Trends in Trip Chaining and Tours:
Analysing Changes in
New Zealanders' Travel Patterns
Using the Ongoing New Zealand
Household Travel Survey

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An important note for the reader

Acknowledgements

Abbreviations

CAPI: Computer Aided Personal Interviewing
LTSA: Land Transport Safety Authority
NZHTS: New Zealand Household Travel Survey
NZTA: NZ Transport Agency
ONZHTS: Ongoing New Zealand Household Travel Survey
TMIF: Transport Monitoring Indicator Framework

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Executive summary

Context

This research report describes the reformulation of the 2004–07 Ongoing New Zealand Household Travel Survey trips database into trip chains and tours, which was undertaken in 2008/09. The reformulation required us to re-create programming sequences for the key elements of the new datasets (segments, trip chains, tours, main mode and main purpose, and three different tour classification schemes) based on our previous reformulation of the 1997/98 New Zealand Household Travel Survey dataset.

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 are able to provide comment on the emergence of some trends in New Zealanders' travel behaviour. These are discussed below.

When considering results from different units (segments, chains, tours), it is often useful to keep in mind just how many of each unit is typical:

- On average, respondents reported **4.3 segments (trip legs) per day** in the 2004–07 dataset; 4.4 segments in the 1997/98 dataset.
- Tours are a distinctly broader unit of measurement and people often complete only one in a day. The average was **1.3 tours per day** in both the 1997/98 and 2004–07 datasets.
- Trip chains, as we defined them using a 90-minute cut-off, provide an alternative unit that is usefully intermediate in scope between segments and tours. Respondents averaged **2.4 trip chains per day** in the 2004–07 dataset (2.3 trip chains in the 1997/98 dataset).

Trends in trip chaining

Trip chains describe how New Zealanders link their travel between 'significant' locations, namely home, work or education, and other activities where they remain for >90 minutes. A trip from home, stopping to pick up the newspaper and travelling on to work is an example of a trip chain.

Key comparisons of our trip chain analysis include:

- The mean number of trip chains per day was basically unchanged (2.3 chains compared with 2.4 chains in 2004–07).
- The mean number of segments within a trip chain declined from 1.9 to 1.7. Other evidence suggests less linking of travel: a 7% increase in the number of one-segment trip chains (from 48% to 55%), in conjunction with a 4% decrease in two-segment trip chains.
- Vehicle driver only trip chains increased significantly from 48% of all trip chains to 53%.

- The tendency for less complex trip chains has increased. For example, in 1997/98, 47% of all vehicle driver trip chains were one segment only, compared with 58% in 2004–07.
- 'Walk only' trip chains declined significantly from 13% of all trip chains to 11%. The number of trip chains with some walking within them also decreased markedly: from 22% in 1997/98 (including walk only) to 18% in 2004–07.
- Overall, the proportions of trips chains that were less than 2 km in total (about 21%) or less than 6 km in total (about 50%) remained unchanged.
- In the case of trip chains less than 2 km long, vehicle drivers' share increased significantly from 30% in 1997/98 to 38% of all modes in 2004–07, while the walk share fell significantly from 45% to 39%.
- Men significantly increased their mean number of trip chains from 4.8 to 5.2 per day.

Trends in tours

Tours describe how New Zealanders link their trip segments in a round trip that begins and ends at home. A simple tour could consist of leaving home, travelling to work and returning home again at the end of the working day. Tours may consist of multiple segments, either for the same purpose (e.g. a 'multi-part' work tour) or for a mix of purposes (e.g. a 'composite' work tour, which contains non-work segments).
Key comparisons from our tours analysis include:

- New Zealanders continued to average 1.3 tours per day, with a mean number of 3.1 segments per tour. The maximum number of tours within two days (13) was unchanged between 1997/98 and 2004–07.
- Overall, tour lengths remained largely the same between the two datasets.
- The share of vehicle driver only tours increased slightly but significantly from 47% (1997/98) to 50% (2004–07), while the share of vehicle passenger only tours remained unchanged (23%).
- The proportions of short tours completed were relatively similar: about 26–27% of all tours were less than 4 km long in both datasets. Just over half (52–53%) were under 10 km.
- In 1997/98, men were slightly (but significantly) more likely to complete two-segment tours (58% of their tours were two segments, compared with 54% of women's tours). This gap was essentially the same (58% compared with 55%) in the 2004–07 dataset.
- The vast majority of tours were still 'non-work/non-education' tours (66% in 1997/09 and 64% in 2004-07). Eighty-five percent of all tours completed by older people (60+) had this purpose.
- Vehicle driver continued to be overwhelmingly the mode of choice for all types of work tours, i.e. simple (77%), multi-part (88%) and composite work tours (81%).
- Older people (aged 60+) increased their vehicle driver tours from 60% to 65% of all of their tours (not quite reaching statistical significance using our rule of thumb), while decreasing their vehicle passenger and walk tours.

- Residents of New Zealand's three metropolitan areas (the four cities of Auckland, the four cities of Wellington, and Christchurch) had a significant increase in the proportion of simple work tours compared with all tours (from 9% to 11.5%). The overall proportion of vehicle driver tours remained relatively unchanged (around 50–51%).

Shopping analysis

Partly to demonstrate some of the kinds of analysis that can be undertaken using the trip chains and/or tour datasets, we devised a further classification of tours specifically distinguishing shopping as an activity within a tour or even as the basis of a tour (the 'multi-part shopping tour' and the 'simple shopping tour' respectively). Using the 2004–07 dataset, we found that simple and complex shopping tours together formed 22% of all tours undertaken by New Zealanders. Most simple and complex shopping tours (61%) were completed as vehicle driver (including vehicle driver plus walk); simple shopping tours were more likely than tours including work or education to be less than 2 km long.

Transport monitoring indicators

Three indicators identified in the government's Transport Monitoring Indicator Framework are intended to be based on trip chains, namely: road-based short trip chains of <5 km by bike, short trip chains of <2 km on foot, and road based short trip chains <5 km solely by walking or cycling. After discussion with Ministry of Transport staff, we clarified the definition of the indicators and estimated them using both datasets.

Potential for further research

The NZ Transport Agency has funded Capital Research and Pinnacle Research & Policy Ltd to undertake a research project for the 2008/09 financial year that will deliver, among other things, an up-to-date and detailed analysis of vehicle occupancy. At a basic level, this could update our analysis of the 1997/98 New Zealand Household Travel Survey (e.g. how vehicle occupancy varied by day of week, time of day, purpose of trip and vehicles per adult in the household). To the extent allowed by improvements in the Ongoing New Zealand Household Travel Survey data collection since 1997/98 that affect comparability, we will consider changes/trends since 1997/98.

Pinnacle Research & Policy Ltd is also completing a project analysing changes in older people's travel patterns between 1997/98 and 2004–07, although this work primarily draws on the original 'trip legs' (segments) datasets rather than the reformulated trip chains and tours datasets.

It is essential to realise that many other applications for the reformulated ONZHTS trip chain and trip tour datasets are possible. The programming we have developed can be readily applied to future datasets, such that ongoing trends can be monitored. Other modifications to highlight different activities (such as the work we did with shopping tours here), demographics, etc. are also feasible. Hence, the most important output from the overall research project is probably the programming that goes with these rather than the initial report.

Abstract

This report describes the 2008/09 reformulation of the 2004–07 Ongoing New Zealand Household Travel Survey trips database into trip chains and tours. The reformulation required us to re-create programming sequences for key elements of the new datasets (segments, trip chains, tours, main mode and main purpose, and three different tour classification schemes) based on previous reformulation of the 1997/98 New Zealand Household Travel Survey dataset.

The reformulated datasets permitted us to compare New Zealanders' travel patterns in 1997/98 and over 2004–07. Thus, we can comment on some trends in New Zealander's travel behaviour.

Comparing the 2004–07 and 1997/98 datasets revealed that:

- The mean number of trip chains per day (2.3) and the mean number of tours per day (1.3) were essentially unchanged.
- Both trip chains and tours were increasingly likely to have fewer segments.
- Vehicle driver only trip chains increased significantly to 53% of all trip chains from 48%. Vehicle driver only tours increased significantly to 50% from 47%. Both findings are significant at a 95% confidence interval.
- Most trip chains and tours were 'non-work/non-education' tours (e.g. personal business, shopping, social, recreational, etc.).
- Walk only trip chains declined to 11% from 13%.

1   Overview

1.1   Background

In 2003/04, Pinnacle Research (now Pinnacle Research & Policy Ltd) and Capital Research reformulated the 1997/98 New Zealand Household Travel Survey (NZHTS) database into two datasets, one comprising what are known as 'trip chains' and the other comprising 'tours.' The results of this work were published as Land Transport New Zealand Research Report 268, *Trip chaining: understanding how New Zealanders link their travel* (O'Fallon and Sullivan 2005), as well as being presented at the Sustainable Land Transport Conference in Wellington (November 2004) and the Australasian Transportation Research Forum in Sydney (September 2005).

When we completed the analysis, we noted that the NZHTS database was reasonably 'old' (being compiled in 1997/98), but that the survey was established as a continuous survey in 2003. With the continuous survey, people in over 2200 households in 280 meshblocks[1] throughout New Zealand are invited to participate in the survey each year. Every member normally resident in a household is then visited and interviewed about all of their travel for two consecutive days specified by the interviewer. Day 1 begins at 4 a.m. and Day 2 ends at 3:59 a.m. A 'complete' dataset representing all of New Zealand is compiled every four years[2].

The Ministry of Transport monitors the travel diary data on an ongoing basis and provides feedback to the contractor carrying out the interviewing. Despite this, the Ministry has found a small drop in reporting on Day 2 of the trip diary. Around 52% of trip segments are recorded on Day 1 rather than the 50% that would be expected in a two-day travel diary. In particular, short driving trips (less than 2 km) appear to be slightly under-reported on Day 2 (L. Povey, personal communication, 7 January 2009)[3].

To enable comparison with the results of the earlier travel surveys, essentially the same questionnaire and response coding was used 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[4] survey was that laptop computers were used by interviewers to improve data quality and reduce the time required for the interviews.

1 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).

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

3 We compared the prevalence of simple versus complex tours on Day 1 and day two of the travel diaries. We found that the proportion of simple tours was not markedly higher on Day 2 (60.2% compared with 59.1% on Day 1).

4 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).

Because the Ongoing New Zealand Household Travel Survey (ONZHTS) uses largely the same questions and response coding as the 1997/98 survey, we were able to modify and apply our programming to the updated database and thus monitor trends in travel patterns. This document reports on the analysis resulting from creating trip chain and tour datasets with the 2004–07 ONZHTS dataset.

To avoid the inherent difficulties in trying to establish what any one individual regarded as their 'day' (as opposed to how a 'day' was defined within the NZHTS/ONZHTS datasets), we simply applied our definitions for trip chains and tours across **both** travel days recorded by the respondent.

The analysis of changes over a period of time (trend analysis) is useful to detect travel patterns that could lead to future quality or infrastructure provision problems (e.g. creating pressures or bottlenecks in infrastructure use) as well as to forecast future demand periods. Understanding the trends in New Zealanders' travel behaviour is also helpful to decision- and policy-makers wanting to select and target travel demand management and travel behaviour-change programmes designed to encourage more sustainable transport use. For example, we are able to provide the evidence to answer questions such as:

- Are New Zealanders' travel patterns becoming more complex?
- Are walking and cycling trip chains and tours increasing relative to car-based tours and trip chains?
- Have the types of people making different types of trip chains or tours changed at all?
- Are work-based trip chains and tours increasing or decreasing relative to tours and trip chains for other purposes?
- Are New Zealanders making longer or shorter trip chains and tours relative to 1997/98?

In addition, establishing the trends in New Zealanders' travel behaviour will enable better calibration of existing transport models, as well as better estimation of new ones designed to predict future travel patterns in light of changes to the transportation network.

Formal recognition of the importance of our alternative units (trip chains and tours) for monitoring trends has come recently in the Ministry of Transport's Transport Monitoring Indicator Framework (TMIF). Two of the travel behaviour indicators in the framework will be based on trip chains (Ministry of Transport 2008a).

1.2 Treatment of 'professional drivers'

People whose job is to transport goods or people for a living pose an issue for travel surveys. Current best practice internationally is to exclude work-related travel by these people (other than the commute to and from the workplace depot or similar) from the scope of household travel surveys. From July 2008, this practice has been implemented in the ONZHTS. The data analysed in this report were collected prior to 2008. One further complication is that the use of computer aided personal interviewing (CAPI) in the current survey facilitated collection of a larger number of trips per person than the paper forms used earlier. In particular, the paper forms had space for up to 20 trips per day; interviewers were instructed to use another form to collect additional trips but the results suggest this was not always done.

