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How We Got to School

A Study of Travel Choices of Christchurch Primary School Pupils

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by

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ABSTRACT

There has been a noticeable swing towards school pupils being driven to and from school, and away from active modes like walking and cycling, in recent decades. This has had a number of side effects. Less reliance on active modes of transport has been a contributing factor in the reducing levels of physical activity for school children. Traffic volumes associated with school trips have also increased. This increased has tended to contribute to an increase in traffic congestion, adverse environmental effects and reductions in levels of sustainability. School trip traffic contributes specifically to congestion at school gates.

Schools have been identified as having significant effects on the transportation system adjacent to them. Schools which seek Resource Consents for new or changed activities are often being required to take measures to mitigate their adverse effects

The purpose of this study is to explore the factors contributing to primary school pupils' travel choices. This will help to identify travel choice patterns which may, in turn, be useful in developing policies and planning initiatives which contribute to achieving an efficient and sustainable transport system.

A range of literature relevant to school and general commuting travel demand was reviewed.

A case study involving the pupils of twenty two Christchurch primary schools was carried out. Pupils and their parents were surveyed to establish mode choices and the factors influencing those choices. The study found that between 55% and 60% of pupils surveyed travel to and from school by car. 30% to 35% walk or scooter, and 5% to 7% cycle. This compares with 34% travelling by car in the late 1980s. In addition, a greater proportion of those pupils who walk, scooter or cycle to school are accompanied by an adult than in the past.

The results of the study also suggested that School Travel Plans, when combined with the energy and commitment to implement them can have a significant effect on school travel choices.

As part of the case study, parents were asked to rank the importance of a number of factors which could influence choices regarding their children's school travel. The responses from parents identified safety concerns, regarding both road and personal safety, as the major factor behind decisions regarding their children's travel choices. Time constraints coupled with the complexity of travel requirements of many families were identified as significant factors.

Multinomial Logit Models for both mode choice and pupils travel independence were then produced for both the journey to and from school. These models were based on the results of the case study. The models produced indicate that, at a school level, there is a correlation between increasing school roll and an increasing proportion of pupils travelling by car. A slight negative correlation between school decile and car usage was also indicated. This is contrary to the normally accepted understanding that in most transport situations there is a positive correlation between increasing affluence and car usage.

Superior model results were obtained at a disaggregated individual level, using nine variables relating to the school, the neighbourhood, and the home, than the results obtained using the school based variables of. However, it is not considered that the effort required to obtain information on the additional variables is justified when estimating mode choices of pupils at an individual school.

It is therefore recommended that a model using Decile, Average Age, and School Roll variables be used to estimate mode choices at an individual school.

At a family level, there was a strong positive correlation between distance from school, age of the pupils, and the number of major roads between school and home, and car usage.

Abstract

It became apparent that the decisions made regarding children's school travel are very complex. Families juggle a number of factors, many of which are in conflict with one another. For example a desire to care for the environment may be in conflict with the demand to get the children to school, and get to work on time.

This complex interrelationship between factors has resulted in some instances where normally accepted "Rules of Thumb", such as the understanding that increased car usage is generally associated with increasing wealth, do not appear to be applicable to school travel. The complexity of interrelationships has further meant that it has not been possible to quantify the impact of any one factor on its own.

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TABLE OF CONTENTS

APPENDICES

LIST OF FIGURES

LIST OF TABLES

ACRONYMS

CCC	Christchurch City Council
HTS	Household Travel Survey
MNL	Multinomial Logit Model
PTA	Parent Teacher Association
STP	School Travel Plan
TNZ	Transit New Zealand
vkt	Vehicle Kilometres Travelled
vpd	Vehicles Per Day

Chapter 1

INTRODUCTION

School travel patterns have changed significantly in recent decades. In the late 1980s a little over one third of primary school pupils travelled to school by car. By the mid 2000s well over on half travelled by car.

This has resulted in a dramatic increase in car numbers at school entrances at the start and end of the school day. Schools are identified as significant generators of vehicle trips. There are a number of impacts arising from the growing trend towards school pupils travelling to school by car. These include impacts on school pupils, schools, the community at large, and the environment.

As part of the Resource Management Act process new schools are being required to provide mitigation for the adverse effects of school traffic.

