Directions.

5.1.7 To assist blind and partially sighted pedestrians, as they approach the crossing, the primary push button/indicator panel should normally be located on the right hand side. The alignment should encourage them to face oncoming vehicles. The centre of the push button should between 1.0 and 1.1 metres above the footway level.

5.1.8 At Toucan crossings it is normal to install a push button unit either side of the crossing place at the height quoted above. Special arrangements may be needed if an equestrian push button is required.

The push button should be readily accessible.

5.1.9 The push button unit should be close enough to the tactile surface to allow all pedestrians, who could reasonably be expected to use the crossing, to reach it easily. This is particularly important for crossings with kerb-side detectors.

5.2 Typical Layouts

5.2.1 Details of road markings and the minimum requirements for equipment are given in the relevant Regulations.

5.2.2 The use of a refuge at a non-staggered crossing is not recommended. They can be confusing for pedestrians and drivers and there is often insufficient space, particularly for prams and push chairs. They should, therefore, only be used if the road width cannot be increased locally to accommodate a staggered crossing. If used the refuge should be provided with push button(s) and signals as required.

5.2.3 Where the road is more than 15 metres wide a staggered layout should be provided. If the road width is greater than 11 metres a staggered layout should be considered.

5.2.4 Staggered signal-controlled crossings are not recommended for one-way roads. If unavoidable, such as within a town centre gyratory system, adequate road markings should be provided in order to deter drivers from weaving when approaching the crossings. Such crossings can also be confusing for pedestrians and consideration should be given to providing informatory signs. Such signs may need authorisation.

5.2.5 Staggered crossings on two-way roads should have a left handed stagger so that pedestrians on the central refuge are guided to face the approaching traffic stream. At some crossings a right handed stagger may be unavoidable. Where this is the case, and there are far-side pedestrian signals, confusion can be caused if the pedestrian signals can be seen simultaneously. A waiting pedestrian may "see through" a red signal to a green signal at the opposite crossing. Careful alignment and special precautions to limit the field of view may be needed.

Left handed stagger installation.

Staggered crossings are not suitable for equestrians and special arrangements may have to be made.

5.2.6 When calculating the settings for signal-controlled crossings, the crossing length used is the distance between footway kerbs except in the case of staggered crossings where each carriageway should be treated as a separate crossing.

5.2.7 Areas where pedestrians are waiting to cross should be of a sufficient size. The area should cater both for those waiting and any wishing to pass by. The central refuge of a staggered crossing should be :-

long enough to indicate the segregation of the crossings. A minimum of 3 metres between crossing limits is recommended;

wide enough to allow pedestrians to pass each other between the crossings. A recommended minimum width of 3 metres will give 2 metres between guard railing;

of sufficient capacity to accommodate pedestrians waiting to cross.

5.3 Vehicle Actuation

5.3.1 Unless part of a linked scheme, vehicle actuation is the normal method of signal operation. The use of both the microwave and inductive loop types of detector are covered in Department of Transport specifications MCK 2123[28] and MCE 0108[29] respectively. Vehicle actuation may be desirable within a linked scheme depending mainly on whether the linking is full time. Each case should be considered on its merits.

5.3.2 On roads subject to a speed limit of 30 m.p.h. and where the 85 percentile approach speeds do not exceed 35 m.p.h., fixed time operation is still an option. Under fixed time operation a pedestrian demand will initiate the Operational Cycle and the vehicle precedence period will terminate when a preset time has expired. The preset time is normally set low, say 20 to 30 seconds, but can be extended during peak periods if the pedestrian waiting area is sufficient. Linked systems are dealt with in the following section 5.4.

5.3.3 Vehicle actuation is essential on roads with higher speed limits or 85 percentile approach speeds. The recommended options are described in Table 2. The "Approach Speed" should be taken to mean the 85 percentile speed under free flow conditions. For further information reference should be made to Departmental Advice Note TA 22[24].

