26th Australasian Transport Research Forum
Wellington
New Zealand
1-3 October 2003

OLDER PEOPLE'S TRAVEL PATTERNS & TRANSPORT SUSTAINABILITY IN NEW ZEALAND CITIES

Dr Carolyn O'Fallon
Pinnacle Research

Dr Charles Sullivan
Capital Research

ABSTRACT

It is common knowledge that the "older" population segment, meaning those over the age of 60, is rapidly increasing as a proportion of the overall population within New Zealand. What is not known, however, is their effect on transport sustainability, particularly the growing problem of emissions and other environmental and health concerns. Are their average annual kilometres travelled per person increasing? What could their contribution be in 5 or 10 years time? Is there a need, apart from safety reasons (due to infirmity for example), to modify their car use? What is the best means to do so?

Recent Australian projections suggest that the combined impact of more older people, a higher proportion of seniors with licences (especially women), and increasing kilometres travelled can have surprisingly dramatic effects on outcomes. For example, the potential for a 175% increase in fatal and serious injury crashes has been found (Richardson & Bell, 2001).

We have used data from the 1997/1998 New Zealand Travel Survey (Land Transport Safety Authority) and the 2001 Census (Statistics New Zealand), to identify the current and potential future patterns of transport, in particular by private motor vehicle, of the older population segments in New Zealand. Having developed a basic understanding of how this population travels, we report on:

- Contrasts with the travel behaviour of younger New Zealand adults (in the three largest urban areas)
- Whether there is a need to influence or change their car use
- What impacts any policies or actions (such as peak time charging mechanisms, increased parking charges, etc) taken by government may have on their ability to move around
- What policies or actions may best be targeted to this group of people.

1. INTRODUCTION

Between 1901 and 1999, the number of people over 65 has increased fourteen-fold, from 31,000 to 446,000 (Statistics NZ, 2000). As a share of the overall population, this represents an increase from 4% to 12%. The 15-64 year old portion of the population has remained at around 65%, whereas the proportion of those under 15 has fallen to 23% from 33% in 1901.

By 2051, older people are projected to make up 25.5% of the total New Zealand population. This growth will occur at the "expense" of both the child population (under 15) and other adult population (15-64). For example, the 15-64 population is expected to have a net increase of 308,000 between 2001 and 2051 while, during the same time period, the 65+ population will increase by nearly 800,000 to 1.22 million (Statistics NZ, 2002).

What are the implications of this shift in population composition for transport sustainability? Apart from accident risk analysis (see for example Keall and Frith's paper at this conference), very little or no study of older people's travel patterns has occurred in New Zealand. We do know that the older population has quite different socio-demographic characteristics compared to the remainder of the adult population: there are "marked" differences in the gender ratio, marital status and household composition, income, employment, and geographical distribution (Statistics NZ, 2000).

Overseas studies of older people's travel patterns have found that, over time, the numbers of retired people holding drivers licenses and continuing to drive until much older ages has increased (see for example, Burkhardt, 1999; Rosenbloom, 2001a; and Tacken, 1998). The studies have also described general travel characteristics of the 65+ age group: fewer trips per day (and decreasing even further with greater age), shorter trip legs, fewer total kilometres traveled per day, and a focus of trip purpose on social/recreational, shopping and personal business rather than work-related (Burkhardt, 1999; Coughlin and Lacombe 1997; Metz 2000; Rosenbloom, 2001a; Tacken, 1998). Most often the purpose of these studies has been to raise issues associated with the safety and access requirements associated with the increased older population (ECMT, 2002; OECD, 2002) or the impact of decreasing mobility / ceasing driving on their quality of life (Burkhardt, 1999; Coughlin and Lacombe, 1997; Metz, 2000; Rosenbloom 2001b).

Very few studies address the potential contribution of the increased elderly population to traffic congestion and environmental issues associated with urban centres. In one study that does this, Rosenbloom (2001a) discusses environmental implications (along with the safety risks and the impact of losing mobility) of greater numbers of older drivers undertaking more shorter trips. Considering possible policy options to alter older drivers' behaviour, she concludes that the "most promising" options are technological improvements to make the car "cleaner and safer"; providing "responsive" public transport; and to enhance the livability of communities and neighborhoods (to reduce the need to drive).

