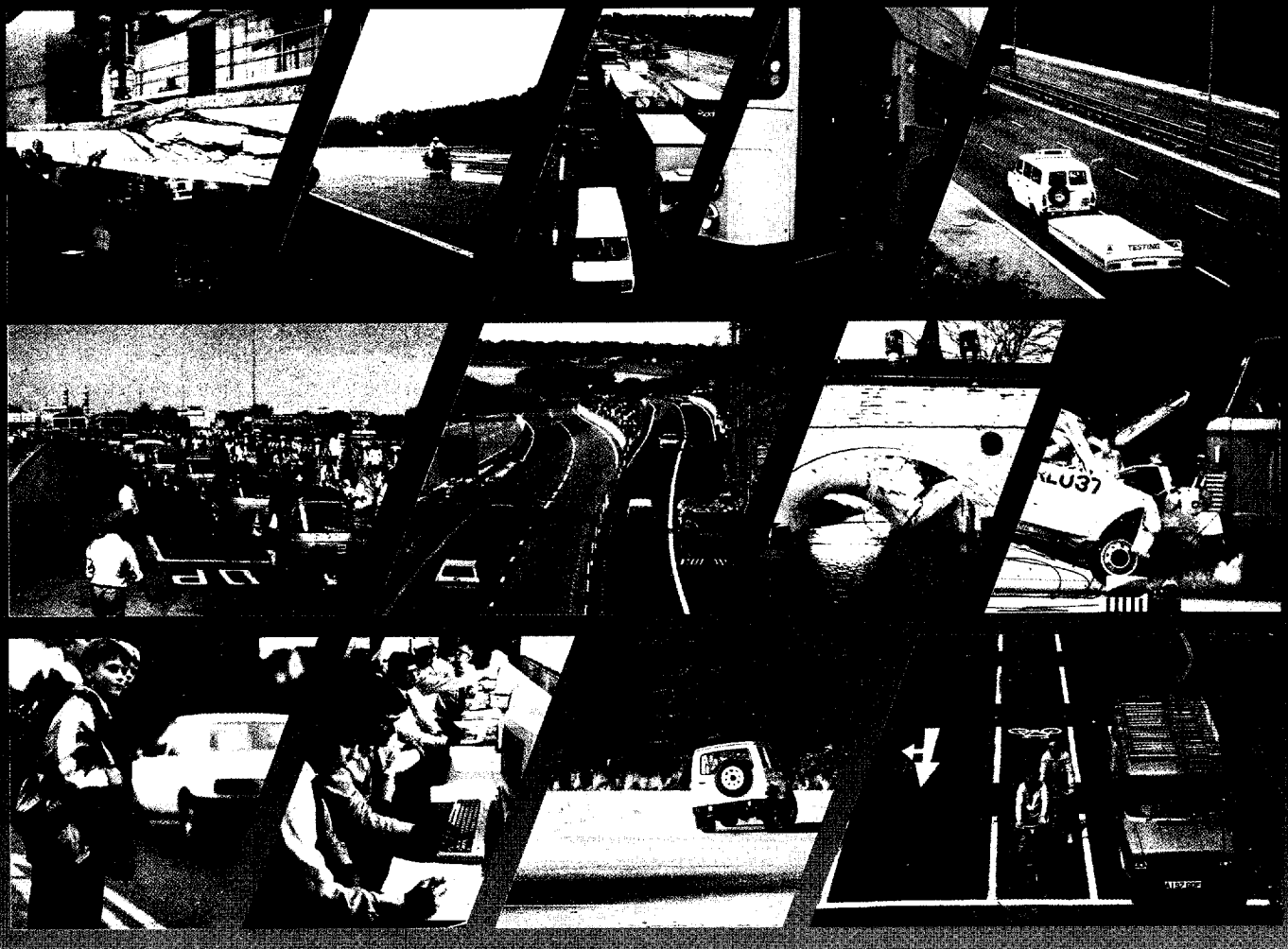
TRL
TRANSPORT RESEARCH LABORATORY



Toucan crossings for cyclists and pedestrians

by J M Morgan

Project Report 47
H5/10D

An executive agency of
THE DEPARTMENT
OF TRANSPORT

ABOUT TRL

The Transport Research Laboratory is an executive agency of the Department of Transport. It provides technical help and advice based on research to enable the Government to set standards for highway and vehicle design, to formulate policies on road safety, transport and the environment, and to encourage good traffic engineering practice.

TRL also sells its services, acting as contractor, consultant or providing facilities and staff on a fee-paying basis for customers in the private sector.

TRL's expertise ranges from the construction of highways, bridges and tunnels, to all forms of road safety, traffic control and driver behaviour.

For instance, highways and structures research at TRL develops improved materials and methods which enable earthworks, roads and bridges to be designed, built and maintained more cost-effectively. New ways of reinforcing earth can cut construction costs, while bridges can be modified to reduce corrosion. Road surfaces developed at TRL can reduce noise and cut wet-weather road spray from lorries by 90 per cent.

Safety research varies from monitoring the incidence of drinking and driving and devising ways of reducing it, to improving junction designs and cooperating with European partners on new standards for improved impact protection in vehicles.

Traffic research seeks to make the most of existing roads by, for instance, improving traffic signal coordination and devising systems which help drivers avoid congestion. Other research looks at the effectiveness of parking controls and improved crossings for pedestrians.

TRL research informs Government transport policy by studying, for example, the effects of bus deregulation and how land use interacts with the road and rail transport system.

TRL employs around 600 scientists, engineers and support staff and is headed by a Chief Executive. Its headquarters are at Crowthorne, Berkshire where its facilities include a 3.8km test track, a separate self-contained road network, a structures hall where bridge structures can be stressed to breaking point, a facility for carrying out accelerated tests on road structures and advanced computer systems which are used to develop sophisticated traffic control programs. A Scottish section in Livingston provides advice to highway authorities on local problems such as rock engineering, bridges, road construction and maintenance.

A large proportion of the research is sub-contracted to industry, consultants and universities. The Laboratory also collaborates with local authorities and other organisations within Europe and elsewhere. In addition, TRL expertise is provided to developing countries as part of Britain's overseas aid programme.

For more information: TRL Public Relations, 0344 770587

TRANSPORT RESEARCH LABORATORY
An Executive Agency of the Department of Transport

PROJECT REPORT 47

TOUCAN CROSSINGS FOR CYCLISTS AND PEDESTRIANS

by J M Morgan

Prepared for: **Project Record:** **H5/10D** **Safety Measures for Cyclists and Pedestrians**
Customer: **Traffic Policy Division, DOT** **(Mr E Wyatt)**

Traffic and Transport Resource Centre
Transport Research Laboratory
Crowthorne, Berkshire, RG11 6AU
1993

ISSN 0968-4093

CONTENTS

EXECUTIVE SUMMARY

This Report describes the evolution of the TOUCAN crossing - a signal-controlled road crossing at which cyclists and pedestrians cross in the same area at the same time. The practice of sharing of crossings has been well established in recent years by the widespread but illegal use made by cyclists of PELICAN crossings. Following extensive studies showing that this sharing of crossings appears not to pose any safety problems or any other adverse effects, a trial of TOUCAN crossings was begun.

Local Highway Authorities have enthusiastically taken part in the trials. The TOUCAN has benefits in terms of lower cost and reduced environmental clutter when compared with the existing approved design of fully segregated cycle/pedestrian crossings. The Department of Transport selected 13 sites with 25 proposed TOUCAN crossings for inclusion in the trials. All of these TOUCANs were built over the period from February 1991 to June 1992. One of them, in The Avenue, Southampton, was subsequently modified to incorporate infra-red detection in December 1992.

Throughout the trials, a working group comprising representatives of all of the local highway authorities involved, the Department of Transport and the Transport Research Laboratory has met and discussed progress and problems. The schemes have been studied by TRL by means of video films of road user behaviour and by classified turning counts of the road traffic and of the TOUCAN crossing users.

Sharing of the crossing space by cyclists and pedestrians has proved satisfactory. The design of the TOUCAN, with push buttons on either side of the waiting area, appears to be working well. Cyclists obviously have no difficulty using the push buttons, and sometimes use the low pole on which the push button plate is mounted for leaning on while waiting.

Some problems have arisen at some sites. At Southampton substantial queues of motor vehicles have formed, resulting in complaints from public and police. Some red-running by drivers has been recorded. The fixed time operation of the TOUCAN signals caused the queueing, and may also have led to red-running because drivers have to wait for a substantial amount of time, during which the crossing user has gone. A solution to the queueing has already been found in the infra-red detectors introduced at the Southampton crossing. If the red-running is, as it appears to be, a result of driver impatience, infra-red detection should also reduce this.

The overall conclusion is that the TOUCAN shared cyclist/pedestrian crossing is a viable alternative to the current design of parallel crossing but that it may operate more safely with a variable crossing time governed by detection of people using the crossing. The one TOUCAN crossing modified with infra-red detection has been found highly successful.

TOUCAN CROSSINGS FOR CYCLISTS AND PEDESTRIANS

ABSTRACT

This Report describes the research into the TOUCAN crossing - a signal-controlled road crossing at which cyclists and pedestrians cross in the same area at the same time. Local Highway Authorities volunteered sites for trial, 13 of which were selected for monitoring by TRL.

Sharing of the crossing space by cyclists and pedestrians has proved satisfactory, with no problems of conflicts or use of the equipment. At some sites substantial queues of traffic have formed due to the fixed-time operation of the signals. These can be overcome by the use of infra-red detection equipment that ends the crossing stage when no pedestrians or cyclists are crossing. This has proved to be very successful at the site where infra-red detection has been installed.

1. INTRODUCTION

This report describes the evolution and research study of the TOUCAN crossing, a new form of signalled crossing at which cyclists and pedestrians may cross the road at the same time, sharing the same space.

