



## Part 3 of 4

### Pedestrian Facilities at Signal-Controlled Junctions

#### INTRODUCTION

This leaflet, of which this document is the third part, looks at the provision of pedestrian facilities at signal-controlled junctions. Parts 1 and 2 should be read first. The reference section for all three and Tables 1 and 2 referred to are in Part 4.

#### BACKGROUND

This leaflet supersedes TA15/81<sup>10</sup> and Traffic Advisory Leaflet (TAL) 5/91, "Audible and Tactile Signals at Signal Controlled Junctions"<sup>14</sup>.

#### GEOMETRIC LAYOUT

Reference should be made to TD50/04<sup>1</sup>.

#### Carriageway Markings

Advice is given in Chapter 5 of the Traffic Signs Manual<sup>15</sup>.

Recent research showed that, of the sites investigated, very few accidents involving pedestrians were due to speeding vehicles but reducing speeds can reduce the severity of many accidents. Reducing actual speed, by even 5 mph, is often achieved only by employing more than one measure.

Pedestrians can be disoriented by complex layouts. For example, a right turn movement at a high-speed site is often separated from the straight ahead/left turn lanes by an island. Here the pedestrian can not only misjudge the direction of the second flow being crossed but also, being unaware of the junction signal operation, the sequence. Other examples include contraflow lanes, where the direction of vehicular flow may not be obvious to pedestrians. If there is any possibility of confusion, appropriate signs and road markings should be used to remind drivers and



pedestrians. These include signs to diagrams 810, 963, 963.1, 963.2, 963.3 and 1029 in the Traffic Signs Regulations and General Directions (TSRGD) 2002<sup>16</sup>.

#### Stop Lines

Recent research showed that, on the sample taken, a disproportionate percentage of pedestrian accidents involved high-fronted vehicles, waiting at the stop line, pulling forward unaware of the pedestrian crossing the road. The same research showed that, by increasing the distance from the stop line to studs, the actual distance from the front vehicle to the studs also

increased. A minimum distance of 3 metres from stop line to studs (2.5 metres from stop line to primary signal post) is recommended to give improved intervisibility between driver and pedestrian. This is particularly important where vehicles sharing the same stop line move during different phases. A greater distance may be applicable. The actual distance will depend on the site and local experience of driver behaviour. At trial sites drivers showed a greater respect for stop lines and other white lining that was in good condition. Regular renewal could be a low cost but effective safety measure.

At some installations the stop line is moved further than 3 metres from the primary signal post. This is normally to accommodate turning vehicles, see TD50/04<sup>1</sup>. It is not normally necessary to move the crossing studs in such circumstances.

### Crossing Studs

The width of the crossing place is dependent upon the site conditions but is normally in the range 2.4 to 5 metres. Exceptional numbers of pedestrians may require the width to be increased to 10 metres. Colouring the carriageway surface between the studs may have a beneficial effect on crossing discipline and vehicle speed. However, giving the same texture and colour to this area and the adjacent footway can introduce problems. Pedestrians using, say, a red paviour surface in a shopping mall could assume an unjustified precedence over vehicles if the same surface is used between crossing studs. Care should be taken, therefore, to introduce some change where footway meets carriageway. Tactile paving is particularly important at such sites but see Diagonal Crossings in Part 1.

It should be noted that where refuges are shown, in the drawings in Part 2, the crossing is bounded on each side by a kerbed area, or separate refuge, giving some physical protection for a pedestrian. Using a hatched marking rather than a physical refuge is not recommended. There is a particularly high risk if any conflicting turning circle passes over the area normally occupied by the refuge.

It is recommended that the footway at the crossing position should be provided with a drop kerb and tactile paving; see "Guidance on the Use of Tactile Paving Surfaces"<sup>17</sup> for details. See also LTN 2/95<sup>6</sup>.

### Approach Markings

Approach markings can help to reduce speeds without reducing capacity. In general, these techniques are still being developed but those used in traffic calming may be worth considering in the right circumstances.