Using data from the 1997/98 New Zealand Household Travel Survey (NZTS) for the three main urban centres (Auckland, Wellington, and Christchurch), we have undertaken an initial investigation to describe the characteristics of the older people's (60-64, 65+) travel patterns compared with the general adult population (25-59). We separated the

60-64 year olds from the general adult population and the older population as this group appears to be transitional between the two others. As we are particularly interested in car use, we excluded the 15-24 year old group, because although they are able to hold a driver's license, proportionately they do very little driving. Based on the characteristics analysed, we discuss the contribution of the older population to current traffic congestion, how managing traffic congestion will impact on this population, and provide a preliminary assessment of possible policy tools that may alter their travel patterns (where it appears to be desirable).

2. METHODOLOGY

We extracted from the 1997/98 New Zealand Household Travel Survey data concerning the three largest urban areas in New Zealand (Auckland, including Waitakere City, North Shore City, and Manukau City; Wellington, including the cities of Upper Hutt, Lower Hutt, and Porirua; Christchurch). There are three reasons for this focus: firstly, two-thirds of the older population live in the major urban areas; secondly, these are the areas in New Zealand with the greatest congestion problems and most extensive public transport (PT) networks; and, finally, these cities are also the ones for which we recently completed stated choice studies. Only data from respondents completing all travel survey interview forms was used.

In total the dataset concerns 27,164 trip legs made by 2696 respondents (1419 in Auckland, 520 in Wellington, 757 in Christchurch). The age grouping of the respondents is shown in Table 1. Each respondent answered questions concerning two consecutive travel days.

Table 1 Total number of respondents in dataset (unweighted counts)

		Total	Auckland	Wellington	Christchurch
Age (in years)	25-59	2136	1128	435	573
	60-64	153	84	25	44
	65+	407	207	60	140
	Total	2696	1419	520	757

The analysis focuses on "trip legs" or "trips" rather than a "trip chain" (Rutherford et al. 1997) or "journey" (NZTS). A "trip leg" (often reported simply as a "trip") is recorded each time travel is interrupted, whether it is to drop off / pick up someone, buy a newspaper, change modes, etc. Rutherford et al. (1997) review several international studies and concluded that a useful definition of a "trip chain" is that it may include one or several "trip legs" and is "broken" when an individual remains at a stop for 90 minutes or longer. By contrast, the NZTS definition of a journey makes no reference to how long an individual remains at a stop, instead it only allows changing modes as the identifier for an incomplete trip chain. Future work will include a substantial effort to re-define the NZTS dataset to create the ability for trip chain analysis.

Although the current NZTS dataset is now reasonably "old" (being compiled in 1997/98), note that the survey is in the process of being established as a continuous survey from 2003, so that analysis at this stage will provide a useful reference point for future monitoring of travel pattern trends.

3. ANALYSIS

Our analysis contrasts older people's (60-64 and 65+) patterns with general adult population (25-59) travel behaviour in order to assess what if any actions may need to be taken by policy makers to manage older people's travel behaviour. The following sections describe the results of this comparative analysis.

3.1. DEMOGRAPHICS AND OTHER PERSONAL CHARACTERISTICS

As mentioned in the introduction, the older population differs from the general population in a number of ways, including:

- Increasing disparities in the ratio of women to men, as women have lower mortality rates and live longer than men. In the NZTS sample, there are approximately 50:50 women to men under 65; in the 65+ group the ratio is 60:40.
- Smaller household sizes among the elderly compared with the general population: in the 65+ group, one-third live in single person households, compared with 7% in the 25-59 age group and 19% in the 60-64 age group; in the 65+ group, only 11% live in households of three or more, compared with 65% of the 25-29 group. Nearly one-half (48%) of the 65+ group live as married or defacto couples; in the 60-64 group, it is 53%.[1]
- Very few of the older population are in the paid work force, whether casual, part or full time (6%), contrasted with 80% of the 25-59 age group. By the age of 60, the "wind down" in employment is occurring: only 39% are in any form of paid work.
- Complementing the low employment rates, the personal and household incomes of the older population are much lower than the general population. In the 60-64 and 65+ age groups, 62% and74 % of individuals, respectively, earn less than $20,000 per year compared with 32% in the 25-59 age group. In terms of household income (adjusted by household size using the Jensen equivalence scale), 58% of the 65+ group earns less than $30,000 per annum and a further 20% earns $30,000-60,000. this is contrasted with the 25-59 age group, where 31% earn $30,000-60,000 and 32% earn $60,000 or more per annum. The 60-64 age group is somewhere in between the two – 41% earn less than $30,000, and 27% earn $30,000-60,000. However, note that older people are often found to be relatively "asset rich" despite being "income poor" because they more often have mortgage free houses.
- There is less ethnic diversity in the 65+ age group, which has a higher proportion of Europeans than the general population.

