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Identifying And Designing For The Needs Of Older Road Users

C Brace, R Elliman, M Page, L Rackliff, R Welsh, A Morris

Vehicle Safety Research Centre, Ergonomics and Safety Research Institute, Holywell Way,
Loughborough LE11 3UZ, UK www.esri.org.uk

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ABSTRACT

The number of older road users is continuously increasing over time. Whilst much research focuses on the likely impact on road safety, little work has been carried out examining the impact on older people themselves of their declining ability to cope with the road environment. Additionally, it is known that because of their increased frailty older drivers are more at risk of sustaining a fatal or serious injury than younger road-users. Consequently older people often feel pressured by family members, health practitioners or an increasing inability to deal with traffic conditions, into giving up driving in favour of some other form of transport. However, the subsequent effect of this may actually be to increase the risk exposure of older people. The aim of this study was to use an accident-independent approach to collect detailed information on the interaction between behaviour, perceived and actual risk and use of transport systems, using both quantitative and qualitative techniques. A focus group and interviews were conducted with older road-users to gain an initial insight into their experiences and perceptions of safety whilst using the UK road infrastructure (including roads, pavements, cycle tracks, pedestrian crossings etc.). Additionally, analysis was undertaken of UK exposure data and casualty rates for older road users. The qualitative and quantitative data sources were compared and contrasted. Older people felt at risk using the road system, and many of these perceptions were upheld according to the statistical reports. Not all of the issues raised by older road-users can be dealt with by improving design, but this study presents a set of recommendations, which, if implemented would increase the safety of all road users.

1. BACKGROUND

In common with much of the rest of Europe, the UK has an aging population; at present 20% of the UK population is over 60, but by the year 2031 it is estimated that this will be 30% of the population. As well as being greater in number, this generation of over-60s is likely to differ from past generations in the degree of car-dependency they exhibit, and the level of mobility they expect. According to the Department for Transport (DfT), there are approximately 2 million drivers over 70, but by 2015 there are expected to be over 4 million. Whilst much research focuses on the likely impact on road safety (specifically on the number of killed and seriously injured casualties) of this increase in older road-users, little work has been carried out into the impact on the older people themselves of their declining ability to cope with the road environment. There is much evidence to suggest that older road-users who continue to drive adopt coping strategies (such as larger gap-acceptance, increased following distance), but little evidence of the safety problems that arise when they choose walking or public transport-use instead. This may have serious implications for policy-makers. It is known that because of their increased frailty older drivers are more at risk of sustaining a fatal or serious injury than younger road-users (Lyman et al 2002).

The physical changes that occur as part of the ageing process may affect driving performance in many different ways. They include:

- Stiff joints & weak muscles, making it difficult to turn to look, to apply force to the brakes, or to manoeuvre the vehicle;
- Deteriorations in eyesight and hearing, loss of peripheral vision and medical problems such as glaucoma and cataracts;
- Dulling of reflexes and reduced attention span, leading to increased reaction times and difficulty processing information.

Many older road-users develop coping strategies to deal with these issues, such as limiting their driving to roads they know and allowing more space between themselves and other cars. According to DfT (2001) *"Older people who believe they are performing less well modify their behaviour in ways that, on the face of it, ought to reduce accident risk. For example, many older drivers reduce night driving"*. It is almost inevitable though that as their physical condition declines, drivers become faced with pressure to consider whether (or rather, when) they should retire from driving. According to DTLR (Noble, 2000): *"declining driving ability and financial constraints mean that many motorists will have to adjust their driving practices and probably ultimately give up their car"*. However, the lifestyle and expectations of the over-60s are changing. In the UK for example, there was a 600% increase in female drivers over 65 between 1965 and 1985 and a 200% increase in male drivers over the same period (DfT, 2001). According to the National Travel Survey (DfT, 2001), both men and women travelled more in 1995/96 than in 1985/86.

