

## **Trends in older New Zealanders' travel patterns**

Carolyn O'Fallon, Pinnacle Research & Policy Ltd, Wellington  
Charles Sullivan, Capital Research, Wellington

**Keywords:** aged, household travel, New Zealand, older people, travel behaviour, travel survey, trend

### **Abstract**

Our earlier study of older people's travel patterns using the 1997/98 New Zealand Household Travel Survey was updated with a comparative analysis using the recently compiled 2004–07 Ongoing New Zealand Household Travel Survey dataset.

We found that older people (60+) travelled distinctively less than the general adult population (aged 25–59), whether one looked at the total or mean number of trip segments per day, the typical distance per trip segment, mean distance per day using 'surface transport' or mean distance per day driven. The total number and mean number of trip segments and distances travelled declined steadily across the age groups (25–59, 60–64, 65–74 and 75+).

Between 1997/98 and 2004–07, the 60+ age group increased their volume of travel considerably, especially driver trips (from 174.5 million per year to 364 million) and distance driven (from 1040 million km to 2500 million km). Older drivers (60+) formed a significantly higher proportion of the vehicle traffic stream (18% compared with 15%) in 2004–07. As the mean distance driven per day per person did not change significantly for older drivers, the increased share of the traffic stream appeared to result from the greater number of older drivers.

### **Background**

Using data from the 1997/98 NZHTS for the three main urban centres (Auckland, Wellington and Christchurch), O'Fallon and Sullivan (2003) did an initial investigation to describe the characteristics of the older people's (60–64, 65+) travel patterns, based on trip segments (also known as 'trip legs'), compared with the general adult population (25–59). We made limited comparisons with the 1989/90 Household Travel Survey results, as we had to rely on the published report (Ministry of Transport 1990) and were not able to generate analysis specifically related to older people's travel.

Subsequent to our original study, in October 2004<sup>1</sup>, the Minister of Transport observed that there had been a 66% growth in the number of drivers aged 80+ since 1999. Statistics NZ projected that the overall population of people aged 65+ will increase from around 450,000 in 2001 to 580,000 in 2011 and to 1.32 million by 2051 (a 190% increase over 2001). The increase in the 65+ population has generated interest in understanding their transport requirements and travel patterns or behaviour. For example, The Office for Senior Citizens commissioned the report *Coping without a car* (Davey 2004) which explored how people over the age of 75, who no longer had access to a car (for various reasons) managed their transport needs.

Given the trend towards an overall older New Zealand population and the uncertainty around their behaviour, we updated our 2003 study with a comparative analysis of older people's travel patterns using the recently compiled 2004–07 Ongoing NZHTS database (ONZHTS). The complete report is published elsewhere (O'Fallon and Sullivan, 2009a).

## The New Zealand Household Travel Surveys

The NZHTS was established as a continuous survey in 2003. Within the continuous survey, people in approximately 2200 households in 280 meshblocks<sup>2</sup> throughout New Zealand are invited to participate in the survey each year. Each person in the household is then visited and interviewed about all their travel for two consecutive days specified by the interviewer. As has been the case for the 1989/90 and 1997/98 surveys, surveying takes place throughout the year, and every day of the year is included in the sampling, thus addressing potential seasonal bias. Day 1 begins at 4 am and Day 2 ends at 3.59 am. In the continuous survey, a 'complete' dataset representing all of New Zealand is compiled every four years.<sup>3</sup>

To enable comparison with the results of the earlier travel surveys, essentially the same questionnaire and response coding was used in the continuous survey as in the 1997/98 and 1989/90 surveys. Minor changes were made to update wording and response categories. One improvement made for the 2004–07<sup>4</sup> survey is that laptop computers were used by interviewers to improve data quality and reduce the time required for the interviews.

## Precision and statistical significance of results

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<sup>1</sup> [www.beehive.govt.nz/release/older+driver+licensing+review+announced](http://www.beehive.govt.nz/release/older+driver+licensing+review+announced)

<sup>2</sup> The meshblock is the smallest geographic unit for which statistical data is collected and processed by Statistics New Zealand. A meshblock is a defined geographic area, varying in size from part of a city block to large areas of rural land. Each meshblock abuts against another to form a network covering all of New Zealand ([www2.stats.govt.nz](http://www2.stats.govt.nz)).

