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AGE-RELATED DIFFERENCES IN THE ROAD CROSSING BEHAVIOUR OF ADULT PEDESTRIANS

by

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ABSTRACT

Pedestrians aged 60 years or more have a fatal and serious casualty rate relative to their numbers in the population that is more than twice that of other adults. In an attempt to explain this difference a large scale study of age effects on adult road crossing behaviour has been undertaken. The results showed that compared with other adults, the elderly were more likely:

i) to delay before crossing
ii) to spend more time at the kerb
iii) to take longer to cross the road
iv) to make more head movements before and during crossing.

However in absolute terms these and other differences were small, and provided little explanation for the differences in casualty rates. The results indicated that the elderly employed a different crossing strategy from that of other adults, but in general the elderly do not appear to form a distinct sub-group within the pedestrian population.

1. INTRODUCTION

The involvement of pedestrians in road accidents has been found to vary markedly with age. Relative to their numbers in the population, elderly pedestrians as a group (defined here as those aged 60 and over) experience a fatal and serious casualty rate that is over twice that of other adults (aged 15 to 59 years). This difference in casualty rates has long been a matter of concern; in the past it has normally been attributed to the deterioration with age of physical and sensory abilities, although the way this might affect the manner in which people cross roads has not been investigated in any detail. In the last two decades there has been a growing interest in the study of pedestrian behaviour in the field. Such studies have been undertaken largely on the assumption that there is a relationship between 'normal' behaviour and accidents. Once this proposition is accepted then knowledge of behaviour can be seen as leading to a better understanding of accident causation and prevention. Despite this interest no detailed survey has yet been undertaken in this country or abroad to examine age-related differences in behaviour over the entire age range of adult pedestrians.

A pilot study of pedestrian road crossing behaviour was carried out by the Laboratory some years ago in Worthing, a town with a high proportion of elderly people in its population. The results[1] showed clear indications of age differences in several aspects of road crossing behaviour. Although these differences were for the most part statistically significant and unlikely to have occurred by chance, the sample was only small and the sites were not considered to be representative of the locations where the majority of accidents involving elderly pedestrians occur, since high concentrations of the elderly in any town might lead to atypical patterns of behaviour on the part of both pedestrians and drivers. A large scale investigation of adult pedestrians was therefore undertaken in what were felt to be more typical suburban shopping streets. The first aim of the study was to collect normative data to provide reliable evidence of any age differences in behaviour over the whole range of adult pedestrians. The second aim was to assess the contribution of any such differences to an explanation for the higher casualty rate experienced by elderly pedestrians.

2. METHOD

2.1 Data collection

Three roads in busy shopping areas were selected for study on the basis of the following criteria:

(i) Straight sections of road 50–100 metres in length, preferably without road junctions;
(ii) Without any pedestrian crossing facilities in the study area or its vicinity;
(iii) Having shops on both sides of the road;
(iv) Having free-flowing traffic within the range 600–1200 veh/hour.

The three roads were:

High Street, Hounslow
Above Bar, Southampton
Victoria Road, Southampton

Time lapse photography was used in this study in order to obtain a complete and permanent record of behaviour at each site. Using a camera operating at 2 frames per second the survey was carried out in off-peak periods (0930–1200 hrs and 1400–1630 hrs) to avoid traffic jams in the area. The camera was positioned at a suitably high vantage point to minimise the possibility of pedestrians being obscured by passing traffic. Filming was carried out for 8–10 days at each site.

A team of six interviewers was employed to question a sample of pedestrians on completion of their road crossing. They used a very brief questionnaire, the main purpose of which was to ascertain the pedestrian's age. In the subsequent film analysis these pedestrians were identified by means of their descriptions and the time of their interview as recorded on the questionnaire.

The age-classified data obtained from the films in this way were subsequently augmented by having film analysts estimate the ages of those pedestrians who had not been interviewed during the survey. The accuracy of the analysts in this task was initially checked by asking them to estimate the ages from film of a sample of pedestrians whose stated age was already known from interviews. Only those analysts who displayed a marked aptitude for the task were used subsequently to estimate the ages of those pedestrians who had been recorded on film but not interviewed. The age estimates finally used were the average of those given by the two most reliable analysts.

The sample was divided into seven age groups, and the accuracy of the age estimation is shown in Table 1. The 95 per cent confidence limits on estimated ages were ± 12.8 years, that is, there was only a 1 in 20 chance that an estimated age differed from a reported age by more than 12.8 years. As can be seen from the table, three out of five in the sample were allocated to the correct age group, while under-estimation and over-estimation occurred in more or less equal proportions.

TABLE 1

Accuracy of age estimation from film for a sample of 164 pedestrians of known ages

	Number	Percentage
Estimate 2 age groups above actual age	3	2
Estimate 1 age group above actual age	32	19
Correct age group*	98	60
Estimate 1 age group below actual age	28	17
Estimate 2 age groups below actual age	3	2

* Age groups used were 15–19 yrs, 20–29, 30–39, 40–49, 50–59, 60–69, 70 yrs and over

2.2 Data analysis

The films were analysed frame by frame on Vanguard analysing projectors. In this way a time-based record for each pedestrian road crossing was obtained for the following measures:—

Age and sex of pedestrian,
Length of delay at the kerb,
Total road crossing time (including any delay in road),
Head movements before crossing the road (divided into those made on approach and those made at the kerb),
Head movements during crossing,
Safety gaps – nearside and farside,
Position of delay in road, if any,
Path taken across road and proximity to parked vehicles,
Whether the pedestrian was alone or accompanied.

Head movements were only recorded when it was judged that they were directed towards the traffic situation. Safety gaps were taken as the time from when a pedestrian was in the path of an approaching vehicle to when that vehicle crossed the path of the pedestrian.

Where pedestrians crossed in groups only one adult in each group was studied. To compensate for this, the data on accompanied pedestrians were weighted by a series of factors based on the average group sizes for each age classification at each site.

3. RESULTS

3.1 Sample size and composition

The interview survey yielded a sample of some 4200 pedestrian road crossings. The age estimation procedure added a further 4900, giving a total sample of 9114. This figure was subsequently increased to 11,111 through application of the accompaniment correction factors described above. A comparison of the age and sex distributions for the interviewed and the age-estimated samples is given in Table 2.

