

A study of pedestrian activity and accident risk: implications for road safety policy

Heather Ward

Principal Research Fellow
Centre for Transport Studies
University College London
Gower Street
London WC1E 6BT

+44 171 391 1564

Abstract

On an average day in an average English town, about three quarters of its residents aged five years and over will walk somewhere. Not necessarily very far, perhaps only from a parking space to the shops or place of work. Not everyone has access to a car and many people rely on their feet for independent mobility. This is especially true for the under 18's and over 65's and of women of all ages compared with men. Short walks need to be considered alongside the longer walks, say from home to the shops, school or office as people are vulnerable to being injured by traffic even when only one road is crossed. Indeed, a pedestrian need not be crossing the road to be injured by a vehicle.

We know quite a lot about where in the road environment pedestrians are injured, how old they are and whether male or female. What we do not know much about is who walks where, with whom and how far. A major study has been undertaken in which the relationship was investigated between how far people walked, how many roads they crossed and the layout of the roads near where they lived and alongside which they walked. The main findings were:

- the average distance walked per head of resident population was just more than 800 metres and females of all ages walk about 8 per cent further per person than males.
- teenagers walk furthest of all, about 1.66 km per day per person
- over half the distance a person walked was within 500 metres of home and about three quarters was within 1 km of home
- four out of five times a child aged between 5 and 9 years crossed a road they were accompanied by an adult
- older children were accompanied by an adult two out of five times they crossed a main road and only one in three times they crossed a local road

These levels of activity and exposure to traffic in the road environment were related to the

casualty figures to give casualty rates and risk indices for different people crossing different types of road. When exposure is taken into account the main findings were:

- the casualty rate per 100 million roads crossed for children aged 5-15 is twice the average rate for people of all ages and about four times that of adults in the age range 25-49
- males are about one and a half times more at risk of injury than females for every kilometre walked alongside traffic or for every road crossed. The exception is young teenage girls who are more at risk in the road environment than males or females of any age

The findings of this study have implications for policy at both national and local level in regard to the provision of education and training for all road users, for enforcement, the design and layout of new roads in urban areas, and the improvement of existing roads both in terms of management of traffic and pedestrians and in terms of changes to the road environment itself.

1 Introduction

How to encourage more people to leave their car at home and walk short distances is a central theme of policies to reduce car dependency. Before such policies can be formulated we need to know much more about why people walk, who walks, how far and where, at what time of day, and which kinds of road they walk alongside and cross. We also need to know more about what discourages people from walking so that the social and physical environments may be changed to reduce barriers to walking.

As a result of the many large travel surveys that have been undertaken over the years we know quite a bit about journeys by car and the travel patterns and habits of car drivers. We know far less about pedestrian activity. The road network, its management and the management of the motorised traffic that uses it has, for the past several decades, taken precedence over routes and facilities for pedestrians. The quality of the road environment in which we walk is important and in recent years more account is being taken of the need for safe and pleasant pedestrian movement. More attention has been given to creating pedestrianised town centres and other traffic free environments where people may meet and shop. The road environment is changing too with the needs of pedestrians being reflected in the introduction of more equitable traffic management measures.

Not everyone has access to a car and many people rely on their feet for independent mobility. This is especially true for the under 18's and over 65's and of women of all ages compared with men. Many people choose to walk to keep fit or to enable them to meet and talk to others on their way. In order to find out more about walking patterns, residents of Northampton, a typical British town, were surveyed as part of a study undertaken by University College London which was

commissioned by the AA Foundation for Road Safety Research. In the first part of this paper a brief outline of the research methodology is given together with the main findings. The second part highlights the implications for policy at both national and local level for the development of strategies for walking. The policy areas covered include provision of education and training for all road users, traffic law enforcement, the design and layout of new roads in urban areas, and the improvement of existing roads both in terms of management of traffic and pedestrians and in terms of changes to the road environment itself.

2 Pedestrian activity and accident risk

2.1 Collection of walk information

Northampton was chosen in which to collect information about walking because it is a medium sized town which has a typical pattern of streets and housing types ranging from victorian terraces near the town centre through all ages of housing until the present day which are located on the eastern and western outskirts of the town. The age distribution of people living in Northampton is typical of a town of its size so is its ethnic mix and number of cars per household. About 264 000 persons aged five years and over lived in Northampton at the time of our study in 1992 to 1994, with females making up 51.5 per cent of the population.