Given these dramatic differences in the socio-demographic characteristics of the older population compared with the general adult population, it is not surprising to find they also have quite different travel behaviour, as we discuss them below.

3.2. VOLUME OF TRAVEL

Before focusing on the different structure of travel between the age groups, we summarise the main differences in the volume of travel.

To quantify the total travel of interest, taking into account both the number of trip legs and distance, we calculated a total daily distance using "surface transport" for each

[1] Because of the straightforward descriptive objectives, the substantial sample size, and the generally large size of important differences found such as those above, this paper dispenses with formal tests of significance as being more irritating than useful.

respondent. "Surface transport" excludes air travel (which is not of interest given our focus on urban congestion) and walking (because the distances for walking are not present in the database supplied). We also excluded the small number of other trip legs with distances 60 km or more. This was not just because extreme values might have a misleading impact on means calculated, but also because trip legs of this length will usually involve travel outside the three main urban areas under study[2]. Table 2 shows that older people travel distinctly less, no matter whether one looks at the number of trip legs, the typical distance per trip leg, average distance per day using "surface transport" or average distance per day driven.

Table 2 Volume of travel

	25-59	60-64	65+
Unweighted sample size	*2136*	*153*	*407*
Number of trip legs (mean per day per respondent)	5.4	4.6	3.1
Distance, excluding walking (median km **per trip leg**)	4.6	3.7	3.0
Distance using surface transport, excluding walking and trip legs 60+ km or more (mean km / day per respondent)	32.0	25.3	13.2
Distance driven (mean km / day per licensed driver)	31.5	23.4	13.8

Table 3 shows a comparison of data from the 1989/90 NZTS with the 1997/98 data. The total number of driver trips and the total annual distance driven by the 65+ age group has increased significantly, particularly with respect to women over the age of 65. This finding is in line with other "European" countries (see for example, Rosenbloom 2001a, Tacken 1998).

Table 3 Total driver trips and annual distance driven by 65+ age group (national estimates)

	Total	Male	Female
Total driver trips (in millions)			
4 1989/90	174.5	121.2	53.3
4 1997/98	268.7	164.8	103.8
Annual distance driven (in 100 million km)			
4 1989/90	10.4	7.9	2.5
4 1997/98	18.8	12.7	6.1

Part of the explanation for the nearly doubling of driver trips and annual distance driven by women over 65 is explained by the dramatic change in driver's license holding by this population group that has occurred in those seven to eight years – Rosenbloom (2001a) reports that in the 65+ age group, 81% of men and 50% of women held driver's licenses in the 1989/90 NZTS database. By contrast, in the 1997/98 NZTS, the comparable figures are 90% and 80% respectively. However, this does not explain the huge increase in vehicle kilometres driven by older men.

But what will happen in the future with respect to older driver's volume of travel? There are conflicting views about this. Some researchers suggest that the vehicle kilometres traveled and total kilometres traveled per day will carry on growing (see for example Rosenbloom, 2001a). However, where there is more historical data available, Tacken (1998) found that the growth in the number of trips for the 65+ group in the Netherlands has stabilized over the past 15 years. He postulated that this is due to relatively low