TABLE 2

Composition of the interviewed and age-estimated samples

	Aged 15–29 yrs	Aged 30–59 yrs	Aged 60 yrs or over	Total	Male	Female	Total
Interviewed sample	33%	49%	18%	100%	30%	70%	100%
Age-estimated sample	27%	62%	11%	100%	31%	69%	100%

Although differences in the age distribution might be attributed in part to inaccuracies in the age estimation procedure, it was reported by the interviewers that the response rate seemed highest amongst the young and the old. In addition, it is probable that the longer delays and slower speed of the elderly made them easier for the interviewers to intercept. Thus while the purpose of the interview was to maximise the accuracy of the data, the procedure might have led to a biased sample had not the decision been taken subsequently to add the age estimated sample.

One further point which should be noted is that with such a large sample very small differences in absolute terms can easily achieve high levels of statistical significance. These differences, although statistically significant, may be of little practical importance and this point should be borne in mind when considering the results.

3.2 Delay at the kerb

Analysis of variance of the mean pedestrian kerb delay by age, sex and accompaniment for the three sites combined showed highly significant effects for all three factors. The mean delays by age and accompaniment are given in Table 3, while the age effect for the total sample is shown in Figure 1.

TABLE 3

Mean delay at kerb (seconds)

	Male	Female	All
Alone	1.6	2.4	2.2
Accompanied	2.3	3.0	2.8
All	1.8	2.7	2.4

The distribution of delays was highly skewed, with 73 per cent of the sample having no delay at all at the kerb. The proportion of pedestrians with no delay was found to decrease significantly with age. Conversely, the mean delay at the kerb for those who were delayed showed no age differences. This suggests that the increase with age in delay for all pedestrians can be accounted for by differences in the proportions of pedestrians who experienced delay at the kerb (see Figure 1).

3.3 Delay in the road

As in the previous case, the distribution of delay in the road was found to be highly skewed with 68 per cent of pedestrians having no delay. However, unlike kerb delay, the proportions of pedestrians with no road delay showed no significant trend with pedestrian age. The mean delay in the road for those pedestrians who were delayed remained fairly steady at about 9 seconds, apart from an increase of 2 seconds in road delay among pedestrians of 70 years or older (see Figure 2).

All delays in the road were classified according to location (ie near the offside of parked vehicles, in the gutter, elsewhere in the roadway, or any combinations of these). The results showed a high degree of consistency among the seven age groups with no evidence of any age effect. Differences between the three sites were considerable, although these could be explained readily by the varying amounts of on-street parking at the sites.

3.4 Total delay

The total delay experienced by pedestrians when crossing the road increased markedly with age, from an average of 4.8 seconds for the 15–19 year olds to 8.4 seconds for pedestrians aged 70 years or more. The proportions of pedestrians delaying by age group are shown in Figure 3, divided into those delaying at the kerb only, in the road only, or both. Figure 3 shows how the increase with age in the proportion of pedestrians delay is accounted for by delay at the kerb rather than in the roadway.

3.5 Head movements before crossing

The number of head movements made by pedestrians in each direction were broken down by age, sex and accompaniment. Analysis of variance indicated highly significant effects of all three factors together with significant age by sex and age by accompaniment effects. The mean number of head movements for the sex and accompaniment groups are shown in Table 4.

TABLE 4

Mean number of head movements made before crossing

	Male	Female	All
Alone	2.4	2.8	2.6
Accompanied	2.8	3.0	2.9
All	2.5	2.9	2.7

The effect of pedestrian age on head movements made before crossing for the total sample can be seen in Figure 4 which also shows that pedestrians look to the right more frequently than to the left before crossing the road, as would be expected.

Not all pedestrians looked in both directions before crossing. In the present study it was found that 11 per cent of all pedestrians looked only to the left, 22 per cent looked only to the right and 63 per cent looked both ways. The remaining 4 per cent (405 pedestrians) did not appear to look at all before starting to cross the road. This proportion showed very little variation with pedestrian age, but the proportion looking both ways increased with age from 59 per cent of the 15–19 year olds to 69 per cent of the 70 year olds and over.

Of all head movements made before crossing the road a considerable proportion was made while the pedestrian was approaching the kerb; this proportion showed a significant decrease with age. It was mentioned earlier that the proportion of pedestrians who did not delay at the kerb also decreased with age, and it would seem that the greater avoidance of delay at the kerb by the young was achieved through their ability to assess the prevailing traffic situation while walking to the kerb.

In three cases out of five the direction of the last look made by pedestrians before stepping into the road was to the right; this proportion was not affected by age.

3.6 Head movements during crossing

Analysis of variance of the data revealed highly significant effects of age, sex and accompaniment on the number of head movements made while crossing the road. The effect of pedestrian age is shown in Figure 5, and sex and accompaniment effects given in Table 5.

TABLE 5

Mean number of head movements made during crossing

	Male	Female	All
Alone	3.2	3.6	3.5
Accompanied	3.5	3.9	3.8
All	3.3	3.7	3.6

While pedestrians were found to look more frequently to the left than to the right before crossing, the opposite effect was apparent during crossing. In total, left looks were more frequent than right looks for all ages, suggesting that pedestrians may have greater difficulty in assessing the traffic situation on the farside than on the nearside of the road.

As noted earlier, one-third of the sample delayed in the road while crossing. Pedestrians who did not delay in the road made virtually the same number of head movements regardless of age, but those with delay made an increasing number of head movements with age up to about 50 years.

Table 6 shows the proportions of pedestrians looking both ways, one way only and not at all before and during crossing the road.

TABLE 6

Pedestrian looking behaviour before and during crossing

Situation \ Pedestrian action		Looked both ways	Looked left only	Looked right only	Did not look in either direction
Before crossing	Number	7031	1230	2445	405
	Per cent	63.3%	11.1%	22.0%	3.6%
During crossing	Number	8232	2091	539	249
	Per cent	74.1%	18.8%	4.9%	2.2%
Before and during crossing	Number	10792	168	146	5
	Per cent	97.1%	1.5%	1.3%	0.05%

One point of interest from this table is the fact that five pedestrians (approximately 1 in 2000) crossed the road apparently without looking at all either before or during their crossing. Of these five pedestrians, two were accompanied females of 50–59 years old who might be assumed to be relying on their companions, but the remaining three pedestrians – one male and two females, all between 15 and 29 years old – crossed alone.