5.3.4 Microwave vehicle detection should not be used with either Speed Assessment or Speed Discrimination equipment.

5.4 Linking with other Signalling Systems

5.4.1 Where it is proposed to site a crossing close to a signalled junction, consideration should be given to a linked system. The distance at which this should be considered will vary with traffic conditions but 100 metres would be a likely minimum.

5.4.2 Crossings within the overall boundary of an Urban Traffic Control (UTC) area may be:-

a) omitted from the UTC scheme and remain on isolated control when coordination is not justified. This may be a permanent or part-time arrangement; or

b) operated as part of an adjacent controlled junction;

c) controlled directly by the computer.

5.4.3 If controlled directly, the normal method employed for a Pelican crossing is to control the change to the start of the pedestrian stage. It is either allowed or inhibited (by use of the "PV bit"). Where a kerb-side detector strategy is used, improved control may also be achieved by modelling the crossing as a junction with the pedestrian stage entered as a stage with a call/cancel facility. This method will also allow for the variable all-red.

5.4.4 The vehicle precedence time of the crossing should be matched to the timings of the adjacent installations.

5.4.5 It may be necessary, and desirable, for a complete crossing sequence to operate more than once within the area cycle time to avoid long pedestrian waiting times.

5.4.6 Under UTC it may be possible to insert artificial pedestrian demands. This practice is to be deprecated because the driver could be presented with an unexpected loss of right of way.

5.4.7 The options for crossings within a local linked scheme are the same as for UTC.

6 PELICAN CROSSINGS

The Pelican Crossing uses far-side pedestrian signal heads and a flashing amber/flashing green crossing period, of a fixed duration, which is demanded solely by push button.

6.1 Timings

The Operational Cycle use and variations are described in Table 3 and the timings in Table 4. The cycle is initiated by a pedestrian demand.

Period A

Under vehicle actuation:-

a) The minimum time will normally be 7 seconds. Exceptionally this may be adjusted for site conditions between the limits of 6 to 15 seconds in increments of not less than 1 second.

b) The maximum time will normally be preset at 40 seconds or less. This may be adjusted for site conditions up to a maximum of 60 seconds.

c) The maximum time will start at the commencement of the minimum time ('pretimed max.') on roads subject to speed limits up to and including 30 m.p.h. and at the pedestrian demand for other roads.

d) Termination will be subject to a pedestrian demand either at the end of the minimum time, when a gap is detected in traffic (gap change), or on the expiry of the preset maximum time (forced change).

e) The extension times for vehicles will be determined by the type of detection system used (see Table 2).

Period B

This is the mandatory 3 second stopping amber signal to vehicles.

Period C

Where the 85 percentile speed exceeds 35 m.p.h., period C will normally be 3 seconds. For other roads it will normally be 1 second for a gap change and 1, 2 or 3 seconds for a forced change.

Period D

The timing for the Pedestrian green walking figure period, with the option of the audible/tactile signal, should normally be set as follows:-

a) 4 seconds for crossings up to 7.5 metres in length.
b) 5 seconds for crossings over 7.5 metres and up to 10.5 metres.
c) 6 seconds for crossings over 10.5 metres and up to 12.5 metres.
d) 7 seconds for crossings over 12.5 metres.

It may be desirable to extend the period by two seconds if-

- the appearance of Period E habitually causes pedestrians to hesitate or turn back;
- it is expected that there will be considerable use by disabled pedestrians;
- a non-staggered central refuge is provided thus enabling pedestrians to get established on the second half of the crossing before the flashing amber signal appears to the vehicle;
- waiting pedestrians have difficulty establishing themselves on the crossing.

Period E

The overlap arrangement may be preferred to that in the previous period:

- to maximise the efficiency of the crossing for both pedestrians and vehicles where there is a traffic capacity problem;
- where pedestrians constantly experience difficulty because of encroachment by vehicles at the commencement of period F. A short period of overlap is allowed between the flashing green figure and vehicle red. This is achieved by extending the vehicle red period by 2 seconds (at the expense of the normal flashing amber time) to run concurrently with the first 2 seconds of the flashing green figure time. The loss of flashing amber time is not compensated for by extending the flashing amber/red standing figure time (Period G).