1.1 Scientific Problem

Schools face a number of obligations and expectations in the way they operate. Those obligations and expectations which are relevant to school travel include:

- An obligation to ensure the safety of their pupils, staff, and visitors at all times;
- An expectation that schools will be good neighbours; and
- A growing expectation that schools will encourage and support sustainability.

The travel mode choices of a school's pupils will affect its ability to meet the obligations and expectations listed above. An increased number of vehicles arriving, parking manoeuvring, and leaving the school entrance will increase the risk of accidents there, and have adverse effects on the immediate neighbours. It will also have effects on the operation of the transportation system in the wider neighbourhood.

The adverse effects on the transportation system and neighbourhood have been recognised, and schools are often required to implement measures to mitigate those effects when they apply for Resource Consents for new schools or alterations to existing schools. These measures can include provision of on site parking and road network upgrades to cope with the additional traffic generated. On site parking and vehicle manoeuvring often uses valuable space on the school property, and much of it is only used for short periods at the start and end of the school day. This land could otherwise be used for school sports and other facilities.

Schools are required to meet their transportation obligations and expectations, and make decisions about measures to mitigate the effects school travel in an environment in which little is known about the factors influencing school travel.

Primary school pupil travel choices are influenced by a number of factors. These include school factors, neighbourhood factors, and household factors. There are often complex

interrelationships between these factors. However, very little is known and understood about these factors and their interrelationships.

The travel of primary school pupils is different from other travel. It is therefore likely that the factors affecting it will vary from those affecting other travel. The areas in which the trips of primary school pupils to and from school differ from most other trips include the following:

- Decisions regarding children's travel are often made by adults;
- Children often rely on adults to provide travel, or to accompany them;
- The trips occur at specific times of the day. The afternoon trips, in particular, occur at quite a different time than most other utility trips (to and from work for example);
- The trips occur at specific times of the year. School term times are different from the working year; and
- Destinations (in the morning) and origins (in the afternoon) can be different to those of other utility trips.

There has been some research, both in New Zealand and internationally which has included the number of pupils using different modes. Often this research has been part of a wider study into travel behaviour, such as the Household Travel Survey in New Zealand. However, no research has been found which specifically identifies school travel mode choices and addresses the factors which may influence those choices.

1.2 Objectives of Study

The purpose of this study is to explore the factors contributing to primary school pupils' travel choices. This will help to identify travel choice patterns which may, in turn, be useful in developing policies and planning initiatives which contribute to achieving an efficient and sustainable transport system.

This study proposes to address two questions, namely:

1. What modes do primary school pupils use for their trips to and from school? and

2. What are the factors influencing their mode choice?

In addition an attempt will be made to consider the interrelationships between the various factors influencing primary school pupil mode choice.

To address those questions a literature review was carried out and twenty two primary schools in the Christchurch urban were surveyed. There were three components to the school surveys, namely Pupils' surveys, Parents' surveys, and a School and Neighbourhood survey. The data obtained from these surveys was then analysed, and Multinomial Logit Models were prepared. Each of the elements of the study is discussed below.

1.3 Research Phases

This study consisted of five phases, namely Literature Review, Study Method, Case Study, Data Analysis, and Model Estimation. These phases are outlined below

1.3.1 Literature Review

A review of relevant literature was carried out. This review included literature specifically addressing school travel issues. It also included literature addressing general travel choices, family decision making processes, and model preparation. The objectives of the literature review included identifying factors, issues and trends specifically relevant to school travel, and relevant also to overall family travel choices, and family decision making processes. The identification of developments in the preparation of a Multinomial Logit Model was also included in the objectives of the Literature Review.

1.3.2 Study Method

A method of studying primary school travel patterns is proposed. The method comprises four main components, namely: School Selection; Survey Process; Design of Survey Forms; and Neighbourhood Surveys.

1.3.3 Case Studies

A number of schools were approached and asked to take part in the case studies. Of these, twenty two schools agreed to take part in the case studies. The schools which were surveyed were selected to provide a broad cross section of urban Christchurch primary schools, and their surrounding neighbourhoods. Factors considered in selecting schools included socio economic factors, school size, and neighbourhood form.