### Traffic Light Signals

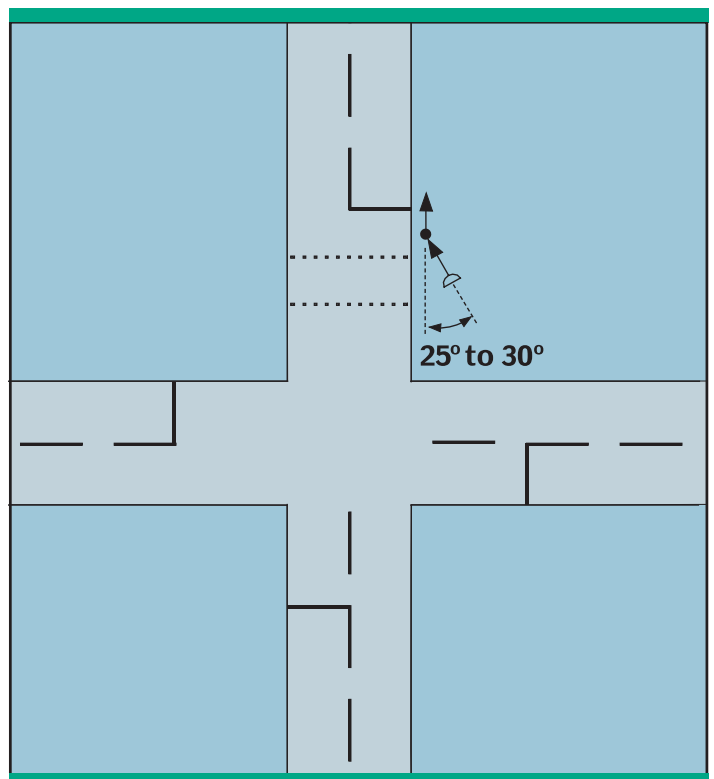
All vehicular and pedestrian signals and road markings are to be as detailed in TSRGD<sup>16</sup>.

Where "Green Man" displays are given to pedestrians concurrently with moving vehicles, on other approaches, care should be taken in positioning the signal heads to ensure that misleading indications are not given to drivers or pedestrians.

### Push buttons and Pedestrian Demand Units

The positioning of these is important. Guidance, on positioning, is given in LTN 2/95<sup>6</sup>, TAL 1/01<sup>7</sup>, TAL 1/02<sup>8</sup> and 2/03<sup>9</sup>. The position of the push button and the general waiting area governs intervisibility, which is covered in TD 50/04<sup>1</sup> and is clearly important to drivers and pedestrians. Indecision caused by a poor line of sight will increase the chance of an accident. Good intervisibility allows an informed choice. Note that where stop lines to diagram 1001.2 are used the distance of 2.5 metres in TD50/04<sup>1</sup> should be measured to the stop line nearest the primary signal post.

Additional push button units are necessary on refuges where pedestrians may be trapped at the end of the pedestrian stage. Remember that blind pedestrians, with a guide dog, will need a push button to their right. On refuges and on one-way streets, this generally means two push buttons, as sighted pedestrians need a push button to the left to encourage them to face oncoming vehicles. They may also be required on wider crossings, especially when nearside signals/above ground detectors are in use. See TAL 1/01<sup>7</sup> and 1/02<sup>8</sup>. Additional high level nearside signals may be required at busy sites to allow clear visibility.





## Guardrailing

Guardrailing can be the right solution, at the right place and in the right amount. If it is poorly sited, or over installed it can alienate pedestrians, look unsightly and easily become damaged, leading to increased maintenance costs and complaints.

It can be used where it is desirable to guide pedestrians, for example:

- where filtering traffic may be moving at times unexpected by pedestrians.
- to encourage pedestrians to cross within the studs, enabling on-crossing detectors to extend the all-red time at nearside signal installations, giving a safer crossing time and
- as an aid to guide blind and partially sighted pedestrians.