A stratified sample of about 400 households was chosen and every resident aged five or over was asked to fill in a diary of their activity on foot over a 24 hour period determined by the study team. In this way walk information was collected from 1037 residents. The importance of this approach was that it sampled across the different types of housing which in turn include the various road layouts which people walk alongside and cross. The main weakness of using this sampling method was that it concentrated on households rather than on individuals who ultimately provide the basis for exposure data so some gender and age groups were not sampled in quite the same proportions as found in the population of Northampton.

Respondents to the surveys provided a wealth of information about their pedestrian activity but they could not be expected to recall all the characteristics of the road environment in which their walking took place; enough of their time had been taken up with asking them to describe the route they had taken for each walk and where they had crossed each road. Information about the road environment in which each walk took place was collected by a member of the study team who rewalked the routes described and noted the presence of features of the road and roadside using a classificatory system devised to deal with all the information about each walk.

2.2 Pedestrian activity in the road environment

On an average day the 164 000 residents of Northampton walk a total of 133 000 kilometres and

cross about 636 000 roads. This is the equivalent of about 825 metres for each man, woman and child aged five and over. About three quarters of the residents walk somewhere on an average day even if it is only from the house to a car parked nearby or the post box on the corner. If just the people who walked somewhere are considered then the average distance walked was about 1.15 kilometres and about 5.5 roads were crossed.

Males and females do not walk the same distance in a day as, on average, females walk about 8 per cent further than do males. In distance this translates to about 100 metres for each female who walks. The distance walked is not uniform across all age groups. The results of the study show that young women aged 16-19 and 25-34 years walk substantially greater distances than males of the same age, and further too than males or females of any age. Male children walk further than female children with 10-15 year old boys walking nearly twice as far as the girls. Within these patterns of distance it is interesting to note that about 60 per cent of all walking is done within 500 metres of home. Men do a greater proportion of their walking further from home than do the women but the extra 100 metres distance the women walk each day is on the roads close to where they live.

That most walking is on streets close to home is consistent with another finding that most walking is on residential roads. This may not be a profound finding at first sight but it does have relevance to wider issues of how people relate to the environment near to where they live and how educational material relating to the use of roads should be targeted.

One of the determining factors in the amount of walking is health and general mobility. Data from the 1985/86 National Travel Survey show that people with a physical or long-standing health problem that makes travelling difficult, make on average about half the number of journeys made by people without such problems (Oxley 1993). In our study people were asked how often they had gone out in the previous week and whether they had any health problems that affected their mobility. Eighty three of the people we interviewed reported a health difficulty. However, nearly two-thirds of these went out on foot on their survey day. We interviewed 24 people who were registered disabled and of these, half went out somewhere on foot.

Whether or not a car is available to the household may affect the amount of walking by household members. Nationally, about 87 per cent of 5 to 10 year olds who live in households where there is no car, walk to school. For households with one car, about two-thirds of the children walk to school but in families where there are two or more cars, only 36 per cent of these children walk (Department of Transport 1995). About three quarters of the people we sampled lived in households with access to a car, which is about the average for Northampton. We found that people living in households without a car walk further than those with a car; one kilometre compared with three-quarters of a kilometre. But whilst they walk further they tend to make fewer walks. people who live in households where the head was not in regular employment and there was no car are appreciably less likely to walk than any other group.

Accompaniment or escorting of children by an older child or adult is common, especially when the younger child needs to cross a busy road. In our study we found the 5-9 age group were

accompanied by an adult on 77 per cent of the times they crossed a road and a further 10 per cent were in the presence of older children.

We recorded the time the walks started and finished and found that in the seven hours 07.00 to 09.59 and 15.00 to 18.59 about half the total distance for the day was accounted for. On average about 8 per cent of all walking by residents is done in hours of darkness.

Hillman et al (1990) found that 98 per cent of junior school children and 76 per cent of senior schoolchildren are not allowed out alone after dark. This together with Hillman et al's finding that increasingly children are being accompanied by car on the school journey lead them to identify five adverse consequences:

- increased resource costs
- constraint of adult opportunities
- contribution to increased traffic congestion
- removal of a routine means for children to maintain physical fitness, and
- limitation of opportunities for the development of independence.

The 16-19 year age group do nearly a quarter of their walking in the evening after 19.00 hours but the largest amount, nearly 600 metres a person, is started between 15.00 and 18.59. This together with the finding that they venture further away from home on foot and cross more main roads than any other age group indicates they are perhaps travelling to the town centre where there is not only a greater concentration of main roads but is where the activities are located that attract young people in the evening.