The steady green figure (Period D) extension and the overlap facility (Period E) should not normally be used together at the same crossing.

Period F

The timing for the flashing green figure/flashing amber period should normally be set at 6 seconds plus 1 second for each 1.2 metres of crossing over 6 metres in length.

NOTE: The controller is capable of extending the timing to a maximum of 18 seconds. It would, however, be unacceptable and impracticable to provide an undivided Pelican crossing of 20.4 metres. Equally it would adversely affect the balance of vehicle and pedestrian delay to depart from the preceding advice.

Period G

The timing for the red standing figure/flashing amber period should normally be set at 1 second for crossings up to 10.5 metres in length and 2 seconds for crossings exceeding this.

7 PUFFIN CROSSING

7.1 General Arrangement

7.1.1 Puffin crossings use near-side pedestrian signal heads and an extendable all-red crossing period which is instigated by a push button request accompanied by a pedestrian detector demand. It is intended that the Puffin operational cycle will become the standard form of pedestrian crossing at stand-alone crossings and junctions.

7.1.2 Puffin crossings have two forms of detection for pedestrians. These are:

a) kerb-side detectors. These cancel pedestrian demands which are no longer required.

b) on-crossing detectors. These extend the all-red time, Period 5.

7.2 Timings

The Operational Cycle use and variations are described in Table 5 and timings in Table 6.

The cycle is initiated by a pedestrian demand formed by both the push button being pressed and occupancy of the kerb-side detector zone. The delay time, after which the call is cancelled if the kerb-side detector does not detect a pedestrian, should be set to a value between 2 and 4 seconds depending on site conditions.

Period 1

Under vehicle actuation:-

- The minimum time will normally be 7 seconds. Exceptionally this may be adjusted for site conditions between the limits of 6 to 15 seconds.
- The maximum time will normally be set between 10 and 30 seconds. Only in exceptional circumstances should a value greater than 30 seconds be used. The highest value available is 60 seconds.
- The maximum period will normally start at the pedestrian demand but may start at the commencement of the vehicle green ('pretimed max.') on roads subject to speed limits up to and including 30 m.p.h.
- it will terminate, subject to a pedestrian demand, either at the end of the minimum time; when a gap is detected in traffic (gap change); or on the expiry of the preset maximum time (forced change).
- The extension times for vehicles will be determined by the type of detection system used (see Table 2).

Period 2

This is the mandatory 3 second stopping amber signal to vehicles.

Period 3

Where the 85 percentile speed exceeds 35 m.p.h., this period will be 3 seconds. For other roads it will normally be 1 second for a gap change and 1, 2 or 3 seconds for a forced change.

Period 4

The timing for the Pedestrian green walking figure period, with the option of the audible and/or tactile signal, should normally be set to 4 or 5 seconds at crossings with light to moderate pedestrian flows. Where one or more of the following conditions occur the length of this period should be increased to 6–9 seconds as appropriate:

- the crossing is in an area where heavy pedestrian flows are generated;
- the distance between kerbs is greater than 11 metres;
- a central refuge is provided;
- space in the pedestrian waiting area is limited.
- areas where there is a higher proportion of disabled or elderly people.

Period 5

The all-red period of 1-5 seconds.

Period 6

The all-red is extended by the on-crossing detectors up to 25 seconds.

The extension period for the pedestrian on-crossing detector should normally be set within the range 1.6 to 2.2 seconds.

Period 7

If the normal maximum of the clearance period is reached when pedestrians are still being detected on the crossing, this operates to permit the pedestrians to clear before the Period 9 commences. The duration of this period is normally 3 seconds but can be adjusted between 0-3 seconds.