1.1 EARLY DESIGNS OF CYCLE CROSSINGS

Safe crossings of main roads are an essential feature of cycle routes (Quenault, 1978). The Department of Transport and TRL have experimented with designs of signal-controlled cycle crossings since 1977 when the first two were introduced on the Peterborough Cycle Route (Quenault, 1981). The first cycle/pedestrian crossing was introduced on the Marton West Beck Cycle Route, Middlesbrough in 1979 (Department of Transport, 1980 and 1982). It comprised separate, parallel crossings with cyclists' and pedestrians' signals running concurrently. Cyclists were detected by induction loop and pedestrians had the standard Pelican-type push buttons; both parts of the crossing operated regardless of which type of user demanded the signal. Cyclists were prohibited from turning in the direction of the pedestrians' part of the crossing. The currently recommended design for cycle/pedestrian crossings is based exactly on this first experimental crossing and is usually referred to as a '1/86' type crossing because it appeared in the Department of Transport's Local Transport Note 1/86 (Department of Transport, 1986)

There are only a few 1/86 type cycle/pedestrian crossings because they are relatively expensive to install and are considered to be excessively cluttered with so many signal heads, normally at least 10 of them. Some Local Authorities used Pelican crossings, with or without 'cyclists dismount' signs as an alternative, and some others constructed their own designs of cycle/pedestrian crossing. There was also some criticism to the effect that cycle routes had not been implemented due to reluctance to install 1/86 type crossings. Responding to this criticism, the Department of Transport commissioned a study through the Transport Research Laboratory of cyclists' use of pedestrian and cycle/pedestrian crossings with the intention of finding a design more likely to be acceptable to Local Highway Authorities.

1.2 CYCLISTS' USE OF PEDESTRIAN CROSSINGS

The study of cyclists' use of pedestrian and cycle/pedestrian crossings (Trevelyan and Ginger, 1989) by the Transport Research Laboratory and ABT Planning and Highways Consultancy Ltd. showed that cyclists use pedestrian crossings safely and that pedestrians and cyclists commonly share the crossing space, even at parallel cycle/pedestrian crossings where they are deliberately segregated. The most important finding was that there were no safety or operational reasons for preventing cyclists and pedestrians from sharing the crossing area. A more simplified design of shared crossing was recommended for trial. The new cycle/pedestrian crossing was referred to as a 'TOUCAN' crossing, because the *two can* cross at the same time in the same space.

1.3 THE TOUCAN CROSSING

The TOUCAN Signal Controlled Crossing is based on the Light Signal Controlled Crossing, used at signal-controlled junctions and prescribed by the Traffic Signs Regulations and General Directions 1981 (TSRGD). Unlike Pelican Crossings there is no 'flashing amber' period. The TOUCAN has additional push buttons, a modified push button plate, and a Green Cycle signal next to the Green Figure signal. At the request of some Local Authorities, the TOUCAN crossings in this study do not have inductance loop detection of pedal cycles, though there is no reason, apart from cost, why loops should not be used. The TOUCAN is less expensive and less environmentally intrusive than existing cycle crossings, and is therefore more likely to be installed.

Some differences between the TOUCAN and earlier designs of cycle crossing should be noted. The TOUCAN crossing does not have a red signal but a Red Figure in accordance with the type shown in Diagram 4002 of the TSRGD. The Red Figure signal is a warning to both cyclists and pedestrians that the main road traffic has priority and that it may be unsafe to cross. It is not an offence in itself for cyclists to cross while the Red Figure is showing. The Green Cycle/Green Figure signals are an invitation to cross with care. Drivers on the main road see standard 3-aspect signal heads operating exactly as they

do at any other signal-controlled road junction. Because cyclists and pedestrians cross in the same space and at the same time, there is no need to prohibit cyclists from making turns, except where other general traffic restrictions apply, such as one-way flow.

2. TRIAL OF TOUCAN CROSSINGS

The Department of Transport, TRL and Local Highway Authorities collaborated in a trial of 25 TOUCAN crossings at 13 different sites distributed as shown on the map of Great Britain in Fig 1. A Working Group, comprising representatives of the organizations directly involved, has met at significant stages in the work.

2.1 INVITATION TO LOCAL HIGHWAY AUTHORITIES

Following a presentation at DoT Headquarters of the results of the study of cyclists' use of pedestrian crossings, an invitation was made to interested LHAs to submit locations and plans for TOUCAN crossings and to attend the first meeting of a Working Group on 10 Jul. 1990. The DoT included with the invitation a set of sketches of layouts to be covered in the trial programme.

2.2 LIST OF TOUCAN CROSSINGS

The following is a list of the authorities participating in the TOUCAN trials together with a description of each TOUCAN crossing. A summary table is given at the end of this Section. Photographs of each site are shown, and

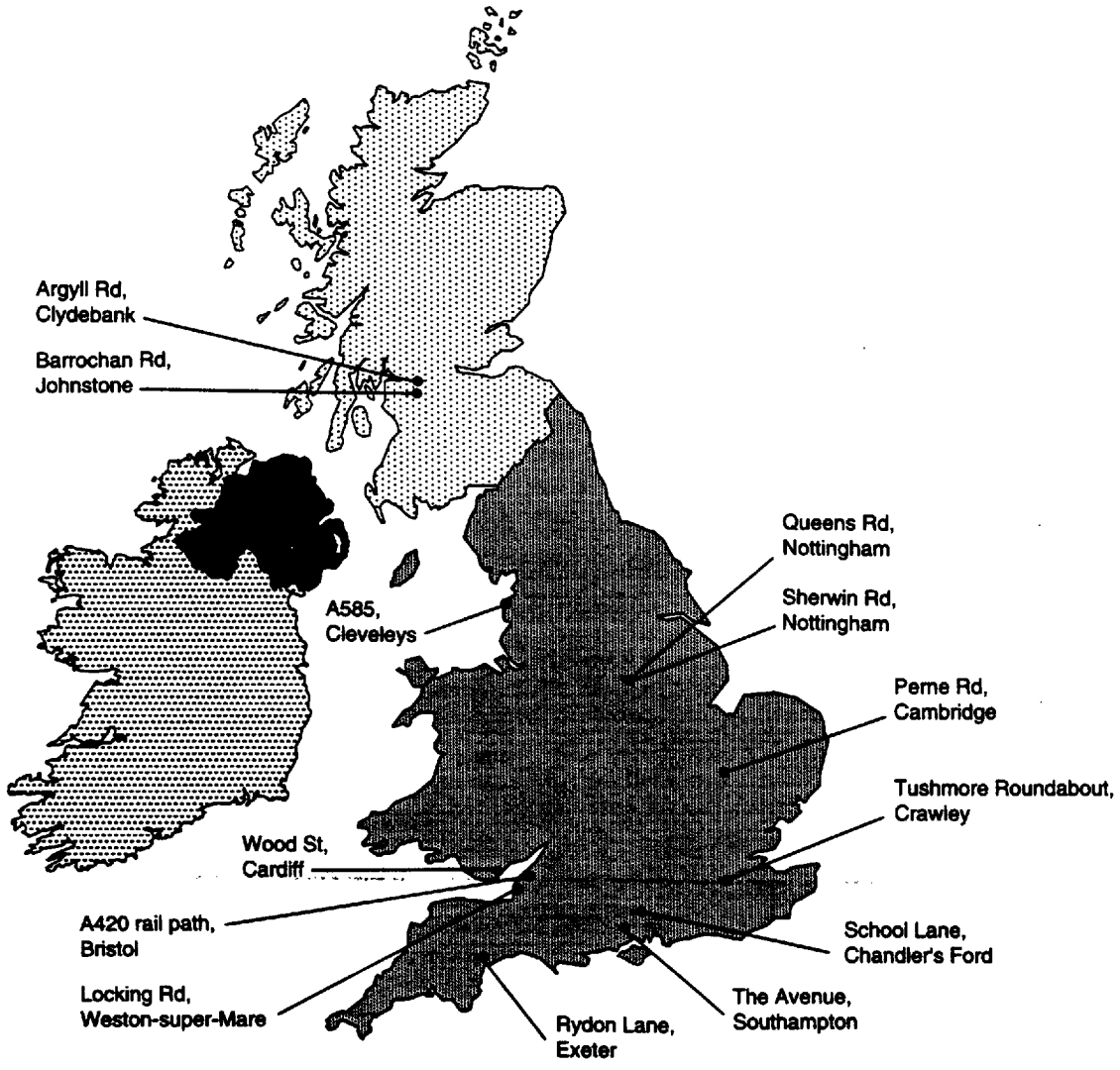


Fig. 1 Toucan Crossings

labelled corresponding, in Plates 1 to 13 in the appendix at the end of the report.

*1 **Bristol: A420/railway path, Warmley (Avon County Council):*** conversion of a Pelican Crossing connecting the cycle/pedestrian railway path across the A420 at Warmley High Street, Bristol. The 4m wide crossing is used mainly by people on recreational trips and is most heavily used at the weekends. The carriageway is 9.0m wide.

The TOUCAN has an unsegregated cycle/pedestrian path approach on both sides. The 'Zig-Zag' markings associated with the Pelican had not been removed at the time when the crossing was studied.

*2 **Weston-super-Mare: Locking Road/Mead Vale (Avon County Council):*** replacement of a Zebra crossing on Locking Road, Weston-super-Mare, close to a school. A cycle track parallel to the road switches to the other side of the road at the crossing. The crossing arrangement is elaborate, with a cycle lane on the eastbound approach detouring on to the footway to form a segregated cycle track/footway. Tactile surfaces, a raised white line and a red surface dressing on the cycle track help to emphasize the segregation. The cycle track and footway merge to form an unsegregated area at the crossing itself, where only one push button has been provided.

The degree of separation of cyclists and pedestrians is greater on the south side of the crossing. Two push buttons have been provided, and a white line separates the cycle track from the footway. The cycle track is further emphasized with a Give Way triangle.

The 'Zig-Zag' markings associated with the Pelican had not been removed at the time when the crossing was studied. The crossing itself is the standard 4m wide, over a carriageway width of 8.4m.

*3 **Cambridge: Perne Road (Cambridgeshire County Council):*** conversion of a Pelican Crossing on the line of the South-East Cambridge Cycle Route. A cycle track runs parallel to the road and past the crossing on the east side. On the west side, another parallel track terminates at the crossing. The 3m width between studs of the replaced Pelican crossing was not altered. The carriageway width is 9.5m.

*4 **Exeter: Rydon Lane/Pynes Hill (Devon County Council):*** four crossings of the newly constructed entry and exit lanes of a new office development at Pynes Hill, off Rydon Lane, near to the grade-separated junction with the A379. There are perpendicular approaches to all TOUCAN crossings. These approaches are segregated by a difference in level between a cycle track and footway, each 2m wide, right up to the edge of the carriageway. The widths of the four carriageways, all one-way, are 5.5 to 6.5m. There are also centrally positioned buttons to further emphasize the segregation. Both of these design features are contrary to the advice given by the Department of Transport since they tend to induce segregated use of what was intended to be a shared crossing. Devon County Council produced imaginative publicity material for the opening of their TOUCAN crossings as shown in Fig 2.