Therefore, preventing the elderly from driving does not, in itself, solve any of the problems. Mobility is important, not only for practical reasons (the necessity to buy food, attend doctors appointments for example) it has also been shown to be essential in maintaining good mental health. According to Marottoli et al. (1997): *"driving cessation was one of the strongest predictors of an increase in depression among older people"*. What is more, walking is at least as hazardous for the elderly as driving; estimates from the DfT suggest that the risk per distance travelled of being killed or injured is 15 times higher for pedestrians than for car drivers. According to Mitchell (2002): *"policies that cause elderly car drivers to become car passengers would, on current casualty statistics, increase road fatalities overall"*. It is not just the risk of being injured in a road accident that increases when older car drivers become older pedestrians; according to the DfT (2003): *"10 times as many people attend accident and emergency departments with injuries sustained in falls on footways and other transport areas as are injured in vehicle accidents"*.

Whilst there is much legislation governing the accessibility of some types of infrastructure (for example, Part V of the Disability Discrimination Act covers accessibility of vehicles such as buses, and facilities such as railway stations; DDA, 1995), there is less information about the physical features of the road infrastructure that are problematic for the elderly. According to the Association of British Insurers (2006): *"Society does not manage the transition from motorist to non-motorist in a consistent way.....More work needs to be done.. to identify drivers who ought to stop driving. And when they stop, people need to be provided with transport options and services that help to support their lifestyle and needs"*.

This work, carried out in the UK in 2006, assesses the evidence around the travel choices of older road-users, and identifies the implications for policy-makers of the increasing importance of this group over the next 10-20 years.

2. AIMS AND OBJECTIVES

The aim of this interview survey was to use an accident-independent approach to collect detailed information on the interaction between behaviour, perceived risk and use of transport systems, using both quantitative and qualitative techniques. The objectives of this study were to collect data on the impact on older people themselves of their declining ability to cope with the road environment and to identify the safety problems that arise when they choose walking or public transport-use as an alternative to driving. It was proposed to examine this data alongside quantitative figures to compare and contrast the perceived and actual situation for safety. A final objective was to suggest recommendations for improvements in design of transport systems.

3. METHODS

A preliminary focus group was conducted with older people (4 participants in total) to gain insight into the issues. The discussions were used to collect preparatory information on patterns of behaviour and transport use, informing the design of materials for the subsequent interview survey. The main part of the study involved semi-structured interviews with a further 13 older people, in their own homes or over the telephone. All individuals were frequent users of road infrastructure, either as pedestrians, and/or car occupants, and/or bus passengers. Participants were recruited through existing subject lists held by the researchers and through contacts within the local community and sampled according

to age and gender using estimated population figures from the UK. The research attempted to achieve a quota sample.

The interviews involved detailed discussion of the use of different transport systems and the reasons behind these choices as well as ascertaining changes in behaviour and the implications on the physical and psychological welfare of the individuals. In addition, participants' ability to carry out a range of daily activities were measured using a self-assessed functional ability questionnaire adapted from the modified Barthel Index (MMBI). Interviewees were briefed both verbally and in writing about the study prior to participation. They were informed that the discussions would consider use of a variety of transport systems. However, they were not given any further information prior to the discussion, to avoid leading responses in any particular direction. Each interview lasted approximately one hour, with the interviews conducted by three different researchers using the same brief. All individuals provided informed consent.

Associated with this qualitative component, data from national statistics were examined to consider actual risk to older people based on exposure and accident frequencies. Behaviour regarding transport use and perceptions of personal safety whilst using transport systems were summarised and comparisons made between qualitative and quantitative findings.

4. DISCUSSION OF RESULTS

4.1 Participant information

The sample comprised a total of 17 individuals, with a mean age of 72 years (standard deviation 7.3, range 61-83 years). The sample was split 82% female, 18% male. Although a wide age range of participants was recruited it should be acknowledged that it was not possible to attract members of the public who were so frail that they were unable or unwilling to participate in the study. The ACORN Profiling method was used to assess socioeconomic status, by using postcode data. The range of socioeconomic groups within the sample was generally good, although slightly biased towards affluence compared to the UK population data. The older participants generally had lower MMBI scores and were less mobile, although there was some considerable variation amongst the relatively small cohort as there is in the general UK older population.