The maximum duration of the pedestrian extendable clearance period (Periods 6 and 7 together), in seconds, should normally be set to 5 + 1.67 (the length of crossing - 3 metres).

Period 8

If the normal maximum of the clearance period is not reached Period 7 will be followed by this period. Normally set to 0 seconds but can be adjusted in steps of 1 second to a maximum of 3 seconds.

Period 9

The red/amber period is fixed at 2 seconds.

8 TOUCAN CROSSINGS

8.1 General arrangement

The Toucan Crossing has the same form of vehicular detection as the Pelican and Puffin crossings and normally the same form of pedestrian on-crossing detector as the Puffin crossing. It is intended to develop kerb-side detectors. The method of operation given in this document is interim and it is intended that the method now used for the Puffin crossings will become standard once development of the Toucan is far enough advanced.

A Toucan crossing is an unsegregated signal-controlled crossing for pedestrians and cyclists, linking cycle track and footway systems on opposite sides of a carriageway.

8.2 Timings

The Operational Cycle use and variations are described in Table 7 and the timings in Table 8.

The Operational Cycle is initiated by a demand by a pedestrian or cyclist.

Period I

Under vehicle actuation:

a) The minimum time will start at the commencement of the vehicular green and should normally be 6 seconds but is adjustable up to 15 seconds to suit unusual site conditions.

b) The maximum time will start at the commencement of the minimum time on roads where the 85 percentile speed is 35 miles per hour or less and at the pedestrian/cyclist demand for other roads.

c) The maximum time should normally be set to 40 seconds or less. This may be adjusted for site conditions up to 60 seconds.

d) It will terminate subject to a pedestrian/cyclist demand either at the end of the minimum time, when a gap is detected in traffic (gap change) or on the expiry of the maximum time (forced change).

e) The extension times for vehicles will be determined by the type of detector system used (see Table 2).

Period II

This is the mandatory 3 second stopping amber signal to vehicles.

Period III

Where the 85 percentile speed exceeds 35 m.p.h., this will normally be 3 seconds. For other roads it will normally be 1 second for a gap change and 1, 2 or 3 seconds for a forced change.

Period IV

The timing for the green figure/cycle, with the option of the audible and/or tactile signal, should normally be set as follows:

a) 4 seconds for crossings up to 7.5 metres in length.

b) 5 seconds for crossings over 7.5 metres and up to 10.5 metres.

c) 6 seconds for crossings over 10.5 metres and up to 12.5 metres.

d) 7 seconds for crossings over 12.5 metres.

It may be desirable to extend the period by 2 seconds. The circumstances are outlined for Period D of the Pelican operational cycle.

Period V

The fixed black-out of 3 seconds.

Period VI

The black-out is extended by the on-crossing detectors from between 3 to 22 seconds.

The extension period for the on-crossing detector should normally be set within the range 1.6 to 2.2 seconds.

A near-side mounted signal may replace the far-side one for future Toucan crossings.

Period VII

If the normal maximum of the clearance period is reached when pedestrians/cyclists are still being detected on the crossing, this operates to permit the pedestrians/cyclists to clear before Period VIII commences. The duration of this period is fixed at 3 seconds.

The maximum duration of the pedestrian extendable clearance period (VI & VII together), in seconds, should normally be set to 5 + 1.67 (the length of crossing - 3 metres).

Period VIII

The all-red should be 1, 2 or 3 seconds.

Period IX

The red/amber period is fixed at 2 seconds.

9 CONSULTATION

Submission of pedestrian crossing schemes is no longer required, but consultation with the police, public notice and written notification to the Secretary of State are necessary before a crossing is established, altered or removed. (The Road Traffic Regulation Act 1984[25]).

It is possible that the installation of a pedestrian crossing may, under certain circumstances, provide liabilities under the provisions of the Land Compensation Act 1973[26], to which reference should be made.