*5 **Southampton: A33 The Avenue/Northlands Road (Hampshire County Council):*** conversion of a Pelican Crossing on The Avenue, just south of the junction with Northlands Road. Cycle tracks run parallel to the road past both sides of the crossing. The TOUCAN crossing is 4m wide, over a carriageway of 12.5m. Fig 3 shows the location of the crossing. This crossing is dealt with is greater detail in Section 5 of this report

*6 **Chandler's Ford: U97 School Lane (Hampshire County Council):*** new crossing of the U97, School Lane. The footpaths approaching the road perpendicularly have been converted to shared use cycle tracks. The crossing is the standard width of 4m, the carriageway is 7.3m.

*7 **Cleveleys, nr Blackpool: A585(T) Amounderness Way/Linden Avenue (Lancashire County Council and North West Regional Office, DOT):*** conversion of a Pelican Crossing of Amounderness Way near the junction with Linden Avenue. Segregated cycle and pedestrian paths, both 2m wide, with perpendicular approaches were constructed on both sides of the crossing. Close to each side of the crossing, the tracks were built with 'dog legs' (two right-angled bends) and guard rails. The single carriageway is 7.4m wide. This is the only Trunk Road site in the TOUCANs trial. It was funded by the Department of Transport Regional Office (North West Network Management Division, Manchester).

*8 **Nottingham: Queens Road, Beeston (Nottinghamshire County Council):*** conversion of existing cycles-only crossing on Queens Road. On one side, the cycle track approaches perpendicularly, on the other, there are both a perpendicular approach and a cycle track parallel to the road. Push buttons replaced the inductance loop detection of cycles.

*9 **Nottingham: Sherwin Road (Nottinghamshire County Council):*** conversion of existing cycles-only crossing on Sherwin Road. A cycle track parallel to the road switches to the other side of the road at the crossing. Push buttons replaced the inductance loop detection of cycles.

*10 **Cardiff: Wood Street (South Glamorgan County Council):*** new crossing of Wood St. with unsegregated cycle/pedestrian tracks approaching perpendicularly on both sides. The crossing is the minimum width of 2.5m over a carriageway width of 9.6m. The road is 7.3m wide on the approaches but is wider on the bend close to which the TOUCAN crossing is located.

*11 **Clydebank: Argyll Road (Strathclyde Regional Council):*** conversion of a Pelican Crossing on Argyll Road with unsegregated cycle/pedestrian tracks approaching perpendicularly on both sides. The crossing is 4m wide, the carriageway 7.3m.

Devon
COUNTY COUNCIL

Cyclists—

YOU TOO CAN cross on a

Toucan Crossing

Pick up a leaflet from your local cycle shop or County Council Road Safety Officer on (0392) 382651 and find out how!

Coming to your town soon!

Fig. 2 Publicity leaflet by Devon County Council

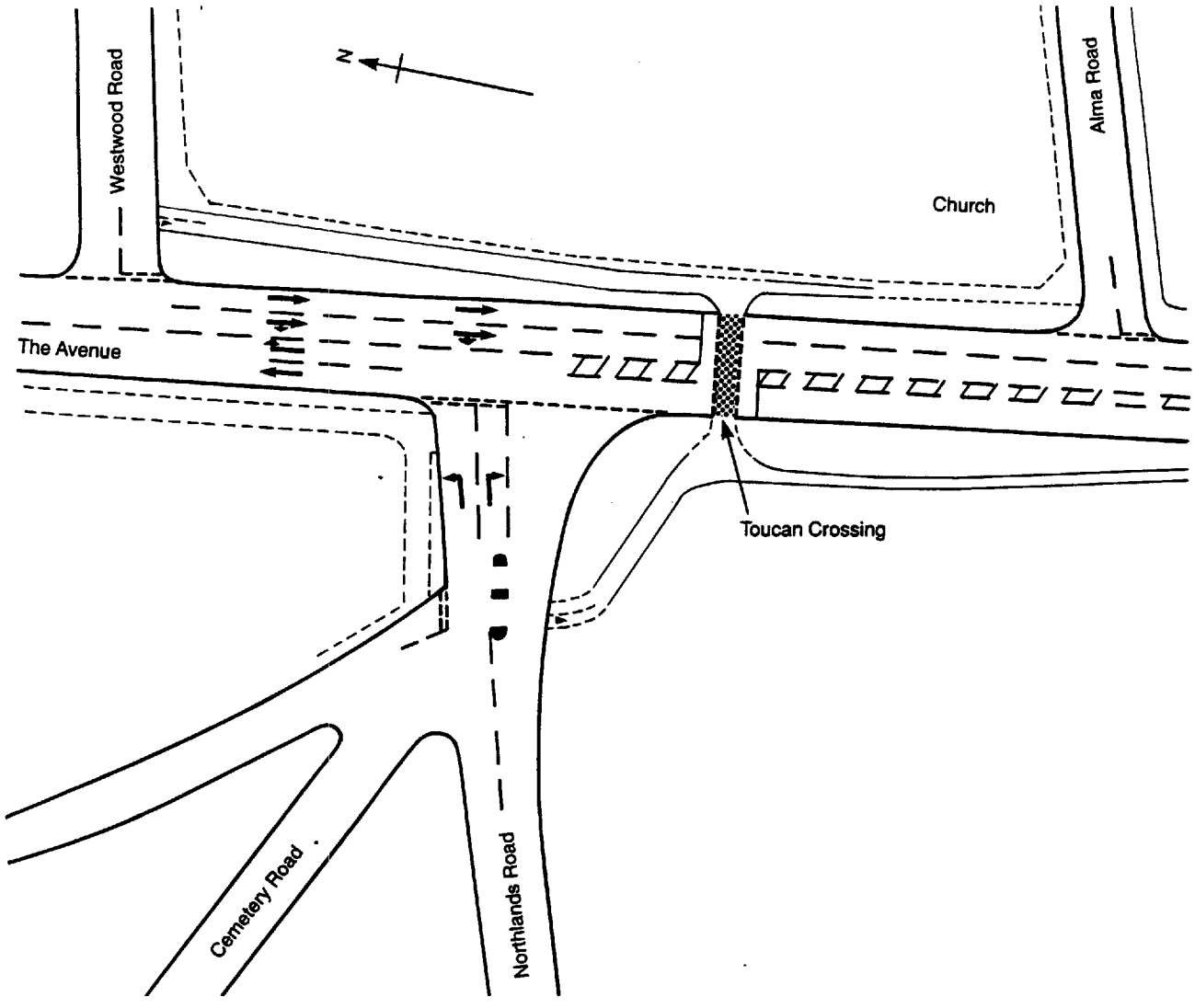


Fig. 3 Location of Toucan Crossing, The Avenue, Southampton

12 Johnstone: Barrochan Road (Strathclyde Regional Council): conversion of a new Pelican Crossing on Barrochan Road with unsegregated cycle/pedestrian tracks approaching perpendicularly on both sides, but with guardrailing to prevent a straightforward crossing. The TOUCAN crossing is 4m wide, the carriageway 7.3m.

13 Crawley: Tushmore Gyratory (West Sussex County Council): ten new crossings of entry and exit arms of the newly signalled Tushmore Gyratory, A23 / Crawley Avenue / London Road, Crawley. In all cases, the width of the TOUCAN crossings was 4m. The carriageway widths were from 4.5m to 11m. (Note that a detailed description of this scheme is given in Taylor and Wiltshire, 1992.)

The following Table summarizes the sites and opening dates:

3. TRAFFIC STUDIES

Most of the TOUCAN crossings have been studied by TRL by means of traffic counts on the main roads and the crossings and the analysis, described in Section 4, of road user behaviour via film taken by TRL Photographic Services.

Turning counts were carried out under contract to TRL by the Local Highway Authorities in ¼h periods from 7am to 7pm on a typical weekday of motor vehicles (classified), pedal cycles (whether riding or pushing) and pedestrians. Cycle and pedestrian movements on the paths or tracks or crossing in the vicinity of the sites and any unusual or apparently dangerous movements were recorded.

The purpose of the motor vehicle counts was mainly to provide background information on the nature of the sites at which TOUCAN crossings had been tested. It was

LOCATION OF TOUCAN CROSSING	OPENED
Bristol: A420/railway path, Warmley	31 Jul 91
Weston-super-Mare: Locking Rd	14 Apr 92
Cambridge: Perne Rd	26 Feb 92
Exeter: Ryden Lane	3 Jun 91
Southampton: A33 The Avenue	26 Feb 91
As above, with IR detection	18 Dec 92
Chandlers Ford, Hants: U97 School Lane	4 Jun 91
Cleveleys, Lancs: A585(T)	18 Nov 91
Nottingham: Queens Rd	5 Dec 91
Nottingham: Sherwin Rd	21 Jan 92
Cardiff, S Glamorgan: Wood St	26 Jun 92
Clydebank, Strathclyde: Argyll Rd	4 Feb 92
Johnstone, Strathclyde: Barrochan Rd	31 Jan 92
Crawley, West Sussex: Tushmore Gyratory	23 Jan 92

recognized from the outset that there could be additional traffic delays at heavily trafficked sites due to the fixed time working of the signals, but it was also felt unnecessary to make detailed studies of these delays since the signal equipment was likely to be improved in the near future. Section 5 below describes the recent study of a just such an improved TOUCAN with infra-red detectors enabling a variable crossing time.

3.1 A420 LONDON RD/RAILWAY PATH, WARMLEY, BRISTOL

The railway path is a recreational route. More people use the path on Sundays than on other days, so the counts were taken on Sundays.

There were 434 cyclists counted on 7 April 1991 'before' when the crossing was operating as a PELICAN, rising to 995 'after' the TOUCAN was installed, measured on 11 August 1991. The numbers for pedestrians were 286 'before' and 156 'after'.

With the 'before' count in early April and the 'after' count in August, the increase in the number of users was to be expected. The fall in the number of pedestrians, by 45%, concurrent with a 130% increase in the number of cyclists, may be due to survey error, though how this may have happened is not known since the numbers of cyclists and the numbers of pedestrians were recorded on separate sheets. The original recording sheets have been checked thoroughly and show unexpected gaps in the flow of pedestrians. It was decided not to replicate the survey since the flows could be obtained from the planned video filming, albeit for a shorter time period. These flows are shown in Table A.1 of the Appendix.