<sup>3</sup> Further detailed information about the continuous survey can be obtained from the Ministry of Transport website [www.transport.govt.nz/ongoing-travel-survey-index/](http://www.transport.govt.nz/ongoing-travel-survey-index/). Information about the 1997/98 NZHTS is recorded in Land Transport Safety Authority (2000).

<sup>4</sup> We have labelled the dataset collected between 1 July 2003 and 30 June 2007 as the '2004/07 dataset', referring to the *end* of the data collection year (which matches the New Zealand Government's financial year, 1 July – 30 June).

At the time of our analysis, the Ministry of Transport was reviewing margin of error estimates for the ONZHTS in general, and we see extending such complex statistical analysis to all results in a report such as this one as beyond the scope of this project. Hence we developed a pragmatic rule of thumb for checking on differences highlighted in the text of this report. We compared the published margin of error estimates for trip segments in the 1997/98 NZHTS with simplistic margin of error estimates that ignore the complex sample design of the survey (ie, by assuming a simple random sample). In short, these comparisons led us to multiply such simplistic estimates by a design factor of 2 (for both 1997/98 and 2004–07 results) as a tolerably conservative<sup>5</sup> way of deciding which differences to highlight as statistically significant. Where we describe a difference as ‘significant’, this indicates that we have examined the relevant confidence interval or carried out a formal hypothesis test (using the conventional 95% confidence level). We have also reported a few differences without comment – ie, as if they are significant – that fall slightly below this level (but no lower than a design factor of 1.2) where the difference is supported by other evidence (eg similar patterns in related age groups or similar Statistics NZ (2000 and 2007) results).

## **Findings from our original study**

In our original analysis, we separated the 60–64 year olds from the general adult population and the older population because this group appeared to be transitional between the two others as 39% of the 60–64 year old group was in paid employment (compared with 80% of the 25–59 and 6% of the 65+ groups). The difference in employment status had an impact on purpose, length and timing of trips. As we were particularly interested in car use, we excluded the 15–24 year old group, because although they are able to hold a driver’s licence, proportionately they do very little driving. The resulting paper was presented at the Australasian Transportation Research Forum in Wellington (September 2003).<sup>6</sup>

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<sup>5</sup> Design factors (ie, the ratio of observed standard errors for a variable to the standard errors that would be obtained from a simple random sample of the same size) can vary quite a lot between results within the same survey. In the comparisons we made, the design factors ranged from 1.0 to 2.1 with an average of 1.5; this justifies our description of using 2 as conservative. (Some readers may be more familiar with the closely related term ‘design effect’ rather than ‘design factor’; the design factor is simply the square root of the design effect.)

<sup>6</sup> In the same year, Davey and Nimmo (2003) prepared an unpublished scoping paper for the New Zealand Land Transport Safety Authority (now New Zealand Transport Agency), using the 1997/98 NZHTS dataset, which focused on the travel behaviour of those aged 65+ in five-year age groups. Our study updates and expands on the analysis contained in their scoping paper.

Generally, our findings were not overly surprising, insofar as the travel patterns of older New Zealanders were found to be similar to older people in other countries such as Australia (Melbourne and Sydney), the United Kingdom, the Netherlands and the United States (Rosenbloom 2001; Tacken 1998). Rosenbloom and Waldorf (2001) reported on the importance of the passenger vehicle as a mode of transport for older people, stating that 80% of all trips in the 1995 United States Nationwide Personal Travel Survey were made by car, either as passenger or driver. All older groups were found to drive for at least one-half of their trips, and walking was the next most important mode of travel after driver and vehicle passenger trips (Rosenbloom and Waldorf 2001). Morris et al (2006) reported that results from the Melbourne Victorian Activity and Travel Survey for 1994–1999 show similar travel patterns for people over the age of 65. We determined that this behaviour was mirrored by older respondents in the 1997/98 NZHTS.