To overcome these problems, the respondent-provided occupational information was used to categorise individuals as 'professional drivers'. This term includes people who walk or cycle as part of their job delivering goods or people, for example, cycle couriers and posties as well as those who drive vehicles of various types. Trips made by these individuals for the purpose of employer's business were then excluded from the analysis dataset. This avoids any potential bias introduced by sampling of one individual with a large number of trips, and increases the consistency with the practice used in earlier surveys.

The decision to remove 'professional driver' trips from the 2004–07 dataset represented a significant change in the structure of the dataset, with respect to comparability with the 1997/98 dataset. Hence, the Ministry of Transport undertook to remove professional drivers from the 1997/98 dataset. However, it was not possible to identify professional drivers from the occupational classifications captured in the 1997/98 survey database. Instead, this information was inferred from a combination of the trip pattern, activity type, addresses visited and vehicle type used. The trip records of all people who reported more than 20 trips on any day were examined, and people who were identified as likely to be professional drivers (based on the vehicle type, trip pattern and addresses visited) were removed from the dataset used for this project. Twenty-nine people from a total of 14,251 people with full responses were identified in this way.

Ideally, only trip segments which were specifically work-related would have been removed; however, resource constraints and the late decision by the Ministry of Transport to re-structure the 2004–07 dataset in this way meant that we completely removed those people for whom a large proportion of their trip segments were part of their occupation (delivering goods and/or services). Hence, we removed 1425 trip segments (1.1%) made by 29 people. This represents 358 chains (0.5%) and 117 tours (0.3%).

The Ministry has undertaken to make a 1997/98 dataset with the professional drivers removed available to researchers for any future analysis.

1.3   Key definitions

1.3.1 Definition origins

The key terms used in our research – 'segment', 'trip chain', 'tour', 'main mode' and 'main purpose' – are defined below. The definitions are abbreviated from our previous work with the 1997/98 NZHTS (O'Fallon and Sullivan 2005).

1.3.2   Segment

A **segment** is a row (trip leg) in the trips database of the 1997/98 NZHTS or the 2004–07 ONZHTS. For example, if you drive from home to work but stop for 30 seconds to drop off a passenger, that travel is counted as two segments (but as one 'trip chain' in our reformulation of the datasets).

1.3.3   Trip chain

Our definition of a trip chain is generally anchored at home or at work (i.e. when an individual departs from home or departs from work, this begins a new chain).

More precisely, a **trip chain** is a series of one or more segments defined by starting a new chain whenever:

- the segment is the first one recorded in the respondent's travel diary (any segments by plane have been excluded because our focus is on land transport);
- the starting point of the segment is their home or their workplace;
- the origin of the trip is neither home nor work, but the respondent has been at that location for more than 90 minutes (and the purpose of the immediately preceding segment was not to change mode); and/or
- plane was the mode used for the previous segment (and plane is not the mode for the current segment).

Thus, a new trip chain *starts* when a person leaves from home or work, or from a location where they remained for 90 minutes or longer (or, in a very few cases, ended travel by plane). Similarly, the current trip chain *ends* 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).

1.3.4   Tour

A **tour** is a series of segments that starts from home and ends at home. Note that this definition leaves some segments not classified into any tour (e.g. segments recorded at the start of the travel diary where the respondent does not start from home). In contrast, all segments are classified into a chain.

1.3.5   Main mode

In the 1997/98 analysis, the 'main mode' for a trip chain or tour was the one used for the greatest distance, because the distance (except for walking) could be reliably computed using geo-coding (as opposed to the respondent's best estimate). Where the distance was missing (only 106 cases in the 1997/98 NZHTS dataset), we took a hierarchical approach to assigning the mode. We used the following hierarchy: ferry, train, bus, vehicle driver, vehicle passenger, taxi, bicycle, other and then walk. For example, if a trip chain involved a taking train and walking, the main mode would be 'train'. This process was applied to tours as well.

In comparing the 1997/98 and 2004–07 datasets, we again determined the main mode for a trip chain or tour as the one used for the greatest distance. However, we generally abandoned the practice of hierarchical assignment of modes because in the 2004–07 dataset, fewer modes had geo-coded trip segment lengths.

Hence, we created a category named 'main mode not defined' where a trip chain or tour included train, ferry, taxi, mobility scooter or 'other'.

We have included a handful of tables which have a main mode category 'passenger transport', which is composed of bus, train and ferry trip segments, and where the main mode has been assigned by either distance (bus) or hierarchy (train and ferry). This means that if either a ferry or train segment occurred in the trip chain or tour, that trip chain or tour's main mode has been declared as 'passenger transport'. We did this because some of our end users expressed specific interest in having information about all passenger transport modes.

We then re-classified main mode in the 1997/98 dataset for the sake of consistency in reporting.

1.3.6   Main purpose

Our rule categorises the **main purpose** of the chain or tour by creating a hierarchy based on the assumed strength of the activity or purpose to shape the individual's movement. Hence, we have a classification with six categories:

- Subsistence – work (including main job, other job and employer's business) or education (meaning the education of the individual undertaking the trip);
- Maintenance – personal business/services, medical/dental, social welfare and shopping;
- Discretionary – social and recreational;
- Accompanying Someone Else – this delineates situations where an individual is travelling somewhere for a purpose other than their own, for example:

  - a child accompanying a parent/caregiver to do the family shopping or for the parent's visit to the doctor;
  - a parent accompanying a child on a trip to or from school (including walking them to school) or taking their child to an activity the child is participating in;

– someone taking their mother to the doctor, etc.

If an individual drives to work but goes out of their way to drop off a partner at their workplace, the first segment will be coded as Accompanying Someone Else;

- Home – where the purpose, usually of a single-segment chain or two-segment tour, is to return home;
- Change Mode – where the only purpose of the chain/tour appeared to be changing from one mode to another.

These reasons are used hierarchically; that is, a chain or tour with any segment having the purpose 'work' is classified as Subsistence, regardless of the other purposes found within the chain or tour.

1.4   Treatment of distances

1.4.1   Ferry, train, taxi, mobility scooter and other

As noted in the discussion on 'main mode' above, the lengths of trip segments have been treated inconsistently between the 1997/98 NZHTS and the 2004–07 ONZHTS. In the 1997/98 database, train, ferry and 'other' modes all had calculated or estimated values for the length of the trip segment. In the 2004–07 dataset, none of these modes (train, ferry or 'other') had trip segment lengths. Mobility scooter, a mode coded separately for the first time in 2004–07, did not have trip segment lengths. To make them comparable, we re-coded the trip chain and tour distances to have 'missing' values where one or more trip segments did not have a length. Hence, 1.0% (693 chains) in 2004–07 and 1% (591 chains) in 1997/98 were missing total chain lengths. A similarly small proportion of tours had missing values.

1.4.2   Walk

Walk trip segments do not have values for length attached to them in either dataset, although they do have trip duration.

The process we used to impute lengths for walk trip segments is described in our earlier work (O'Fallon and Sullivan 2005). Essentially, we used a single value, 4.4 km/h, to impute distances walked from the times recorded.

1.5   Precision and statistical significance of results

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 being beyond the scope of this project. Therefore, we have developed a pragmatic rule of thumb for checking the differences highlighted in the text of this report. We did this by comparing 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 (i.e. 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[5] 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 or higher).

In the tables presented in this report, totals may not add exactly because of rounding.

1.6   Structure

This paper is structured as follows:

- Chapter 2 considers the fundamental trip chain trends based on our reformulated trip chain datasets for 1997/98 and 2004–07.
- Chapter 3 outlines the fundamental tour trends based on our reformulated tour datasets for 1997/98 and 2004–07.
- Chapter 4 highlights the shopping tour analysis.
- Chapter 5 provides the relevant performance indicators for 1997/98 and 2004–07 based on the recently-released Ministry of Transport's TMIF.
- Chapter 6 summarises our conclusions.

It is important to note that this project can only illustrate a handful of the very large number of possible uses of trip chains and tours; most of the effort has gone into the definition and careful programming required to create these new fundamental units of travel behaviour.

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5 Design factors (i.e. 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.

2   Trip chains: initial results

2.1   Basic information about chains

As noted in Section 1.1, we applied our definition for trip chains across **both** travel days recorded by the respondent, with the result that the number of chains reported per respondent reflects the total number of trip chains they made within two travel days.

Once the 1997/98 NZTS database was reformulated based on trip chains, we had n=64,719 valid trip chains on which to base our analysis. These were derived from 122,664 segments[6].

When the 2004–07 ONZHTS dataset was reformulated based on trip chains, we had n=67,100 valid trip chains on which to base our analysis. These were derived from 118,111 segments[7].

In 1997/98, the number of trip chains over the two-day period ranged from 0 (where a person stayed home on both travel days) to 25 trip chains[8]. In 2004–07, the range of trip chains over the two-day period was 0 to 59. In all, 14 people had more than 25 chains (representing less than 0.2% of all the trip chains) in the 2004–07 dataset and we have left these chains intact (see Section 2.2).

All of the values given in the following sections have been weighted in terms of 'millions of chains per year', using weights derived for the NZHTS/ONZHTS. We have not adjusted the weighting to take account of the fact that around 2% of segments in 1997/98 and 0.1% of segments in 2004–07 were not translated into chains.

When weighted, the 64,719 valid trip chains within the 1997/98 dataset represent 3,172 million trip chains per year. The 2004–07 contained 67,084 valid trip chains, which represent 3,777 million trip chains per year.

Apart from Section 2.2, all of the following analysis of trip chains has been based on those people who completed at least one trip chain within the two travel days.

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6 This is around 2% fewer than the total number of segments in the original LTSA trip database (with complete interview forms). Exclusions were made where apparent inconsistencies in recorded times made creation of chains unreliable or wherever the travel mode was by plane.

7 This is around 0.1% fewer than the total number of segments in the original LTSA trip database (with complete interview forms). Owing to the changes in recording respondents' information (using laptop computers), the dataset for the ONZHTS has far fewer time inconsistencies and other errors that could result in the trip segment and/or trip chain being excluded from the trip chain dataset.

8 Sampled households and household members from whom responses could not be obtained were not replaced by other respondents, but were imputed for using data obtained from other similar respondents. Bias caused by non-response was minimised by requiring a minimum of four attempts (made at different times of the day) to contact people who were not at home. Weights have also been used to reduce the inevitable bias caused by non-response.

2.2   Number of trip chains per person

As explained in Section 2.1, we applied our definition for trip chains across both travel days recorded by the respondent. Hence, in 1997/98, the number of trip chains ranged from 0 (where a person stayed home both travel days) to 25. On average, respondents completed 2.3 chains per day (compared with 4.4 segments per day[9]). This average incorporates the effect of those who did not travel at all during the two days of the survey (and hence recorded as 0 chains). It also takes account of the handful of cases where chains spanned two travel days[10].

The mean number of chains and segments per day remained virtually unchanged from 1997/98 to 2004–07, when respondents completed an average of 2.4 chains per day and 4.3 segments per day (Table 2.1). The differences (±0.1 chain or segment per day) noted here are small enough to be explained by the changes in recording methodology between the two surveys.

Table 2.1   Comparing the mean number of trip chains and segments (1997/98 and 2004–07).

Statistic	1997/98	2004–07
Chains (unweighted count)	*N=64,719*	*N=67,084*
Mean number of chains per person per day	2.3	2.4
Mean number of trip segments per person per day	4.4	4.3
Mean number of trip segments per trip chain	1.9	1.7
Maximum number of trip chains within two travel days	25	59

As noted in Section 1.2, the use of CAPI in the ONZHTS facilitated collection of a larger number of trips per person than the paper forms used for the earlier survey. The paper forms had space for up to 20 trips per day and, while interviewers were instructed to use another form to collect additional trips, the results suggest this was not always done. Hence, although the mean number of chains and segments per day remained largely the same between 1997/98 and 2004–07, a discrepancy appears in the maximum number of trip chains within two travel days (25 compared with 59).

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9 This average may differ by about 0.1 from that calculated in the original NZHTS database. This is because, in the interests of comparability, our average is restricted to those segments used for our analysis of chains and tours (that is, segments travelled by air are excluded, and some segments are excluded because inconsistencies in their recorded times precluded translating them into chains).

10 This was done by subtracting one from the number of chains recorded for this handful of respondents. A subtraction is appropriate because a chain spanning two travel days is an indicator of the frequency with which sequences of segments at the start or end of the two-day travel diary are really incompletely recorded fragments of longer chains (rather than complete chains in themselves). Take, for example, someone whose only travel every day is a trip chain starting at 3 a.m. and finishing at 5 a.m. every day (thus spanning two travel days, given that travel days start at 4 a.m.).
- Clearly, on two travel days, they should be counted as having two chains.
- But our programming would have created three apparent chains, the first and last ones really being misleading fragments.
- The solution is to subtract one as indicated by the chain detected as spanning two travel days, i.e. 3-1=2 (the true number of chains over two days).

Given that only five of the 67,100 trip chains spanned two travel days, we ignored the few fragments implied in all other analysis (they were treated as complete chains).