The 'Before' traffic count was lost because survey staff failed to show up on the last available Sunday before the TOUCAN crossing was installed. 'After' counts were carried out as planned on 11 Aug 1991 when a total of 2769 vehicles passed through the junction Eastbound and 3083 Westbound, between 7am and 7pm.

3.2 LOCKING ROAD, WESTON-SUPER-MARE

'Before' counts were taken on 19 July 1991 when there were 44 cyclists and 291 pedestrians using the ZEBRA crossing between 7am and 7pm. After the installation of the TOUCAN there were 24 cyclists and 214 pedestrians counted on 8 January 1992. These figures show a disappointing decline in cycling at this location. Counts taken in 1988 had shown 40 children crossing Locking Road by cycle from north to south to gain access to Worle School, off Mead Vale; a further 23 turned right west of the junction to travel via Cranford Drive to Mead Vale. All these would have been potential users of the TOUCAN crossing. The 'before' survey in 1991 indicated a decline in the number of cyclists. The 'after' survey was in January, so there would have been a reduction in cycle flows even though it was a fine sunny day. Nevertheless, the flows are extremely low, and not a good test of a TOUCAN crossing.

The fall in the number of school children cycling on the cycle route and crossing prompted the County Council to make enquiries at the nearby school. The Head Teacher had not introduced any new rule about cycling to school but said that the school could not guarantee the security of the cycles left in their out-of-sight parking shelter and was also of the opinion that this, and increased traffic danger, had caused more parents to drive their children to school in cars.

Improved conditions for cyclists and pedestrians on Locking Road are expected by the County Council as a result of a bypass scheduled for completion in 1995/6.

Counts of traffic 'before' were 22759 vehicles passing through the junction, including 291 cycles. Total traffic through the junction 'after' was 21073 vehicles, including 214 cycles.

3.3 PERNE ROAD, CAMBRIDGE

Cambridge County Council decided to carry out their classified turning counts and crossing counts by means of video film. The 'before' survey at the original PELICAN crossing was carried out between 7am to 7pm on 18 October 1991. Due to equipment failure the 'after' survey, intended to be exactly a year later, was postponed to 6 November 1992, after the end of British Summer Time. Filming was possible only until 5pm. Thus, the results below are based on the period 7am to 5pm for both surveys.

There were 382 cyclists in the 'before' period, along with 144 pedestrians. The number of cyclists rose slightly to 470, while the numbers of pedestrians remained nearly the same at 139, 'after' the TOUCAN was installed. The small increase in the proportion of cyclists using the crossing in preference to the main road alternative between 'before' and 'after' surveys is not statistically significant.

In the case of the 'before' survey, the effect of omitting the last 2 hours is to reduce the cycle count by 20%. It is stressed that, even with this same time period, the surveys are not directly comparable. The start of GMT means a journey home in the dark for many working people and an associated drop in the amount of cycling.

A total of 9464 vehicles were recorded passing Northbound and 9644 Southbound through the junction 'before', a total of 19108 vehicles in total including 725 cyclists. The 'after' counts were 8596 vehicles Northbound, 9307 Southbound, a total of 17903 including 734 cyclists.

3.4 RYDON LANE/PYNES HILL, EXETER

The new business area at Pynes Hill had not been developed as quickly as had been planned, therefore with so little traffic entering and leaving, and with so few people using the crossings, traffic and behaviour studies were not carried out.

3.5 THE AVENUE, SOUTHAMPTON

Counts taken in March 1990 showed a morning peak hourly flow of 2437 vehicles (1605 city-bound) and an evening peak hourly flow of 2521 (1494 leaving city). Peak hourly flows on the Pelican crossing were 73 pedestrians and 61 cyclists in the morning and 142 pedestrians and 53 cyclists in the evening.

Just before installation of the TOUCAN, a 7am to 7pm count of users of the PELICAN showed 229 cyclists travelling Eastbound and 153 cyclists Westbound. The equivalent numbers for pedestrians were 414 and 434 respectively. Only a few pedestrians and cyclists crossed The Avenue near to but not on the crossing, no doubt due to the heavy traffic conditions.

The above count was used to determine the hours of video filming. 'After' flows of pedestrians and cyclists are shown in Table A.1 in the Appendix. For a direct comparison, the 'Before' flows for the filming periods 0745 to 1045 and 1445 to 1745 were 223 pedestrians and 142 cyclists in the morning 3 hours and 254 pedestrians and 123 cyclists in the afternoon 3 hours.

Traffic flows 'after' the installation were 10350 vehicles Southbound and 9882 vehicles Northbound. Delays to vehicles were significantly increased following the TOUCAN being installed and this led to the addition of infra-red detection to reduce the time given to crossing movements. This is discussed in more detail in Section 5.

3.6 U97, SCHOOL LANE, CHANDLERS FORD

This new crossing was provided in anticipation of heavier flows of pedestrians and cyclists resulting from new housing development and a new cycle route. Use of the crossing during the trial period was light, so was not studied in detail.

3.7 A585(T), CLEVELEYS

Counts made at the existing PELICAN crossing made on 15 July 1991 were 167 cycles and 170 pedestrians in a 12 hour period. 'After' counts on 29 June 1992 were 186 cycles and 197 pedestrians.

The total numbers of vehicles between 7am and 7pm were 15041 'before' and 14912 'after'.

3.8 QUEENS ROAD, BEESTON, NOTTINGHAM

Nottinghamshire County Council carried out 12 hour counts of pedestrians using the cycle crossing on 30 April 1991 ('before') when there were 131 in a 12 hour period. This number rose to 398 in the 'after' period measured on 22 November 1992. A total of 488 cyclists used the new TOUCAN crossing.

Traffic flows were 25192 vehicles, including 191 cycles 'before' and 30832 vehicles, including 231 cycles 'after'.

The 'before' counts indicated an obvious demand for pedestrians to cross at this location. With the change to pedestrian and cyclist operation, it is not surprising that there has been an increase in the number of pedestrians crossing.

3.9 SHERWIN ROAD, NOTTINGHAM

Measurements at the original cycles only crossing made on 26 February 1991 showed it was used by 219 pedestrians over a 12 hour period. This increased to 391 'after' the installation of the TOUCAN, when 220 cycle crossings were measured on 22 October 1992.

Vehicle flows rose slightly from 15107 'before' to 15935 'after'.

3.10 WOOD STREET, CARDIFF

South Glamorgan County Council recorded all movements at this crossing and road junction. The 'before' survey on 1 November 1991 counted 335 cycles and 6169 pedestrians in a 12 hour period, but with only 17 cyclists and 73 pedestrians making a direct crossing of Wood St.. The corresponding figures for the 'after' survey on 30 October 1992 were 359 cyclists and 6491 pedestrians, with 39 cyclists and 197 pedestrians crossing Wood St.. No doubt the increase in recorded crossing movements is due to people using the TOUCAN instead of walking along Wood St. until there was a gap in the traffic.

Vehicle flows at the site were 16918 'before' and 15685 'after'.

3.11 ARGYLL ROAD, CLYDEBANK

Measurements made on 16 January 1992 on the original PELICAN showed it was used by 49 cyclists and 1108 pedestrians in a 12 hour period. After installation of the TOUCAN 65 cyclists and 1340 pedestrians were counted on 23 April 1992.

Vehicle flows were 10481 'before' and 11528 'after'.

3.12 BARROCHAN ROAD, JOHNSTONE, STRATHCLYDE

A total of 20 pedal cycles and 165 pedestrians were counted on 4 December 1991 at the original PELICAN crossing. After the installation of the TOUCAN, 21 cycles and 98 pedestrians were counted on 4 March 1992.

Vehicle flows were 11122 'before' and 10983 'after'.

3.13 TUSHMORE GYRATORY, CRAWLEY

An extensive 'before' survey of traffic and crossing movements was carried out by West Sussex County Council. Results are shown diagrammatically in Figs 4a and 4b. It was considered unnecessary to replicate this survey because only 2 of the 10 TOUCAN crossings were studied in detail, and traffic flows at these 2 sites could be taken from the video films. These 'after' flows are included in Table A.1 in the Appendix.

4. ROAD USER BEHAVIOUR AT TOUCAN CROSSINGS

The major difference between a TOUCAN and a PELICAN crossing is the absence of the flashing amber phase and a longer wait for the motorists. It is likely that most users of the crossing would not realise any difference, so the behaviour of those using the crossing was expected to be the same as that observed in the original study of cyclists' use of pedestrian crossings.

The signals operate as if the crossing was a crossroads junction, with the crossing stage acting as the minor road. Unlike a typical signalled crossroads, however, the crossing flow (minor road traffic) clears almost immediately and there are no vehicle detectors to minimize the time lost by the major road traffic. It was anticipated that some red-running was likely because of the amount of wasted time between a pedestrian or cyclist crossing and the change of priority to the road traffic.

Road user behaviour at the TOUCAN crossings was studied by means of video films. This method was used in the study of cyclists using pedestrian and cycle/pedestrian crossings, though more attention has been given here to the details, particularly because of concern over compliance resulting from the use of fixed time signals. Driver compliance with the signals and safe behaviour by cyclists and pedestrians were of particular importance at this new type of crossing.

4.1 FILM ANALYSIS

The films were analyzed with the aim of answering the following questions:

1 On approach to crossing:

- any conflict between cyclists and pedestrians where cyclists cross or turn across the footway to use the crossing?
- any conflict between pedestrians about to use the crossing and cyclists not using it?

2 On arrival at crossing:

- does location of push button cause any problem for cyclists or pedestrians (compare TOUCAN types)?
- what are the proportions of cyclists and pedestrians needing to push button who did push button?
- is button used when there is no traffic?
- do cyclists stop at edge of road or at stop line?
- any interaction between cyclists and pedestrians waiting to cross?

3 Delay to cyclists using crossing

- do cyclists wait when there is no traffic?
- length of time stopped?