In addition, we found that, compared with younger adults (25–59), the older age groups:

- did fewer trip segments per day
- made shorter trip lengths
- travelled fewer vehicle kilometres per day or year
- made most trips with the purpose of social/recreational/personal business (ie, not work or education).

However, comparing the 1989/90 NZHTS data with the 1997/98 data revealed that the total number of driver trips and the total annual distance driven by the 65+ age group had increased markedly in those eight years, particularly for women aged 65+. This finding is in line with other Westernised countries.<sup>7</sup> We were able to partly explain the nearly doubling of driver trips and annual distance driven by women over 65 as being due to a dramatic change in driver's licence-holding by this population group between 1989/90 and 1997/98. Specifically, Rosenbloom (2001) reported that, according to the 1989/90 NZHTS database, 81% of men and 50% of women in the 65+ age group held driver licences. By contrast, in the 1997/98 NZHTS, the comparable figures were 90% and 80% respectively. However, this did not explain the huge increase in vehicle kilometres driven by older men.

This raised serious questions about what older driver's volume and patterns of travel would be like in future. We found conflicting views about this. Some researchers suggested that the total vehicle kilometres travelled and kilometres travelled per person per day would carry on growing ad infinitum (see for example Rosenbloom 2001). However, Tacken (1998), with more historical data available, found that the growth in the number of trips for the 65+ group in the Netherlands had stabilised over a 15-year period. He suggested that this was due to relatively low increases in incomes creating greater pressure on expenditure.

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<sup>7</sup> See for example: Rosenbloom 2001 and Tacken 1998.

Even if the vehicle kilometres travelled and total kilometres travelled per person does level off, it is likely that New Zealand will experience an overall growth in travel by older people, simply as a result of their population increase.

## Older people's population and demographic characteristics

Demographically, the number of people aged 65+ in the New Zealand population has grown by 31% since 1989/90 (when the first household travel survey was completed) (Statistics NZ 2000 and 2007). Since 1997/98, there have also been significant increases in:

- the driver licence-holding rates among the older population and older women in particular;
- the mean ratio of vehicles to adults (in all age groups); and
- the employment rates of those aged 60–64 and 65–74.

All of these factors have undoubtedly influenced the travel patterns of the older population. For example, women aged 65+ living alone did 11% of their trip segments as vehicle passengers in 2004–07 compared with 38% for those in households with another adult (ie aged at least 19). Comparable figures for men over 65 varied much less (5%, 7%). Table 1 shows that licence-holding rates of older women in 2004–07 were still much lower than those of younger women (eg, 61% in the 75+ age group compared with 91% in the 25–59 age group), with the result that fewer trips as vehicle drivers were undertaken by women aged 75+ (42% compared with 64% for women aged 25–59).

**Table 1 Car driver licence-holding by age and gender**

Year	Total	25-59		60-64		65-74		75+	
		F	M	F	M	F	M	F	M
1997/98 (N=8983)	89.5%	90.4%	96.1%	84.2%	94.8%	75.0%	92.4%	51.8%	76.8%
2004-07 (N=9274)	90.5%	90.7%	95.4%	87.2%	97.5%	82.9%	93.3%	61.0%	83.1%

The ratio of vehicles to adults was significantly higher in 2004–07 than in 1997/98 (mean of 0.98 cf.0.88;  $t= 6.96$ ,  $p<.001$ ). This increased mean was also detectable for those aged 65+ (0.78 cf. 0.71;  $t=2.19$ ,  $p=0.03$ ).

## Trends in older people’s trip segments

### Older people continue to travel less than younger adults

Older people travel distinctively less than the younger adult population (aged 25–59), no matter whether one looks at the total or mean number of trip segments per day (refer Figure 1 below), the typical distance per trip segment, average distance per day using ‘surface transport’ or average distance driven per day. The total number and mean number of trip segments and distances travelled declined steadily across the age groups (25–59, 60–64, 65–74 and 75+), with the 75+ age group undertaking the fewest trip segments and travelling the least kilometres of all the groups.