1.3.3.1 Parents' Surveys

Parents' survey forms were provided to each family at the school. Parents were asked to complete the survey forms and return them to school. The objectives of the parents' surveys were to identify the proportions of pupils using each mode for school travel, to identify features of the family or individual pupil which may influence school travel

choices, and to rank the importance parents placed on a number of factors which may influence school travel choices.

As a general principle, it was considered preferable to get a large number of responses from a wide variety of parents rather than very detailed information from a smaller number of parents. The parents' forms were therefore designed to be easily understood by a wide cross section of society, and to be quick and easy to complete. The survey forms were kept as simple and straightforward as possible. The use of technical terms and jargon was minimised and the language kept simple. "Multi-choice" type questions, which only required the ticking of appropriate boxes, were asked.

The information sought from parents included:

- The location of their home. This was to enable information on the nature of their neighbourhood to be applied;
- The number of primary age children in their home, and the number and ages of those attending the school being surveyed;
- The numbers of cars in the home;
- The children's mode choices for the week; and
- The importance they placed on a number of factors which may influence children's travel choices.

A copy of the parent's survey form is included in Appendix A. Data was obtained from 1,600 parents, representing 2,300 pupils, and covering 20,000 trips to and from school. This represented a response rate of 35% of pupils at the schools surveyed.

1.3.3.2 Pupils Surveys

The objectives of the pupils' surveys were to identify the proportions of a broad cross section of the school pupil community who used each mode for school travel. This

information was used to give an indication of the extent to which the parents' surveys were representative of the school pupils.

The ages of pupils completing the Pupils' survey ranged from 5 years to 12 years. The school survey form was therefore designed to be visually appealing, and easily understood and completed by a 5 year old. Cartoon style images of the applicable mode choices were included. The only data sought from pupils was their mode choice on each of the days of the week. A copy of the pupils' survey form is included in Appendix B

1.3.3.3 School and Neighbourhood Surveys

Surveys of each school and the neighbourhood immediately surrounding it were also carried out. The objective of these surveys was to identify features of each school and neighbourhood which may influence school travel choices.

Pedestrian Ratings and pedestrian and road connectivity were assessed for the neighbourhoods immediately surrounding the school. The factors identified as being important in the pedestrian environment for primary school pupils included:

- Safety, both road and personal;
- The quality of pedestrian facilities, including surface quality and width of paths; and
- The pleasantness of the pedestrian environment, including proximity to vehicles, feeling of spaciousness, and the amount of greenery such as grass and trees.

1.3.4 Data Analysis

The data obtained from the Case Studies was analysed. The analysis sought to identify trends and correlations between pupils' mode choices, and school, neighbourhood and household factors. Analysis was carried out at an overall aggregated level, a disaggregated school by school level, and a further disaggregated individual level.

In addition to mode choice, the analysis also investigated the relationships between independent travel and the school, neighbourhood and household factors.

Some trends were identified, and correlations established. A number of complex interrelationships between independent factors were observed.

1.3.5 Multinomial Logit Model

At a general level, models are useful for determining the relationships between independent variables and their relative contribution to the dependent variable. Furthermore, they can be used to estimate future states of the dependent variable given changes in the other variables.

Models were therefore prepared for both school travel mode choices and for degree of independence of pupils school travel.

1.4 Thesis Outline

This thesis is divided into six chapters in addition to this introduction.

Chapter Two is a summary of the literature which has been reviewed in the preparation of this thesis. It considers five broad areas, namely School travel choice trends, Impacts of school travel choices, Factors influencing those trends, Household decision making processes, and Survey and Model development.

Chapter Three describes the method used to carry out the case study at a general level. It includes the method used to select schools, and the methods used to survey pupils, parents, and the school and its neighbourhood.

Chapter Four outlines some specific issues related to this case study in Christchurch. It also identifies some schools, or their neighbourhoods which incorporate a particular feature or features that make them of special interest in this study, and considers general observations from the neighbourhood surveys.

Chapter Five is a summary of the results of the case studies. It explores the correlations between travel choices of school pupils and their neighbourhood, and school and household factors, and between the importance placed by parents on influencing factors and the travel choices of their children.