It is normally provided on refuges with staggered pedestrian movements, where it not only acts as a guide for blind and partially sighted pedestrians but also give a feeling of security to the more vulnerable pedestrian.

Some authorities are removing guardrailing as part of urban design changes to improve the quality of public space. When considering guardrailing at junctions the objective should be to provide only as much as is necessary for the safe and convenient use of crossings. Further guidance on the use of guardrailing will be published in due course.

The current standard for guardrails is British Standard 7818:1995<sup>18</sup>. There is some advice in LTN 2/95<sup>6</sup> and in

TA 57/87<sup>19</sup> on using guardrailing. The Department's "Inclusive Mobility"<sup>20</sup> provides additional guidance on this and other aspects of pedestrian infrastructure design for disabled people.

## PHASING AND STAGING

Pedestrians may still cross in gaps in the vehicular flow, or wait for the intergreen period. In either case there are several scenarios that are known to increase problems for pedestrians crossing.

Shared stop lines are a particular problem, as the pedestrian can assume that once the first lane has stopped all others sharing the same stop line will follow suit. In a similar way, where staging includes a right turn indicative arrow, and one arm of a previous two arm flow is shut down, pedestrians may cross in front of the approach still having a green signal assuming that both approaches will stop together. There may be added confusion if the right turn arrow only appears at peak times and a pedestrian may have previously crossed in the off-peak. Where this type of vehicular signalling is unavoidable, pedestrian signalling is recommended to reduce possible confusion.

Unsaturated flows often encourage pedestrians to seek gaps despite the increased vehicular speeds. Good vehicle responsive operation, with sensible green times, giving vehicle platoons with high saturation flows are, therefore, better for pedestrians, as they are more likely to wait for a green man signal. The resultant shorter cycle time also gives more opportunity for pedestrians to cross.

The controller should be configured to ensure that, on termination of the pedestrian period, the right of way would revert to a nominated stage in the absence of other



demands. If there is no obvious default stage, this could be an all-red so that the response to the next demand will be with minimum delay.

On multi-stage installations the stages may not always appear in strict cyclic order. Unusual stage sequences should be examined during the risk assessment, detailed in TA 84/01<sup>5</sup>, and potentially dangerous stage changes should be inhibited. Care should be taken to ensure adequate clearance time exists for vehicles before the start of a pedestrian stage, particularly after any unusual stage changes.

Pedestrians are not only vulnerable at the signal-controlled junction but may also be affected by it when crossing some distance away. Designers should be aware of the queue lengths anticipated, and of neighbouring crossing points. It could be that these should be brought within the operation of the junction to avoid pedestrians trying to cross between queuing vehicles. Designers should also anticipate possible queuing in side roads caused by waiting vehicles on the approach to the signal-controlled junction. These queues could present problems for pedestrians and additional facilities, possibly repositioned dropped kerbs/tactile paving, or an additional refuge, may be necessary.

There are a number of points to consider when deciding on the stage sequence.

- One particular approach of a junction may be more difficult for pedestrians to cross than others. Generally it is better that the pedestrian stage follows the end of the vehicle stage on this approach.
- Turning vehicles may have difficulty in clearing the junction before the appearance of the pedestrian stage. Ensure that the intergreen period is sufficient and if there is still a problem consider ways of extending the all-red to ensure that vehicles have cleared. Remember that detectors used for this purpose will fail to the "detect" mode and it is important to monitor their operation and repair faults quickly.
- When an early cut-off stage is provided, the pedestrian stage must not immediately follow if a left filter-maneuvre is permitted on the side road concurrently with the early cut-off stage.
- If stage skipping is employed, care should be taken that pedestrian facilities are not affected.