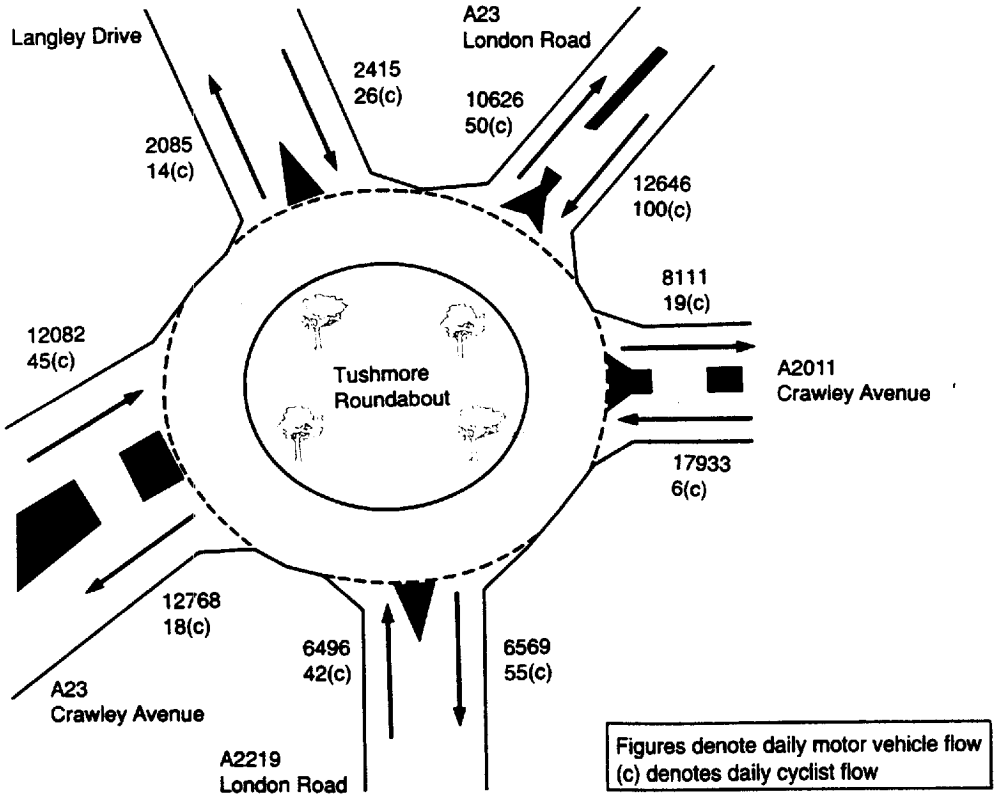


Fig. 4a Vehicle and pedal cycle count, Tushmore Roundabout

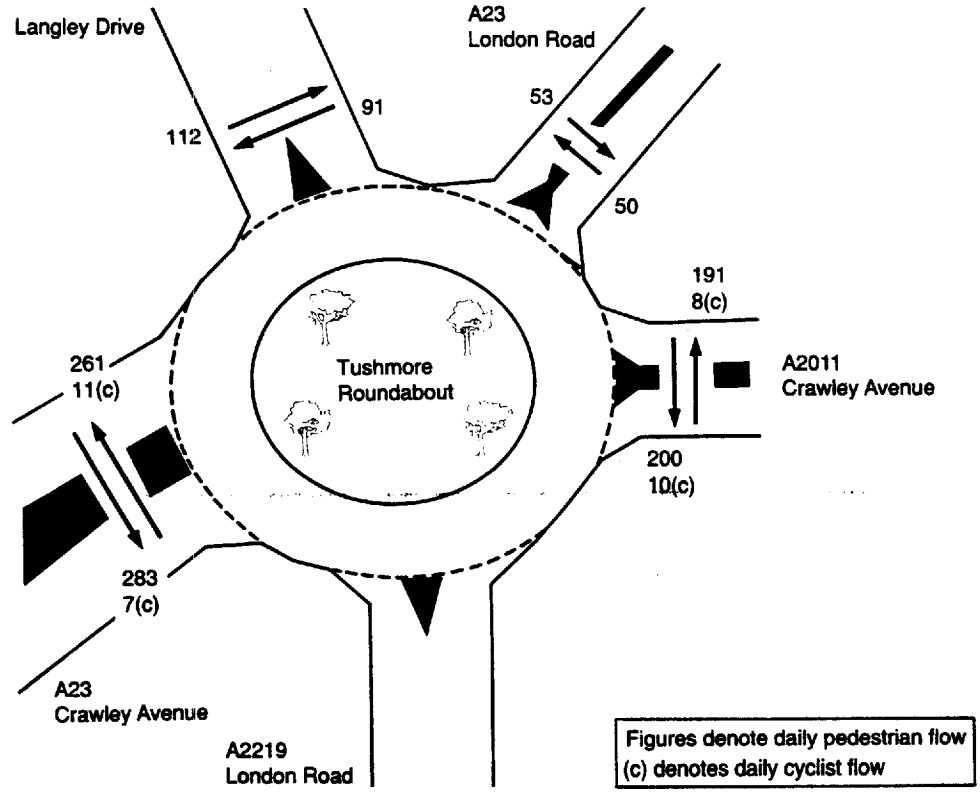


Fig. 4b Pedestrian and cycle crossing movements, Tushmore Roundabout

4 How cyclists use the crossing:

- any crossing against the red phase?
- do any cyclists dismount (count 'scooting' as dismounted)?
- do cyclists/pedestrians cross straight or diagonally?
- can cyclists/pedestrians use the crossing without conflict e.g. diagonal crossings causing conflicts?
- extent of sharing of crossing by cyclists and pedestrians during their green signal phase?
- any conflict between cyclists crossing in same direction or in opposite directions?
- do cyclists use crossing to leave or join the carriageway?

For staggered crossings with a central reserve:

- is width adequate for both pedestrians and cyclists without the cyclists having to dismount?
- does the stagger make cyclists dismount?
- do cyclists take alternative routes to avoid dismounting?
- any interaction between cyclists and pedestrians on the central reserve?

5 Violations of signals by motorists

- what sort of violation?
- when does it occur relative to signal phases?

6 Incidents such as conflicts between motorists and cyclists or pedestrians

- record all details

7 Overall research:

- compare operation of TOUCAN crossing types
- accident risk between crossing types
- adequacy of equipment - any modifications desirable?

4.2 SITES INCLUDED IN FILM SURVEY

Video films have been taken of the following 9 TOUCAN sites:

Bristol, A420/railway path

Cambridge, Perne Rd

Hants, A33 The Avenue, Southampton

Hants, A33 The Avenue, Southampton, with IR detection

Lancs, A585, Cleveleys

Nottingham, Queens Rd

Nottingham, Sherwin Rd

South Glams. Wood St, Cardiff

Strathclyde, Argyll Rd

West Sussex, Tushmore Gyratory

The following 4 TOUCAN sites have not been filmed because of the very infrequent use made of these crossings:

Weston-super-Mare, Locking Road

Devon, Ryden Lane, Exeter

Hants, U97 School Lane, Chandlers Ford

Strathclyde, Barrochan Road

The low use of the Weston-super-Mare crossing has been mentioned before. Delays in new building developments has meant that there is still only light use of the Exeter and Chandlers Ford crossings. The Barrochan Road crossing was not expected to carry much crossing traffic, and this has turned out to be the case.

4.3 BEHAVIOUR AT THE TOUCANS

The full results of the film analysis are given in the Appendix. Since there may be some interest in noting any differences in use and road user behaviour according to the time of day, the results from each film have been kept separate. For completeness, the results obtained from The Avenue, Southampton following conversion to variable crossing time are included. It should be noted that the duration of the films varied from 1 to 4 hours, so should a direct comparison be required between sites or between times of day at the same site of some particular incident such as signal violations, the number of incidents should be divided by the duration of the observations, thus giving an hourly rate. A similar calculation may be carried out with traffic or crossing flow as the denominator.

On no occasion was there conflict between cyclists and pedestrians on the cycle track/footpath approach to a crossing, and the position of the push buttons caused no apparent difficulty, so these two aspects are not included in the results.

The average delay to all cyclists varied from 5 seconds at Cardiff to 25 seconds at Crawley. Considering only cyclists who had to make a stop, the average delay varied from 11 seconds at Cardiff to 60 seconds at Crawley.

Generally cyclists did not dismount to cross, except at Bristol, where about 60% dismounted and at Cardiff where the percentage was 19% in the morning and 38% in the afternoon. At most of the other sites the percentage was usually less than 10%.

There were very few conflicts observed between cyclists or pedestrians and vehicles. The TOUCAN site with most conflicts, 7 in 6 hours of filming, was The Avenue, Southampton, while it was still fixed time. After the introduction of variable crossing time, the number of conflicts was one in 7.6 hours.

5. INFRA-RED DETECTION

The unnecessary traffic delays resulting from fixed time signals may be minimized by the use of infra-red detection of people on the crossing. IR detection ends the cyclist/ pedestrian crossing stage early when there is no-one on the crossing. Infra-red detectors have been used successfully in experimental 'PUFFIN' pedestrian crossings (Davies, 1992).

5.1 PUFFIN CROSSINGS

PUFFIN crossings have additional detectors (piezo-electric pressure pads) at the kerb side to detect people waiting to cross, but these are considered to be problematical for TOUCAN crossings because of the variations in the stopping positions of cyclists. At TOUCAN crossings the demand for the crossing will continue to be by means of push buttons or induction loops. The presence of people crossing the road is confirmed by infra-red sensors positioned on top of the traffic signal poles. Each detector scans a matrix of sensors focused on particular segments of the scene in front of the detector. Any heat source that moves from one segment to another is registered during a scan and a signal is passed to the controller. Thus, the device detects moving heat sources, in particular pedestrians or cyclists using the crossing. Standing pedestrians and stationary cyclists and other vehicles are not detected.

A major innovation of PUFFIN crossings is in the position of the signal heads, located only on the near side of the crossing, and mounted on the signal pole just above the push button. Once on the crossing, no signals are visible.

Following a demand by push button for the crossing, the green figure/green cycle is displayed for a fixed time, typically 6 seconds. At the end of this period, the red figure replaces the green figure/green cycle to discourage newcomers from crossing. This fixed period is followed by a variable extension period, the length of which is determined by the presence of cyclists or pedestrians on the crossing. The extension has a minimum and a maximum length (set at 3 and 15 seconds in experimental PUFFIN crossings) and a fixed additional period of 3 seconds. A short period of time, known as the latch time and set at about 1.5 seconds, is allowed between the detector failing to detect the presence of anyone on the crossing, and the change to the next traffic phase.