4.2 Use of transport systems

Just over half (53%) of the sample were car drivers, and the majority of the participants were regular car passengers (88%). A high proportion (88%) of the individuals reporting using the bus network, and walking (88%). None of the individuals used motorcycles, one person used a bicycle, and one person reported using a scooter/buggy as transport. One third of the participants (30%) reported using the train and similar numbers used coach and taxi services (38% and 31% respectively).

Changes in transport use. Two thirds of participants in the study (n=13) reported that they had changed their behaviour with respect to transport use recently. Three individuals in the cohort had been put under pressure not to drive any longer due to reduced health and ability. The source of this pressure came from family members, doctors and police.

Perception of risk. A variety of issues were raised although a general theme emerged throughout: older people felt at risk using the road system, regardless of their road-user group. Although it was recognised that using the road environment had many benefits for maintaining levels of independence and social interaction, it was suggested by the cohort that the road environment is often poorly designed with respect to the needs and abilities of older road users. Examples were given in relation to design and location of pedestrian crossings, the texture and condition of pavements, design of filter lanes/merging lanes, and the positioning of signage. Furthermore, the pros and cons of using alternative (public) transport systems were identified by the participants. Additionally, members of the cohort described feeling vulnerable as a result of the behaviour of other road users including unsafe/improper use of the road environment and crime. It was suggested that as a result, older people become fearful of going out, and become isolated.

Actual risk. To compare perceptions against reality, an examination of data concerning casualty rates (DfT, 2004), exposure rates (DfT, 2001) and population data (ONS, 2006) was undertaken, in order to obtain casualty rates for miles travelled by different age groups in the population, Figure 1.