2.3 Number of segments within a trip chain

A clear fall could be seen in the mean number of segments within a trip chain. In 1997/98, the mean number of segments per chain was 1.9; in 2004–07, it was 1.7, a relative decrease of around 10%[11].

The proportion of trip chains having one segment only (e.g. driving from home to work or walking from school to home) has had an absolute increase of 7%, such that these trip chains comprised 55% of all trip chains made in 2004–07, compared with 48% in 1997/98 (Table 2.2). This change (and the related reduction in number of segments per chain noted immediately above) may reflect slight changes in the level of probing between the different surveys about short trips rather than real changes in travel behaviour. These sorts of differences are very sensitive to changes in reporting/probing for short trips.

Table 2.2   Number of segments within a trip chain (1997/98 and 2004–07).

Number of segments within chain	1997/98		2004-07		Absolute change (%)
	Million chains per year	%	Million chains per year	%	
1	1,533	48.3	2,083	55.2	6.9
2	1,034	32.6	1,099	29.1	-3.5
3	320	10.1	344	9.1	-1
4	137	4.3	129	3.4	-0.9
5 or more	148	4.7	122	3.2	-1.5
Total	**3,172**	**100%**	**3,777**	**100.0**	–

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[11] Although this difference may look small in absolute terms, it is clearly significant statistically. To two decimal places, the averages are 1.91 and 1.75, giving a difference of 0.16. The confidence interval estimate around each of ±0.03 (using Equation 2.47 for ratios from Cochran (1977) is very narrow, despite it having been doubled by the design factor discussed in Section 1.5.

2.4   Travel modes within a trip chain

In 2004–07, 92% of all trip chains used a single mode. This compares with 90% of all trip chains in 1997/98. 'Vehicle driver' remained the most frequent single mode used by New Zealanders in a trip chain, growing significantly from 48% mode share[12] in 1997/98 to 53% in 2004–07, an absolute increase of 5%. This represents a relative increase of 11% between 1997/98 and 2004–07.

By contrast, the number of 'walk only' trip chains decreased significantly from 13% of all trip chains undertaken in New Zealand in 1997/98 to just over 11% of all trip chains in 2004–07 – a relative decline of 15% in less than ten years. Related to this, the number of trip chains with some walking within them decreased markedly from 22% in 1997/98 (including walk only) to 18% in 2004–07 (but this change may be sensitive to the extent of probing by interviewers about short walks at the end of car trips, etc.).

Table 2.3   All modes used within a chain (regardless of relative distance) in 1997/98 and 2004-07.

Modes used in a chain	1997/98		2004–07		Absolute change (%)
	Million chains/year	%	Million chains/year	%	
Vehicle driver	1,522	48.0	2,014	53.3	5.3
Vehicle driver & walk	101	3.2	78	2.1	-1.1
Vehicle passenger	804	25.4	923	24.4	-1.0
Vehicle passenger & walk	70	2.2	61	1.6	-0.6
Cycle	73	2.3	56	1.5	-0.8
Cycle & walk	2	0.1	1	0.0	-0.1
Train (incl. train & walk)	5	0.2	5	0.1	-0.1
Bus	26	0.8	37	1.0	0.2
Bus & walk	65	2.1	70	1.8	-0.3
Ferry & walk	0	0.0	1	0.0	0.0
Taxi	15	0.5	15	0.4	-0.1
Taxi & walk	3	0.1	3	0.1	0.0
Other modes (not plane) only	6	0.2	18	0.5	0.3
Mobility scooter	n/a	n/a	2	0.0	n/a
Walk only	402	12.7	419	11.1	-1.6
Vehicle driver & vehicle passenger (& perhaps walk)	37	1.2	31	0.8	-0.4
Vehicle driver & bus/train/ferry (& perhaps walk)	8	0.2	10	0.3	0.1
Vehicle passenger & bus/train/ferry (& perhaps walk)	17	0.5	18	0.5	0.0
Other combinations	14	0.4	15	0.4	0.0
Total	**3,172**	**100.0**	**3,777**	**100**	**–**

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12 Significance tests of mode share percentages cannot use the simple calculations routinely used for opinion polls, etc. For significance testing of these (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)´100. The formula to approximate the RSE of a percentage formed from the ratio of two estimates is: RSE(x/y)= $\sqrt{[RSE(x)]^2 - [RSE(y)]^2}$. Australian Bureau of Statistics (2007) provides further details and a worked example of this method.

We also examined the main mode for individual trip chains (Table 2.4), i.e. the mode used for the greatest distance within the chain, and found that the patterns shown for all modes in a chain have been repeated: trip chains with 'vehicle driver' as the main mode clearly increased, by 4%, while all other main modes (vehicle passenger, walk, cycle and bus) declined.

Table 2.4   Main mode (defined by distance) used in individual trip chains (1997/98 and 2004–07).

Main mode used in a chain	1997/98 (%)	2004-07 (%)	Absolute change (%)
Chains (unweighted count)	*N=64,719*	*N=67,100*	–
Vehicle driver	51.8	55.8	4.0
Vehicle passenger	28.1	26.4	-1.7
Walk	13.0	11.5	-1.5
Cycle	2.4	1.5	-0.9
Bus	3.3	3.1	-0.2
Main mode not defined*	1.3	1.6	not relevant
Total	**100.0**	**100.0**	–

* category includes ferry, train, taxi and mobility scooter, but not plane.

2.5   Total length of trip chains

2.5.1   General observations on trip chain length

We also calculated the lengths of trip chains[13] as part of the reformulated datasets. This was particularly relevant where the chain had more than one segment. Leaving aside any other factors that could affect the choice of travel mode, knowing the length of the chain allows us to refine our expectations of the volume of 'short trips' currently made by private car that are potentially suitable for encouraging travel behaviour change. We contend that the chain-based and tour-based results are more relevant than using trip segment lengths for quantifying the potential for mode shift away from short car driver trips.

In 2004–07, one-half (50%) of trip chains (by all modes) were less than 6 km in total length and 21% were less than 2 km in total (Table 2.5). This was virtually unchanged from 1997/98.

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13 The length of trip chains is calculated only for those chains which have values for all segments within the chain. Vehicle driver, vehicle passenger, cycle, taxi and bus trip segments generally have geo-coded distances, and we have imputed distances for walk segments. If a trip segment's length is missing (e.g. for train, ferry, mobility scooter or other), then the chain has been excluded from any analysis involving trip chain length.

Table 2.5   Total chain length (1997/98 and 2004–07).

Total chain length*	1997/98 (%)	2004-07 (%)
Chains (unweighted count)	*n=64,719*	*n=67,100*
Up to 0.99 km	9.6	10.2
1.00–1.99 km	11.8	11.0
2.00–2.99 km	9.7	9.9
3.00–3.99 km	7.5	7.3
4.00–4.99 km	6.5	6.6
5.00–5.99 km	5.1	5.5
6.00–9.99 km	13.9	14.9
10.00–19.99 km	17.0	16.3
20.00 km or more	17.9	17.2
Missing	1.0	1.3
Total	**100.0**	**100.0**

* The distance of walk trip legs has been imputed.

When we examined the length of trip chains by main mode (

Table 2.6 and Table 2.7), we found that we had few differences to report (leaving aside bus and cycling, which, because of the small number of people using the bus or cycling over their two travel days, has large margins of error).

Table 2.6   Length of trip chains by main mode (1997/98).

Total chain length (walk dist imputed)	Main mode (defined by longest distance) travel within chain					
	All*	Vehicle driver	Vehicle passenger	Walk	Cycle	Bus
Chains (unweighted count)	*N=64,128*	*N=33,333*	*N=18,710*	*N=8,222*	*N=1,694*	*N=1,869*
Up to 0.99 km	9.7%	3.9%	4.5%	45.8%	15.0%	0.0%
1.00–1.99 km	11.9%	8.5%	10.8%	27.8%	25.3%	1.2%
2.00–2.99 km	9.8%	8.6%	10.0%	13.7%	18.7%	5.6%
3.00–3.99 km	7.6%	7.9%	8.1%	4.6%	11.0%	5.2%
4.00–4.99 km	6.6%	7.1%	6.9%	3.5%	10.8%	4.8%
5.00–5.99 km	5.2%	5.4%	5.5%	1.5%	6.1%	11.0%
6.00–9.99 km	14.0%	16.5%	14.6%	2.2%	7.9%	21.4%
10.00–19.99 km	17.2%	20.8%	18.2%	0.7%	3.9%	27.4%
20.00 km or more	18.1%	21.3%	21.5%	0.1%	1.2%	23.4%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

*'All' excludes 591 chains with missing or undefined segment lengths.

Table 2.7   Length of trip chains by main mode (2004–07).

Total chain length*	Main mode of travel within chain					
	All**	**Vehicle driver**	**Vehicle passenger**	**Walk**	**Cycle**	**Bus**
Chains (unweighted count)	*N=66,391*	*N=37,397*	*N=18,085*	*N=7,372*	*N=1,279*	*N=1,890*
Up to 0.99 km	10.4%	5.9%	5.6%	44.2%	23.6%	0.6%
1.00–1.99 km	11.1%	8.5%	9.6%	28.0%	21.0%	4.5%
2.00–2.99 km	10.0%	9.1%	9.9%	14.5%	15.3%	7.3%
3.00–3.99 km	7.3%	7.9%	7.0%	4.9%	11.7%	7.4%
4.00–4.99 km	6.7%	6.7%	7.4%	4.0%	5.3%	9.5%
5.00–5.99 km	5.5%	6.0%	6.1%	1.5%	5.4%	7.2%
6.00–9.99 km	15.0%	16.6%	16.5%	1.8%	9.6%	25.0%
10.00–19.99 km	16.5%	19.9%	16.1%	0.9%	5.4%	23.2%
20.00 km or more	17.4%	19.4%	21.7%	0.2%	2.6%	15.3%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

* Walk distances have been imputed.
** 'All' excludes 368 further chains with missing or undefined segment lengths.

Generally speaking, it is accepted in New Zealand that trip segments and/or trip chains less than 2 km long are 'walkable' while those less than 6 km long are 'cyclable'. Support for these suppositions is shown by the fact that 72% of walk trip chains were less than 2 km and 82% of cycling trip chains were less than 6 km in 2004–07 (see Table 2.7). Hence, if we consider vehicle driver trip segments and trip chains of these lengths, we can get a sense of how great the potential for mode shift is.

As Table 2.8 shows, nearly half (44%) of vehicle driver trip chains are less than 6 km in length (potentially cyclable), while fewer (14%) were potentially walkable. The proportion of driver trip *segments* that were short (e.g. up to 1.99 km, up to 2.99 km or up to 5.99 km) showed no evidence of falling as would be expected if people were switching to modes such as walking and cycling for short trips (Table 2.8 shows increases of about 1% in each case between 1997/98 and 2004–07, not that changes of this size are statistically significant). Similarly, the proportion of vehicle driver trip *chains* that were short also showed no evidence of falling (44% of vehicle driver trip chains were less than 6 km long in 2004–07 compared with 42% in 1997/98).

Table 2.8   Trends in short vehicle driver trip chains and segments (1997/98 and 2004–07).

Total length of trip chain/segment	Vehicle driver trip chains		Vehicle driver trip segments	
	1997/98	**2004–07**	**1997/98**	**2004–07**
Up to 1.99 km	12.5%	14.4%	29.8%	31.3%
Up to 2.99 km	21.1%	23.52%	42.9%	44.6%
Up to 5.99 km	41.5%	44.1%	64.8%	65.8%

Another way of examining trip chain length and mode use is to assess what the mode split is for trip chains of a particular length. We were asked by the Ministry of Transport to consider what the mode split is for trip chain lengths of up to 1.99 km, 2.00–4.99 km and 5.00 km or more. These are shown in Table 2.9.

Table 2.9   Main mode of trip chains by total chain length in three categories (1997/98 and 2004–07).

Main mode of trip chains (reduced categories)	Total chain length							
	Total		up to 1.99 km		2.00–4.99 km		5.00 km or more	
	1997/98	2004-07	1997/98	2004-07	1997/98	2004-07	1997/98	2004-07
Chains (unweighted count)	*N=63,862*	*N=66,023*	*N=14,419*	*N=14,904*	*N=15,754*	*N=16,456*	*N=33,689*	*N=34,663*
Vehicle driver	52.6%	56.8%	30.3%	38.0%	51.9%	56.1%	61.7%	64.4%
Vehicle passenger	28.5%	26.8%	20.2%	18.9%	29.8%	27.3%	31.3%	29.8%
Walk*	13.2%	11.7%	44.9%	39.2%	12.0%	11.4%	1.1%	0.9%
Cycle	2.4%	1.5%	4.5%	3.2%	4.1%	2.1%	0.8%	0.6%
Bus	3.3%	3.2%	0.2%	0.7%	2.1%	3.2%	5.0%	4.1%
Total**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

* Walk distances have been imputed.
** Excluding trip chains where the main mode was not defined.