During the minimum period, the controller interrogates the infra-red detectors, and if a positive signal is received from any of them, an addition is made to the extension time. Interrogation continues with the crossing time being extended by successive fixed additions until such time as none of the infra-red detectors registers the presence on anyone on the crossing. At this point the crossing phase is terminated and the next traffic stage is called. The variable extension period following the fixed green figure/ green cycle is sometimes called the clearance period or clearance red period. Should the maximum extension be reached while people are still being detected, the pedestrian phase is terminated, but the fixed additional period is added to allow people to complete their crossing.

5.2 INFRA-RED TOUCAN IN SOUTHAMPTON

The TOUCAN crossing on The Avenue, Southampton, was converted to infra-red detection in December 1992. The Traffic Policy Division of DOT supplied the County Council with a Draft Specification for use in obtaining equipment for this new trial.

The company Microsense Systems Ltd. installed the 4 IR detectors, 2 scanning the nearsides of the road and 2 directed towards the centre of the crossing area. The nearside detectors were mounted on new, tall posts, replacing the short posts used for the additional push-buttons. The centre detectors were mounted on the existing signal posts. Caution was exercised in the introduction because regular users of the TOUCAN crossing would have been familiar with the previous long 'blackout' period following the extinguishing of the green crossing signal, during which they could cross before the traffic started moving. When the infra-red TOUCAN was commissioned, a generous blackout period was provided. Over the next few weeks, this period was gradually reduced.

The current settings are a 7 seconds steady green for cyclists/pedestrians and a variable blackout period of from 5 to 10 seconds, and the usual 3 seconds all red. Extensions to the crossing time are 3 seconds for the nearside detectors and 1½ seconds for the centre detectors. The previous setting was for a 10 second blackout that occurred in every signal cycle. The blackout period with IR detection rarely lasts the maximum 10 seconds, so there is more time for the main road traffic while there is no penalty for cyclists and pedestrians using the crossing.

Hampshire County Council had received a number of complaints about the fixed time TOUCAN because of the traffic delays it caused. The Police were given cause to complain because the traffic queued back across the side road access to their Headquarters. Since the introduction of the infra-red TOUCAN, there have not been any complaints.

5.3 ROAD USER BEHAVIOUR AT THE INFRA-RED TOUCAN, SOUTHAMPTON

Films were taken again 2½ months after conversion to infra-red detection, and after final adjustments to the signal settings. The results are included in the Appendix.

The findings indicate good compliance on the part of main road drivers, there being no violations of their signals. The push buttons appeared to be positioned conveniently. Nearly all cyclists and pedestrians who needed to push the button did so. Those described in the Appendix as ignoring the button were not people who waited for any significant time to cross, but crossed as soon as they judged it to be possible and appeared to have no intention of waiting for the signals. There were 114 occasions in the 7.6 hour period when the crossing

was shared by at least one cyclist and at least one pedestrian. Cyclists used the crossing when joining or leaving the carriageway and also used it to cross directly into Northlands Road.

When the TOUCAN was first opened in 1991, brief inspection showed that many cyclists dismounted to use the crossing. Both of the above surveys indicate that the crossing appears to be better understood now, with very few cyclists dismounting to cross.

6. SUMMARY

This Report describes the evolution of the TOUCAN crossing - a signal-controlled road crossing at which cyclists and pedestrians cross in the same area at the same time. The practice of sharing of crossings has been well established in recent years by the widespread but illegal use made by cyclists of PELICAN crossings. Following extensive studies showing that this sharing of crossings appears not to pose any safety problems or any other adverse effects, a trial of TOUCAN crossings was begun.

Local Highway Authorities have enthusiastically taken part in the trials. The TOUCAN has benefits in terms of lower cost and reduced environmental clutter when compared with the existing approved design of fully segregated cycle/pedestrian crossings. The Department of Transport selected 13 sites with 25 proposed TOUCAN crossings for inclusion in the trials. All of these TOUCANs were built over the period from February 1991 to June 1992. One of them, in The Avenue, Southampton, was subsequently modified to incorporate infra-red detection in December 1992.

Throughout the trials, a working group comprising representatives of all of the local highway authorities involved, the Department of Transport and the Transport Research Laboratory has met and discussed progress and problems. The schemes have been studied by TRL by means of video films of road user behaviour and by classified turning counts of the road traffic and of the TOUCAN crossing users.

Sharing of the crossing space by cyclists and pedestrians has proved satisfactory. The design of the TOUCAN, with push buttons on either side of the waiting area, appears to be working well. Cyclists obviously have no difficulty using the push buttons, and sometimes use the low pole on which the push button plate is mounted for leaning on while waiting.

Some problems have arisen at some sites. At Southampton substantial queues of motor vehicles have formed, resulting in complaints from public and police. Some red running by drivers has been recorded. The fixed time operation of the TOUCAN signals caused the queueing, and may also have led to red-running because drivers have to wait for a substantial amount of time, during which the crossing user has gone. A solution to the queueing has already been found in the infra-red detectors introduced at the Southampton crossing. If the red-running is, as it appears to be, a result of driver impatience, infra-red detection should also reduce this.

The overall conclusion is that the TOUCAN shared cyclist/pedestrian crossing is a viable alternative to the current design of parallel crossing but that it may operate more safely with a variable crossing time governed by detection of people using the crossing. The one TOUCAN crossing modified with infra-red detection has been found highly successful.

7. ACKNOWLEDGEMENTS

The author wishes to thank all those who took part in the meetings of the TOUCAN Crossing Working Group and in the installation of the crossings. Those from the Local Authorities were:

Avon County Council	Mike Dunwell Mike Ginger Allan Sharp
Cambridge City Council	John Isherwood
Cambridgeshire County Council	Andrew Wallace
Devon County Council	Bryan Holman Dick Taylor
Hampshire County Council	Ken Laughlin Peter Rayment
Lancashire County Council	Rick Hayton
Nottinghamshire County Council	Ian Chatfield Neil Hodgson Chris Randall Trevor Richmond Allan Solaini
South Glamorgan County Council	Paul Williams
Strathclyde Regional Council	Ronnie Hamilton
West Sussex County Council	Eric Parkin Noel Turner

Thanks are due to Graham Carter of Hampshire County Council, formerly of DOT, for his support and encouragement when TOUCAN Crossings were conceived.

8. REFERENCES

DAVIES, H E H (1992). The PUFFIN pedestrian crossing: experience with the first experimental sites. *TRL Research Report RR364.* Crowthorne. (Transport Research Laboratory).

DEPARTMENT OF TRANSPORT (1980) Marton West Beck Cycle Route, Middlesbrough. Part 1: Design and implementation. Traffic Advisory Unit Report. March. (Department of Transport).

DEPARTMENT OF TRANSPORT (1982) Marton West Beck Cycle Route, Middlesbrough. Part 2: Monitoring. Traffic Advisory Unit Report. (Department of Transport).

DEPARTMENT OF TRANSPORT and The Welsh Office (1986a) *Local Transport Note 1/86* Cyclists at road crossings and junctions. August, London. (HMSO).

QUENAULT, S W (1978). Cycle routes in Portsmouth. III - Attitude surveys. *Department of the Environment/ Department of Transport, TRRL Report LR 875.* Crowthorne. (Transport and Road Research Laboratory).

QUENAULT, S W (1981). Peterborough experimental cycle route. *Department of the Environment/Department of Transport, TRRL Report LR 975.* Crowthorne. (Transport and Road Research Laboratory).

TAYLOR, G B and P J Wiltshire (1992). TOUCAN crossings at Tushmore Gyratory, Crawley. *Traffic Engineering and Control,* June, pp 380-382.

TREVELYAN, P and M Ginger (1989). Cyclists' use of pedestrian and cycle/pedestrian crossings. *TRL Contractor Report 173.* Crowthorne. (Transport Research Laboratory).

APPENDIX: ANALYSIS OF BEHAVIOUR AT TOUCAN CROSSINGS

TABLE A.1

Road User Behaviour at TOUCAN Crossings

	Date filmed	Film Times	Duration of film, h	Ped	Cyc	MV
A420 Railway Path, Bristol AM	10/11/91	1030 to 1400	3.50	51	181	2288
A420 Railway Path, Bristol PM	10/11/91	1415 to 1700	2.75	38	117	1902
Cleveleys A585 AM	3/6/92	0750 to 1025	2.58	30	36	3662
Cleveleys A585 PM	2/6/92	1430 to 1730	3.00	70	76	4407
Cambridge AM	25/5/92	0749 to 1017	2.47	82	168	3887
Cambridge PM	24/5/92	1456 to 1800	3.07	11	192	5474
Clydeside PMa	4/6/92	1215 to 1515	3.00	71	87	4407
Clydeside PMb	4/6/92	1515 to 1800	2.75	17	26	3007
Sherwin Rd AMa	26/5/92	0653 to 0900	2.12	45	23	2493
Sherwin Rd PMa	26/5/92	1150 to 1400	2.17	61	38	3041
Sherwin Rd PMb	25/5/92	1553 to 1802	2.15	64	58	3404
Queens Rd AM	26/6/92	0642 to 0945	3.05	40	98	6076
Queens Rd PM	25/6/92	1528 to 1816	2.80	48	182	6824
A23 (South Entry) Crawley						
PM1	23/6/92	1454 to 1740	2.77	155	39	2520
PM2	23/6/92	1741 to 1844	1.05	39	7	1150
AM	24/6/92	0657 to 1000	3.05	110	38	4664
A23 (South Exit) Crawley						
PM1	23/6/92	1436 to 1731	2.92			
PM2	23/6/92	1734 to 1834	1.00			
AM	24/6/92	0705 to 1008	3.05			
Cardiff AM	9/3/93	1030 to 1330	3.00	178	16	3899
Cardiff PM	9/3/93	1355 to 1755	3.67	210	24	3059
The Avenue AM before Infra-Red	6/11/91	0745 to 1045	3.00	181	168	5447
The Avenue PM before Infra-Red	6/11/91	1445 to 1745	3.00	251	171	5878
The Avenue AM after Infra-Red	4/3/93	0720 to 1100	3.67	204	170	5897
The Avenue PM after Infra-Red	4/3/93	1404 to 1800	3.93	274	190	6471