3.7 Safety gaps

As a possible indication of the safety of a given crossing manoeuvre, the amount of time each pedestrian had to spare over an approaching vehicle was recorded. Because the range of safety gap values obtained in this way was very considerable, it was decided that examination of the incidence of small safety gaps might be more meaningful than that of average values. Small safety gaps were arbitrarily defined as those of less than two seconds duration. Table 7 shows that male pedestrians had a higher proportion of safety gaps under 2 seconds than did females; all groups of pedestrians had significantly higher proportions of small safety gaps on the farside of the road than on the nearside.

TABLE 7

Pedestrians with safety gaps of less than 2 seconds (%)

	Male	Female	Alone	Accompanied	All
Nearside	3.4	2.1	2.8	2.0	2.5
Farside	6.2	4.8	5.2	5.3	5.2

No significant age trends were found, although there was a tendency for the proportion of pedestrians with small safety gaps on the farside of the road to decrease with age, as shown in Figure 6. Earlier work on pedestrian accidents[2] has indicated that while the proportion of pedestrians injured on the farside of the road increased with age, the majority of pedestrians of all ages were injured on the nearside. However, Table 7 shows that the proportion of pedestrians with small safety gaps was higher on the farside than on the nearside. Thus small safety gaps would not seem to be a reliable indication of a dangerous crossing manoeuvre, and may even be a reflection of skill in the crossing task.

Two other measures of pedestrian gap acceptance which could have been taken are (i) the time from when a pedestrian steps into the road to when the next vehicle crosses the pedestrian's path behind him, and (ii) the time of the gap between vehicles in which the pedestrian decides to cross.

However, all these measures have a common disadvantage in that they can take no account of any avoiding action by drivers or pedestrians. Gap acceptance measures by themselves do not appear a particularly fruitful area for further study, and more detailed analysis of pedestrian/vehicle interaction would seem preferable.

3.8 Crossing time

The average time spent by a pedestrian in walking across the road (excluding any delay in the road) was found to increase with age as shown in Figure 7. Analysis of variance indicated that accompanied pedestrians had significantly longer average walking times than those who were alone, but the absolute value of the difference was small (8.8 seconds compared with 8.5 seconds). There was no significant difference in walking time between males and females.

Figure 7 also shows the mean time taken for the total crossing manoeuvre (ie including any delay at the kerb or in the road) for all pedestrians by age group. For the youngest age group the total crossing manoeuvre took on average 13.3 seconds compared with 18.5 seconds for the oldest age group. The mean walking times were 8.5 seconds and 10.1 seconds respectively. Thus the majority of the age difference in total crossing time can be attributed to the greater delay, either at the kerb or in the road, incurred by the elderly.

3.9 Walking speed

In order to obtain reliable estimates of walking speed certain categories of pedestrians were excluded from the analysis. All those who crossed in a diagonal path were omitted, since it was not possible to measure the distance they had travelled. Accompanied pedestrians were also omitted because they could have been influenced by the walking speeds of their companions. In addition, pedestrians who delayed at all in the road were excluded as it was possible that their walking speed could have been affected by the interruption of the crossing manoeuvre. Data on walking speeds were therefore confined to single pedestrians crossing at right angles to the kerb and without any delay in the road. Results are shown for the whole age range in Figure 8 and are summarised in Table 8.

The decrease in walking speed with age is seen clearly in Figure 8, but although no significant overall sex difference was found there was a significant age/sex interaction. Among the younger adults, men were observed to walk slightly faster than women, whereas with the elderly men tended to walk slightly more slowly, as shown in Table 8. Thus although increasing age led to slower walking speeds for both sexes the effect was more pronounced among males than females.

TABLE 8

Pedestrian walking speed (metres per second)
(single pedestrians crossing directly without delay in road)

Sex \ Age	15–59 years	60 years and over	All ages
Male	1.37	1.10	1.32
Female	1.29	1.15	1.27
Both sexes	1.32	1.13	1.28

3.10 Path taken and proximity to parked vehicles

Two other aspects of the road crossing manoeuvre which were considered were the path taken across the road and the proximity to parked vehicles. The path taken was classified as direct if it was within about 10^{o} of a right angle, and otherwise as diagonal. Two pedestrians out of three crossed on a diagonal path as so defined, but no age trend in the proportion doing so was apparent. One-third of pedestrians crossed near (ie within approximately 5m) parked vehicles, but again there were no age differences. This last result excludes the data from Above Bar, Southampton, since parking meters were present on one side of that road.

3.11 Site differences

Although similar age effects were found to be present at all three of the sites studied, there were differences between the sites in the mean values of many of the behavioural items investigated. The results for the three sites separately are summarised in Table 9.

TABLE 9

Summary of results from the three sites

	High Street Hounslow Road width 9.4m	Above Bar Southampton Road width 9.8m	Victoria Road Southampton Road width 9.6m
Vehicle flow per hour	1010	1040	570
Pedestrian sample size	2954	4981	3176
Kerb delay – Mean (seconds)	4.1	2.0	1.5
Per cent with none	60%	79%	77%
Road delay – Mean (seconds)	2.6	4.0	1.5
Per cent with none	70%	60%	78%
Total delay – Mean (seconds)	6.7	6.1	3.0
Per cent with none	42%	44%	60%
Walking time – Mean (seconds)	8.3	8.5	9.2
Standardised to 10m road width	8.8	8.7	9.6
Total time to cross – Mean (seconds) (Including kerb and road delay)	15.0	14.6	12.2
Walking speed* – Mean (metres/second)	1.34	1.35	1.21
Crossing direction – Per cent crossing diagonally	68%	73%	58%
Head movements before crossing			
Mean number per pedestrian	3.5	2.5	2.4
Per cent making none	2%	6%	2%
Per cent looking both ways	74%	54%	68%
Per cent made on approach to kerb	52%	66%	73%
Head movements during crossing			
Mean number per pedestrian	3.4	4.0	3.1
Per cent making none	3%	2%	2%
Per cent looking both ways	70%	78%	71%
Safety gaps			
Per cent less than 2 seconds – nearside	1.5%	2.2%	3.8%
farside	5.1%	6.2%	3.9%

* The estimates of pedestrian walking speeds are derived from a reduced sample; see Section 3.9 of text.

The majority of the observed differences in behaviour between the Victoria Road site and the other two sites can probably be explained by the lower vehicle flow at Victoria Road. Differences between Hounslow High Street and Above Bar – sites with very similar vehicle flows – can in turn be attributed mainly to differences in crossing strategies. At Above Bar, with almost continual car parking on one side, there was a tendency for pedestrian delay to occur more frequently in the road. However the total delay (kerb plus road delay) and the total number of head movements made (before plus during crossing) were very similar at the two sites.