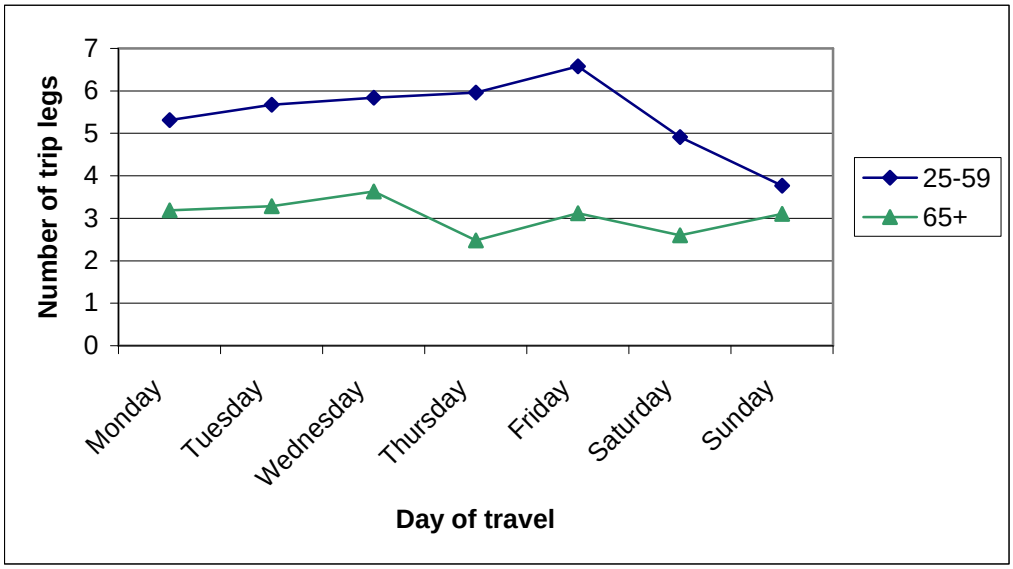
[2] Note that fewer than 1% of the non-walking trip legs had distances greater than 60 km, and a number of these trip legs involved air transport.

increases in incomes creating greater pressure on expenditure, a situation very similar to that in New Zealand. Once NZTS data is collected on a continuous basis, it will become easier to establish on-going trends.

3.2.1. Number of trips

As noted in Table 2, older people make fewer trips *per day* than either of the 25-59 or 60-64 age groups. Figure 1 reveals that their *pattern* of trip-making also differs from these groups, in that the 65+ age group has a much "flatter" trip-making pattern, averaging between 2.5 and 3.6 trips per day, whereas the means for the general adult population (25-59) range between 3.8 and 6.6.

Figure 1 Number of trip legs per person by day of travel and age group



Note: The 60-64 age group is omitted from this graph because the base sample size is statistically too small when split by day of travel.

People over the age of 65 are far more likely stay at home on any given day than other adults. Table 4 shows that only 56% of older adults made trips on both days of their trip diary, compared with 86% of the 25-59 age group and 77% of the 60-64 group. Fully 17% of the 65+ group stayed home on both days compared with only 3% in the 25-59 age group.

Table 4 Propensity to stay at home on travel day - by age group

		Total	25-59	60-64	65+
	Unweighted Count	*N=2696*	*N=2136*	*N=153*	*N=407*
Stayed in same place on one or both travel days	Stayed home on both days	5.5%	2.9%	7.4%	17.3%
	Stayed home on 1 day	14.0%	11.3%	15.3%	26.6%
	made trips on both days	80.6%	85.8%	77.3%	56.1%
Total		100.0%	100.0%	100.0%	100.0%

The propensity of older people to stay at home more frequently (that is, not travel on any given day) mirrors the same tendency found in the US (Metz 2000) and the Netherlands (Tacken 1998).

3.3. TRIP PURPOSE

Not surprisingly, there are significant differences in the purpose of trips by older people relative to the general adult population. Trips to work or (own) education are reduced to 2% of all trips, compared with 21% for the 25-59 age group. The 60-64 age group is clearly already transitioning to "retirement", insofar as only 14% of their trips are to work or education. Employment status information confirms this: only 2% of the 65+ age group are in full time employment, compared with 62% of the 25-59 group and 26% of the 60-64 age group. Nearly one-half (49%) of the 60-64 group is retired or an aged pensioner while 94% of the 65+ group is. This pattern may have changed somewhat in recent years because of the increased age of eligibility for superannuation.

Table 5 shows that work and education trips are replaced with shopping, personal business and social / recreational trips.

Table 5 Purpose of trip leg by age group

		Total	25-59	60-64	65+
	Unweighted Count	*N=27017*	*N=22977*	*N=1458*	*N=2582*
Destination/purpose of trip leg (compressed)	Home	28.9%	28.4%	28.3%	33.7%
	Work/education	19.1%	21.3%	14.1%	2.4%
	Shopping	12.9%	12.0%	16.0%	18.7%
	Personal business/services	6.4%	5.9%	7.0%	10.3%
	Social/recreational	15.3%	14.4%	19.8%	21.1%
	Change mode	8.5%	8.8%	7.2%	6.7%
	Accompany somebody else	8.9%	9.2%	7.7%	7.1%
Total		100.0%	100.0%	100.0%	100.0%

3.4. TIME OF TRAVEL

The bulk of trips by older people (59%) start between the hours of 9:30 a.m. and 3 p.m., compared with the 25-59 age group who make nearly 50% of their trips in the two "peak periods", that is before 9 a.m. and between 3 p.m. and 6:30 p.m., and only 39% of their trips between 9:30 a.m. and 3 p.m.