10 PUBLICITY

General guidance is given in the Highway Code[30]. Specific information on Puffin pedestrian crossings, is available in 'How To Use a Puffin Crossing'[31], (Bilingual versions available in Wales), and 'The Use of Puffin Pedestrian Crossings'[32]. Reference to the Toucan crossings is made in Traffic Advisory Leaflet 10/93, "Toucan" An Unsegregated Crossing for Pedestrians and Cyclists'[33]. It is most important when installing or modifying a crossing that local publicity is provided. Visits, by Road Safety Officers, to schools and centres for elderly or disabled people help to inform the more vulnerable. Posters designed and produced by local authorities have been very successful in getting the message across. These have been displayed in schools, centres, libraries, surgeries, etc. and together with a localised postal distribution of 'How to Use a Puffin Crossing' can reach a wide audience.

11 REFERENCES

Note: * References are for Northern Ireland.

Introduction

1 The 'Zebra' Pedestrian Crossing Regulations 1971, updated by the Amendment Regulations 1990

* 'Zebra' Pedestrian Crossings Regulations (Northern Ireland) 1974

2 The 'Pelican' Pedestrian Crossings Regulations and General Directions 1987

* The (Pelican) Pedestrian Crossings Regulations (Northern Ireland) 1982

3 The 'Puffin' Pedestrian Crossings Regulations (in preparation)

4 The Traffic Signs Regulations and General Directions 1994

* The Traffic Signs Regulations (Northern Ireland) 1979

5 Department of Transport Specification TR 0141B,(in preparation at time of this publication).

6 Department of Transport Local Transport Note 1/95 The Assessment of Pedestrian Crossings

General Requirements

7 BS 3049: 1976 Pedestrian Guard Rails (Metal)

8 HD28 (Design Manual for Roads & Bridges [DMRB] 7.3.1) Skidding Resistance

9 Manual of Contract Documents for Highway Works Vol. 1 [MCHW -1]

10 Disability Unit Circular No DU 1/91. The Scottish Office equivalent is SOID Circular 2/1994.

11 Traffic Advisory Leaflet 4/91 - Audible and Tactile Signals at Pelican Crossings.

12 BS 5489 Part 2:1992 Code of Practice for Road Lighting - Lighting for Traffic Routes.

13 Institution of Lighting Engineers, Technical Report No. 12, Lighting of Pedestrian Crossings.

14 Traffic Signs Manual, Chapter 4, Warning Signs, Table A.

'Zebra' Pedestrian Crossings

15 Traffic Signs Manual, Chapter 5, Road Markings.

16 British Standard 873 Part 2:1984. Road Traffic Signs and Internally Illuminated Bollards - Specification for Miscellaneous Signs.

17 The Highways (Road Humps) Regulations 1990. The Scottish Office equivalent is The Road Humps (Scotland) Regulations 1990.

* The Highways (Road Humps) Regulations 1992

Signal-controlled Crossings

18 Departmental Advice Note TA 13, (DMRB Vol.8, Section 1). Requirements for the Installation of Traffic Signals and Associated Control Equipment.

19 Departmental Advice Note TA 14, (DMRB Vol.8, Section 1). Procedures for the Installation of Traffic Signals and Associated Control Equipment.

20 Departmental Standard TD 24, (DMRB Vol.8, Section 1). All Purpose Trunk Roads and Trunk Road Motorways. Maintenance of Traffic Signals.

21 Departmental Standard TD 25, (DMRB Vol.1, Section 2). All Purpose Trunk Roads and Trunk Road Motorways. Maintenance of Traffic Signs.

22 Departmental Standard TD 26, (DMRB Vol.8, Section 2). All Purpose Trunk Roads and Trunk Road Motorways. Maintenance of Road Markings.

23 Standard BD 2 (DMRB Vol.1, Section 1) - Technical Approval of Highway Structures on Trunk Roads (including Motorways).