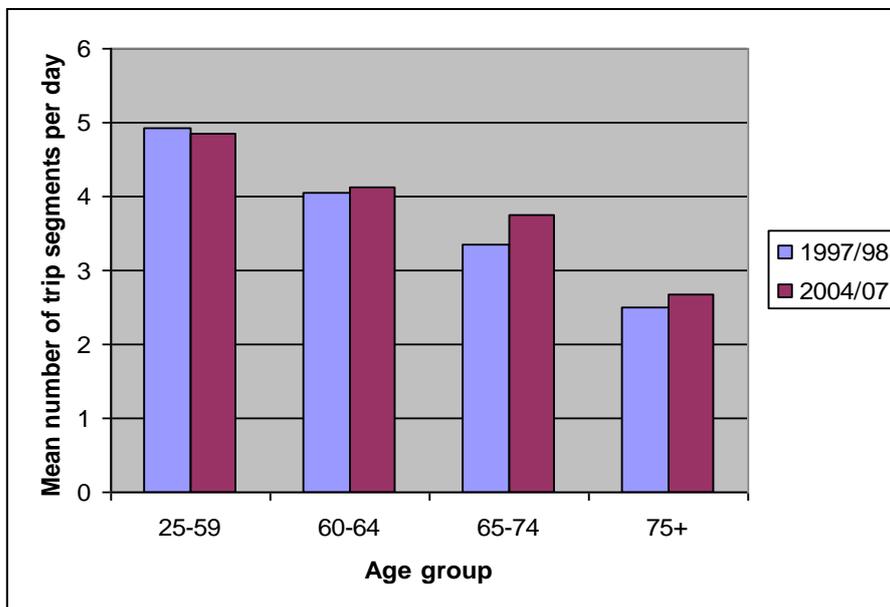


Figure 1 Mean number of trip segments travelled per day per respondent by age group (1997/98 and 2004–07)

As can be seen in

Table 2, when considering the adult population aged 25+, older people made a significantly<sup>8</sup> greater share of trip segments in 2004–07 compared with 1997/98 (20% compared with 18%). The proportion of trip segments made by respondents aged 75+ was basically unchanged (4% in 1997/98 and 5% in 2004–07), despite their growth as a population segment.

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<sup>8</sup> For significance testing of mode share percentages (and other later results based on the ratio of two estimates), we have approximated the standard error (SE) through use of the relative standard error (RSE). The RSE expresses the standard error as a percentage of the estimate:  $RSE\% = (SE/estimate) \times 100$ . The formula to approximate the RSE of a percentage formed from the ratio of two estimates is:  $RSE(x/y) =$   . Australian Bureau of Statistics (2007, pp 42–43) provides further details and a worked example of this method.

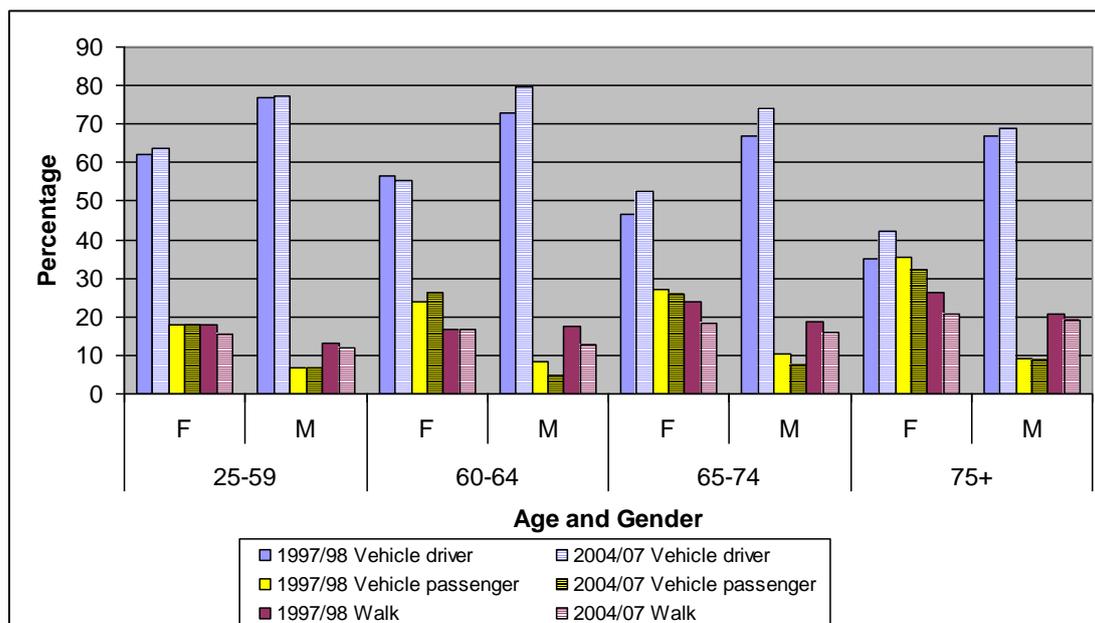
**Table 2 Share of all trips made by age group (1997/98 and 2004-07)**