As mentioned in the Introduction, this work was undertaken following a pilot study in Worthing. The results of that study are shown in Figure 9 together with appropriate data from the present survey for comparison. At the Worthing site only pedestrians crossing alone without any delay in the road were studied, so the data shown for the three sites in the present study were based on a similar sample of pedestrians.

It can be seen from Figure 9 that the average delay at the kerb for pedestrians of 70 years and more at Worthing was much higher than at the other three sites, with a corresponding difference in the number of head movements made before crossing. This could not be attributed to differences in vehicle flow, and may be connected in some way to the fact that Worthing has a higher proportion of the elderly in its population than the other sites.

The road width at Worthing was less than that at the other three sites, which accounts for the overall difference in mean crossing time. However, although no age effect on crossing time had been apparent at Worthing, the much larger sample from the other three sites showed a clear increase in crossing time with increasing pedestrian age.

The mean head movements per pedestrian during crossing at Worthing had shown a tendency (without reaching statistical significance) to decrease with pedestrian age. This trend was not repeated at the three sites of the present study, where there was no significant variation with age.

4. DISCUSSION

The aims of this study were to investigate age related differences in pedestrian road crossing behaviour, and to assess the contribution of any such differences to an explanation of the higher casualty rate experienced by elderly pedestrians. The growth in the number of studies on pedestrian behaviour in recent times has largely been based on the assumption that there exists some relationship between 'normal' behaviour and accidents. The work which has been reported here represents the first major empirical test of this assumption as far as adult pedestrians are concerned.

The results that have been presented in the previous section have shown age differences in several aspects of road crossing behaviour; the contribution these can make to an explanation of differential casualty rates will now be considered.

The fact that the elderly delay longer at the kerb and make more head movements before crossing than do other adults may be a reflection of the greater difficulty they experience in assessing a traffic situation. The display of greater caution by the elderly is another explanation, which could well be associated with the first. However, the higher casualty rate for the elderly compared with other adults suggests that the additional delay and attention paid to the task are not in themselves reliable predictors of greater safety.

Another aspect of behaviour before crossing is the likelihood of any given pedestrian delaying at the kerb. The proportion of pedestrians who delayed at the kerb was found to increase significantly with age. Furthermore the proportion of head movements made before crossing which were performed while walking along the pavement decreased with age. This would suggest the existence of differences in crossing strategy. Rather than it being simply the case that the elderly delay longer before crossing, it would appear that the younger adult is more capable of avoiding delay by assessing the prevailing traffic situation while approaching the kerb. Grayson[3] found the same strategy difference between children and adults, the children in that study behaving in the same manner as the elderly were found to do in this one.

The mean road crossing time from kerb to kerb increased with age from 11.2 seconds for pedestrians under 30 years old to 14.4 seconds for those aged 70 years or more, indicating that the elderly were exposed to traffic in the roadway for 29 per cent more time than were young adults. The mean number of head movements made during crossing increased from 3.4 per pedestrian under 30 years old to 3.9 per pedestrian aged 70 years or more, a difference of 15 per cent. These two trends together indicate a decrease with age in the rate of head movements made per unit time while crossing the road. It is not immediately clear what effect this could have on the safety of pedestrians of different ages since this also involves other factors, such as the amount of time spent looking at traffic during a head movement and the speed and efficiency of handling the information which is obtained. Nevertheless, the result could well be an indication of the difficulties which the elderly face in the complex task of road crossing, and is a topic which would seem to merit further attention.

In general, however, the results of this study provide little evidence which could be used to explain differences in accident rates. Compared with other adults, elderly pedestrians were more likely to stop at the kerb, to have longer delays, to make more head movements before and during crossing, and they did not have more small safety gaps when crossing. Although age differences in behaviour exist, they would not seem of sufficient scale to account for the higher accident rate of elderly pedestrians, who have more than twice as many fatal and serious casualties per head than do other adults. Indeed many of the results point in the opposite direction, in that they can be interpreted plausibly as demonstrating greater caution on the part of the elderly. It should be noted though that only basic first order effects have been examined so far; there is still the possibility that more complex measures of behaviour might relate more closely to differences in accident rates. Alternatively, these findings could indicate that explanations of differences in accident rates might more profitably be sought in terms of differential exposure to risk.

One final point is that in comparing the results of this study and the pilot study which preceded it, there is a strong suggestion that areas with high proportions of the elderly in the population may be cases from which it is difficult, and even dangerous to generalise. The results obtained from the more typical urban conditions in this study indicate that the elderly on the whole do not form a distinct sub-group within the pedestrian population. In most cases the behaviour of the elderly is merely the continuation of a trend which begins many years earlier.

5. SUMMARY AND CONCLUSIONS

More than 11,000 road crossings by adult pedestrians were recorded on some 82 hours of cine film taken at three busy shopping streets where there were no crossing facilities. The study was undertaken to investigate age differences in road crossing behaviour which might explain the high casualty rate of elderly pedestrians (defined as those aged 60 years or more) compared with other adults. The results of the analysis showed age differences in several aspects of crossing behaviour. Compared with other adults, the elderly were more likely to stop at the kerb, experienced longer delays before crossing, made more head movements before and during crossing, and took longer to cross the road. No age differences were found in the proportions of pedestrians crossing the road diagonally, crossing near parked vehicles, or incurring small safety gaps (ie less than 2 seconds between them and the next approaching vehicle).

Although age differences in behaviour were found, in absolute terms they were small in magnitude and would not seem sufficient to account for the higher casualty rate of the elderly; indeed, in some respects the results pointed in the opposite direction. The study thus provides little support for the contention that 'normal' behaviour is related to accidents. It is possible that more complex measures of behaviour may yield better relationships, but at this stage it would seem more profitable to seek explanations of differences in casualty rates in terms of differential exposure to risk.

Finally, the results suggest that the elderly tend to adopt crossing strategies similar to those of children as opposed to those used by younger adults. However, the differences were generally in the form of trends over a wide range of ages, and in behavioural terms the elderly do not appear to form a distinct sub-group within the pedestrian population.

6. ACKNOWLEDGEMENTS

The work described in this report was carried out in the Road User Characteristics Division of the Safety Department of TRRL. The assistance of the photographic section is gratefully acknowledged; J Inwood organised the collection of the data, and P Scott advised on its statistical analysis.