As can be seen, proportionately fewer walk trip chains were less than 2 km and between 2 and 5 km in length in 2004–07 compared with 1997/98. At the same time, the share of short vehicle driver trip chains increased. For example, in the case of trip chains less than 2 km long, vehicle drivers' share increased significantly from 30% in 1997/98 to 38% of all modes in 2004–07, while the walk share fell significantly, from 45% to 39%, in the same timeframe.

Because cycle and bus use are relatively rare occurrences in the ONZHTS, examination of cycling and bus trip chains beyond the national level (e.g. considering trip chain lengths) should be treated with caution. That said, the cycling share of short trip chains in Table 2.9 showed no signs at all of growth between 1997/98 and 2004–07.

2.5.2 Complexity and length of trip chain by main mode

Comparing 1997/98 with 2004–07, we found an increasing tendency of New Zealanders completing one-segment trip chains, which occurred across all main mode[14] trip chains. As Table 2.10 and Table 2.11 show, the greatest increase in one-segment trip chains involved 'vehicle driver': in 1997/98, 47% of all vehicle driver trip chains had one segment only, compared with 58% in 2004–07.

Table 2.10   Main travel mode by number of segments within a chain (1997/98).

Number of segments within chain	Main mode of travel within chain						
	Total	Vehicle driver	Vehicle passenger	Walk	Cycle	Passenger transport	Not defined*
Chains (unweighted count)	*N=64,719*	*N=33,396*	*N=18,768*	*N=8,243*	*N=1,700*	*N=2,164*	*N=448*
1	48.3%	47.5%	52.0%	47.4%	66.4%	20.5%	68.2%
2	32.6%	32.8%	28.3%	43.3%	26.4%	30.8%	20.9%
3	10.1%	10.3%	9.3%	5.7%	3.3%	31.8%	6.1%
4	4.3%	4.4%	4.9%	1.9%	2.7%	8.5%	1.2%
5 or more	4.7%	4.9%	5.4%	1.6%	1.3%	8.4%	3.6%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

  * Includes taxi but not plane.

Table 2.11   Main travel mode by number of segments within a chain (2004–07).

Number of segments within chain	Main mode of travel within chain						
	Total	Vehicle driver	Vehicle passenger	Walk	Cycle	Passenger transport	Not defined*
Chains (unweighted count)	*N=67,084*	*N=37,425*	*N=18,116*	*N=7,372*	*N=1,279*	*N=2,237*	*N=655*
1	55.2%	57.9%	54.8%	48.6%	71.3%	25.0%	77.4%
2	29.1%	27.6%	27.6%	43.1%	22.4%	26.7%	13.1%
3	9.1%	8.1%	9.6%	5.4%	4.4%	34.4%	5.6%
4	3.4%	3.3%	3.9%	1.7%	1.0%	7.7%	1.7%
5 or more	3.2%	3.1%	4.1%	1.3%	.8%	6.2%	2.2%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

  * Includes taxi but not plane.

As might be expected, we found that when the number of segments in a trip chain increased, the overall length of the chain was likely to increase as well. Thus, Table 2.12 shows that in 2004–07, 5% of trip chains with five or more segments were less than 5 km in total length. The vast majority of such trip chains (81%) were 10 km long or more. By contrast, in 2004–07, 53% of one-segment trip chains and 46% of two-segment trip chains were less than 5 km long. The 1997/98 dataset had similar values.

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14 As discussed in Section 1.3.5, the 'main mode' is generally the mode used for the longest trip segment in a trip chain. In this section, the exception is for 'passenger transport': if a trip chain had a ferry segment or a train segment, it was automatically coded as a passenger transport trip chain. A trip chain containing a bus segment would be coded 'passenger transport' if the bus segment was the longest segment in the trip chain.

Table 2.12   Total chain length by number of segments in the chain (2004–07).

Total chain length*	Number of segments within a trip chain					
	Total	1	2	3	4	5 or more
Chains (unweighted count)	*N=66,391*	*N=36,449*	*N=19,682*	*N=5,732*	*N=2,302*	*N=2,226*
Up to 0.99 km	10.4%	13.5%	9.4%	1.1%	0.3%	0.1%
1.00–1.99 km	11.1%	13.8%	10.7%	3.2%	2.5%	0.1%
2.00–2.99 km	10.0%	11.4%	10.5%	5.5%	3.3%	0.9%
3.00–3.99 km	7.3%	7.8%	7.9%	5.5%	4.6%	1.7%
4.00–4.99 km	6.7%	6.7%	7.6%	6.1%	3.7%	2.1%
5.00–5.99 km	5.5%	5.1%	6.4%	7.0%	3.8%	2.6%
6.00–9.99 km	15.0%	13.5%	16.0%	22.0%	17.4%	11.4%
10.00–19.99 km	16.5%	14.8%	15.7%	23.4%	27.7%	24.0%
20.00 km or more	17.4%	13.4%	15.8%	26.3%	36.7%	57.0%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

* Walk distances have been imputed.

## 2.6	Purpose of trip chains

Although going home is a significant purpose category in both 1997/98 and 2004–07, this merely reflects the fact that after completing other activity chains, people return to their residence. It is more interesting, therefore, to consider the Subsistence, Maintenance and Discretionary (leisure) categories in Table 2.13 and Table 2.14.

Table 2.13   Main purpose of trip chain by main mode of travel (1997/98).

Activity/purpose in hierarchical order	Main mode of travel within chain						
	Total	Vehicle driver	Vehicle passenger	Walk	Cycle	Bus	Not defined
Chains (unweighted count)	*N=64,697*	*N=33,384*	*N=18,766*	*N=8,242*	*N=1,700*	*N=,1916*	*N=689*
Subsistence (work/education)	24.4%	28.4%	15.8%	20.2%	34.0%	**41.3%**	32.8%
Maintenance (shopping, social welfare, personal business)	21.2%	24.0%	18.4%	22.0%	11.7%	**7.1%**	13.5%
Discretionary (social/recreational)	23.2%	17.2%	31.3%	32.9%	24.0%	10.4%	18.8%
Accompanying Someone Else	7.5%	7.8%	10.6%	3.6%	0.3%	0.8%	1.1%
Home	23.3%	22.3%	23.6%	20.6%	30.0%	39.2%	31.7%

Note: The total of each column is not 100% because a small number of trip chains with the purposes 'left country', 'change mode' and 'round trip' (no specified purpose) were excluded.

Table 2.14   Main purpose of trip chain by main mode of travel (2004–07).

Activity/purpose in hierarchical order	Main mode of travel within chain*						
	Total	Vehicle driver	Vehicle passenger	Walk	Cycle	Bus	Not defined
Chains (unweighted count)	*N=67,051*	*N=37,418*	*N=18,094*	*N=7,368*	*N=1,279*	*N=1,893*	*N=999*
Subsistence (work/education)	27.6%	33.1%	16.6%	22.0%	32.8%	40.1%	27.3%
Maintenance (shopping, social welfare, personal business)	21.5%	24.5%	17.4%	23.2%	9.5%	8.6%	9.6%
Discretionary (social/recreational)	18.4%	13.7%	24.5%	28.1%	23.1%	9.6%	22.6%
Accompanying Someone Else	8.0%	5.2%	16.6%	5.5%	1.4%	1.7%	3.5%
Home	24.1%	23.1%	24.5%	20.9%	33.1%	39.7%	35.1%

*The total of each column is not 100% because a small number of trip chains with the purposes 'left country', 'change mode' and 'round trip' (no specified purpose) were excluded.

Comparing 1997/98 with 2004–07, we found that the overall purpose of trip chains shifted significantly. In 1997/98, fairly equal numbers of chains each had the main purposes Subsistence, Maintenance and Discretionary (24%, 21% and 23% respectively). In 2004–07, however, 3% more trip chains than in 97/98 had the purpose of Subsistence, while 5% fewer were for Discretionary purposes. Maintenance trip chains continued to comprise about 21–22% of the trip chains made.

The increase in Subsistence trip chains was probably caused, in part, by a higher proportion of the working-age population being at work in 2004–07 than in 1997/98 (e.g. the labour force participation rate was 66.5–68.5% compared with around 65% and the unemployment rate was 3.6%–4.7% compared with around 7%)[15]. Specifically, increasing numbers of people aged 60+ have remained in the workforce (Statistics New Zealand 2007). This was as a result of several factors, including:

- the gradual increasing of 'entitlement' age for New Zealand superannuation from 60 to 65 years between 1992 and 2001;
- statutory changes to the Human Rights Act 1993, effective in early 1999, that abolished the compulsory retirement age; and
- growth in service jobs and other 'non-standard employment' such as part-time and casual work.

We also noted that significantly more vehicle driver trip chains had the purpose of Subsistence in 2004–07 (33% compared with 28% in 1997/98). Subsistence continued to dominate the reason for bus trip chains (around 40% of all bus trip chains).

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15 Source: Statistics New Zealand (2007). Several figures are approximate because they have been taken from long-term graphs.

2.7   Number of trip chains by gender

We examined the number of trip chains travelled over two days and the mean number of
trip chains (over two days) by gender (Table 2.15). Males significantly increased their
mean number of trip chains from 4.8 to 5.2 per day (t=3.1, p<.001). Males completed
significantly more trip chains: they more commonly made six or more trip chains over two
days than females do (37% compared with 32% in 2004–07); their mean number of trip
chains (over two days) was significantly higher than the female mean (5.2 compared with
4.6 in 2004–07; t=5.6, p<.001).

**Table 2.15   Number of trip chains (within two travel days) by gender (1997/98 and
2004–07).**

Number of trip chains	Total		1997/98		2004–07	
	1997/98	2004–07	Female	Male	Female	Male
Chains (unweighted count)	*N=14,013*	*N=14,067*	*N=7,317*	*N=6,695*	*N=7,293*	*N=6,774*
0	6.0%	5.3%	6.9%	5.0%	5.6%	5.0%
1 or 2	16.7%	14.6%	18.3%	15.1%	16.4%	12.8%
3–5	43.0%	45.5%	43.1%	43.0%	45.6%	45.4%
6+	34.3%	34.6%	31.8%	37.0%	32.4%	36.8%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Mean	4.6	4.9	4.4	4.8	4.6	5.2

2.8   Number of trip chains by age

At the request of the NZ Transport Agency (NZTA), we examined the effect of age,
particularly those aged 75+ (where the New Zealand law requires a driver to be assessed
for fitness to drive) on the number of trip chains completed within two days, the main
mode used and the purpose of the trip chains for the 2004–07 dataset. Here we consider
the total number of trip chains, and the mean number of trip chains completed within two
days by age group.

Further information on older people's trip chaining behaviour (including purpose and trip
chain length) is found in Chapter 4 of our report *Trends in older people's travel patterns:
analysing changes in older New Zealanders' travel patterns using the Ongoing NZ
Household Travel Survey* (O'Fallon and Sullivan 2009).

As can be seen from Table 2.16, in 2004–07, the mean number of trip chains completed
over two days declines as the adult population ages (e.g. those aged 25–59 averaged
5.6 trip chains over two days, while those aged 75+ had a mean of 2.6 trip chains). It is
not surprising, then, to find that those aged 15–64 were more likely to have completed
six or more trip chains within two travel days than those aged 75+ or 0–14. People aged
75+ were much more likely to have only completed 1 or 2 trip chains within the two
travel days than any other age group. The 1997/98 dataset results are very similar to the
2004–07 output with respect to trip chain completion rates.

Table 2.16   Number of trip chains completed over two days by age group (2004–07).

Number of chains (over two days)	Age group						
	Total	**0–14**	**15–24**	**25–59**	**60–64**	**65–74**	**75+**
Chains (unweighted count)	*N=14,067*	*N=3,101*	*N=1,692*	*N=6,484*	*N=686*	*N=1,157*	*N=947*
0	5.3%	4.9%	4.7%	3.5%	6.7%	8.8%	18.0%
1 or 2	14.6%	15.4%	10.9%	11.1%	18.9%	25.9%	35.8%
3–5	45.5%	57.8%	46.7%	41.2%	40.2%	44.7%	36.9%
6+	34.6%	21.9%	37.7%	44.2%	34.2%	20.6%	9.4%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Mean	4.9	4.1	5.1	5.6	4.8	3.7	2.6

3   Tours: initial results

3.1   Tour types

We used the same two classification schemes for tours in this study as we did in our earlier one (O'Fallon and Sullivan 2005).

One classification scheme is quite simple, being based solely on purpose, with the purpose assigned on a hierarchical basis. Our 'trip chain' analysis also uses this classification (described in Section 1.3.6).

In our work with the 1997/98 dataset (O'Fallon and Sullivan 2005), we wanted to adopt a classification scheme that recognised the complexity of tours and incorporated time of day, tour purpose and the structure of tours. The structure of tours considered whether they were:

- 'multi-part' tours – consisting of two or more segments (e.g. several work-related segments), all for the same purpose; or
- 'composite' tours – comprising segments with differing purposes (e.g. a work-related segment with one or more non-work segments).