Perhaps not surprisingly, people aged over 65 year do two thirds of their walking between 10.00 and 14.59. These older pedestrians have a walking pattern more similar to that of children than to that of adults with about 85 per cent of the distance they walk being within one kilometre of home. The main difference being the number of main roads the older people cross. Children cross on average one main road every other day whilst the older pedestrian crosses about one a day. This is probably a reflection on where in the town the older people live and their lifestyle which includes visiting the shops which tend to be located on or near to main roads. Carthy et al (1995) report that shopping or looking around shops comprised the majority of outings for the older age group in their study, and represented two out of every three trips. A common destination was the city centre.

Car ownership and use is not distributed evenly across the age range of people in Northampton. From our data we could determine where the walk started from. About one third started from home, a third from another walk, a further quarter started from a car and in Northampton, only three per cent started from the bus. The 16-19 year olds and the older people were the greatest users of the bus with about 11 per cent of their walks starting from a bus journey.

The destination of walks also shows an interesting pattern across the age groups. The 16-19 year age group links fewer walks to a car than any other age group which again highlights their

independence and lack of personal transport other than their feet. By contrast, the 50-59 year age group link more of their walks to a car than any other age group. In general, about 30 per cent of the walks done by the people of Northampton are 50 metres or shorter but these represent only about one per cent of the total distance walked. Of these very short walks, about 44 per cent are to a car. Over two thirds of all walks are no longer than 350 metres and of these nearly a third are to a car whilst only three per cent were to a bus stop.

The differences in patterns and amounts of walking by people of different ages, gender and personal circumstances briefly covered in this paper highlights the complexity of the task facing those responsible for planning new and improving existing pedestrian environments.

2.3 Where in the road environment are people injured?

The location in the road environment together with the distribution over time of accidents involving injury to pedestrians are of importance to those involved with making the roads safer and more pleasant for all people as pedestrians.

In Britain about 95 per cent of all pedestrian casualties are injured on roads where there is a speed limit of 40 miles/h or less. There is comparatively little walking in rural areas and alongside the faster roads which explains the predominance of the problem in urban areas. Because pedestrians are vulnerable to injury when struck even at low speeds by vehicles, the proportion of all injuries sustained by pedestrians that are fatal or serious is higher in urban areas than for say, occupants of cars who are protected by the vehicle shell itself. The proportion of pedestrian injuries which were fatal or serious in Northampton for the period we studied was 37 per cent which is somewhat higher than the national average of 27 per cent.

Crossing main roads is difficult for pedestrians of all ages with half of all injuries occurring there. These roads are especially difficult for those over the age of 60 years as nearly two-thirds of injuries to this group of people are sustained whilst crossing these busy roads. This age group tended to be more severely injured than would be expected from national figures with 57 per cent being killed or seriously injured on Northampton's roads. Up to the age of 60 years more males are injured than females of the same age.

Children and young persons between the ages of 5 and 15 years comprise 39 per cent of all pedestrian casualties. None was killed in the five year period studied but 89 were seriously injured. Whilst older pedestrians tend to be injured whilst crossing or walking alongside main roads, children of school age are injured closer to home with 68 per cent of their injuries being sustained on the residential roads. In this age group boys are injured more frequently than girls in a ratio of approximately three to two.

The fact that most walking is done close to home has already been discussed and in relation to this it is of interest to look at where the casualty was injured in relation to home to see whether the injuries occur on the very familiar streets close to home or on those some distance away. The young children were injured close to home with 80 per cent being injured within 1 km and over half injured within 400 metres. Older children venture further afield and this is reflected

in their injury pattern with 40 per cent of the 10-15 year olds being injured within 400 metres of home and two-thirds within one kilometre. The wide ranging 16-19 year olds tend to be injured at places more distant from their homes with only 17 per cent of casualties being within 400 metres of home. The older pedestrians have an injury pattern more like that of children with 73 per cent of casualties being within 1 km of home. These patterns are not surprising given where the walking is done and serve to reinforce the need for safe access to shops, schools and amenities for all age groups whether they live on a quiet or a busy road.