Evening travel (after 6:30 p.m.) is significantly lower for the 65+ age group (6% of trips compared with 14% of the 25-59 age group).

3.5. TRIP MODE

Overall, 72% of all trip legs by older people are in a passenger vehicle, slightly less than the approximately 76% of the two younger groups. However, the mix of trips (i.e. vehicle driver vs. vehicle passenger) differs considerably when considering the 25-59 and 65+ groups. Table 6 shows that over 63% of trips by the former are as vehicle driver while just 53% of the 65+ age group trips are as vehicle driver.

The 65+ age group have a higher proportion of walking and cycling trips than the other age groups, possibly reflecting the relative cost of these modes compared with driving in addition to the shorter distances they often travel.

Table 6 Trip mode share by age group

		Total	25-59	60-64	65+
	Unweighted Count	*N=27027*	*N=22987*	*N=1458*	*N=2582*
Travel mode	Vehicle driver	63.4%	64.6%	62.2%	53.0%
	Vehicle passenger	12.5%	11.6%	14.5%	18.9%
	Walk	20.5%	20.1%	20.8%	23.8%
	Bus & train	2.1%	2.1%	1.8%	1.6%
	Cycle	.7%	.6%	.5%	1.6%
	Other	.9%	.9%	.1%	1.1%
Total		100.0%	100.0%	100.0%	100.0%

A closer look at the data for the main travel modes (vehicle driver, passenger and walking – see Table 7) reveals that it is primarily women who change their mode use after the age of 65. The proportion of male trips as drivers shows very little variation between the 3 age groups (ranging between 69 and 72%), while trips by women drivers decrease from a high of 58% (25-59 year olds) to 39% (65+). Likewise, the share of male trips as "vehicle passenger" is relatively constant, at around 6-7%, while for women, the vehicle passenger trips increases from 17% in the younger age group to 30% in the 65+ group. The mode share for walking shows much greater variation for women than men, with older women having a higher proportion of walking trips than either younger women or men.

Table 7 Trip mode share by age group and gender

		Total		25-59		60-64		65+
			F	M	F	M	F	M
	Unweighted Count	*N=27027*	*N=12259*	*N=10728*	*N=811*	*N=647*	*N=1261*	*N=1321*
Travel mode	vehicle driver	63.4%	57.5%	72.0%	55.3%	69.9%	38.5%	68.9%
	passenger	12.5%	17.1%	5.9%	21.3%	6.9%	29.7%	7.1%
	walk	20.5%	22.1%	18.0%	19.8%	21.9%	27.5%	19.7%
	other	3.6%	3.2%	4.0%	3.5%	1.3%	4.3%	4.3%
Total		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

3.6. VEHICLE TRIP CHARACTERISTICS

3.6.1. Number of household vehicles

Given that they have smaller household sizes, it is not surprising to find that adults aged 65+ have fewer cars per household than do other households – for example, 53% of the older adult households have only one vehicle compared with 27% of the 25-59 age group. (Note that 33% of the 65+ households comprise one adult, compared with 7% in the 25-59 age group.)

It is more relevant to consider, therefore, the ratio of vehicles to adults in a household as is shown in Table 8. Generally speaking, as the age of the adults in the household increases, the ratio of vehicles to adults decreases. While 41% of the 65+households still have one car per adult, 30% have one vehicle per couple (1:2 ratio). This compares with 55% of 25-59 year olds having a 1:1 ratio and 15% having a 1:2 ratio. The younger age group is far more likely to have a ratio of greater than one vehicle per adult in a household (17% compared with 7% of 65+).