Hence, we created a tour classification scheme comprising ten tour types (see Table 3.1).

Table 3.1   Classification of tours by complexity and purpose (adapted from O'Fallon and Sullivan 2005).

Tour description	Sequence[a]
Simple work	h—w—h
Multi-part work	h—w—(w)[b]—w—h
Composite to work	h—psl/e—(psl/w/e)—w—h
Composite from work	h—w—(psl/w/e)—psl/e—h
Composite to and from work	h—psl/e—(psl/w/e)—w—(psl/w/e)—psl/e—h
Composite at work	h—w—(psl/w/e)—psl/e—(psl/w/e)—w—h
Simple/multi-part education[c]	h—e—(e)—h
Composite education & non-work	h—psl—e—(psl)—h **and** h—(psl)—e—psl—h
Simple non-work/non-education	h—psl—h
Multi-part non-work/non-education	h—psl—psl—(psl)—h

Notes to Table 3.1:
a: h = home,
        w = work,
        e = education,
        psl = personal (includes personal business/services, medical/dental and social welfare), shopping and leisure (includes social, leisure and recreational purposes), i.e. neither work nor education).
b: The bracketed terms represent additional segments that may be in the tour.
c: Multi-part education tours form less than 0.5% of all tours within the database, hence they are combined with the 'simple education' tour category.

More recently, we had interest expressed in developing an understanding of New Zealanders' tour-making patterns when the activity 'shopping' formed part of their tour. In response to this, we developed a further tour classification which distinguishes shopping from work/education and other 'personal' (i.e. non-work/non-education) activities. This is shown in Table 3.2.

The shopping tour classification consists of seven tour types. We combined 'work' and 'education' together to simplify the presentation and, because of their relatively small numbers when considered separately, created a classification of 'complex' work/education tours, which may be either 'multi-part' or 'composite' work/education tours.

Table 3.2   Classification of tours highlighting shopping activity.

Tour description	Sequence[a]
Simple work/education tour	h—w/e—h
Complex work/education tour (including composite & multi-part work/education tours)	h—w/e—(w/e)[b]—w/e—h **or** h—pl—(pl/w/e)—w/e—h **or** h—pl—(pl/w/e)—w—(pl/w/e)—pl—h
Shopping combined with work/education tour	h—s—w/e—h **or** h—w/e—s—h **or** h—s—w/e—s—(s)—h **or** h—w/e—s—(s)—w/e—h
Simple personal business/leisure tour	h—pl—h
Multi-part personal business/leisure tour	h—pl—pl—(pl)—h
Simple shopping tour	h—s—h
Complex shopping tour (including multi-part shopping tours & shopping tours with non-work/non-education components)	h—s—s—(s)—h **or** h—s—s/pl—(s/pl)—h

Notes to Table 3.1:
a: h = home,
        w = work,
        e = education,
        s = shopping,
        pl = personal (includes personal business/services, medical/dental, social welfare) and leisure (includes social, leisure and recreational purposes), i.e. neither work, shopping nor education.
b: The bracketed terms represent additional segments that may be in the tour.

To put the tours combining shopping with work/education in perspective, nearly two-thirds of these included shopping on the way home *from work*, while one-third had shopping as part of an '*at work*' tour. A very small number of these tours had shopping on the way to work/education, or both on the way to work/education and on the way home again. Unfortunately, the overall numbers meant that it was not possible to analyse each of these potential tour types separately.

The analysis of shopping-related tours is found in Chapter 4.

3.2   Basic information about tours

As noted in Section 1.1, we applied our definition for tours across both travel days recorded by the respondent, with the result that the number of tours per respondent reported reflects the total number of tours they made within two travel days.

Tours are based on the concept of a complete round trip, beginning and ending at home. We have also made provision for work-based 'subtours', which begin and end at a person's place of employment. We think that tours are particularly relevant when considering how to encourage travel behaviour change (e.g. having people shift from driving a car to walking, cycling or using passenger transport) as, generally speaking, the mode people choose to use as they leave home pre-determines the mode they use throughout their trip/day and for their return journey to home.

All of the values given in the following sections have been weighted statistically to correct for non-response and to reflect the New Zealand population better, using weights derived by the Ministry of Transport for the NZHTS/ONZHTS. In the 1997/98 dataset, where all of the 37,446 valid tours are included in the analysis, the weighted total is 1,825 million tours per year. The 2004–07 dataset has 2,022 million tours per year when all of the 36,367 valid tours are included in the analysis.

We have not adjusted weighting to take account of the fact that some segments (with weights) in the original datasets were not translated into tours.

3.3   Tours per day and segments per tour

Essentially, the mean number of tours per New Zealander per day did not change between 1997/98 and 2004–07, and neither did the mean number of segments per tour, the maximum number of tours over two days nor the number of segments in a tour.

Table 3.3 summarises some key tour-related statistics. In both 1997/98 and 2004–07, the number of tours undertaken by any one respondent ranged from 0 (where a person stayed home both travel days) to 13. On average, respondents completed 1.3 tours per day in 1997/98 and in 2004–07. This average includes those who did not travel at all during the two days of the survey (recorded as 0 tours). It also takes account of the cases where tours spanned two travel days.[16] The mean number of segments per tour in 1997/98 and 2004–07 was 3.1. In 1997/98, the maximum number of segments in a tour was 28; in 2004–07, the maximum number of segments was 23.

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16 This was done by adding one to the number of valid tours recorded for the respondent, because tours spanning two travel days are an indicator of the frequency with which sequences at the start and end of the two-day travel diary formed part of longer valid tours (but which were not counted as such because the start or end of the tour fell outside the two days specified for the travel diary). Take the example of someone whose only travel every day is one tour starting at 3 a.m. and finishing at 5 a.m. every day (thus spanning two travel days, given that travel days start at 4 a.m.).
  • Clearly on two travel days, they should be counted as having two tours.
  • But our programming would have created only one valid tour and two 'sequences' of segments.
  • The solution is to add one valid tour as indicated by the tour detected which spanned two travel days, i.e. 1+1=2 (the true number of tours over two days).

Table 3.3   Comparing mean number of tours and segments (1997/98 and 2004–07).

Statistics	1997/98	2004–07
Tours (unweighted count)	*N=37,446*	*N=36,367*
Mean number of tours per person per day	1.3	1.3
Mean number of trip segments per tour	3.1	3.1
Maximum number of tours within two travel days	13	13
Maximum number of segments per tour	28	23

As can be seen from Table 3.4, the number of segments in a tour was also largely unchanged between 1997/98 and 2004–07.

Table 3.4   Number of segments in a tour (1997/98 and 2004–07).

Number of segments in tour	1997/98		2004–07	
	Tours (million/year)	%	Tours (million/year)	%
2	1,025	56.2	1,143	56.5
3	303	16.6	356	17.6
4	208	11.4	236	11.7
5	105	5.7	105	5.2
6	74	4.1	75	3.7
7–8	64	3.5	67	3.3
9 or more	46	2.5	41	2.0
Total	**1,825**	**100.0**	**2,022**	**100.0**

We also investigated the effect of the tour purpose on the number of segments in a tour, and found that Discretionary (social/recreational) and Accompanying Someone Else tours tended to be less complex – usually only having two segments – than tours for other purposes (Table 3.5). This basically mirrors what occurred in 1997/98.

Table 3.5   Number of segments in tour by tour purpose (2004–07).

Number of segments within tour - reduced categories	Total	Subsistence	Maintenance	Discretionary	Accompanying Someone Else
Tours (unweighted count)	*N=36,360*	*N=12,574*	*N=11,087*	*N=8,577*	*N=4,090*
2	56.5%	47.8%	47.7%	74.2%	72.4%
3	17.6%	15.7%	24.1%	13.0%	15.7%
4	11.7%	14.5%	12.9%	7.6%	7.6%
5	5.2%	6.9%	6.3%	2.4%	2.0%
6	3.7%	5.8%	3.8%	1.5%	0.9%
7–8	3.3%	5.4%	3.5%	0.9%	1.0%
9 or more	2.0%	3.9%	1.7%	0.3%	0.4%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

In total, 432 valid tours spanning two travel days were in the dataset. In other analyses, the incomplete tours at the start and end of the travel days have generally been excluded because of their incompleteness.

We examined the datasets for differences in the number of segments in a tour based on gender and age. In 1997/98, men were slightly (but significantly) more likely to complete two-segment tours (58% of their tours had two segments, compared with 54% of women's tours) while no distinctive differences appeared with respect to age[17]. The gap between men and women making two-segment tours was essentially the same (58% compared with 55%) in the 2004–07 dataset.

In examining the 2004–07 dataset for the effects of age on the number of segments in a tour, we found that the age groups up to 65–74 did not differ greatly.

3.4   Type and complexity of tours

The vast majority of tours are 'non-work/non-education' tours: in 2004–07, these formed 64% of all tours. However, this may be a 2% decrease since 1997/98, where 66% of all tours were non-work/non-education (the change verges on significance at the conventional 5% level). Table 3.6 shows how tour type and complexity have changed between the two datasets.

Table 3.6   **Types of tours (1997/98 and 2004-07)**

Tour type	1997/98 (%)	2004–07 (%)	Absolute change (%)
Simple non-work/non-education tour	41.3	40.0	-1.3
Multi-part non-work/non-education tour	24.9	23.9	-1.0
Simple work tour	10.6	12.7	2.1
Multi-part work tour	3.2	3.2	0.0
Composite to work tour	2.0	2.2	0.2
Composite from work tour	4.0	4.3	0.3
Composite to and from work tour	1.7	1.9	0.2
Composite at work tour	2.0	1.8	-0.2
Simple/multi-part education tour	6.8	6.7	-0.1
Composite own-education & non-work tour	3.6	3.4	-0.2
Total	**100.0**	**100.0**	**–**

Comparing 1997/98 and 2004–07, we found that simple work tours, where the respondent travelled from home to work and then back home again with no intermediate stops, remained fairly constant at just over 1 in 10 tours.

In 1997/98, those aged 3–17 undertook the vast majority of education-related tours: 84% of the simple/multi-part education tours and 74% of the composite education tours. However, reflecting the rapid growth in tertiary education participation rates between 1998 and 2005 (Ministry of Education 2008), we found that 3–17 year olds completed less than 80% of simple/multi-part education tours in 2004–07.

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[17] The age groups we examined in 1997/98 were slightly different, in that we had 0–14, 15–24, 25–59, 60–64 and 65+. The 75+ age group did not have the numbers to be a separate group. In 2004–07, the sample size for this age group was large enough to consider separately, though not in too much detail.

Older people are much more likely to complete simple and multi-part non-work/non-education tours than any other kind of tour. In 1997/98, 91% of the 60+ age group's tours were of this type; in 2004–07, this had decreased to 85%, with a corresponding increase in work-related tours (particularly simple work tours, rising from 4% to 8%). This reflects the trend for older people to stay in the workforce longer than previously (as noted in Section 2.6).

3.5 Main purpose of tour

3.5.1 General observations

The preceding tour classification is helpful for considering the complexity of journeys that New Zealanders make, but the categories focus on the reasons or purposes for the work- and education-based tours, which are just over one-third (36%) of all tours. Hence, we also categorised tours (Table 3.7) using the same hierarchical purpose classification we adopted for trip chains (Subsistence, Maintenance, Discretionary and Accompanying Someone Else).

Table 3.7   Main purpose of tour (1997/98 and 2004–07).

Tour type	1997/98		2004–07		Absolute change (%)
	Tours (million/year)	%	Tours (million/year)	%	
Subsistence	616	33.8	731	36.2	2.4
Maintenance	526	28.8	610	30.2	1.4
Discretionary	507	27.8	465	23.0	-4.8
Accompanying Someone Else	174	9.5	213	10.5	1.0
Total (includes other minor purposes)	**1,825**	**100.0**	**2,022**	**100.0**	–

Hence, we can see that Maintenance tours, which include purposes such as personal business, social welfare and shopping, formed 30% of all tours in 2004–07, while Discretionary tours (leisure, social and recreational purposes) were 23% of all tours, a smaller share than in 1997/98 (28%).

3.5.2 Relationship between tour purpose and gender

As was the case in 1997/98, in 2004–07, men made more of the Subsistence tours than women (56% compared with 44%), while exactly the opposite occurred with Maintenance tours (women made 57% of these tours compared with 43% by men). Discretionary tours were split equally among men and women, while women were more likely to undertake a tour Accompanying Someone Else (58% compared with 42% of men). An example of this would be a woman taking an elderly family member to the doctor or a child to school: for the family member or child, the trip would be denoted as Maintenance or Subsistence respectively; for the woman, the tour would be classified as Accompanying Someone Else. Table 3.8 gives more details regarding tour purpose and gender.

Table 3.8   Tour purpose by gender (2004–07).