24 Departmental Advice Note TA 22, (DMRB Vol.8, Section 1) - Vehicle Speed Measurement on All Purpose Roads.

Consultation

25 Road Traffic Regulation Act 1984

* The Road Traffic (Northern Ireland) Order 1981

26 Land Compensation Act 1973. The equivalent in Scotland is the Land Compensation (Scotland) Act 1973.

Visibility Requirements

27 Departmental Advice Note TA 12, (DMRB Vol.8, Section 1). Traffic Signals on High Speed Roads.

Vehicle Detection Requirements

28 Department of Transport Specification MCK 2123

29 Department of Transport Specification MCE 0108/MCK 1030 - Siting of Inductive Loops for Vehicle Detecting Equipment at Permanent Road Traffic Signal Installations.

Publicity

30 The Highway Code - HMSO

31 ‘How to Use a Puffin Crossing’ - Departmental pamphlet

32 Department of Transport Advisory Leaflet ‘The Use of Puffin Pedestrian Crossings’.

33 Department of Transport Traffic Advisory Leaflet 10/93 “Toucan” An Unsegregated Crossing for Pedestrians and Cyclists.

12 TABLES

Table 1 ALL TYPES OF CROSSING - VISIBILITY REQUIREMENTS

Reference should be made to Departmental Advice Note TA 12/81[27]

85 Percentile Approach Speed (m.p.h.)	25	30	35	40	45	50
Desirable Minimum Visibility (metres)	50	65	80	100	125	150
Absolute Minimum Visibility (metres)	40	50	65	80	95	115

Table 2 PELICAN, PUFFIN & TOUCAN CROSSINGS - VEHICLE DETECTION REQUIREMENTS

Speed Limit (m.p.h.)	**85 percentile approach speed (m.p.h)**	**Recommended Operation**
Up to and including 30	Up to and including 35	(a) Fixed time operation, or (b) Microwave vehicle detection (MVD) in accordance with Department of Transport Specification MCK 2123[27] & [28], or (c) With a single loop sited 39m from the stop line with a 4.0 second extension time for vehicles, (see Note 1) or (d) With a multi loop configuration such as System D, (see Note 1)
Above 30	Up to and including 35	Vehicle actuation as in (c) or (d) above
Not relevant	Greater than 35 and up to and including 45	Vehicle actuation as in (c) or (d) above. In addition, Speed Discrimination loops spaced at 79m from the stop line (vehicles travelling in excess of 30 m.p.h. being granted 3.0 second extensions) should be used (see Note 1).
Not relevant	Greater than 45 (see paragraph 2.1)	Vehicle actuation as in (c) or (d) above. In addition, Speed Assessment loops sited 151m from the stopline should always be used (see Note 1).
Note 1: In accordance with Department of Transport Specification MCE 0108[27] & [28]		
Note 2: In Scotland, microwave vehicle detection may be used on higher speed roads but signal settings must be adjusted to ensure safe clearance periods are introduced. The adoption of this form of strategy must be agreed with the Scottish Office.		

Table 3 PELICAN CROSSINGS - OPERATIONAL CYCLE, USE & VARIATIONS

PERIOD	USE	VARIATION FOR
A	Vehicle running time	Traffic volume
B	Standard stop warning to vehicles	None
C	Vehicle clearance period	Vehicle actuation
D	Pedestrian invitation to cross	Road width, disabled pedestrians, crossings with central refuge
E	Warning to pedestrian to clear the crossing and not to cross. Vehicles remain stopped. For use with divided crossing	Site conditions
F	As period E above but with vehicles allowed to proceed provided the crossing is clear of pedestrians ahead of them	Road width
G	Additional pedestrian clearance time before vehicle running period	Road width