Table 8 Ratio of vehicles to adults in household by age group

		Total	25-59	60-64	65+
	Unweighted Count	*N=2696*	*N=2136*	*N=153*	*N=407*
Vehicle:Adult ratio in household	<0.5	9.3%	7.3%	12.4%	18.2%
	0.5	17.1%	14.6%	13.6%	30.3%
	0.51-0.99	5.8%	6.4%	4.0%	3.7%
	1	52.5%	54.5%	58.0%	41.3%
	>1	15.2%	17.2%	12.0%	6.5%
Total		100.0%	100.0%	100.0%	100.0%

3.6.2. Vehicle occupancy

Older drivers tend to make as many "driver only" trips as do any other age group (around 65% of all vehicle trips). However, they make appreciably more trips with exactly 2 people in the vehicle (including the driver) – 31% compared with 22% in the 25-59 age group and 21% in the 60-64 age group. In comparison, the younger age groups make significantly more trips with 3 or more people in the vehicle (15% compared with 4%).

These trip-making habits clearly reflect both the smaller household sizes (generally limited to one or two adults with no children) and the lower vehicle ownership rates of the older population.

3.6.3. Parking

Given the different destinations typically sought by the 65+ age group compared with the general adult population, there is surprisingly little variation in the parking places used by the different groups.

4. IMPLICATIONS FOR TRANSPORT POLICY DEVELOPMENT

Our analysis demonstrates that the older population group (65+ years old) has quite different travel patterns compared with the younger adult population of 25-59 years. The 60-64 year old age group is clearly "in transition" – presumably from full time employment to retirement – and their travel patterns differ from both the younger and older population groups. While these differences are not much of an issue currently in terms of traffic management – the 65+ age group only undertook 8% of the trip legs in the 1997/98 database – this will change dramatically over the next 50 years as the older population group comes to form a much greater proportion of the total New Zealand population (estimated to be 26% in 2051 compared with 12% in 2001).

The travel patterns of older New Zealanders are similar to those found in other countries such as the UK, Netherlands and the US. Specifically, compared with younger adults (25-59), this group:

- does fewer trip legs per day
- makes shorter trips
- travels fewer vehicle kilometres per day or year
- makes most trips with the purpose of social / recreational / personal business (i.e. not work or education)

In addition we found that, contrasted with the younger generation, older New Zealanders tend to:

- have more "at home" days than the general population
- make a higher proportion of their trips as a passenger in a vehicle and fewer as driver
- make most of their trips between 9:30 a.m. and 3 p.m. (although just over one-third of the 65+ trips are made during the morning and afternoon peak periods)
- make fewer trips in the evening / nighttime.

The growth in the 65+population segment, coupled with their different travel patterns, has some implications for policy development in the transport sector. The OECD (2002) and ECMT (2002) reports provide a solid basis for addressing the *safety* issues and possible mechanisms or tools to address these. The discussion here is focused on issues associated with traffic management, congestion and environmental impact.

On the whole, the 65+ age group contributes less to traffic congestion than any other age group as most of them (65%) occur outside of the peak periods, either in the middle of the day or evening. Indeed, travel by the older population comprised only about 6% of the total trip legs made in the morning peak, and less than half of these were as "vehicle driver". A significant proportion (29%) of the 65+ trip legs were walking in this period. The growth in the 65+ age group will undoubtedly result in some increase in their contribution to peak period traffic (given the relatively low growth rates projected for the 15-64 age groups), but the modal share and trip purposes would not be expected to shift dramatically – unless specific policies force them to.

We examine various policy tools for addressing traffic management (particularly alleviating congestion) and environmental impacts separately below.

Cordon tolls
The implementation of morning peak period cordon tolls to reduce congestion is likely to have little effect on older drivers (given the timing of their trips). Few of their trips (9%) in the morning peak are to work or education, thus implying that they have some flexibility to change the timing of the trip or, in some cases, the destination, to avoid being charged.

Electronic road user charges
If electronic road user charges were introduced as a means of reducing all vehicle kilometres traveled (as opposed to affecting only travel in the peak periods), it could strongly affect older people's travel patterns, given their lower incomes. Because of the shorter distances driven, the actual amount of road user charges paid per individual by people over the age of 65 would be less than for younger adults (25-59), although such charges could have a much greater fiscal or economic impact on the older population. At the same time, given their shorter trip lengths – and in the absence of physical or other disability – it is conceivable that suitable alternatives to driving a car may be found (such as walking or public transport). However if disability is an issue, such charges could result in social exclusion for the people or households affected by the charges.