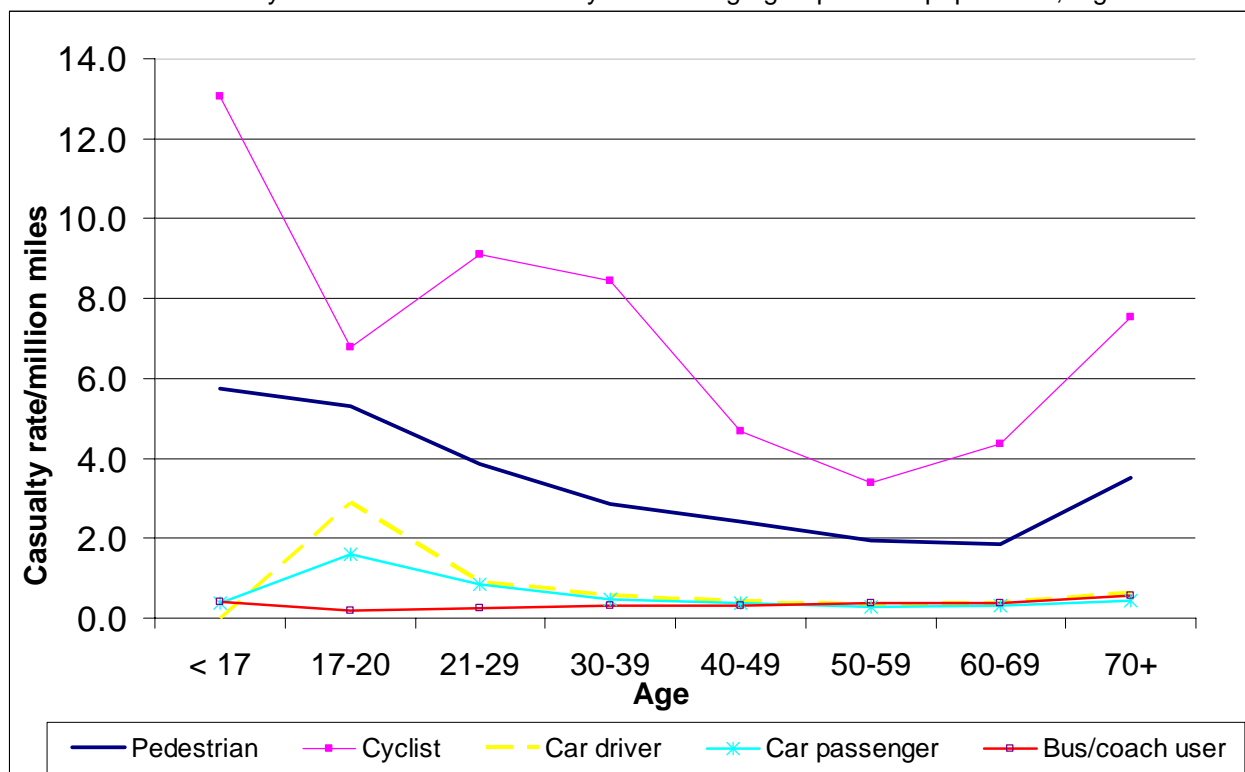


Figure 1. Casualty rates for miles travelled by different age groups in the population

The qualitative and quantitative findings of the study are discussed in the next sub-sections with each transport mode examined in turn.

4.3 Car users

The majority (11 out of 13) of the older road users interviewed stated the car as being their preferred mode of transport either as a driver or passenger because the car was seen as 'convenient', 'reliable' and 'safe'. However, many participants had either completely given up or limited their driving. This suggests that the car is an important means of transport for older road users but that for some driving has become less of an option.

Impact of giving up. None of the participants who were still driving (n=6) wanted to give up citing 'loss of independence and freedom' as a major factor in this reluctance: *"I would feel isolated if I didn't drive."* Those who had made the decision to give up driving for themselves appeared to be more content with this than those who had based their decision on the advice of a doctor or family member.

Opportunities to become a car passenger rather than the driver may help to reduce feelings of isolation but perhaps not for independence and freedom. For example one participant who had many friends and family members who could give her lifts still felt the loss of freedom:

"I'd like to be able to say I'll toddle off to [local town] ... but you can't do it you've got to await other people haven't you." Female, aged 83

However physical health and opportunities to conveniently use alternative modes of transport may limit the negative impacts of giving up driving for some older road users. One participant who lived in walking distance from the bus stops and a local supermarket commented *"We don't miss it [car] now do we... I think people probably make too much of a fuss if for any reason they can't drive."*

Reasons for giving up/limiting car use. Reasons for giving up/limiting driving included physical illness e.g. stroke, lack of confidence and pressure from other road users:

"I rarely do long journies now because I feel the pressure of the traffic." Female aged 68

Traffic issues were raised by many of the participants. The general perception was that traffic volume had increased, *"traffic today, there's far more of it"*, and that other drivers are more aggressive and want to travel faster: *"They've just got to get past you"*. This may also contribute to reduced confidence amongst older road users.

Perceptions of personal safety whilst travelling as a passenger in other people's cars, particularly those of friends and family, were raised. The responses were variable and dependant on their perceptions of each driver's competency. According to Evans (1988) the threat to other road users posed by the elderly increases only slightly for the over 70s compared to the average. That increase is vastly over-shadowed by the risk to other road-users posed by the under 25s. The accident rate of drivers over 70 remains lower than that of drivers under 30 (Rabbitt et al, 1996). This is aligned to the casualty rates based on exposure (Figure 1), as there is no trend to demonstrate that older car users are more likely to be casualties than other age groups within the population.

Travelling in taxis was generally perceived as a negative experience. Only three of the participants stated that they used taxis, with one participant commenting that she would not be happy to use one at night. The focus group also identified a number of disadvantages of using a taxi including difficulties with getting in and out of the vehicle, not being able to hear/understand the driver, with another citing the expense as a disadvantage.

Coping strategies. A number of coping strategies had been adopted by the participants who drive in order to help reduce the impact of the above traffic issues on their driving. For example, taking a friend as a passenger, driving more slowly, taking more time at junctions, avoiding the rush hour, and not driving in the dark. Another coping strategy which was employed was to take an alternative mode of transport, e.g. service bus, in order to avoid problems such as difficulties in parking.