Age group	1997/98	2004-07
<i>Unweighted respondent count</i>	<i>N=81336</i>	<i>N=81892</i>
25-59	82.5%	80.1%
60-64	5.1%	6.4%
65-74	8.3%	8.6%
75+	4.2%	4.9%
<b>Total</b>	<b>100.0%</b>	<b>100.0%</b>

### Older women continue to have different travel patterns to older men

As Figure 2 shows, it was mainly older women whose mode use varied after the age of 65. The proportion of male trips as drivers showed limited variation, ranging from 69% to 80% in 2004–07, between the four age groups (25-59 years; 60-64; 65-74; and 75+). In 2004–07, the proportion of trips for which women drove decreased sharply from 64% (25–59 year olds) to 42% (75+). Women age 75+ were vehicle passengers for 32% of trips compared with 9% for men of the same age. As can be seen in Figure 2, these travel patterns are little changed from 1997/98.

Gender differences for walking were less pronounced. All groups showed some decline in the proportion of walking trips (as a share of all trips made) between 1997/98 and 2004–07. Cycle and public transport trips were too small to be split into age groups and gender differences without impractically large margins of error.



**Figure 2 Comparing proportion of trips by mode (vehicle driver, vehicle passenger, and walking), age group and year (1997/98 and 2004–07)**

Our analysis supported the qualitative research findings of Davey (2004), who explored how people aged 75+ met their transport needs once they no longer had access to a car. She found, as we did (see Figure 2 above), that 'lifts' (or being a vehicle passenger) and walking trips became more predominant in terms of mode share. Another 'way in which older people without transport cope is to stay at home more' (p 20) as is illustrated in Table 3, which looks at the propensity for older people to not have travelled on either one or both of the travel days they completed ONZHTS travel diaries. Non-licence holders were far less likely to have travelled on both travel days in 2004-07 (30.3% compared with 63.2% of licence-holders).

**Table 3 Tendency for 75+ age group to stay at home on one or both travel days by driver licence holding rate (2004–07)**

	Hold car licence	Don't hold licence
<i>Unweighted respondent count</i>	<i>N=672</i>	<i>N=275</i>
Stayed home on both days	10.4%	35.6%
Stayed home on 1 day	26.3%	34.0%
Made trips on both days	63.2%	30.3%
<b>Total</b>	<b>100.0%</b>	<b>100.0%</b>

### **Older *drivers* are increasing their volume of travel**

Although they travelled less than the general adult population (aged 25–59), older people as a group significantly increased their volume of travel, especially their driver trips and distance driven, between 1989/90 and 2004–07. Older *drivers* (60+), formed a significantly higher proportion of the vehicle traffic stream in 2004–07 than they did in 1997/98 (18% compared with 15%), although older age groups still made fewer of their trips as 'vehicle driver' than did 25–59 year olds.. As can be seen in

Table 4, driving trip segments increased from 174.5 million per year to 364 million, while the distance driven increased from 1040 million km to 2500 million km. The increased trip segments and distance driven is only partially explained by the 31% growth in population shown in Table 5.