Parking mechanisms
Parking mechanisms, such as metered or time restricted (i.e. for a maximum time period) parking at strategic shopping or leisure/recreation destinations or parking surcharges for car parking lots or buildings, have been used to reduce the traffic flows to congested urban areas. The impact on older drivers of such measures will depend on the flexibility they have to choose their destination – for example, a trip to a specialist or library may not be able to be re-located, while a shopping trip could be. Where there was no alternative destination or that alternative was located further away, this could impose economic hardship on the older driver.

Constraining the availability of parking spaces may have an impact on the ability of an older person to access services and activities as well, given that older people are far more likely to experience difficulties in moving about.

Ridesharing and high occupancy vehicle (HOV) lanes
Overall, vehicle occupancy by the 65+ age group is similar to that of the general adult population. However, attempts to increase ridesharing or carpooling, either through ridesharing programmes or construction of HOV lanes, are not likely to significantly alter this group's travel patterns, principally because of the nature of the trips being made and their typically smaller households. To be effective, ridesharing requires "habitual" trip patterns, with large groups of people travelling to a common destination and sharing a similar timetable (Department for Transport, 2002). Generally, work or education trips fit this definition (particularly in terms of the volume of people regularly travelling to a location) more closely than most of the personal business, leisure, sporting and recreational activities being undertaken by older people. This is not to say that informal carpooling will not occur for travel to and from particular social activities. Higher vehicle operating costs (i.e. electronic road user charging) could possibly encourage ridesharing as a means of reducing their impact.

Improved vehicle technology
The shorter distances traveled per trip leg by older adults raises the concern that, due to a greater number of "cold starts" and ownership of older vehicles[3], this population segment may be creating more than their "fair share" of vehicle air emissions as well as using more fuel. Rosenbloom (2001a) suggests that improving vehicle technology is an important factor in overcoming these concerns. Alternatively, encouraging even more walking (remembering that this population segment already has the greatest proportion of walking trips), and more use of public transport (could be productive as a means of replacing energy inefficient, high emissions short trips. Public transport use might be encouraged by improving service frequency, physical access, and/or personal security, as well as through education programmes.

Improved public transport services
The 65+ age group uses public transport (PT) marginally less often than the general adult population, for less than 2% of its trips. The decline in PT use possibly stems from a number of factors:

[3] This is speculation on our part as we did not have access to data to assess the average age of vehicles owned by age group. We assumed, given the income constraints of the retired population, that they would generally own cars that were at least the average age (10.7 years) of the total NZ vehicle fleet (LTSA 2000). However, even if the older population owned relatively new vehicles, i.e. vehicles with advanced catalytic converters, their propensity to make short trips would mean that the converters would be unlikely to get "hot" enough to function properly.

- lessening ability to physically access the service (i.e. climb/descend stairs, walk to the bus stop)
- traveling largely in off-peak when services are less frequent
- destinations (social or recreational) may not be on the "service route"
- need to be certain of arriving at appointments on time.

PT often becomes an inexpensive travel option, as many councils offer substantial fare discounts to older users. Older users may also have more flexibility to schedule some of their activities to take into account PT timetables. Logically, these factors should make PT an attractive alternative to driving a car. The current low use of PT demonstrates that this is not the case, as driving, being a vehicle passenger and walking are much-preferred modes. Simply providing additional services or greater frequency may not be adequate to encourage greater PT use. Exploring the issues associated with PT use by 65+ is a potential area for future research.

5. CONCLUSIONS

We have used data from the 1997/1998 New Zealand Travel Survey (Land Transport Safety Authority) and the 2001 Census (Statistics New Zealand), to contrast the travel patterns of older New Zealanders (60-64 and 65+) with younger adults (25-59) in the three largest urban areas. We confirmed that the travel behaviour of the older age group is similar to that found in other countries: they make fewer trips, travel shorter distances, stay at home for the day more often, travel more in the daytime and during off-peak periods, and have different trip purposes (i.e. not work). Our analysis also showed that there has been a significant change in licence holding and amount of travel over an eight year period and that the 65+ age group is expected to increase significantly in the next fifty years (from 12% of the population to 25%).

Putting safety concerns to one side, we considered congestion and environmental management issues associated with this growing population segment. While older people do travel during peak periods, it is to a far lesser extent than other population segments, is less dependent on the private passenger vehicle (i.e. more walking and passenger travel) and generally for other purposes (not work or education). This implies that traffic management tools, such as tolls and parking mechanisms, designed to discourage car use at these times may not highly impact the older population. At the same time, given their low share of the traffic stream, if older people do shift their trip time or travel mode, it will not have a large impact on congestion. Given their lower income, electronic road user charges may have a much greater effect on the 65+ population than the general population.