Gender	Total	Subsistence	Maintenance	Discretionary	Accompanying Someone Else
Tours (unweighted count)	*N=36,360*	*N=12,574*	*N=11,087*	*N=8,577*	*N=4,090*
Females	50.6%	43.6%	56.7%	50.6%	57.6%
Males	49.4%	56.4%	43.3%	49.4%	42.4%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Women had a much greater tendency to be vehicle passengers on Maintenance and Discretionary tours (73% compared with 27% of men and 58% compared with 42%, respectively).

In 53% of the tours Accompanying Someone Else in 2004–07, the main mode was as a vehicle passenger while the main mode was as the vehicle driver for a further 37%. As was the case in 1997/98 with tours Accompanying Someone Else, where the mode was vehicle driver, women (62%) were more likely than men (40%) to be the driver. In 2004–07, the vehicle passengers in tours Accompanying Someone Else were children under the age of 18 in 88% of the occurrences. This is similar to 1997/98.

3.6   Travel modes within a tour

In 2004–07, 86% of all tours used a single mode, similar to the 84% of all tours in 1997/98. As is to be expected, this is lower than the 92% of trip chains (in 2004–07) that used one mode. Table 3.9 shows that the share of vehicle driver only tours increased slightly but significantly from 47% (1997/98) to 50% (2004-07), while the share of vehicle passenger only tours remained unchanged (23%).[18]

The proportion of walk only tours were similar between 1997/98 and 2004–07.

Table 3.9   All modes used within a tour (regardless of relative distance) for 1997/98 and 2004–07.

Modes used in a tour	1997/98		2004–07	
	million tours/year	%	million tours/year	%
Vehicle driver	851	46.6	1,008	49.9
Vehicle driver & walk	84	4.6	73	3.6
Vehicle passenger	411	22.5	464	22.9
Vehicle passenger & walk	73	4.0	68	3.4
Cycle	40	2.2	29	1.4
Cycle & walk	3	0.2	3	0.1
Train & walk	2	0.1	1	0.1
Bus	9	0.5	12	0.6
Bus & walk	26	1.4	33	1.6
Ferry & walk	–	–	1	0.0
Taxi	4	0.2	3	0.2
Taxi & walk	2	0.1	1	0.1
Other modes (not plane) only	3	0.2	5	0.2
Other modes (not plane) & walk	–	–	1	0.0
Mobility scooter	n/a	n/a	1	0.1
Walk only	216	11.9	218	10.8
Vehicle driver & vehicle passenger (& perhaps walk)	49	2.7	48	2.4
Vehicle driver & bus/train/ferry (& perhaps walk)	5	0.3	6	0.3
Vehicle passenger & bus/train/ferry (& perhaps walk)	29	1.6	26	1.3
Other combinations	19	1.1	21	1.1
Total	**1,825**	**100.0**	**2,022**	**100.0**

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18 The Ministry of Transport notes that some under-reporting of walk/vehicle combinations is expected. To minimise this, interviewers are trained to probe for walk segments with questions like 'Where did you park?' or 'How did you get to the shop from there?' etc.

3.7 Main mode of tour

3.7.1 General trends

As is the case with trip chains, in order to simplify our analysis, we determined the main mode for each tour where more than one mode was used, based on the mode used for the greatest distance within the tour. About 14% of all tours used more than one mode and will be affected by this simplification. Table 3.10 lists trends in main modes used.

The increase in the proportion of tours with vehicle driver as the main mode (55% compared with 53% in 1997/98) was not large enough to reach statistical significance. Differences for other modes between the time periods were all around one percentage point or smaller.

Table 3.10   Main mode used in a tour (1997/98 and 2004–07).

Main mode (defined by distance) used in a tour	1997/98 (%)	2004–07 (%)	Absolute change (%)
Tours (unweighted count)	*N=37,446*	*N=36,360*	–
Vehicle driver	53.0	55.1	2.1
Vehicle passenger	27.8	27.5	-0.4
Walk	13.0	11.9	-1.1
Cycle	2.4	1.6	-0.8
Passenger transport	3.3	3.2	0.1
Not defined*	0.6	0.7	0.1
Total	**100.0**	**100.0**	**–**

* Category includes taxi and mobility scooter, but not plane.

3.7.2 Relationship between main mode and tour type

Given that vehicle driver continued to dominate as the main mode for the majority of all tours, it is not surprising to find that vehicle driver was still the most common main mode for a number of different tour types, such as simple and multi-part non-work/non-education tours (50% and 54% respectively – in 1997/98, the corresponding figures were 49% and 52%). Table 3.11 also reveals that vehicle driver continued to be overwhelmingly the mode of choice for all types of work tours: simple (77%), multi-part (88%) and composite work tours (81%). The vehicle driver shares of the work-based tours in 1997/98 were 75%, 85% and 80% respectively.

Table 3.11   Main mode of tour by tour type (2004–07).

Main mode used	All tours	Simple work tour	Multi-part work tour	Composite work tours (all types)	Simple/ multi-part education tour	Composite education & non-work tour	Simple non-work/ non-education tour	Multi-part non-work/ non-education tour
Tours (unweighted count)	*N=36,360*	*N=4,511*	*N=1,154*	*N=3,567*	*N=2,211*	*N=1,131*	*N=14,871*	*N=8,915*
Vehicle driver	55.1%	76.9%	88.5%	81.5%	10.7%	15.0%	50.1%	54.0%
Vehicle passenger	27.5%	9.6%	7.5%	9.3%	38.5%	62.1%	28.6%	37.7%
Walk	11.9%	6.1%	0.9%	2.2%	28.4%	12.6%	18.2%	5.4%
Cycle	1.6%	2.5%	0.7%	1.4%	3.9%	1.7%	1.6%	0.6%
Passenger transport	3.2%	4.3%	2.3%	5.0%	17.3%	8.3%	0.8%	1.4%
Not defined	0.7%	0.7%	0.1%	0.5%	1.2%	0.3%	0.7%	0.8%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

3.7.3   Relationship between age and mode use

Comparing the main mode used in a tour and the age of the person undertaking the tour, we find that some significant changes in mode use occurred between 1997/98 and 2004–07, as highlighted in Table 3.12 and Table 3.13.

Table 3.12   Main tour mode by age (in five categories) for 1997/98.

Main mode of tours	Age					
	Total	0–4	5–17	18–24	25–59	60+
Tours (unweighted count)	*N=37,431*	*N=2,652*	*N=7,488*	*N=3,057*	*N=19,525*	*N=4,709*
Vehicle driver	53.0%	0.1%	5.8%	54.4%	75.0%	59.9%
Vehicle passenger	27.8%	86.5%	56.4%	23.5%	12.8%	18.9%
Walk	13.0%	12.4%	21.4%	11.8%	9.1%	17.8%
Cycle	2.4%	0.1%	6.8%	4.7%	0.8%	1.6%
Passenger transport	3.3%	0.5%	9.2%	4.6%	1.7%	1.3%
Not defined	0.6%	0.4%	0.4%	1.0%	0.6%	0.5%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Table 3.13   Main tour mode by age (in five categories for 2004–07.

Main mode of tours	Age					
	Total	0–4	5–17	18–24	25–59	60+
Tours (unweighted count)	*N=36,360*	*N=2,400*	*N=6,178*	*N=2,870*	*N=18,644*	*N=6,268*
Vehicle driver	55.1%	0.0%	5.2%	55.5%	75.0%	65.2%
Vehicle passenger	27.5%	88.5%	63.4%	21.8%	12.7%	16.4%
Walk	11.9%	10.4%	18.7%	14.3%	8.5%	15.3%
Cycle	1.6%	0.2%	4.3%	0.7%	1.2%	0.8%
Passenger transport	3.2%	0.6%	7.5%	6.3%	2.1%	1.4%
Not defined	0.7%	0.3%	0.9%	1.5%	0.5%	0.9%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

While the main part of the adult population (18–59 year olds) showed no change in its mode share for vehicle drivers between 1997/98 and 2004–07, older people (aged 60+ have increased their vehicle driver tours as a proportion of all their tours from 60% to 65% (this difference does not quite reach statistical significance when applying the rule of thumb introduced in Section 1.5, but the trend is consistent with other results such as increased driver licence-holding among older people). This appears to have been at the expense of walk and vehicle passenger tours. The increased driver tours and decreased walk and passenger tours in the older age group is not totally surprising, given the increased proportion of older women holding drivers' licences: in the 1997/98 NZHTS, 75% of women aged 65–74 and 52% of women aged 75+ held drivers' licences. In 2004–07, the licence-holding rate of women in these two groups had increased to 83% and 61% respectively. Further analysis of older people's travel patterns is found in O'Fallon and Sullivan (2009).

3.7.4   Relationship between gender and mode use in tours

As was the case in 1997/98, we found that men were more likely than women to complete tours as a vehicle driver (54% compared with 46%), and women were more likely than men to be vehicle passengers (59% compared with 41%). These rates are within 1% of what they were in 1997/98. Table 3.14 gives more details relating gender and tour mode.

Table 3.14   Main mode used in tours by gender (2004–07).

Gender	Total	Vehicle driver	Vehicle passenger	Walk	Cycle	Passenger transport	Not defined
Tours (unweighted count)	*N=36,360*	*N=20,022*	*N=10,183*	*N=4,178*	*N=714*	*N=1,009*	*N=254*
Females	50.6%	45.6%	59.0%	57.2%	26.5%	51.6%	52.9%
Males	49.4%	54.4%	41.0%	42.8%	73.5%	48.4%	47.1%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

3.8 Tour length

3.8.1 Total length of tour

Overall, Table 3.15 reveals no large changes in total tour length between 1997/98 and 2004–07.

Table 3.15 Total tour length (1997/98 and 2004–07).

Total tour length*	1997/98	2004–07
Tours (unweighted count)	*N=37,311*	*N=35,982*
up to 1.99 km	13.1%	12.6%
2.00–3.99 km	14.5%	13.1%
4.00–5.99 km	11.2%	10.9%
6.00–9.99 km	14.4%	15.3%
10.00–19.99 km	18.6%	19.0%
20.00–29.99 km	9.0%	9.1%
30.00 km or more	19.3%	20.0%
Total	**100.0%**	**100.0%**

*Walk distances have been imputed.

Similarly, when total tour length by main mode is compared between the two datasets, nothing interesting could be noted. The proportion of vehicle driver tours that are walkable and cyclable distances remained constant: in 2004–07, 18% of vehicle driver tours were under 4 km (i.e. less than 2 km each way), while 45% were less than 10 km. This compares with 19% and 46%, respectively, in 1997/98.

3.8.2 Relationship between tour length and tour type

Work and education-based tours had quite different patterns with respect to tour length; education-based tours were typically shorter.

In both the 1997/98 and 2004–07 datasets, 24% of simple work tours were less than 4 km and 51% were under 10 km. Multi-part work tours (involving at least two work-related segments) were quite different from simple work tours, as fewer (20% in 1997/98) of these were less than 10 km in total, while 53% were more than 30 km in length.

Composite work tours were similar to multi-part work tours in that about 20% were less than 10 km, while 41% were greater than 30 km (in both datasets).

By contrast with the simple work tours, more than two-fifths (42% in 1997/98 and 44% in 2004–07) of simple or multi-part education tours were less than 4 km long.

3.8.3   Relationship between vehicle driver tour length and tour type

The New Zealand Government's 2008 New Zealand Transport Strategy (Ministry of Transport 2008b) and Government Policy Statement on Land Transport Funding (Ministry of Transport 2008c) set targets designed to reduce congestion and vehicle-kilometres travelled on New Zealand land transport networks, and to encourage the use of active transport modes. We therefore examined the nature of the vehicle driver tours in more detail.

In the 1997/98 dataset, we found that nearly one in five (19%) of all vehicle driver tours were less than 4 km in length. As seen in Table 3.16, simple work tours (19%), simple education tours (16%) and simple non-work/non-education tours (33%) were more likely to be less than 4 km than were multi-part or composite tours of any type. These patterns/proportions (within ±1%) were the same for vehicle driver tours in the 2004–07 dataset.

Table 3.16   Type of vehicle driver tour by tour length (1997/98).

Total tour length*	All vehicle driver tours	Simple work tour	Multi-part work tour	Composite work tours (all types)	Simple/ multi-part education tour	Composite own-education & non-work tour	Simple non-work/ non-education tour	Multi-part non-work/ non-education tour
Tours (unweighted count)	*N=19,668*	*N=3,052*	*N=976*	*N=2,816*	*N=202*	*N=178*	*N=7,621*	*N=4,823*
Up to 1.99 km	6.9%	6.4%	0.7%	0.5%	6.3%	0.8%	13.9%	1.5%
2.00–3.99 km	12.0%	12.6%	2.3%	2.4%	9.8%	2.7%	19.9%	7.5%
4.00–5.99 km	10.8%	10.1%	4.3%	4.1%	9.5%	3.6%	15.8%	9.0%
6.00–9.99 km	15.8%	17.4%	8.5%	10.4%	14.6%	12.7%	18.1%	16.1%
10.00–19.99 km	20.7%	19.7%	16.3%	23.0%	18.2%	18.5%	16.9%	27.2%
20.00–29.99 km	10.4%	11.0%	10.9%	15.3%	10.2%	16.0%	6.6%	12.9%
30.00 km or more	23.3%	22.9%	57.0%	44.3%	31.5%	45.8%	8.7%	25.7%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

* Distances have been imputed for walk segments.