**Table 4 Total driver trip segments and distance driven by 65+ age group (national estimates)**

	Total	% increase from previous household travel survey	Male	Female
<b>Total driver trips (in millions)</b>				
1989/90 <sup>9</sup>	174.5	--	121.2	53.3
1997/98	270	54.7%	165	105
2004-07	364	34.8%	214	150
<b>Annual distance driven (in 100 million km)</b>				
1989/90	10.4	--	7.9	2.5
1997/98	18.7	79.8%	12.7	6.2
2004-07	25.0	33.6%	15.8	9.2

**Table 5 Aged 65+ population (Census statistics, 1991, 1996, 2006 – source Statistics NZ 2007)**

	Population	% increase from previous Census
March 1991	379,767	
March 1996	422,667	11.3%
March 2006	495,603	17.3%

### Older people continue to make most of their trips in the ‘off-peak’

Older adults (60+) undertook 20% of all trip segments by adults aged 25+ in the 2004–07 dataset. Looking at the time of day, we found that older adults (60+) were (relatively) less likely to be travelling after 6.30 pm, when they made 13% of all trips by adults aged 25+. Adults aged 25–59 made 87% of the trips in this time period. Older adults had a greater share of the ‘traffic’ stream in the 9.01 am to 3 pm time period, when they made 25% of all the trips by adults. The presence of older adults in the morning (up to 9 am) and evening (3.01 to 6.29 pm) peak periods was much lower, being 13% and 18% respectively.

In 1997/98 and 2004–07, over 60% of trips by people 65+ started between the hours of 9.01 am and 3 pm. In contrast, just over 40% of trips by adults aged 25–59 started then (see **Error! Reference source not found.3.6**). In line with their much greater participation in the work force in recent years, the 60–64 age group had a larger portion of their trips in the morning (up to 9 a.m.) and afternoon (3.01 pm to 6.29 pm) peak periods (40% in 2004–07 compared with 36% in 1997/98).

<sup>9</sup> 1989/90 figures are taken from Ministry of Transport, 1990.

**Table 6 Leaving time of trip segments by age group (2004-07)**

Leaving time	Total	25-59	60-64	65-74	75+
<i>Unweighted segments</i>	<i>N=81,892</i>	<i>N=62,658</i>	<i>N=5636</i>	<i>N=8662</i>	<i>N=4936</i>
Up to 9 am	17.3%	18.7%	14.4%	11.9%	7.9%
9.01 am to 3 pm	44.6%	41.5%	49.5%	57.5%	66.3%
3.01 pm to 6.29 pm	26.3%	27.0%	25.8%	22.9%	20.8%
6.30 pm onwards	11.8%	12.8%	10.4%	7.7%	5.0%
<b>Total</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>

Approximately 63% of the public transport trips by people aged 65+ started between 9.01 and 3 pm.

### Other findings

In comparing 2004–07 with 1997/98, we also found that:

- Mean surface kilometres travelled (by vehicle driver, vehicle passenger, walk, cycle and bus passenger) per day per person increased in all four age groups analysed, but not to a statistically significant degree.
- The median and mean trip segment length were shorter for the older age groups.
- All age groups were more likely to have travelled on both travel days (in 2004–07 compared with 1997/98), although the proportions were still less in the older age groups.
- Significantly more people aged 65+ in one-adult households travelled on both travel days (60% compared with 48%), whereas those aged 65+ living in two-adult households showed no change.
- People aged 60–64 and 65–74 made more trips for ‘work/education’ purposes (although the numbers involved are too small to reach statistical significance).
- Vehicle availability continued to be much lower for those aged 75+: in 2004–07, about one-quarter (24%) of the oldest age group, 75+, did not have any vehicles in their household, compared with 7% of 65–74 year olds and 5% of 25–59 year olds.

## **Basic results from trip chains and tours analysis**

Recently, we completed the reformulation of the 2004–07 Ongoing New Zealand Household Travel Survey trips database into trip chains and tours and provided some preliminary results using the reformulated datasets. The reformulation of the 2004–07 dataset permitted us to draw some comparisons between New Zealanders' travel patterns in 1997/98 and more recently over the four-year period of 2004–07. Thus, we were able to provide comment on the emergence of some trends in New Zealand travel behaviour. The observations we made regarding older people's behaviour in making trip chains and tours are discussed below. Our full analysis of trip chains and tours has been published separately (O'Fallon and Sullivan, 2009b).