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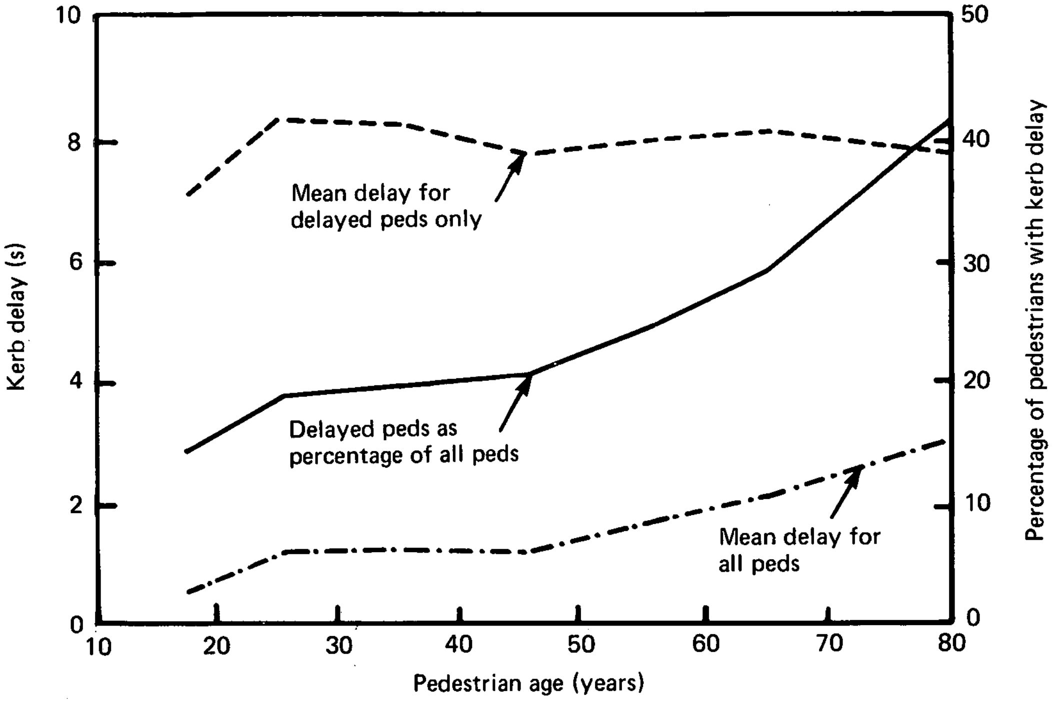