2.4 Pedestrian accident risk

Much is known about casualty rates and levels of risk for drivers and passengers of vehicles as estimates of distance driven or passenger kilometres have been collected for some time, for example as part of the National Travel Survey (DOT 1993a). These casualty rates are expressed per 100 million kilometres. The casualty rates in common usage for pedestrians is expressed in terms of per 100 000 population as no current measures of exposure exist for walks of all lengths on different types of road by people of different ages.

We have estimated that the residents of Northampton walk 133 000 km on an average day and cross some 636 000 roads. All this activity results in about 0.43 pedestrian casualties a day. Expressing this as a casualty rate gives 411 casualties per 100 million kilometres walked or 66 casualties per 100 million roads crossed. Whilst in reality it takes the people of Northampton nearly three years to walk this far it does provide a casualty rate which is expressed in similar terms to those for drivers and passengers of vehicles. For 1992 data the casualty rate per 100 million vehicle kilometres for bicycles was estimated to be 526 and for car drivers to be 34 per 100 million vehicle kilometres (DOT 1993b).

Estimates of the amount of walking indicate that females walk a greater distance and cross more roads whilst the casualty information indicates that males are injured more frequently than females. When the amount of walking is considered along with the number of casualties we find that females have a casualty rate of 263 per 100 million kilometres walked, or 54 per 100 million roads crossed while the corresponding rates for males are higher at 386 and 82 respectively.

The casualty rates per 100 000 head of population indicate that boys aged 5 to 15 years are about one and a half times more at risk of being injured as pedestrians than girls of the same age. When the amount of walking is taken into account we find that boys and girls up to the age of 9 years have similar casualty rates per kilometre walked but boys are one and a half times more likely to be injured when crossing the road.

Throughout adulthood up to the age of 64, females have lower casualty rates than males, the rate for young adult females being half that for males of the same age. Older female pedestrians are as much at risk as children aged 5-9 years when walking alongside traffic and about the same as 10-15 year old males when crossing the road. Older females are two and a half times more at risk of injury than males of the same age for the same distance walked or number of roads crossed.

Just over half the pedestrian casualties occur on the main roads in Northampton but they only account for about 20 per cent of the total length of roads in the Borough and only 16 per cent of the walking of Northampton residents is alongside these types of road. For all residents of households aged 5 years and over the casualty rate per head of population indicates that the average person is just over twice at risk on the main roads as on the residential roads. However, when exposure is taken into account the relative risk is more than six times for walking

alongside main road traffic and more than nine times for crossing a main road.

3 Towards a safer road environment

The findings of studies of pedestrian behaviour have implications for policy decisions at both national and local level in regard to the provision of education and training for all road users, for enforcement, for the design and layout of new roads in urban areas, and the improvement of existing roads both in terms of management of both traffic and pedestrians and in changes to the road environment itself.

The study reported here highlights the implications for education and training of people of all ages, especially the young and those who are responsible for their safety such as parents and guardians, teachers and school governors. Far too many children and young people are injured whilst they are crossing the road so the challenge is for educators, planners and road safety professionals to identify locations and behaviours which can be targeted for remedial treatment. That children are walking less is of great concern to those responsible for promoting healthy lifestyles and transport policies. Children should be encouraged to walk more but this can only be achieved if the environment is improved to make it both safer and less threatening for children and their parents.

The older pedestrian is seen to be almost as much at risk as children and this is also an issue which needs addressing by education and training. The older age group has for too long been left out of the planning process. The older end of this age group is dominated by women as they tend to live to a greater age than men. These women tend to be frail and liable to severe injury when struck by a vehicle. They are much less likely than average to have had a car or driving licence thereby making it important both to understand their mobility problems and to work with them to make their trips to the shops, post office and elsewhere safe and with reduced threat from fast moving traffic (Carthy et al 1995).

People do one seventh of their walking on footways with cracked paving or badly worn surfaces. This is not a reflection on Northampton in particular as most urban areas suffer similar problems. However, there are implications for the ease of mobility for older pedestrians and those with difficulties going out on foot. Department of Trade and Industry figures suggest that up to ten times as many people attend Accident and Emergency Departments of hospitals with injuries sustained in falls on the footways and other transport areas as are injured in road traffic accidents (DTI 1990). Whilst it was not possible in this study to calculate casualty rates other than for road traffic accidents, investigation of other aspects of pedestrian safety are important when considering the pedestrian environment in its wider sense.

It is not just the older and younger pedestrians who are at particular risk as the study has highlighted the young adults, especially males. How to reach this group poses a challenge to educators at both local and national level.