The propensity of older people to make shorter trips creates a concern about their potential contribution to environmental degradation. Technological innovation and mechanisms to encourage the use of alternative transport modes appear to be the best option for addressing this.

There seems to be little opportunity for formal rideshare programmes for the elderly as their destinations are largely unsuitable and/or disparate. Public transport seems a good option for older people given its low cost (due to subsidies) and their apparent flexibility

in scheduling activities. However, other factors may be inhibiting its use and these could be worth exploring further.

Other areas for further research include the extent to which older people are "flexible" in their ability to schedule activities and the potential for alternative modes such as mobility scooters or neighbourhood car sharing programmes.

ACKNOWLEDGEMENTS

The authors gratefully acknowledge the financial assistance provided by the Foundation for Research Science and Technology without which this project, as part of a larger research programme, could not have been undertaken. We also acknowledge and thank the many "end user" collaborators who helped us to focus our research programme into the areas of greatest interest. The LTSA, particularly Bill Frith and Lynley Povey, are thanked for providing the NZTS 1997/98 dataset together with help on its use.

REFERENCES

Benekohal, R.F., Michaels, R.M., Shim, E. and Resende, P.T.V. 1994. Effects of ageing on older drivers' travel characteristics. *Transportation Research Record* 1438: 91-98.

Burkhardt, J.E. 1999. Mobility Changes – their nature, effects, and meaning for elders who reduce or cease driving. *Transportation Research Record* 1671:11-19.

Coughlin, J.F. and Lacombe, A. 1997. Ten myths about transportation for the elderly. *Transportation Quarterly* 51(1): 91-100.

Department for Transport. 2002. *Making travel plans work – lessons from UK case studies*. UK: Department for Transport.

European Conference of Ministers of Transport. February 2002. *Transport and Ageing of the Population*. ECMT, Europe.

Keall, M.D. and Frith, W.J. 2003. Older driver crash rates in relation to type and quantity of travel. In Proceedings: 26th ATRF, 1-3 October 2003, Wellington, New Zealand.

Land Transport Safety Authority. 2000. *Travel survey report 1997/98: increasing our understanding of New Zealanders' travel behaviour.* Land Transport Safety Authority, Wellington, New Zealand.

Metz, D.H. 2000. Mobility of older people and their quality of life. *Transport Policy* 7:149-152.

OECD. 2001. *Ageing and transport – mobility needs and safety issues.* OECD, Paris, France.

Richardson, A.J. and Bell, D.A. 2001. A simulation of traffic crashes into the 21st century. In Proceedings: 24th ATRF, October 2001, Hobart, Australia.

Rosenbloom, S. 2001a. Sustainability and automobility among the elderly: an international assessment. *Transportation* 28: 375-408.

Rosenbloom, S. 2001b. Driving cessation among older people – when does it happen and what impact does it have? *Transportation Research Record* 1779: 93-99.

Rutherford, GS, McCormack, E and Wilkinson, M. August 1997. Travel Impacts of Urban Form: Implications from an analysis of Seattle area travel diaries. *Final Report from Urban Design, Telecommuting and Travel Forecasting Conference: Summary, Recommendations and Compendium of papers.* Accessed on 26 July 2002 from: http://tmip.fhwa.dot.gov/clearinghouse/docs/udes/ .

Statistics New Zealand. 2002. 2001 Census Snapshot 9: Older people. Accessed from: http://www.stats.govt.nz/domino/external/pasfull/pasfull.nsf/web/Media+Release+2001+Census+Snapshot+9+Older+people?open on 29 May 2003.

Statistics New Zealand. 2002. Projections Overview. Accessed from: http://www.stats.govt.nz/domino/external/web/prod_serv.nsf/htmldocs/Projections+Overview on 18 July 2003.

Statistics New Zealand. January/February 2000. Key statistics: Population ageing in New Zealand. Accessed from: http://www.stats.govt.nz/domino/external/web/prod_serv.nsf/htmldocs/Population+ageing+in+New+Zealand+-+article on 29 May 2003.

Tacken, M. 1998. Mobility of the elderly in time and space in the Netherlands: An analysis of the Dutch National Travel Survey. *Transportation* 25: 279-393.