Fig. 1 KERB DELAY AND PEDESTRIAN AGE

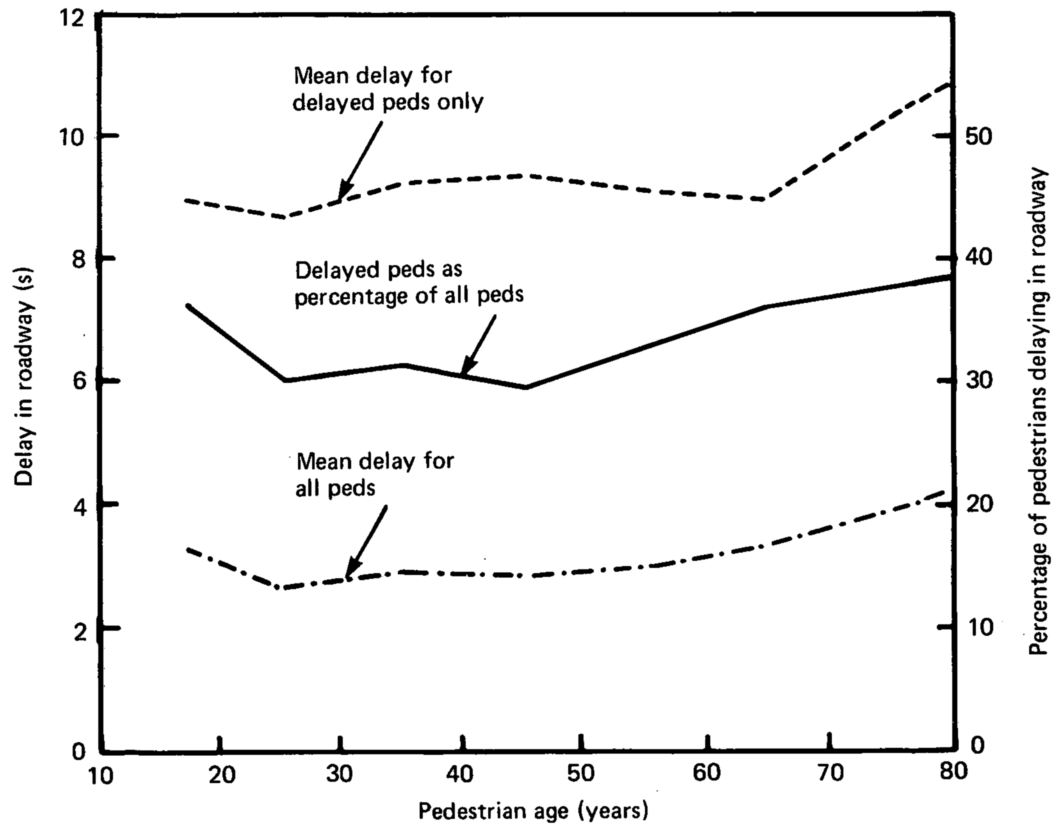


Fig. 2 DELAY IN ROADWAY AND PEDESTRIAN AGE

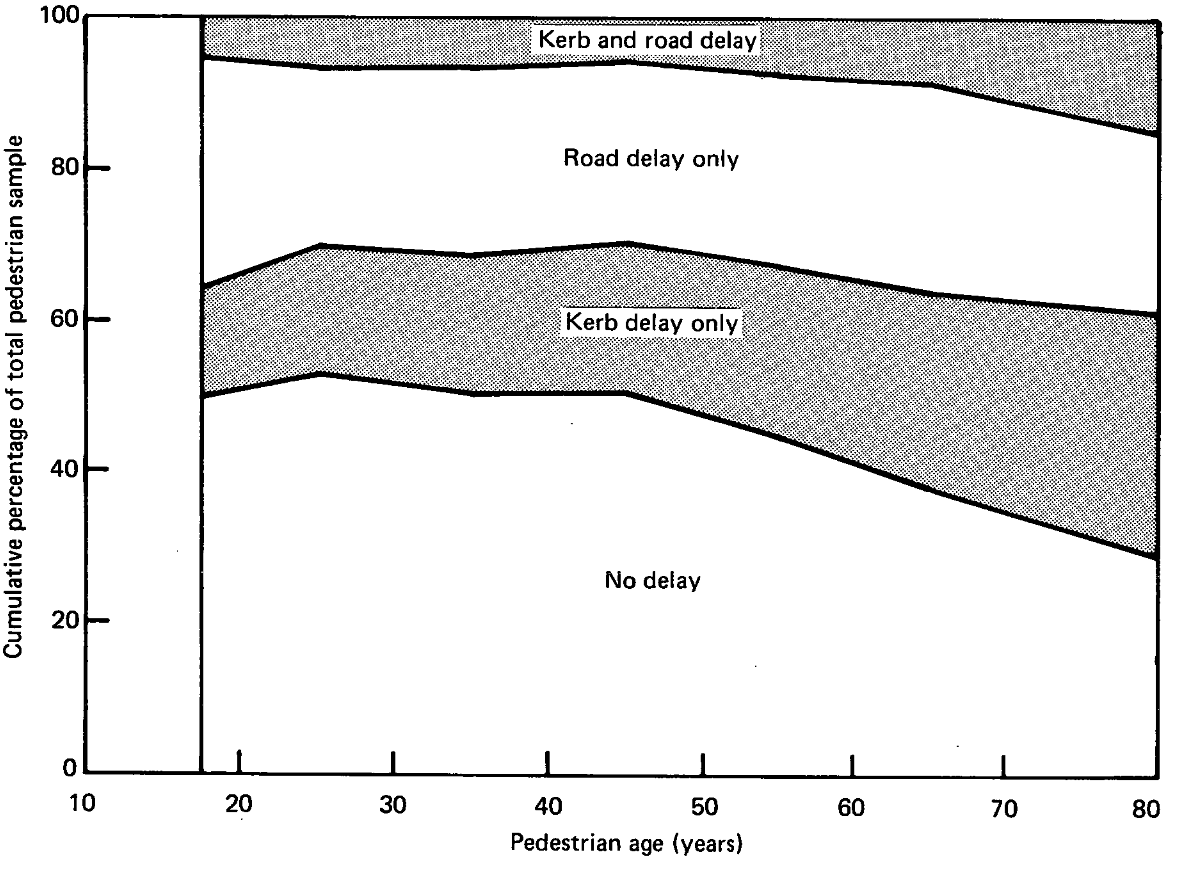


Fig. 3 PERCENTAGE OF PEDESTRIANS DELAYED AND PEDESTRIAN AGE

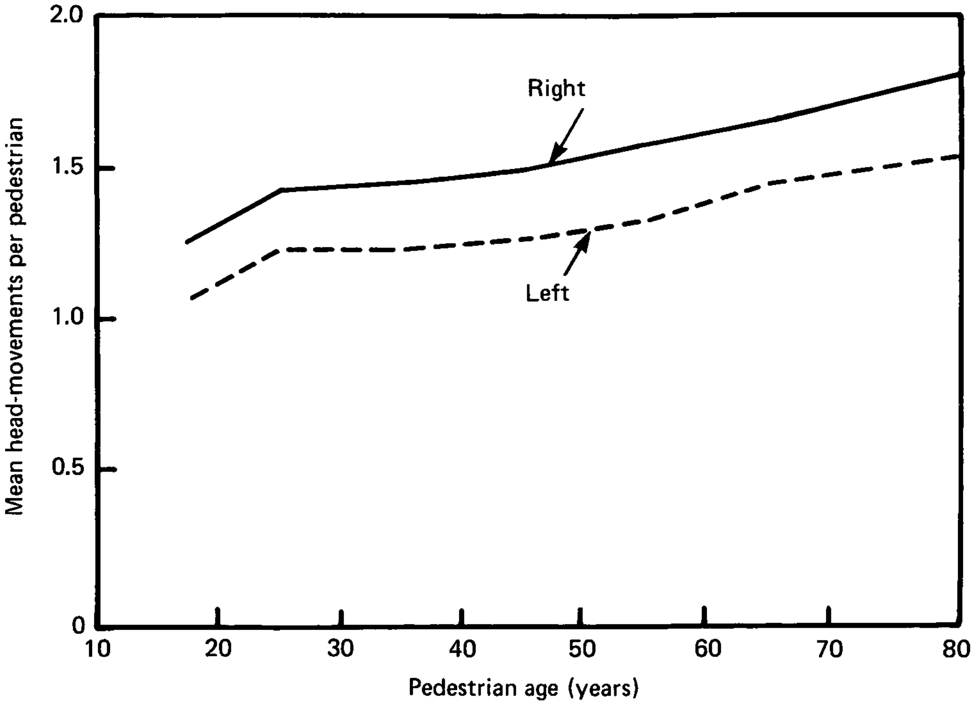


Fig. 4 HEAD MOVEMENTS BEFORE CROSSING AND PEDESTRIAN AGE

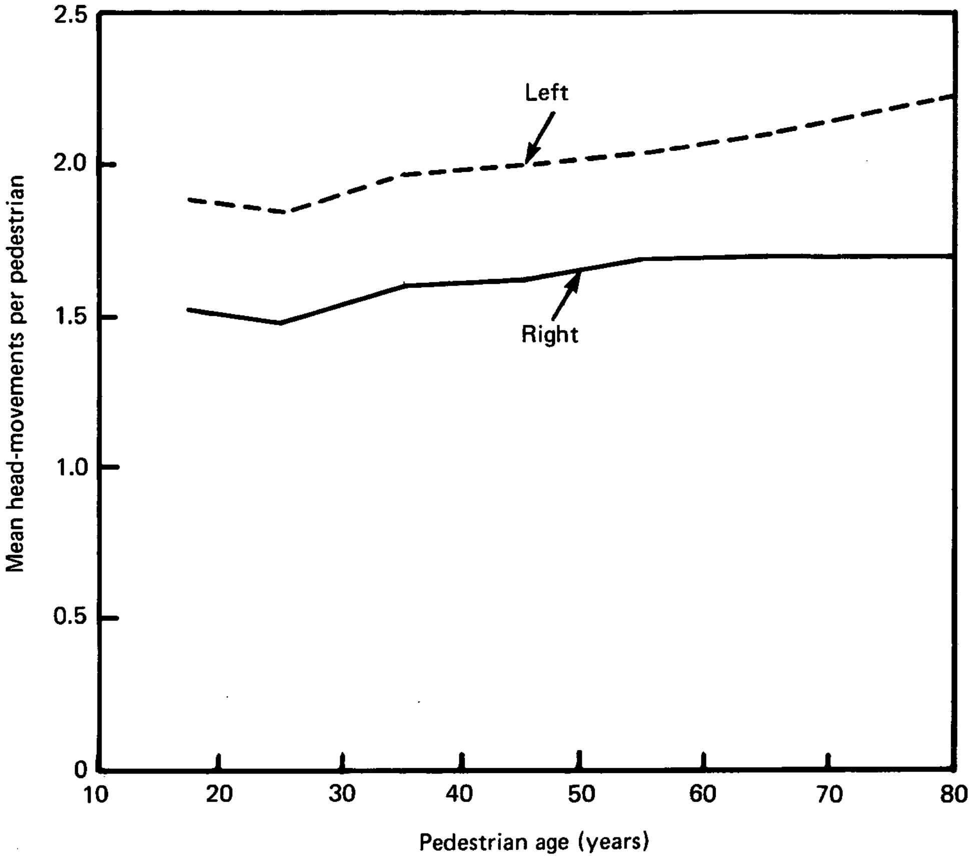


Fig. 5 HEAD MOVEMENTS DURING CROSSING AND PEDESTRIAN AGE

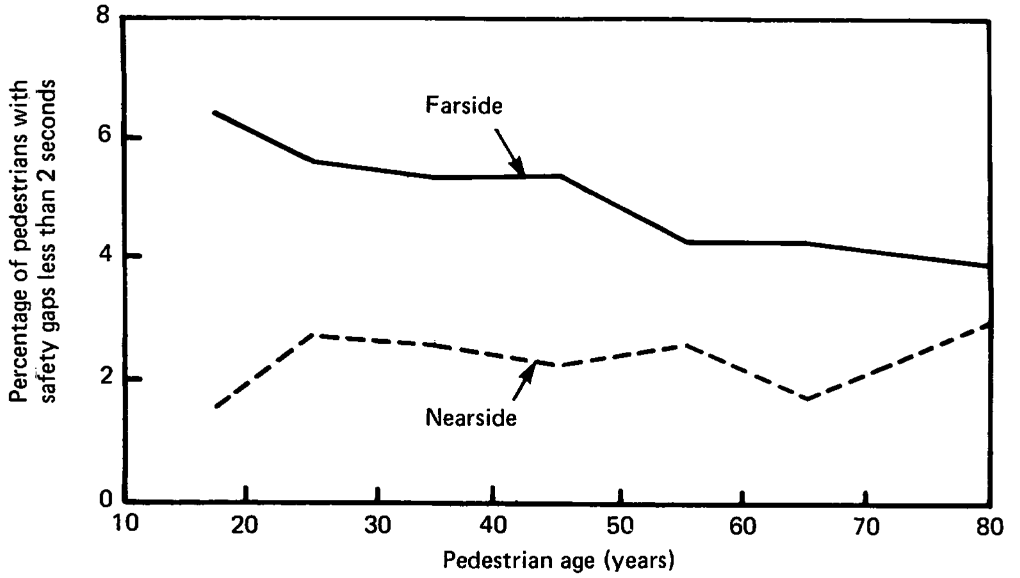


Fig. 6 PERCENTAGE OF PEDESTRIANS WITH SMALL SAFETY GAPS (< 2s) AND PEDESTRIAN AGE

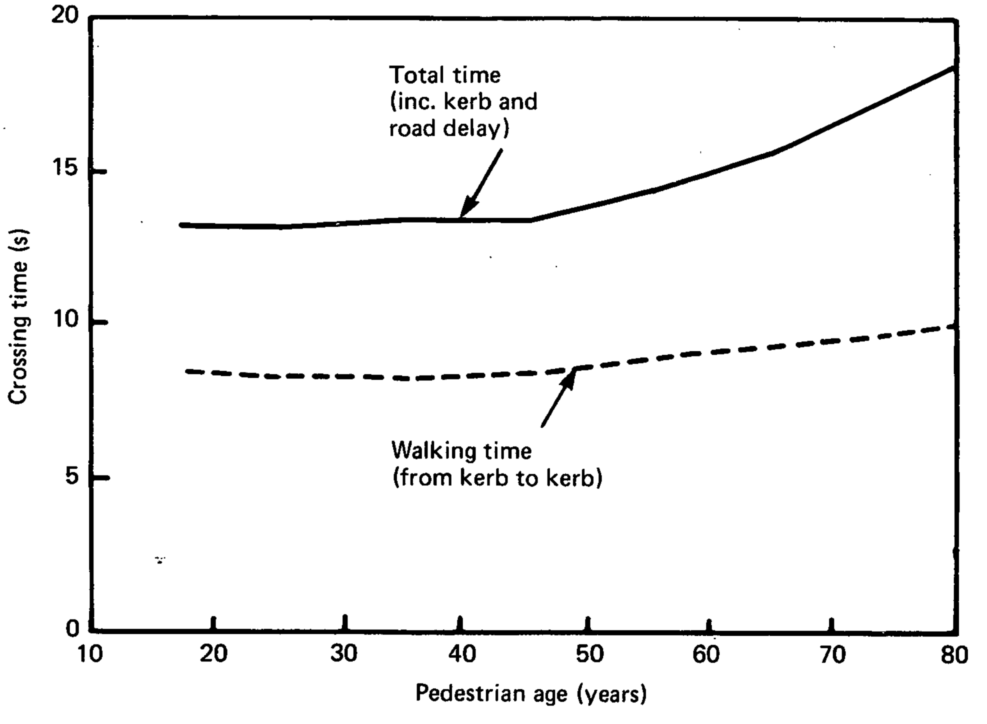


Fig. 7 CROSSING TIME AND PEDESTRIAN AGE