Road infrastructure issues. Road infrastructure changes may have a particular impact on older drivers. For example one participant stated that she didn't use the signs in familiar environments and that *"first times in a new place are always a bit awkward"*. Another participant stated that she gets so *"geared up"* that when she negotiates a particular roundabout she *"always [does] something wrong"*. She suggests that the reason for this is a change in road layout completed a number of years previously which increased the number of exits and therefore choices. Another problem identified was the size of writing on country road sign posts. One participant felt under pressure whilst trying to read road signs which were *"not large enough"* to be read whilst travelling at the speed limit.

4.4 Using the bus network

Within this small sample, the bus was reported to be used predominantly for getting into town/city centres, as it was a way of avoiding parking problems and being delivered directly to the centre of an urban area. However, it was also reported that the bus service was used for commuting, shopping, getting to social occasions, and for travelling to hospital appointments, dependant on route, locality and personal circumstances. A clear motivator for using the bus which results in increased use is the bus pass which enables discounted fares, an obviously strong benefit to older people. Other reasons for using the bus were due to changes in personal circumstances: *"I use it now my husband has died."*

Design features. The interviewees explained that the recent design improvements to the public transport infrastructure, including low floor buses and the raised kerbside shelter areas, were generally very beneficial in allowing access and egress from buses. However, individuals with particular limitations on their mobility still experienced difficulties with general design of the bus infrastructure system:

"I've not been on a bus since [the accident]. I've not tried – because of physical issues – getting on and off... and the bus drops you a distance from where you want to go. It's too painful for me to walk too far." Female, aged 67

Steps inside the bus can also be difficult due to reductions in mobility, balance, and visual acuity.

Driver behaviour. One of the biggest problems with travelling on the bus was described as the driver accelerating before the passengers have been able to sit down and the sudden acceleration and deceleration experienced during the journey. Such behaviour by the driver was deemed unacceptable by the interviewees due to the safety issues resulting:

“Safety – [the bus drivers are] brake and accelerator boys – if I find that the driver is one then I won’t get up until it’s time to get off the bus. When get on the bus – some drivers will wait for you to sit down before they leave but not many – I guess they have to stick to the schedule.”

“I won’t use buses on my own – they start up before I sit down...my balance isn’t so good.”

[Sudden stopping] "I'm not so good on my legs."

Vision, vestibular sense, speed of reaction, proprioception, neuromuscular control and muscle strength are all involved in postural stability. Normal ageing is associated with deterioration in these adaptation processes, resulting in postural instability. Deterioration of balance is often reported to be one of the major contributing risk factors to falling in older people (Tinetti et al 1995), and can be exacerbated by external sources, e.g. sudden movements when in a moving vehicle. Due to the frequently turbulent ride, even when seated, it was questioned as to *“Why don’t they have seat belts in buses like they do in cars?”*. Research examining public service vehicle accident records has demonstrated that older people are often injured on buses due to loss of balance caused by driving style (Kirk et al, 2003). However, the casualty rates based on exposure (Figure 1), do not show a trend to demonstrate that older bus/coach users are more likely to be casualties than other age groups within the population. This may be due to the source of the data; it is likely that the casualty figures do not reflect the full number of casualties on buses/coaches. This is because many of the injuries will not be reported to the police (the source of the data) and, potentially, because the injury outcomes may be more serious than first recorded due to the higher chance of complications suffered by an older, frailer individual after a comparatively minor injury.

Infrastructure issues. Other problems with the bus network included: having to alight or change buses when crossing city and county boundaries, poor punctuality of bus services (especially waiting which results in the individual having to stand for long periods at inadequate bus stops/shelters), the time consuming nature and lack of directness of some routes. Additional personal safety issues raised included: using the bus network at night or in the dark, and buses ‘mounting the kerb’ in narrow streets: *“Buses mount the pavement to get past each other as the road isn’t wide enough.”*

4.5 Walking

The changes in flexibility, strength, posture, gait and pain are influenced internally by biological aging and disease. These factors can also be influenced by functional changes in the lifestyles of older people. It was reported that walking was not as widespread amongst the participants as they grew older, due to these issues.