Besides the age and gender differences the most important finding to emerge, and perhaps the one with the most far reaching implications, is that of the high relative risk of injury on main roads compared with local distributor and residential roads. In turn, the local distributors carry a higher risk to pedestrians than the residential roads. The problem is complex due to the interplay of function and use of these roads in providing routes for traffic to gain access to the commercial centre and to move goods and people from one part of the town to another. This conflicts with the needs of pedestrians to be able to cross the road safely without needing to walk undue extra distance or incur undue delay. Sixteen per cent of the walking and fifteen per cent of the crossings produce nearly 50 per cent of the casualties. Those with responsibility for the safety of the road environment need to work closely with the educators and Police to understand more clearly how to reduce the conflict between pedestrian and vehicular movement on this type of road in order to reduce risk to pedestrians.

The large differences in risk of an accident in daylight and darkness point to the need for further work to be carried out to increase our understanding of the difficulties encountered in darkness both by pedestrians and by other road users.

The amount of walking at different distances from home can provide input to the discussion on how planners and those responsible for the safety of the road environment enter into dialogue with people about different road safety problems and possible solutions to them. People's perceptions of their environment may well differ depending upon how familiar they are with it, which in turn may depend on the amount of walking and social interchange with neighbours. More work is needed to understand how people relate to different road environments. In particular the requirement for safe access for women and young adults needs to be addressed because these are the groups who walk the greatest distances. Also highlighted is the need for young and older people to have good, safe access on foot to the public transport system because the young do not have access to their own independent means of transport, nor do many of the older people.

This study has made an important contribution to increasing the understanding of the patterns of walking of pedestrians of different ages and gender in different parts of the road environment. Its findings can contribute to the discussion about the direction of future research into pedestrian safety and provides more information than was hitherto available to input to policy decisions about the safety of the pedestrian environment.

The study also provides a methodology to enable comparative studies to be undertaken to enable an exchange to be made of more systematically collected information between regions or between countries. This in turn will enable good practice in relation to decisions about the pedestrian environment to be shared more widely and help us to put into perspective by the addition of exposure data the apparently poor pedestrian safety record in Great Britain compared with some other European countries.

4. Acknowledgements

The study was undertaken on behalf of the AA Foundation for Road Safety Research between December 1991 and April 1994. Mike Boyle and Brian Langer administered the study and Barbara Sabey was the Technical Adviser to the Foundation and her support, guidance and encouragement is recorded with thanks.

The text of this paper draws on material in the published report of the study and the contribution is acknowledged of the other authors; Julie Cave, Alan Morrison, Richard Allsop and Andrew Evans of UCL, and Carin Kuiper and Luis Willumsen of Steer Davies Gleave.

Special thanks go to the 1037 people of Northampton who gave their time to answer our interviewers' questions and who so conscientiously logged their pedestrian activity and to those who contributed in smaller ways by responding to our surveys.

Thanks are also due to the staff of Northamptonshire County Council, Northampton Borough Council, Northamptonshire Police, Nene College, Northampton General Hospital and to the interviewers who collected the household and personal walk information.

5 References

- Carthy, T. Packham, D. Salter, D. and Silcock, D (1995) *Risk and safety on the roads; the older pedestrian*, (AA Foundation for Road Safety Research, Basingstoke)
- Department of Trade and Industry (1990) *Home and Leisure Accident Research. Twelfth Annual Report: 1988 Data*, (Department of Trade and Industry, Consumer Safety Unit, London)
- Department of Transport (1993a) *National Travel Survey 1989/91. Transport Statistics Report*, (HMSO).
- Department of Transport (1993b) *Road Accidents Great Britain 1992*, (HMSO)
- Department of Transport (1995) *National Travel Survey 1992/94. Transport Statistics Report*, (HMSO).
- Hillman, M. Adams, J. and Whitelegg, J. (1990) *One False Move... a study of children's independent mobility*, (Policy Studies Institute, London)
- Oxley, P.R. (1993) Special needs: a fairer opportunity for mobility, in P Stonham (Ed.) *Local Transport Today and Tomorrow*, (Local Transport Today, London) 61-65.
- Ward H, Cave, J.A. Morrison, A. Allsop, R.E. Evans, A.E. Kuiper, C. and Willumsen, L.G. (1994) *Pedestrian Activity and Accident Risk*, (AA Foundation for Road Safety Research, Basingstoke)