A **trip segment** (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. A **trip chain** is a sequence of one or more trip segments, anchored at home or at work (ie, when an individual is departing from home or departing from work, this begins a new chain), with the current trip chain ending when the person arrives at work or at home, or when they stay at one location for 90 minutes or longer (or, in a very few cases, begin to travel by plane). A **tour** is a series of segments that starts from home and ends at home.

Generally, it can be said that the findings and trends reported for trip segments are mirrored in the trip chain and tour analysis. Compared with the 25–59 age group, older people made:

- fewer trip chains and tours per two travel days and per person per year. For example, there was very little difference in the mean number of tours per day between 25–59 and 60–74 year olds (mean of 1.5 tours per day compared with 1.3); the sharp contrast was with the 75+ age group, who completed a mean of 0.9 tours per day
- shorter trip chains and tours
- less complex trip chains and tours (ie, had fewer segments per chain or tour). The mean number of segments in a tour for those aged 75+ (2.7) was clearly less than for the 25–59 age group (3.2)
- fewer trip chains and tours as vehicle driver, and more as vehicle passenger or by walking as the main mode. However, older people (aged 60+) increased their vehicle driver tours between 1997/98 and 2004–07 from 60% to 65% of all of their tours, while decreasing their vehicle passenger and walking tours
- the 75+ age group had a significantly greater proportion of walking trip chains than the 25–64 age group (15% compared with 9%)
- far more of their trip chains and tours for purposes (such as personal business, shopping, social, recreational) rather than work or education. Almost all (97%) of the 75+ age group's tours were for non-work and non-education purposes, compared with 89% of the 65–74 and 70% of the 60–64 age groups.

Older people's trip chain mode use and purposes appeared to be similar to those reported by Alsnih and Hensher (2005) for Sydney, using a travel chain dataset formulated from the 2002 Sydney Household Travel Survey.<sup>10</sup>

## **Summary of findings and discussion**

*As a group*, older people have increased their volume of trip segments and kilometres travelled between 1989/90 and 2004-07, particularly as vehicle drivers, at a much higher rate than their population increase would imply (e.g. in 2004-07, people aged 60+ did 34% more driver trips and kilometres than in 1997/98, while their population increased by 17% during that same period). However, both their trip-making and kilometres travelled were at much lower levels than for those aged 25–59, suggesting that older people caused less pressure on the transport network, especially since the majority of their trip segments (60%) occurred during the 'off-peak' hours of 9.01 am to 3 pm.

*On an individual basis*, between 1997/98 and 2004–07, older people made more trip segments and tours as vehicle drivers (probably reflecting higher licence-holding and vehicle ownership rates), but did not significantly increase the mean number of trip segments and surface kilometres travelled per person. The driver tours occurred at the expense of vehicle passenger and walking tours, both of which declined. Our findings corroborate Tacken's (1998) view that there is a limit to the potential growth in the volume of trip segments (and kilometres travelled) per person, as he found occurred in the Netherlands.

Our analysis suggests that, over the next 40 years, as older people become a greater proportion of the total New Zealand population (predicted by Statistics NZ (2007) to increase from 12% to 25% or more), there will be a discernible impact on the overall travel patterns of New Zealanders. For example, as older people form an even greater proportion of the vehicle traffic stream, among other things, there may be noticeable differences in the amount (both quantity of trip segments and their length) and timing of travel on the roads and public transport; overall vehicle kilometres travelled per day per person may decline; and walking as a mode share may increase. Of course, some of the change may be masked by overall population growth in New Zealand.

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<sup>10</sup> The results are not directly comparable, as Alsnih and Hensher (2005) created a different trip chain typology, more closely resembling the one we created for tours.

While older people do travel during peak periods, it is to a far lesser extent than other population segments, is less dependent on driving themselves (i.e. more walking and passenger travel, although the proportion of vehicle driver trip segments or chains is growing) and generally for other purposes (not work or education). This implies that traditional traffic management tools, such as tolls, electronic road user charges and parking mechanisms, designed to discourage car use at these times may not highly impact the older population. At the same time, given their growing share of the traffic stream (simply because there will be more of them due to population increases), if older people do shift their trip time or travel mode, it may have some impact on congestion. It appears that provision of good off-peak passenger transport services may be important as the proportion of older people in the population increases.