## PEDESTRIAN CROSSING DISPLAY SEQUENCE

The normal pedestrian crossing display sequence at a junction signal installation is given in Table 2, in Part 4. It comprises of a green man period, the invitation to cross, followed by a period long enough to cross the carriageway even if the activity is started at the end of the green man

invitation period. How this second period is made up depends on whether farside, or nearside, signalling is used. The farside pedestrian system will have a black-out, (when neither the red nor the green man is shown), plus an all-red. Nearside pedestrian signals, based on the Puffin pedestrian crossing, will have an all-red period immediately following the green man. This second period is particularly important for vulnerable users, including disabled pedestrians and site observations will be vital to ensure that the time allowed is suitable.

In parallel pedestrian facilities, the required duration of periods 4-8 inclusive, in Table 2, must be safeguarded as the minimum. If the vehicular phase is not fixed and the green man period can be greater than the values in Table 2, care should be taken with wide variations as these may confuse pedestrians.

Where the intersection is included in an Urban Traffic Control scheme of any description, no plan capable of being operated by the central control shall be employed unless the above requirements for the pedestrian stages are met fully.

## NEARSIDE ON-CROSSING DETECTION

**It must be stressed that for the safe operation of any nearside installation there must be sufficient on-crossing detectors, properly installed, aligned and maintained in accordance with the manufacturer's guidelines.**

Following the green man period, the all-red "clearance period" can be extended by the on-crossing detection. A fault monitor algorithm in the controller checks for outputs from the on-crossing detector during the pedestrian and vehicular traffic stage. This is to ensure the correct operation of the detector. The operation of the on-crossing detector is checked between the end of one pedestrian clearance period to the start of the next. In normal operation, vehicles passing the detector would trigger operation. If nothing is detected, indicating a





possible fault, the following pedestrian clearance period would be extended to a maximum pre-set value stored in the controller. This process is repeated each cycle.

At some sites vehicular flows can be very light on one arm during off-peak periods. This could typically be an arm only serving a business premises, working 08.00 to 16.30 weekdays. In this example, there may not be vehicles on the arm after, say, 17.30 and the controller, detecting no passage of vehicular traffic, would assume a fault, imposing a maximum clearance time during the evening peak period. To overcome this type of problem, it is recommended that the controller is configured so that this arm is connected to a separate phase. The default value of the clearance period can be set at a reduced value but not be below that covered by the width of the carriageway divided by 1.2. It may be that more than one arm needs treating in this manner.

### AUDIBLE AND TACTILE (RECOGNISED BY SENSE OF TOUCH) SIGNALS

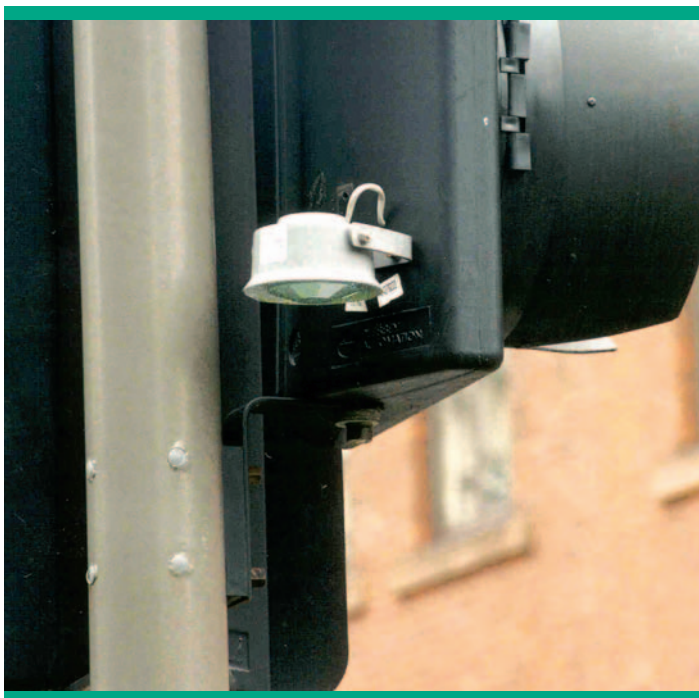
There are two standard audible signals available\*, the normal standard "bleeper" and the "Bleep and Sweep" signal, see picture. (\*In Scotland, contact the Scottish Executive for further advice.) These are both specified in TR0155<sup>21</sup>.