Simple tours also tended to be shorter than multi-part and composite tours when the proportion of vehicle driver tours that were less than 10 km in length were compared.

The small number of simple/multi-part and composite own-education tours completed by vehicle drivers pre-empts any comments on their length.

3.9   Comparison of tour characteristics by major city

3.9.1   Tour type

We briefly analysed the tours dataset to determine if any notable differences in tour-making patterns were obvious between Auckland (the four cities of North Shore, Waitakere, Auckland and Manukau, including Papakura and part of Rodney District), Wellington (the four cities of Porirua, Upper Hutt, Lower Hutt and Wellington) and Christchurch.

Table 3.17 shows that simple work tours were increasing in all three cities (the increase of 2.5% for the three cities combined is clearly significant statistically).

Table 3.17   Comparison of tour types in the three major cities (1997/98 and 2004–07).

Tour type	All cities combined		Auckland		Wellington		Christchurch	
	1997/98	2004–07	1997/98	2004–07	1997/98	2004–07	1997/98	2004–07
Tours (unweighted count)	*N=12,132*	*N=11,589*	*N=6,316*	*N=5,225*	*N=3,528*	*N=3,116*	*N=2,288*	*N=3,248*
Simple work tour	9.0%	11.5%	9.1%	11.9%	9.1%	10.9%	8.2%	10.8%
Multi-part work tour	3.1%	2.8%	3.1%	3.0%	2.4%	3.4%	3.9%	1.8%
Composite work tours (all types)	11.2%	10.8%	10.7%	10.2%	10.4%	13.7%	13.7%	10.4%
Simple/multi-part education tour	7.0%	7.3%	8.1%	8.1%	4.4%	4.5%	6.2%	6.6%
Composite education & non-work tour	3.7%	4.0%	4.1%	4.3%	2.9%	3.3%	3.3%	3.9%
Simple non-work/non-education tour	41.1%	40.0%	40.4%	39.6%	43.7%	38.8%	40.7%	42.6%
Multi-part non-work/non-education tour	25.0%	23.5%	24.6%	23.0%	27.2%	25.4%	23.9%	23.9%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

3.9.2   Mode

When the three major cities are considered together (Table 3.18), the proportion of tours
completed as a vehicle driver (including vehicle driver and walk) was stable (50% in
1997/98 and 51% in 2004–07). By contrast, the proportion of tours completed as a
vehicle driver (including vehicle driver and walk) within the whole New Zealand population
grew from 51% in 1997/98 to 54% in 2004–07.

Table 3.18   Comparison of modes used in tours by the three major cities (1997/98 and 2004–07).

Modes used (regardless of relative distance)	All cities combined		Auckland		Wellington		Christchurch	
	1997/98	2004–07	1997/98	2004–07	1997/98	2004–07	1997/98	2004–07
Tours (unweighted count)	*N=12,132*	*N=11,589*	*N=6,316*	*N=5,225*	*N=2,288*	*N=3,116*	*N=3,528*	*N=3,248*
Vehicle driver	44.4%	47.2%	45.8%	48.8%	40.5%	43.0%	44.0%	45.3%
Vehicle driver & walk	5.8%	3.7%	5.9%	2.6%	5.2%	7.7%	6.1%	4.1%
Vehicle passenger	22.1%	23.8%	23.4%	24.7%	18.8%	22.7%	20.9%	21.3%
Vehicle passenger & walk	4.6%	3.4%	5.0%	3.0%	4.4%	4.8%	3.9%	3.3%
Cycle (& perhaps walk)	2.1%	1.0%	1.3%	0.5%	2.6%	0.9%	3.8%	3.0%
Train & walk	0.2%	0.1%	0.1%	0.1%	0.6%	0.4%	0.0%	0.0%
Bus/Bus & walk	2.0%	2.9%	1.8%	3.1%	2.7%	2.5%	1.8%	2.5%
Taxi (& perhaps walk)	0.4%	0.2%	0.3%	0.1%	0.8%	0.1%	0.5%	0.5%
Other modes only (not plane)	0.0%	0.5%	0.0%	0.6%	0.0%	0.0%	0.0%	0.1%
Walk only	12.1%	11.3%	10.8%	11.2%	14.4%	9.7%	14.2%	13.3%
Vehicle driver & vehicle passenger (& perhaps walk)	2.4%	2.3%	2.4%	2.2%	2.7%	2.2%	2.2%	2.8%
Vehicle driver & bus/train/ferry (& perhaps walk)	0.4%	0.4%	0.1%	0.3%	1.5%	1.1%	0.1%	0.4%
Vehicle passenger & bus/train/ferry (& perhaps walk)	2.2%	1.6%	2.2%	1.3%	3.2%	2.8%	1.2%	1.6%
Other combinations	1.3%	1.6%	0.9%	1.4%	2.7%	1.9%	1.2%	1.6%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

3.9.3   Tour length

Comparing the results for all three cities combined in Table 3.19, we can see that the distribution of tour lengths did not change markedly between 1997/98 and 2004–07. One marked difference is consistent between the two datasets: Christchurch respondents again made fewer really long tours (greater than 30 km) than Aucklanders or Wellingtonians (12% compared with 20% and 21%, respectively, in 2004–07).

Table 3.19   Comparison of tour length in the three major cities (1997/98 and 2004–07).

Total tour length (walk dist imputed)	All cities combined		Auckland		Wellington		Christchurch	
	1997/98	2004–07	1997/98	2004–07	1997/98	2004–07	1997/98	2004–07
Tours (*unweighted count*)	*N=11,971*	*N=11,359*	*N=6,278*	*N=5,103*	*N=2,173*	*N=3,013*	*N=3,520*	*N=3,243*
up to 1.99 km	12.2%	11.7%	11.0%	12.1%	13.4%	11.8%	14.8%	10.4%
2.00–3.99 km	13.6%	11.8%	13.7%	10.6%	13.6%	15.1%	13.6%	13.1%
4.00–5.99 km	10.8%	10.1%	11.4%	10.1%	10.3%	9.1%	9.3%	11.2%
6.00–9.99 km	13.7%	15.8%	13.3%	15.9%	16.1%	14.8%	12.5%	16.0%
10.00–19.99 km	19.9%	21.2%	18.3%	20.5%	19.9%	19.0%	24.7%	25.4%
20.00–29.99 km	10.6%	10.6%	10.5%	10.6%	7.5%	9.1%	13.6%	11.9%
30.00 km or more	19.2%	18.8%	21.8%	20.2%	19.2%	21.0%	11.5%	11.9%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

4   Shopping: analysis of a modern pastime

4.1   Background

Earlier in 2008, Pinnacle Research & Policy Ltd was asked to prepare some analysis regarding the prevalence of shopping in New Zealanders' travel patterns, specifically their tour-making behaviour. As a result of this, we devised a further classification of tours specifically distinguishing shopping as an activity within a tour or even the basis of a tour ('simple shopping tour' and 'multi-part shopping tour'). This classification is described in Section 3.1.

Once we had created the new classification, we had 37,919 valid tours, with a weighted total of 2,010 million tours per year using the 2004–07 dataset.

4.2   Shopping tours relative to all tours

Simple and complex shopping tours together formed 22% of all tours undertaken by New Zealanders. When combined shopping and work/education tours are taken into account, this figure rises to one-quarter (26%) of all tours having at least one tour segment of shopping included in them (Table 4.1).

Table 4.1   **Tour types highlighting shopping activity.**

Tour type	Tours (million/yr)	%
Tours (unweighted count)	*N=37,919*	–
Simple work/education	392	19.5%
Complex work/education	244	12.2%
Shopping combined with work/education	82	4.1%
Simple shopping	284	14.1%
Complex shopping	167	8.3%
Simple personal business/leisure	613	30.5%
Multi-part personal business/leisure	227	11.3%
Total	**2109**	**100.0%**

4.3   Mode use in shopping tours

The majority of simple and complex shopping tours were completed as vehicle driver or vehicle driver & walk (61% and 63% respectively). By contrast, 54% of simple work/education tours and about 45% of simple and multi-part personal business/leisure tours were undertaken as vehicle driver and vehicle driver plus walk (see Table 4.2).

Table 4.2   Comparison of different types of tours by mode(s) used (2004–07).

Tour mode*	Total	Simple work/ education	Complex work/ education	Shopping plus work/ education	Simple shopping	Complex shopping	Simple personal business /leisure	Multi-part personal business /leisure
Tours (unweighted count)	*N=36,159*	*N=6,774*	*N=4,236*	*N=1,363*	*N=5,084*	*N=3,135*	*N=11,382*	*N=4,185*
Vehicle driver	49.8%	53.3%	53.4%	55.6%	59.2%	53.6%	44.9%	36.5%
Vehicle driver & walk	3.6%	1.1%	9.0%	16.5%	1.4%	9.5%	0.6%	4.1%
Vehicle passenger	23.0%	15.0%	12.3%	5.5%	19.4%	20.2%	30.6%	41.1%
Vehicle passenger & walk	3.3%	3.9%	6.4%	4.3%	1.1%	5.5%	1.1%	5.8%
Cycle (incl walk)	1.6%	2.9%	1.1%	1.4%	0.9%	0.3%	1.8%	1.0%
Passenger transport (incl walk)	2.4%	6.8%	2.7%	5.8%	1.0%	1.1%	0.6%	0.7%
Walk	10.8%	11.4%	3.1%	2.6%	15.1%	3.1%	17.1%	4.5%
Vehicle driver & vehicle passenger (& sometimes walk)	2.3%	0.7%	5.1%	3.4%	0.8%	3.8%	2.1%	3.2%
Vehicle passenger & passenger transport (& sometimes walk)	1.3%	2.8%	3.5%	2.1%	0.2%	0.8%	0.2%	0.7%
Other combinations (incl taxi but not plane)	1.9%	2.1%	3.5%	2.9%	1.0%	2.1%	1.1%	2.4%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

* Regardless of distance

4.4   Length of shopping tours

Simple shopping tours exhibited a very similar pattern to simple personal business/leisure tours. As shown in Table 4.3, both have a greater tendency to be less than 3.99 km long (about 39% and 38% respectively) than simple work/education tours (30%). Both were also short more frequently than any of the complex or multi-part tours (which all had less than 10% shorter than 4 km).

Table 4.3   Comparison of different types of tours by total tour length (2004–07).

Total tour length*	Total	Simple work/ education	Complex work/ education	Shopping plus work/ education	Simple shopping	Complex shopping	Simple personal business /leisure	Multi-part personal business /leisure
Tours (unweighted count)	*N=35,778*	*N=6,662*	*N=4,146*	*N=1,339*	*N=5,060*	*N=3,111*	*N=11,324*	*N=4,136*
Up to 1.99 km	12.7%	15.4%	1.2%	1.0%	20.3%	1.1%	20.6%	2.0%
2.00–3.99 km	13.1%	15.1%	4.6%	3.0%	18.7%	5.4%	17.8%	7.9%
4.00–5.99 km	10.9%	11.6%	6.5%	4.6%	14.5%	6.6%	13.4%	8.1%
6.00–9.99 km	15.3%	14.4%	12.1%	13.6%	17.6%	14.1%	16.3%	16.3%
10.00–19.99 km	19.0%	18.2%	23.9%	24.2%	15.5%	25.7%	15.3%	23.1%
20.00–29.99 km	9.1%	8.7%	13.9%	13.7%	4.9%	14.8%	5.9%	12.5%
30.00 km or more	20.0%	16.7%	37.8%	39.8%	8.5%	32.2%	10.6%	30.0%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

* Walk distances have been imputed.

4.5 Gender and shopping tours

While the difference between men and women making simple work or education tours was large (28% of all men's tours compared with 18% of women's tours), the differences with respect to shopping-related tours were much less marked, with simple or complex shopping tours forming 22% of all women's tours compared with 17% of men's (see Table 4.4).

Table 4.4   Comparison of tour types by gender.

Tour type	Total	Females	Males
Tours (unweighted count)	*N=36,159*	*N=18,695*	*N=17,464*
Simple work/education tour	22.8%	17.7%	28.1%
Complex work/education tour	8.8%	8.8%	8.9%
Shopping combined with work/education tour	4.1%	4.2%	4.0%
Simple shopping tour	14.1%	15.3%	12.9%
Complex shopping tour	5.3%	6.8%	3.7%
Simple personal business/leisure tour	30.5%	32.3%	28.7%
Multi-part personal business/leisure tour	14.3%	14.9%	13.7%
Total	**100.0%**	**100.0%**	**100.0%**

5 Transport monitoring indicators

The Transport Monitoring Indicator Framework (TMIF) was developed by the Ministry of Transport in 2006/07 to provide a national and, where feasible, regional framework for the 'robust and consistent monitoring of the New Zealand transport system' (Ministry of Transport 2008a).