Their varied travel patterns and trip purposes imply that initiatives generally targeting the household or community (such as TravelSmart) and encouraging a mixture of walking, cycling, public transport use and more efficient car use may be more suitable for older people than those targeting the workplace or specific initiatives such as a rideshare programme. Neighbourhood car sharing schemes may work quite well for older people, particularly where they are living in 'adult' or 'retirement' communities.

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

## References

- Alsnih, R., and Hensher, D. 2005. Travel behaviour of seniors in an aging population: An exploratory study of trip chains and modal preferences in the greater metropolitan area of Sydney. WORKING PAPER ITLS-WP-05-17. Accessed December 2005 from [www.itls.usyd.edu.au/research/working\\_papers.html](http://www.itls.usyd.edu.au/research/working_papers.html) (subsequently published in *Road and Transport Research* 14:4)
- Australian Bureau of Statistics. 2007. *Participation in sports and physical recreation 2005–06*. Canberra: Australian Bureau of Statistics.
- Davey, J. 2004. Coping without a car. Report prepared for Office for Senior Citizens. Available from [www.osc.govt.nz/publications/coping-without-a-car.html](http://www.osc.govt.nz/publications/coping-without-a-car.html)
- Land Transport Safety Authority. 2000. *Travel survey report – increasing our understanding for New Zealanders' travel behaviour 1997/98*. Wellington: Land Transport Safety Authority.
- Ministry of Transport. 1990. New Zealand household travel survey July 1989 – June 1990. *Traffic Research Report 43*. Wellington: Ministry of Transport, Safety Standards Branch, Land Transport Division.

- Morris, J., Pattinson, W., Fell, E., and Slattery, M. 2006. Ageing – towards a transport policy response. Paper presented at the 29th Australasian Transport Research Forum, 27–29 September 2006, Gold Coast. Accessed October 2008 from [www.patrec.org/atrf/index.php](http://www.patrec.org/atrf/index.php)
- O’Fallon, C., and Sullivan, C. 2009a. Trends in older people’s travel patterns – analysing changes in New Zealanders’ travel patterns using the Ongoing NZ Household Travel Survey. *NZ Transport Agency Research Report 369*. Available from: [www.nzta.govt.nz/research/reports/index.html](http://www.nzta.govt.nz/research/reports/index.html)
- O’Fallon, C., and Sullivan, C. 2009b. Trends in trip chaining and tours – analysing changes in New Zealanders’ travel patterns using the Ongoing NZ Household Travel Survey. *NZ Transport Agency Research Report 373*. Available from: [www.nzta.govt.nz/research/reports/index.html](http://www.nzta.govt.nz/research/reports/index.html)
- O’Fallon, C., and Sullivan, C. 2003. Older people’s travel patterns and transport sustainability in New Zealand cities. Paper presented at the Australasian Transportation Research Forum, September 2003, Wellington, New Zealand. Available from [www.patrec.org/atrf/index.php](http://www.patrec.org/atrf/index.php)
- Rosenbloom, S. 2001. Sustainability and automobility among the elderly: An international assessment. *Transportation 28*: 375–408.
- Rosenbloom, S., and Waldorf, B. 2001. Older travellers: Does place or race make a difference? In *Personal travel: The long and short of it*. Conference proceedings 28 June – 1 July 1999. *Transportation Research E-Circular. E-C026*. Washington, DC. pp 103–120.
- Statistics New Zealand. 2000. Key statistics: Population ageing in New Zealand. Accessed May 2003 from: [www.stats.govt.nz/domino/external/web/prod\\_serv.nsf/htmldocs/Population+ageing+in+New+Zealand](http://www.stats.govt.nz/domino/external/web/prod_serv.nsf/htmldocs/Population+ageing+in+New+Zealand)
- Statistics New Zealand. 2007. New Zealand’s 65+ population: A statistical volume. Wellington. Accessed September 2008 from: [www.stats.govt.nz/people/communities/olderpeople.htm](http://www.stats.govt.nz/people/communities/olderpeople.htm)
- 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.