The former is housed in the push button housing and can be heard at some distance from its origin. Where the audible signal at one crossing could be heard at another, it can only be used if all vehicles are stopped when pedestrians are signalled to cross, such as at a full pedestrian stage. Such a stage may have a number of associated phases, perhaps because of the need to provide more audible/tactile signals than can be driven from one phase. In this case it is important that the audible/ tactile signal is not activated until all phases have started and there is time to provide an adequate invitation period to those relying on the audible/tactile signal. The

audible/tactile signal must not continue past the end of the first green man indication to finish.

The latter is installed at signal head height and uses an output level variation to restrict the range and hence reduce the possibility of confusion at, say, a staggered crossing. However, there are still distance restrictions, see A, B and C in TAL 4/91<sup>22</sup>. Bleep and Sweep equipment needs individual site authorisation before it can be used at a signal-controlled junction. See LTN 2/95<sup>6</sup> for possible nuisance problems with audible signals in residential areas.

The tactile signal is a small knurled truncated cone fitted to the underside of the push button box, see photograph below. The relevant specification is TR 0157B, Tactile Equipment<sup>23</sup>. The cone rotates whilst the green man pedestrian signal is lit, giving blind and partially-sighted pedestrians the necessary information.



It is important that a risk assessment is carried out into possible misinterpretation of audible/tactile signals by vulnerable users. At existing sites it may be necessary to re-design staging/phasing and re-arrange the layout of posts, push buttons etc to achieve safe, unambiguous, signalling. Audible and tactile signals should be installed unless specific considerations warrant their exclusion.

The position of equipment to be used by pedestrians is important. For example, a tactile signal, because of its location with the push button, is normally placed close to the kerb. However, sometimes the push button is at the back of the footway. If this cannot be avoided, the local mobility officer and visually impaired residents should be consulted to agree the best compromise.

When specifying staging and timings, there must be no vehicular movements once audible/tactile signals have been activated. Audible/tactile signals must be coincident with the start of the associated pedestrian green man signal and activated only whilst the green man signal is lit. The green man shall not start until the red vehicular stopping signal has been given for a sufficient time for turning vehicles to clear all pedestrian crossing facilities.

RED LAMP MONITORING

See TR2210A<sup>24</sup> on sections for Safety Monitoring. Pedestrian signalling must not be used with traffic signal controllers without a red lamp monitoring facility.

TYPE APPROVAL

TSRGD<sup>16</sup> calls for some equipment to be of a type approved. For such equipment designers should request the supplier to provide a copy of the Type Approval Certificate issued by the Highways Agency.

PUBLICITY

There is still a great deal of misunderstanding regarding the sequence and meaning of pedestrian signals. This is mainly due to the variety of signal displays after the green man at crossings in the UK: blackout and red man at stand-alone crossings and signal-controlled junctions, and flashing green at stand-alone Pelican crossings for farside signals and red man for nearside signals. It is hoped that the change to nearside signals will clarify the situation.

However, there is still a considerable mix of signal types and it is important that publicity is used to inform road users what to expect. "How to use a Puffin crossing"<sup>25</sup> is available for widespread distribution. Leaflets with a local theme are often very useful in bringing matters to people's attention.

Details of Traffic Advisory Leaflets available on the DfT website can be accessed as follows: [www.dft.gov.uk](http://www.dft.gov.uk)  
From the DfT homepage, click on Roads and Vehicles, then Traffic and Parking Management and then Traffic Advisory Leaflets.

The Department for Transport sponsors a wide range of research into traffic management issues. The results published in Traffic Advisory Leaflets are applicable to England, Wales and Scotland. Attention is drawn to variations in statutory provisions or administrative practices between the countries.  
The Traffic Advisory Unit (TAU) is a multi-disciplinary group working within the Department for Transport. The TAU seeks to promote the most effective traffic management and parking techniques for the benefit, safety and convenience of all road users.

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