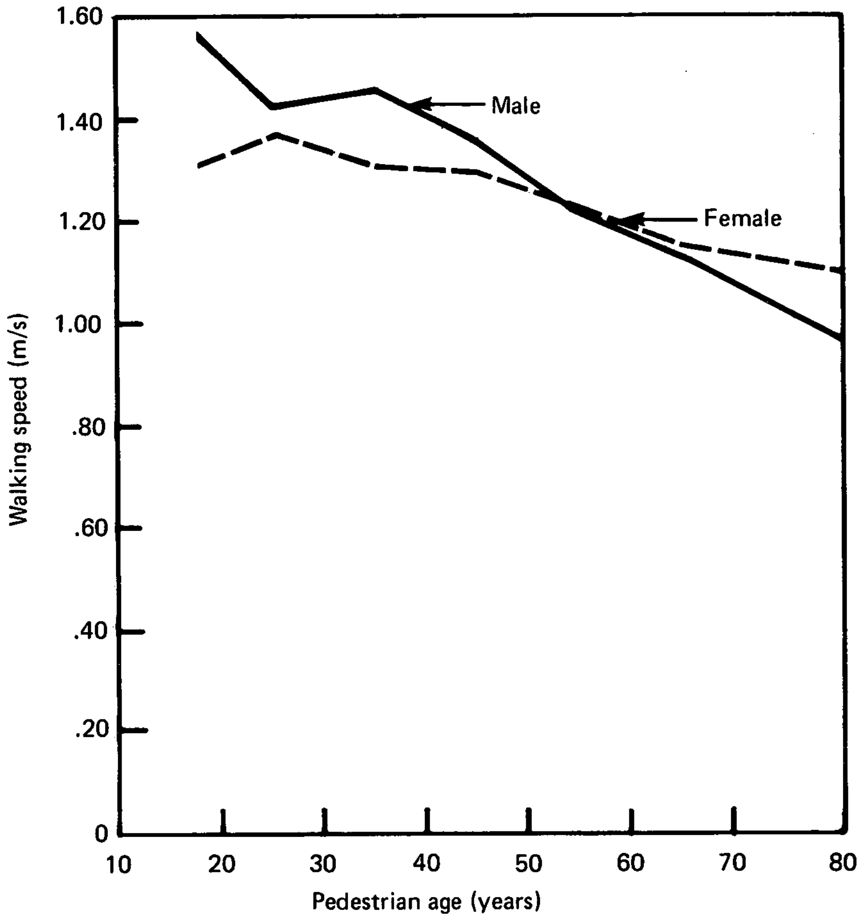
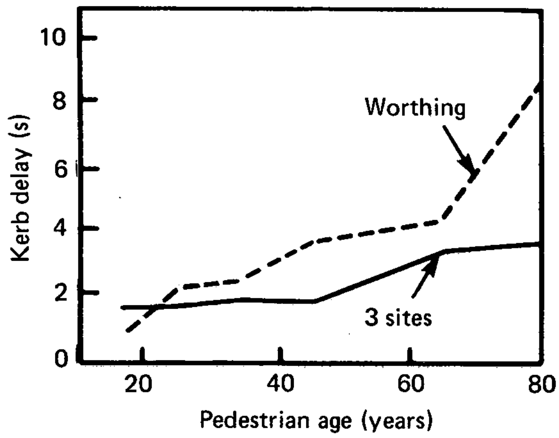
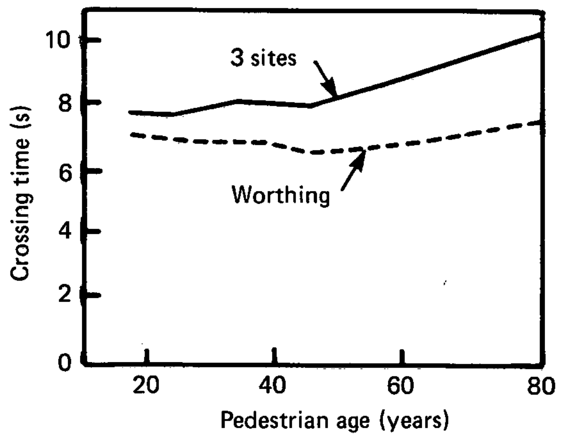


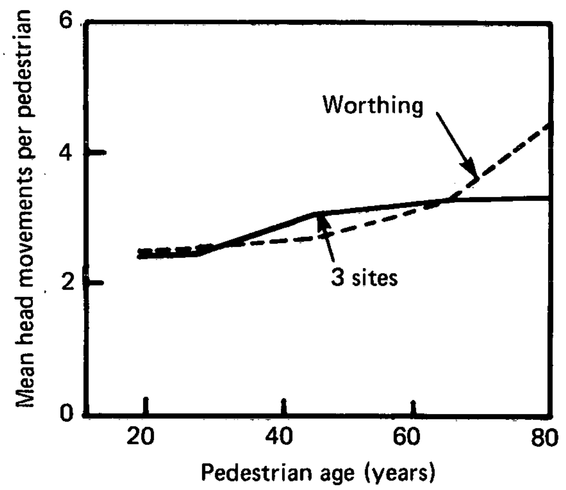
Fig.8 WALKING SPEED AND PEDESTRIAN AGE
(single pedestrians, direct crossing)



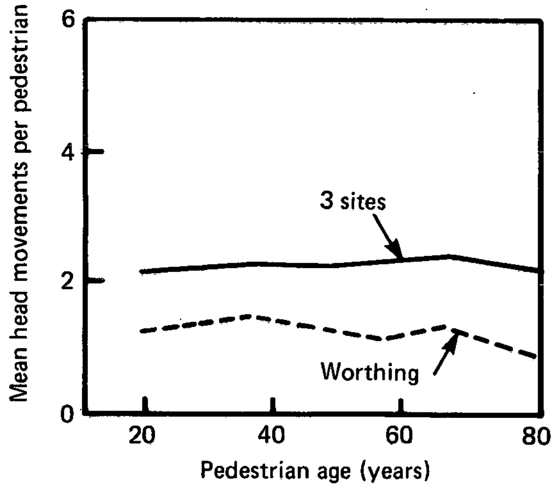
(a) KERB DELAY AND PEDESTRIAN AGE



(b) CROSSING TIME AND PEDESTRIAN AGE



(c) HEAD MOVEMENTS BEFORE CROSSING AND PEDESTRIAN AGE



(d) HEAD MOVEMENTS DURING CROSSING AND PEDESTRIAN AGE

Note: These results refer only to pedestrians crossing alone and without delay in the roadway

Fig. 9 COMPARATIVE RESULTS FOR WORTHING AND THE THREE SITES OF THE PRESENT STUDY

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ABSTRACT

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i) to delay before crossing
ii) to spend more time at the kerb
iii) to take longer to cross the road
iv) to make more head movements before and during crossing.

However in absolute terms these and other differences were small, and provided little explanation for the differences in casualty rates. The results indicated that the elderly employed a different crossing strategy from that of other adults, but in general the elderly do not appear to form a distinct sub-group within the pedestrian population.

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