Design features. Dropped kerbs were reported to be enabling for people with reduced mobility and users of aids for ambulation. However, there were some difficulties experienced with crossing roads, regarding the motorists not giving way at allocated crossings, including the willingness of cars to wait for people to cross when the lights have changed, crossings having technical faults, and feeling vulnerable when crossing the road. These difficulties resulted in the development of a variety of coping strategies: *“I don’t cross at the zebra crossing because then I can wait til there is no traffic and cross when I want compared to getting the traffic to stop, as sometimes they don’t.”* Uneven or poorly maintained ground surfaces, and carrying shopping and other heavy bags were reported as problematic with respect to balance. Cars parked on the pavement or other obstructions, e.g. overgrown trees/shrubbery, caused problems for older pedestrians, particularly when the pavement is narrow or a walking aid is being used (as more width is required to ambulate). Often this results in an individual having to walk in the road:

“Have to walk on the road quite often as the hedges are overgrown and you’d walk into them otherwise, as you need space for the person and their stick!” Female, age 83

Personal safety. The participants also reported feeling that their personal safety was at risk whilst walking next to busy roads and during the hours of darkness (due to crime). These feelings of anxiety

are aligned to the casualty rates based on exposure (Figure 1), as there is a trend demonstrating that from age 70 upwards, there is a marked increase in casualties for exposure rates than between the ages of 30-69 years within the population.

4.6 Cycling

Only one participant rode an electric bike. He was happy riding it but felt that there could be more cycle paths in his area. A few participants had ridden a bike in the past but no longer do so. One reason given was a feeling of vulnerability because of the amount of traffic on the roads. These feelings of nervousness are allied to the casualty rates (Figure 1), as there is a trend demonstrating that from age mid-60s upwards, there is a marked increase in casualties for exposure rates compared to casualty rates between the ages of 40-69 years within the population.

5. RECOMMENDATIONS

5.1 Proposed improvements in design of transport systems

A socially inclusive society is one with sustainable communities and a good quality of life for its members. Work, health, shopping and leisure activities are some of the factors which can affect our quality of life, and transport is a key element in our ability to access these. Different sections of society have differing travel needs, some of which may depend on physical mobility, and have varying access to different modes of transport, such as cars and public transport. Access to public transport networks needs to be as good as possible to enable larger numbers of the population to easily use them, in order to maintain mobility for as long as possible to avoid feelings of depression, isolation and increased health problems. It is clear that a big issue for the bus safety of older people is that of driver behaviour, e.g. driver making sudden manoeuvres, accelerating/braking clumsily, parking at bus stops inappropriately. Additional issues raised were those of reliability, cleanliness, efficiency, and safety of buses and bus shelters. The term 'service' to passengers means the complete package: timing, routes, cleanliness and safety of vehicles, information and staff attitudes (DfT, 2005). Staff attitudes are an important part of the overall package and, if it is poor, it is yet another hurdle to using public transport. Therefore, direction should be given to examining the reasons for these attitudes and changes made accordingly. Whilst the percentage of older people casualties is low (Figure 1) and analyses of exposure indicate that bus travel is one of the safest modes of transport (Kirk et al, 2003), these proposals for change should make local bus transport even safer. Recent experience in the UK indicates that the public has a keen awareness of the safety of public transport and an expectation of very high levels of safety if they are to use public transport. Furthermore, as this study shows, if new low floor buses make travel more viable for less physically mobile passengers it is important to make sure that these people are not suffering injuries inside the vehicle, which will make the overall proportion of bus casualties higher (Kirk et al, 2003).

It is recommended that feedback is given to older road users based on fact if their perceptions are flawed. For example, the statistics examined in this study suggest that older road users are more at risk of injury when walking and cycling compared to the other modes of travelling. Additionally, it is clear from this small study that older people (and potentially other age groups of the population) have inconsistent ideas about safety. For example, coping strategies are developed to attempt to increase safety, but individuals may be putting themselves more at risk of injury/accident, e.g. an individual avoids motorway driving as they think motorways are more dangerous to drive on than other road types, although this is actually incorrect.