Ped = Pedestrians

Cyc = Cyclists

MV = Motor Vehicles

	Pushed Button		MV		Pushing button & waiting in absence of traffic			
	No.	%	Violations	Cyc Stop	Ped	%	Cyc	%
A420 Railway Path, Bristol AM	63	88	17	79	5	19	4	11
A420 Railway Path, Bristol PM	36	93	4	69	3	7	2	6
Cleveleys A585 AM	31	34	0	34	5	8	0	0
Cleveleys A585 PM	19	54	3	54	5	8	0	0
Cambridge AM	All	100	42	ALL				
Cambridge PM	All	100	30	ALL				
Clydeside PMa	51	72	5	ALL	4	6	5	6
Clydeside PMb	51	72	2	ALL	11	6	8	25
Sherwin Rd AMa	36	78	5	ALL				
Sherwin Rd PMa	57	83	5	ALL				
Sherwin Rd PMb	60	83	12	ALL				
Queens Rd AM	72	94	15	ALL				
Queens Rd PM	All	100	14	ALL				
A23 (South Entry)								
Crawley								
PM1			1	15				
PM2			0	1				
AM			4	19				
A23 (South Exit) Crawley								
PM1								
PM2								
AM								
Cardiff AM			0	8				
Cardiff PM			0	10				
The Avenue AM before Infra-Red	61	87	21	99				
The Avenue PM before Infra-Red	68	91	45	103				
The Avenue AM after Infra-Red	288	77	0	130				
The Avenue PM after Infra-Red	358	76	0	148				

Pushed Button = Cyclists and pedestrians pushing the button, expressed as a percentage of the total number of crossing users.

MV Violations = Motor vehicles violating signals.

Cyc Stop = Cyclists stopping at kerb

Pushing Button and Waiting in the Absence of Traffic = Persons waiting for the signal, even though crossing could be carried out safely.

	Average Delay		Unexpected Crossings				Crossing Shared	%age
	Stop Cyc	All Cyc	Ped	%age	Cyc	%age		
A420 Railway Path, Bristol AM	17	6	3	6	0	0	6	6
A420 Railway Path, Bristol PM	14	6	7	18	5	4	11	15
Cleveleys A585 AM	17	6	0	0	0	54	0	0
Cleveleys A585 PM	21	8	0	0	0	29	12	12
Cambridge AM	23	18	6	7	0	0	39	N/A
Cambridge PM	28	22	3	2	0	0	46	N/A
Clydeside PMa	12	12	47	66	0	0	12	13
Clydeside PMb	19	19	7	4	0	0	5	4
Sherwin Rd AMa	23	17	2	4	0	0	5	N/A
Sherwin Rd PMa	18	16	4	7	0	0	1	N/A
Sherwin Rd PMb	24	19	2	3	0	0	12	N/A
Queens Rd AM	25	19	0	0	0	0	17	N/A
Queens Rd PM	27	21	0	0	0	0	23	N/A
A23 (South Entry) Crawley								
PM1	20	8	38	25	21	54	9	8
PM2	60	9	12	31	2	29	1	0
AM	16	8	19	12	15	39	6	6
A23 (South Exit) Crawley								
PM1	17	11	51	31	21	49	12	
PM2	25	25	20	43	1	17	0	0
AM	17	8	16	15	5	13	4	3
Cardiff AM	11	5					0	0
Cardiff PM	25	11					9	6
The Avenue AM before Infra-Red	35	20	41	23	22	13	55	44
The Avenue PM before Infra-Red	38	23	50	20	25	15	62	56
The Avenue AM after Infra-Red	29	22					50	32
The Avenue PM after Infra-Red	26	20					64	37

Average Delay - Stop Cyc = Average delay (in seconds) between pushing the button and moving off from the kerb.
- All Cyc = Average delay for all cyclists.

Unexpected Crossings = Occurs when there is clear segregation of cyclist and pedestrian approach lanes and a crossing user pushes the other users button or crosses using the other's area of the crossing.

Crossing Shared = Both pedestrians and cyclists use the crossing at the same time, expressed as a percentage if the total number of crossing.

	Cyclists Dismount to	%age	Crossing Against Phase				Cyc Join /Leave C'Way	Conflict
			Ped	%age	Cyc	%age		
A420 Railway Path, Bristol AM	117	65	11	22	38	21	10	0
A420 Railway Path, Bristol PM	68	58	6	16	35	30	0	0
Cleveleys A585 AM	0	0	16	15	15	40	2	0
Cleveleys A585 PM	0	0	18	26	15	20	3	0
Cambridge AM	19	11	0	0	1	1	35	1
Cambridge PM	19	17	1	1	0	0	34	0
Clydeside PMa	0	0	20	28	26	30	3	0
Clydeside PMb	2	8	59	35	12	38	4	0
Sherwin Rd AMa	0	0	5	11	5	22	5	0
Sherwin Rd PMa	1	3	8	13	10	26	10	0
Sherwin Rd PMb	1	2	6	9	10	17	8	0
Queens Rd AM	0	0	4	10	0	5	3	0
Queens Rd PM	1	0.5	5	10	5	0	17	4
A23 (South Entry) Crawley								
PM1	2	5	1	1	0	0	0	0
PM2	0	0	2	5	0	0	0	1
AM	1	3	8	7	4	11	4	0
A23 (South Exit) Crawley								
PM1	2	5	22	13	8	19	1	0
PM2	1	17	12	26	2	33	0	0
AM	4	11	40	37	5	13	1	0
Cardiff AM	3	19	81	46	8	50	9	0
Cardiff PM	9	38	114	54	15	63	9	0
The Avenue AM before Infra-Red	5	3	7	4	6	4	78	5
The Avenue PM before Infra-Red	5	3	3	1	6	4	43	2
The Avenue AM after Infra-Red	7	4	14	8	9	5	22	0
The Avenue PM after Infra-Red	7	4	10	4	5	3	56	1

Cyclists Dismount to Cross = Cyclists dismounting and pushing the bicycle across the crossing, expressed as a percentage of total cyclists

Crossing Against Phase = Users crossing when the signal phase is green. Expressed as a percentage of total number of crosses for each category

Cyc Join/Leave C'Way = Cyclists using the crossing as a means of joining or leaving the dual carriageway.

Conflict = Cyclist or pedestrian conflict with motor vehicles; could be due to a violation made by either party, and involves some avoiding action

	Use of Push Button by Pedestrians					
	Ped - Yes	%age	Ped - No	%age	Ped - Ignore	%age
A420 Railway Path, Bristol AM						
A420 Railway Path, Bristol PM						
Cleveleys A585 AM						
Cleveleys A585 PM						
Cambridge AM						
Cambridge PM						
Clydeside PMa						
Clydeside PMb						
Sherwin Rd AMa						
Sherwin Rd PMa						
Sherwin Rd PMb						
Queens Rd AM						
Queens Rd PM						
A23 (South Entry) Crawley						
PM1	109	69	1	1	46	30
PM2	22	57	6	15	11	28
AM	71	65	8	7	31	28
A23 (South Exit) Crawley						
PM1	139	84	5	3	21	13
PM2	27	59	19	41		
AM	73	68	16	15	18	17
Cardiff AM	97	55	3	2	78	43
Cardiff PM	128	61	4	2	78	37
The Avenue AM before Infra-Red						
The Avenue PM before Infra-Red						
The Avenue AM after Infra-Red	161	79	0	0	43	21
The Avenue PM after Infra-Red	211	77	1	-	62	23

Use of Button - Yes/No = Pedestrians pushing/not pushing the button when they needed to cross, expressed as a percentage of total number of pedestrians

Use of Button - Ignore = Pedestrians choosing not to push the button, and then crossing while the signals showed priority to the main road

	Use of Push Button by Cyclists					
	Cyc - Yes	%age	Cyc - No	%age	Cyc - Ignore	%age
A420 Railway Path, Bristol AM						
A420 Railway Path, Bristol PM						
Cleveleys A585 AM						
Cleveleys A585 PM						
Cambridge AM						
Cambridge PM						
Clydeside PMa						
Clydeside PMb						
Sherwin Rd AMa						
Sherwin Rd PMa						
Sherwin Rd PMb						
Queens Rd AM						
Queens Rd PM						
A23 (South Entry) Crawley						
PM1	14	36	3	8	22	56
PM2	1	15	-	-	6	85
AM	18	47	1	3	19	50
A23 (South Exit) Crawley						
PM1	24	57	4	10	14	33
PM2	5	83	1	17	-	-
AM	6	17	10	20	24	63
Cardiff AM	6	37	1	7	9	56
Cardiff PM	9	38	1	4	14	58
The Avenue AM before Infra-Red						
The Avenue PM before Infra-Red						
The Avenue AM after Infra-Red	127	76	2	1	41	24
The Avenue PM after Infra-Red	147	78	0	0	43	22

Use of Button - Yes/No = Cyclists pushing the button when they needed to, expressed as a percentage of total number of cyclists

Use of Button - Ignore = Cyclists choosing not to push the button, and then crossing while the signals showed priority to the main road

APPENDIX: PLATES 1 - 13

Plate 1 Bristol: A420/railway path, Warmley (Avon County Council)

Plate 2 Weston-super-Mare: Locking Road/Mead Vale (Avon County Council)

Plate 3 Cambridge: Perne Road (Cambridgeshire County Council)