The 'travel behaviour' indicator set within the TMIF includes two indicators based on trip chains:

- percentage of road-based short trips of less than 5 km by bike (TB008);
- percentage of short trips of less than 2 km on foot (TB009).

A third one, which is noted in the online version of the TMIF, is '% road-based short journeys <5 km solely by walking or cycling'.

We estimated values for these indicators using the 1997/98 and 2004–07 datasets. In further refining the definitions of the indicators, we have:

- included only respondents aged 5+, to be consistent with most of the other indicators in the TMIF Travel Behaviour indicator set;
- included, in the appropriate indicator, 'cycle only' (TB008), 'walk only' (TB009), and combined 'cycle only', 'walk only' and 'cycle & walk' (unnumbered) trip chains – no other combinations (e.g. 'bus & walk' and 'vehicle driver & walk' were excluded);
- included all of New Zealand (e.g. we did not limit the indicator to 'main urban areas');
- prepared the indicators as 'trip chains' (rather than 'tours'). A trip chain ends when a person arrives at home, work or their place of education, or stays in one place for 90 minutes or more (we assumed that in this situation, it would be feasible for someone to complete a further 2 km walk or 5 km cycle to make the return journey); and
- reported the indicator as a proportion of all trip chains made of the specified chain length (e.g. up to 5 km long or up to 2 km long).

Given the official status of these indicators, we leave judgement as to whether the apparent declines in walking and cycling are significant or not to the Ministry of Transport (who will have more precise tests available than the rule of thumb we introduced in Section 1.5). Our results are presented in Table 5.1.

Table 5.1   Change in trip chain proportions between 1997/98 and 2004-7 for the TMIF indicators.

TMIF number	Indicator		1997/98	2004–07	Absolute change (%)
TB008	Road-based short trip chains of <5 km by bike	*Chains (unweighted count)*	*28,377*	*29,853*	-1.7
		%	4.4	2.7	
TB009	Short trip chains of <2 km on foot	*Chains (unweighted count)*	*13,582*	*14,187*	-5.1
		%	44.7	39.2	
(none)	Road-based short trip chains <5 km solely by walking and/or cycling	*Chains (unweighted count)*	*28,377*	*29,853*	-4.8
		%	31.8	27.0	

6   Conclusions

6.1   Overview

This research report describes the reformulation of the 2004–07 ONZHTS trips database into trip chains and tours. The reformulation required us to re-create programming sequences for the key elements of the new datasets (segments, trip chains, tours, main mode and main purpose, and three different tour classification schemes) based on our previous reformulation of the 1997/98 NZHTS dataset.

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 are able to provide comment on the emergence of some trends in New Zealand travel behaviour. These are discussed below.

When considering results from different units (segments, chains or tours), it is often useful to keep in mind just how many of each unit is typical:

- On average, respondents reported 4.3 segments (trip legs) per day in the 2004–07 dataset; 4.4 segments in the 1997/98 dataset.
- Tours are a distinctly broader unit of measurement, and people often complete only one in a day. The average was 1.3 tours per day in both the 1997/98 and 2004–07 datasets.
- Trip chains, as we defined them using a 90 minute cut-off, provide an alternative unit that is usefully intermediate in scope between segments and tours. Respondents averaged 2.4 trip chains per day in the 2004–07 dataset (2.3 trip chains in the 1997/98 dataset).

6.2   Trends in trip chains

Trip chains describe how New Zealanders link their travel between 'significant' locations, namely home, work or education, and other activities where they remain for >90 minutes. A trip from home, stopping to pick up the newspaper and travelling on to work is an example of a trip chain.

Key comparisons of our trip chain analysis include:

- The mean number of trip chains per day was basically unchanged (2.3 chains compared with 2.4 chains in 2004–07).
- The mean number of segments within a trip chain declined from 1.9 to 1.7. Other evidence suggests less linking of travel: a 7% increase in the number of one-segment trip chains (from 48% to 55%), in conjunction with a 4% decrease in two-segment trip chains.
- Most trip chains incorporate only one mode: 92% in 2004–07 compared with 90% of all trip chains in 1997/98.
- Vehicle driver only trip chains increased significantly from 48% to 53% of all trip chains.
- The tendency for less complex trip chains increased: for example, in 1997/98, 47% of all vehicle driver trip chains consisted of one segment only, compared with 58% in 2004–07.
- 'Walk only' trip chains declined significantly from 13% of all trip chains to 11%. The number of trip chains with some walking within them also decreased markedly: from 22% in 1997/98 (including walk only) to 18% in 2004–07.
- Overall, the proportions of trip chains that were less than 2 km in total (about 21%) or less than 6 km in total (about 50%) remained unchanged.

Other highlights from our trip chain analysis:

- In the case of trip chains less than 2 km long, vehicle drivers' share increased significantly from 30% in 1997/98 to 38% of all modes in 2004–07, while the walk share fell significantly from 45% to 39%.
- The proportion of Subsistence trip chains increased, probably reflecting the increasing proportion of older people in the workforce, statutory changes affecting the retirement age, and growth in part-time and casual work.
- More vehicle driver trip chains had a work or education purpose (33% compared with 28% in 1997/98).
- Men significantly increased their mean number of trip chains from 4.8 to 5.2 per day.
- Men completed significantly more trip chains: they more commonly made six or more trip chains over two days than women (37% compared with 32% in 2004–07); their mean number of trip chains (over two days) was significantly higher than the female mean (5.2 compared with 4.6 in 2004–07).

- Considering New Zealanders aged 75+, we found that those aged 75+ were completing fewer trip chains on average over two days: e.g. 25–59 year olds averaged 5.6 trip chains over two days, while those aged 75+ had a mean of 2.6 trip chains. Those aged 75+ were also more likely to only complete one or two trip chains over two travel days than any other age group.

6.3   Trends in tours

Tours describe how New Zealanders link their trip segments in a round trip that begins and ends at home. A simple tour could consist of leaving home, travelling to work and returning home again at the end of the working day. Tours may consist of multiple segments, either for the same purpose (e.g. a 'multi-part' work tour) or for a mix of purposes (e.g. a 'composite' work tour, which contains non-work segments).

Key comparisons from our tours analysis include:

- New Zealanders continued to average 1.3 tours per day, with a mean number of 3.1 segments per tour.
- Overall, tour lengths remained largely the same between the two datasets.
- The share of vehicle driver only tours increased slightly but significantly from 47% (1997/98) to 50% (2004–07), while the share of vehicle passenger only tours remained unchanged (23%).
- The proportions of short tours completed were relatively similar: about 26–27% of all tours were less than 4 km long in both datasets. Just over half (52–53%) were under 10 km.
- About one in five (18–19%) vehicle driver tours was less than 4 km long in total. This figure remained stable between 1997/98 and 2004–07.

Other highlights from our tours analysis:

- The maximum number of tours within two days (13) was unchanged between 1997/98 and 2004–07.
- In 1997/98, men were slightly (but significantly) more likely to complete two-segment tours (58% of their tours were two segments, compared with 54% of women's tours). This gap was essentially the same (58% compared with 55%) in the 2004–07 dataset.
- The vast majority of tours remained 'non-work/non-education' tours (66% in 1997/98 and 64% in 2004–07). Eighty-five percent of all tours completed by older people (60+) had this purpose.
- Those aged 3–17 continued to complete the vast majority of education-based tours (more than 75% in 2004–07).
- As was the case in 1997/98, in 2004–07, men made more of the Subsistence tours than women (56% compared with 44%), while exactly the opposite occurred with Maintenance tours (women made 57% of these tours compared with 43% by men).
- Vehicle driver continued to be overwhelmingly the mode of choice for all types of work tours: simple (77%), multi-part (88%) and composite work tours (81%).

- Older people (aged 60+) increased their vehicle driver tours from 60% to 65% of all of their tours (not quite reaching statistical significance using our rule of thumb), while decreasing their vehicle passenger and walk tours.
- People aged 75+ were:

    – more likely to have less complex tours (two segments only) and less likely to complete tours of five or more segments; and

    – more likely to complete simple and multi-part 'non-work/non-education' tours (85% of all their tours in 2004–07) than any other age group.

- Residents of New Zealand's three metropolitan areas (four cities of Auckland, four cities of Wellington, and Christchurch) had a significant increase in the proportion of simple work tours compared with all tours (from 9% to 11.5%). The overall proportion of vehicle driver tours remained relatively unchanged (around 50–51%).
- Christchurch residents continued to make fewer really long tours (greater than 30 km) than Aucklanders or Wellingtonians (12% compared with 20% and 21% respectively).

6.4   Shopping tours

Partly to demonstrate some of the kinds of analysis that can be undertaken using the trip chain and/or tour datasets, we devised a further classification of tours specifically distinguishing shopping as an activity within a tour or even as the basis of a tour (the 'simple shopping tour' and the 'multi-part shopping tour'). Using the 2004–7 dataset, we found that:

- Simple and complex shopping tours together formed 22% of all tours undertaken by New Zealanders;
- Most simple and complex shopping tours were completed as vehicle driver, or vehicle driver plus walk (about 61%) compared with a combined total of 53% when all tour types were considered;
- Simple shopping tours, like simple personal business/leisure tours, had a greater tendency to be less than 2 km or between 2.00 and 3.99 km long than tours which included work or education; and
- Women made slightly more shopping tours than did men (22% compared with 17%).

6.5   Transport monitoring indicators

Three indicators identified in the Government's TMIF are intended to be based on trip chains:

- TB008: road-based short trip chains of <5 km by bike,
- TB009: short trip chains of <2 km on foot, and
- road based short trip chains <5 km solely by walking or cycling.

After discussion with Ministry of Transport staff, we clarified the definition of the indicators and estimated them using both datasets.

6.6   Potential for further research

The NZTA has funded Capital Research and Pinnacle Research & Policy Ltd to undertake a research project for the 2008/09 financial year that will deliver, among other things, an up-to-date and detailed analysis of vehicle occupancy. At a basic level, this can update our analysis of the 1997/98 NZHTS (e.g. how vehicle occupancy varies by day of week, time of day, purpose of trip, and vehicles per adult in the household). To the extent allowed by improvements in ONZHTS data collection since 1997/98 that affect comparability, we will consider changes/trends since 1997/98.

Pinnacle Research & Policy Ltd has also completed a project analysing changes in older people's travel patterns between 1997/98 and 2004–07 (O'Fallon and Sullivan 2009) which primarily draws on the original 'trip legs' (segments) datasets rather than the reformulated trip chains and tours datasets.

It is essential to realise many other applications are possible for the reformulated ONZHTS trip chain and trip tour datasets. The programming we have developed can be readily applied to future datasets, such that ongoing trends can be monitored. Other modifications to highlight different activities (such as the work we did with shopping tours here), demographics, etc are also feasible. Hence, the most important output from the overall research project is probably the programming that goes with these rather than the initial report.

7 References

Australian Bureau of Statistics. 2007. *Participation in Sports and Physical Recreation 2005–06*. Canberra: Australian Bureau of Statistics.

Cochran, W.G. 1977. *Sampling Techniques* (3rd ed.). New York: John Wiley & Sons.

Land Transport Safety Authority. 2000. *Travel Survey Report – increasing our understanding of New Zealanders' travel behaviour 1997/1998.* Wellington, New Zealand: Land Transport Safety Authority.

Ministry of Transport. 2008a. TB008. *http://www.transport.govt.nz/tmif/metadata/TB008.htm.*

Ministry of Transport. 2008b. *The New Zealand Transport Strategy 2008.* Accessed September 2008 from *www.transport.govt.nz*

Ministry of Transport. 2008c. *Government policy statement on land transport funding 2009/10 – 2018/1*9. Accessed September 2008 from *www.transport.govt.nz*

Ministry of Education. July 2008. Participation rates in tertiary education. *http://www.educationcounts.govt.nz/indicators/indicator_page/tertiary/1963.*

O'Fallon, C., Sullivan, C. 2005. *Trip chaining: understanding how New Zealanders link their travel. Transfund New Zealand Research Report No. 268.* Wellington: Transfund New Zealand.

O'Fallon, C., Sullivan, C. 2009. Trends in older people's travel patterns: Analysing changes in older New Zealanders' travel patterns using the Ongoing NZ Household Travel Survey. NZ Transport Agency Research Report 369. Wellington: NZ Transport Agency.

Statistics New Zealand. 2007. New Zealand's 65+ population: A statistical volume. Wellington. *http://www.stats.govt.nz/analytical-reports/new-zealand-65plus-population.htm.*