Table 4 PELICAN CROSSINGS - OPERATIONAL CYCLE & TIMINGS

PERIOD	SIGNALS SHOWN		TIMINGS (Seconds)
	TO PEDESTRIANS	TO VEHICLES	
A	Red Standing Figure (wait)	Steady Green (proceed if way is clear)	20-60 (fixed) 6-60 (VA)
B	Red Standing Figure	Steady Amber (stop unless not safe to do so)	3 (Mandatory)
C	Red Standing Figure	Steady Red (stop, wait behind Stop line on carriageway)	1 to 3
D	Green Walking Figure with audible signal if provided (cross with care)	Steady Red	4 to 7 (in some circumstances plus 2)
E	Flashing Green Figure (do not start to cross)	Steady Red	0 or 2
F	Flashing Green Figure	Flashing Amber (give way to pedestrians on the crossing - they have priority)	6 to 18
G	Red Standing Figure	Flashing Amber	1 or 2

Table 5 PUFFIN CROSSINGS - OPERATIONAL CYCLE, USE & VARIATIONS

PERIOD	USE	VARIATION FOR
1	Vehicle running time	Traffic volumes
2	Standard amber to vehicles	None
3	Vehicle clearance period	Vehicle actuation
4	Pedestrian invitation to cross	Road width, disabled pedestrians, crossings with central refuge
5	Pedestrians must not start to cross	Type of detector
6	Completion of pedestrian crossing time	Road width
7	Additional pedestrian clearance time	Pedestrian detection
8	Additional pedestrian clearance time	Pedestrian gap change
9	Standard red/amber to vehicles	None

Table 6 PUFFIN CROSSINGS - OPERATIONAL CYCLE & TIMINGS

PERIOD	SIGNALS SHOWN		TIMINGS (Seconds)
	TO PEDESTRIANS	TO VEHICLES	
1	Red Standing Figure (Wait)	Green (proceed if way is clear)	20-60 (fixed) 6-60 (VA)
2	Red Standing Figure	Amber (stop unless not safe to do so)	3
3	Red Standing Figure	Red (stop, wait behind Stop line on carriageway)	1 to 3
4	Green Walking Figure with audible signal if provided (cross with care)	Red	4 to 9
5	Red Standing Figure (do not start to cross)	Red	1-5
6	Red Standing Figure	Red	0-22 (pedestrian extendable period)
7	Red Standing Figure	Red	0-3 (only appears on a maximum change if pedestrians are still being detected)
8	Red Standing Figure	Red	0-3 (only appears at a pedestrian gap change)
9	Red Standing Figure	Red with Amber (stop)	2

Table 7 TOUCAN CROSSINGS - OPERATIONAL CYCLE, USE & VARIATIONS

PERIOD	USE	VARIATION FOR
I	Vehicle running time	Traffic volumes
II	Standard amber to vehicles	None
III	Vehicle clearance period	Vehicle actuation
IV	Pedestrian invitation to cross	Road width, disabled pedestrians, crossings with central refuge
V	Pedestrians must not start crossing	None
VI	Completion of pedestrian crossing time	Road width
VII	Additional pedestrian clearance time	Pedestrian detection
VIII	All red	Pedestrian clearance
IX	Standard red/amber to vehicles	None

Table 8 TOUCAN CROSSINGS - OPERATIONAL CYCLE & TIMINGS

PERIOD	SIGNALS SHOWN		TIMINGS (Seconds)
	TO PEDESTRIANS	TO VEHICLES	
I	Red Standing Figure (Wait)	Green (proceed if way is clear)	20-60 (fixed) 6-60 (VA)
II	Red Standing Figure	Amber (stop unless not safe to do so)	3 (mandatory)
III	Red Standing Figure	Red (stop, wait behind stop line on carriageway)	1 to 3
IV	Green Walking Figure with audible signal if provided (cross with care)	Red	4 to 7
V	Black-out - no signal shown (Do not start to cross)	Red	3 (fixed period)
VI	Black-out	Red	0 to 22 pedestrian extendable period)
VII	Black-out	Red	0-3 (only appears on a maximum change if pedestrians are still being detected)
VIII	Red	Red	1-3
IX	Red Standing Figure	Red with Amber (stop)	2

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