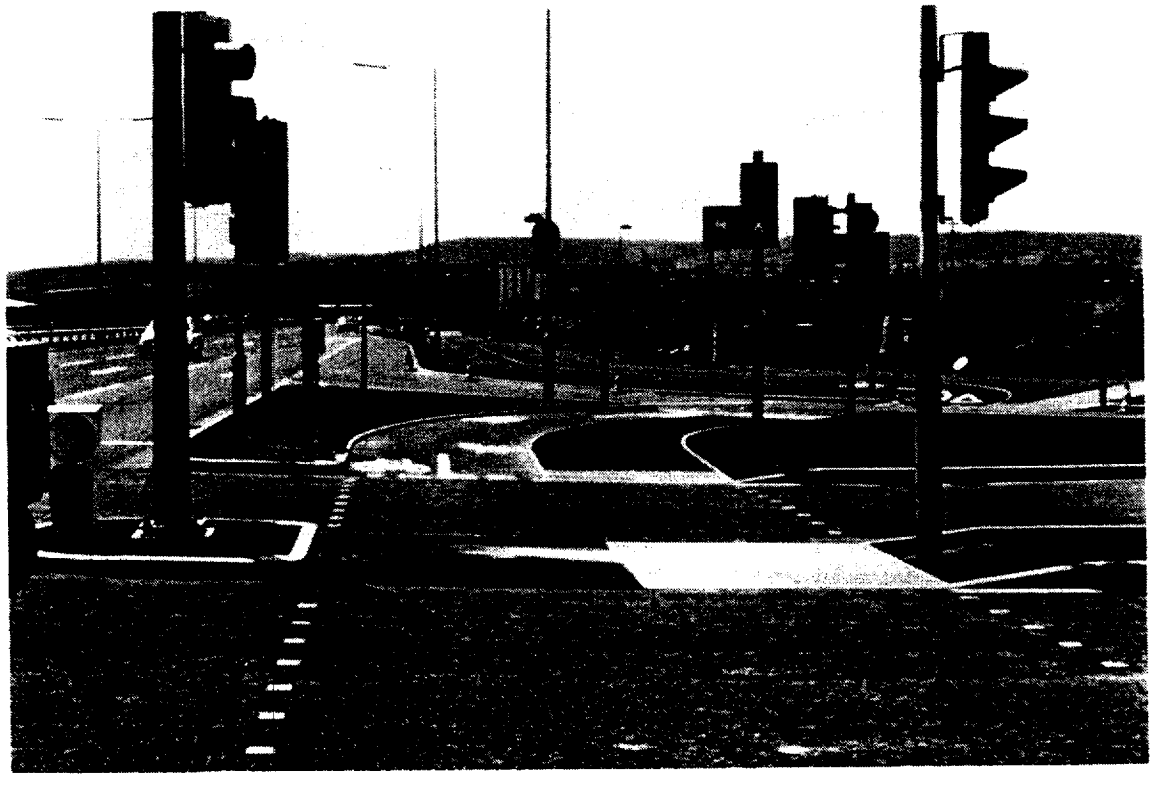


Plate 4 Exeter: Rydon Lane/Pynes Hill (Devon County Council)

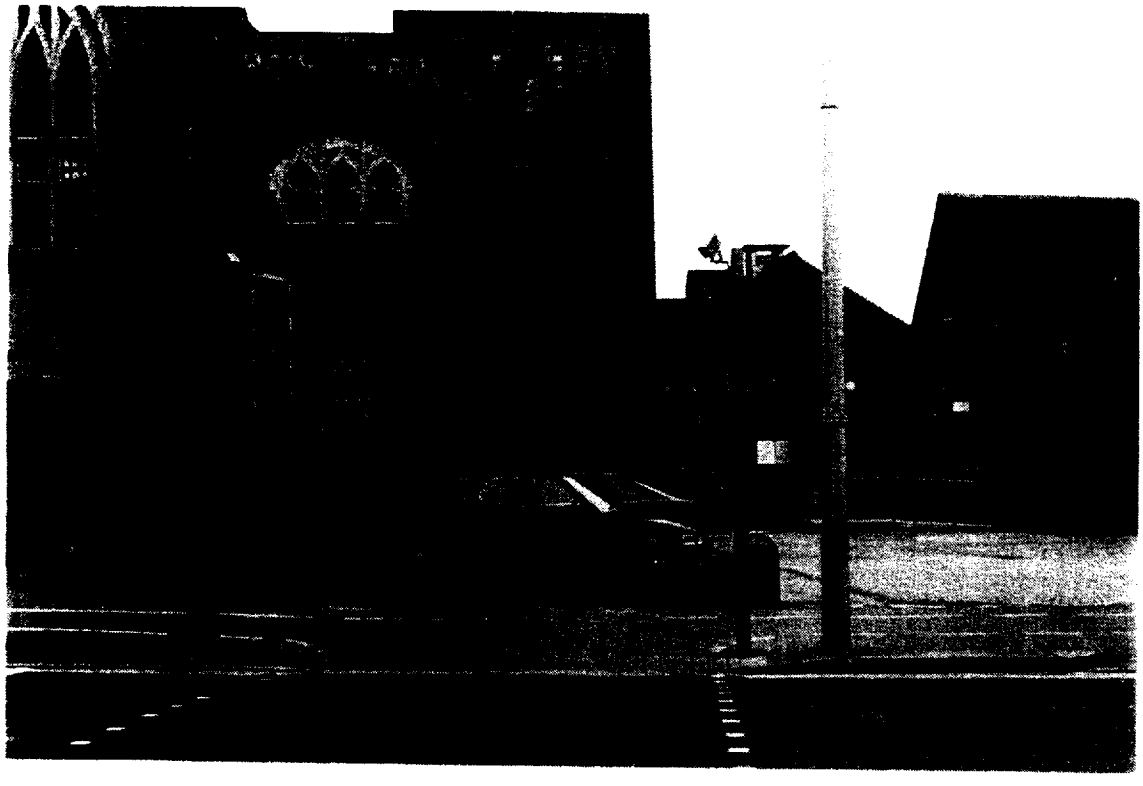


Plate 5 Southampton: A33 The Avenue/Northlands Road (Hampshire County Council)

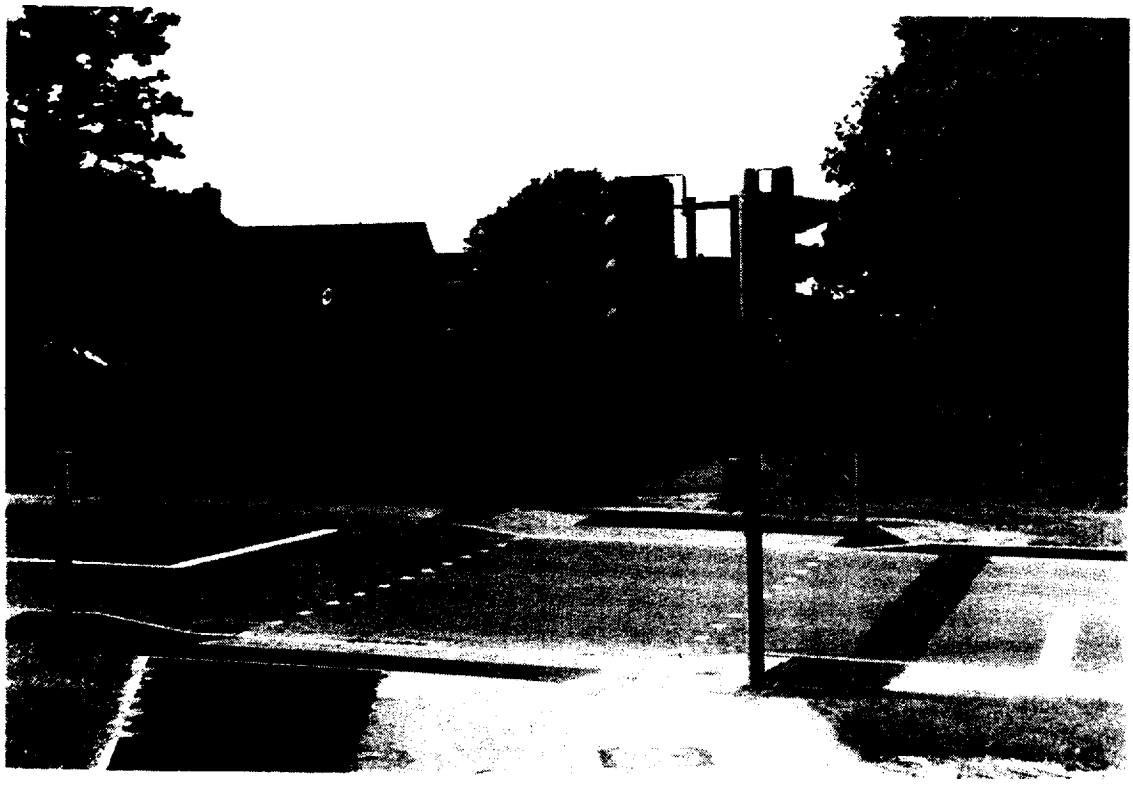


Plate 6 Chandler's Ford: U97 School Lane (Hampshire County Council)

Plate 7 Cleveleys, nr Blackpool: A585(T) Amounderness Way/Linden Avenue (Lancashire County Council and North West Regional Office, DOT)

Plate 8 Nottingham: Queens Road, Beeston (Nottinghamshire County Council)

Plate 9 Nottingham: Sherwin Road (Nottinghamshire County Council)

Plate 10 Cardiff: Wood Steet (South Glamorgan County Council)

Plate 11 Clydebank: Argyll Road (Strathclyde Regional Council)

Plate 12 Johnstone: Barrochon Road (Strathclyde Regional Council)

Plate 13 Crawley: Tushmore Gyratory (West Sussex County Council)

MORE INFORMATION FROM TRL

TRL has published the following other reports on this area of research:

CR173 (1989) Cyclists' use of pedestrian and cycle/pedestrian crossings. P Trevelyan (ABT) and M Ginger (Avon CC), Price Code C

PR15 (1993) Cycling in pedestrian areas. P Trevelyan (ABT) and J M Morgan, Price Code E

RR336 (1992) Advanced stop lines for cyclists at Oxford, Newark and Bristol, A H Wheeler. Price Code E

CT2 (1992) Cycling Safety (1989-1992) TRL, Current Topics in Transport, Price £10

CR174 (1989) Accident analysis methodologies and remedial measures with particular regard to cyclists, R D Hall and J H Harrison (University of Southampton) and D G Harland, Price Code D

If you would like copies, photocopy and fill in the slip below. There is a 20% discount if you take all the reports listed above. Prices include postage and are correct at the time of publication. Please see the enclosed letter for current price code values and handling charge. Enquiries to TRL Library Services, 0344 770783 or 770784.

.....

To: Publication Sales, TRL Library, PO Box 304, Wokingham, Berkshire, RG11 6YU.
Please send me the following TRL reports (state report Nos and quantity)

.....

.....

.....

.....

Name .....

Address .....

.....

.....

Postcode .....

Telephone .....

.....

Credit card address (if different from above) ...

.....

PAYMENT:

• I enclose a cheque for £ .....
payable to Transport Research Laboratory

• Please debit my Deposit Account
no .....

• Please debit my Credit Card by £.....

• Credit card no .....

Expiry date .....

Signature .....

Toucan crossings for cyclists and pedestrians

PR47