The availability of driver retraining strategies, e.g. SAGE – Safer Driving with Age (<http://www.wiltshire.gov.uk/road-safety-driver-training>), needs to be increased and more widely publicised so that larger number of older people who feel vulnerable behind the wheel can benefit from useful safety measures. These retaining initiatives can be linked in with health checks, e.g. eye tests, to ensure that those individuals who are increasing the risk on the roads can be recognised. Such programmes could also assist older drivers with the understanding and more proactive use of the active safety systems that are frequent in new vehicles.

5.2 Recommendations for further investigation

We must recognise that older road users are not one homogenous group with respect to strength, mobility, fitness etc. and further work needs to be done to fully understand the needs and requirements of this diverse group. We need to continue the research efforts that are being conducted towards designing passive safety systems to incorporate older road users' anthropometrics, whilst considering the behaviours of this group, e.g. are older people more likely to drive older or smaller vehicles? As well as considering the physical attributes of older road users, we must also examine and reflect on the multiple socioeconomic issues including family circumstances, social status and income, which impact on transport use.

An accident does not always equal a casualty. Research is needed to examine accident rates and road user group by age, and examine accident causation to establish if there are any specific issues for older road users, e.g. pedestrians hit by cars at crossings because these systems are not designed with adequate time for crossing to be undertaken by an individual with reduced mobility. Additionally, older people may travel few miles but within many frequent, short trips compared to younger people. Therefore, further analysis needs to be completed to examine the type of miles travelled, for example, it is known that the majority of RTAs occur in close proximity to home. By examining accident causation in detail, and combining this information with an understanding of the functional limitations and difficulties experienced by a large proportion of the older population, appropriate countermeasures can be developed. By designing for older and disabled people, road infrastructure and transport systems can be inclusive, and safety can be improved for all members of society.

6. REFERENCES

- Association of British Insurers (ABI) (2006). Older drivers: Road safety, mobility and insurance. ABI.
- Disability Discrimination Act (DDA) (1995). Available from:
<http://www.opsi.gov.uk/acts/acts1995/1995050.htm>
- Department for Transport (DfT) (2001). Focus on Personal Travel 2001 (including the report of the national travel survey 1998/2000). The Stationary Office, London.
- Department for Transport (DfT) (2003). Older pedestrians. RS Research Report No 37, DfT.
- Department for Transport (DfT) (2004). Road Accidents Great Britain, 2004. TSO, London, www.dft.gov.uk
- Department for Transport (DfT) (2005). Customer Care and Corporate Culture in Public Transport, http://www.dft.gov.uk/stellent/groups/dft_mobility/documents/pdf/dft_mobility_pdf_033886.pdf
- Evans (1988). Older driver involvement in fatal and severe crashes. *Journal of Gerontology*, 43, 186-193.
- Kirk A, Grant R and Bird R (2003). Passenger Casualties in Non-Collision Incidents on Buses and Coaches in Great Britain. Proceedings of the 18th International Technical Conference on the Enhanced Safety of Vehicles, US Department of Transportation, National Highway Traffic Safety Administration, ESV 2003, Nagoya, Japan, 19-22 May, 2003, 10 pp, [CD-ROM].
- Lyman, S, Ferguson, S, Braver, E, Williams, A (2002). Older driver involvements in police reported crashes and fatal crashes: trends and projections. *Injury Prevention*. 8 (2), 116-120.
- Marottoli R et al (1997). Driving cessation and increased depressive symptoms: prospective evidence from the New Haven EPESE. *Journal of the American Geriatrics Society*, 45 (2), 202-206.
- Mitchell C (2002). Older People and Road Safety: Dispelling the Myths, *World Transport Policy & Practice*, Vol 8, No 2, 2002, pp. 17-26.
- Noble B (2000). Travel characteristics of older people. *Transport Trends*. DTLR.

Office for National Statistics (ONS) (2006). 2001 Census data,
<http://www.statistics.gov.uk/census2001/census2001.asp>

Rabbitt P (1996). When and why older drivers give up driving. AA Foundation for road safety research, Basingstoke, UK.

Tinetti ME, Doucette JT and Claus EB (1995). Contribution of predisposing and situation risk factors to serious fall injuries. *Journal of the American Geriatrics Society* 43:1207-1213.