Chapter Six outlines the process used to develop the Multinomial Logit Models, and describes the results of those models.

Chapter Seven records recommendations made as a result of this study. Recommendations are made in the areas of further study, school location and size, and transportation infrastructure near schools.

Chapter 2

LITERATURE REVIEW

2.1 Introduction

A review of current international and New Zealand literature relevant to school travel choices was carried out. This review provided background information on school travel, and the decisions around travel choices. It also provided more general information on modelling processes, and the data needed to produce a mode choice model.

The information from the literature review is divided into five broad areas, namely School Travel Choice Trends, Impacts of School Travel Choices, Factors Influencing those Choices, Household Travel Decision Making Processes, and Survey and Model Development.

This chapter is an outline of the literature review. It considers school travel trends in recent decades, and the impacts of travel change on schools, pupils, and the environment

2.2 School Travel Choice Trends

The proportion of school pupils travelling as car passengers has increased significantly both in New Zealand, and internationally, during the past few decades. This increase has been accompanied by a corresponding reduction in the proportion of pupils walking and biking to school.

Table 1 shows the total number and proportion of trips to or from school by each mode for children aged 5 to 14 for the years 1989/90, 1997/98, and 2003-06. This table is based on data from the Ministry of Transport Household Travel Survey Fact sheet (2007). Trip numbers are estimated total annual trips to or from school throughout New Zealand.

The percentage increase in car usage has flattened from 16% in the eight years from 1989/90, to 6% in the eight years from 1997/98. This is still a significant rate of increase.

Table 1 School Pupil Travel Modes (from NZ Household Travel Survey)

	1989/90		1997/98		2003 - 2006	
	Trips (million)	%	Trips (million)	%	Trips (million)	%
Walk	26.1	46%	25.1	33%	20.5	30%
Car	19.1	34%	37.9	50%	38.3	56%
Bike	7.1	12%	6.1	8%	4.2	6%
Bus	4.3	8%	6.1	8%	5.1	7%
Other	0.3	1%	0.6	1%	0.2	0%
	56.9	100%	75.8	100%	68.3	100%

The travel surveys have identified that the average time spent walking or cycling for children aged from 5 to 14 has decreased from 2 hours 10 minutes per week in 1989/90 to 1 hour 20 minutes per week in 2003/06 (Ministry of Transport, 2007).

The growth in car travel to school in New Zealand reflects similar growth in similar countries (Gilbert and O'Brien, 2005).

2.2.1.1 Trip Chaining

A significant proportion of car trips to school involve trip chaining. When considering school travel, trip chaining typically involves the school child being dropped off at or

picked up from, school as part of another trip. O'Fallon and Sullivan (2005) investigated trip chaining using data from the 1997/98 New Zealand Household Travel Survey (HTS). They considered school trip chaining with respect to both school pupils and the adults driving them. They included primary, intermediate and secondary school pupils in their research.

They reported a much higher proportion of pupils recording more than one leg for their trip from school (34%) than for the trip to school (15%). They also reported that pupils trips from school had up to ten segments, while those to school only had up to 4. The purpose of many of the legs of a child's trip chain to or from school were recorded as "*Accompanying someone else*"

O'Fallon and Sullivan only had data from a small sample of drivers for whom a school trip was part of their trip chain. They therefore suggest that their results for this group be regarded as indicative only.

The data available indicates that the majority of car trips to school (59%) are part of a trip to work or their own education. Approximately one quarter (27%) have "*Accompanying someone else*" as the purpose of the trip. It is assumed that the bulk of this group are transporting a pupil to school. However, it may include transporting a number of pupils to different schools. 14% had "*Maintenance"* as the purpose of the trip. This included activities such as shopping and personal business. The remaining 3% indicated that "*Social"* was the purpose of their trip.

For the trip from school, only 5% indicated "*Subsistence"* (that is work or own education) as the trip purpose. 61% recorded "*accompanying someone else",* and 21% "*Maintenance"*. However, 34% of the trips home from school originated from work, and 59% from home. 70% of the trips to school and 80% of those to home were by women.

This data suggests that the majority of car trips to school (including trips to primary, intermediate and secondary schools), and a smaller proportion of those from school are

part of a trip to work. A significant proportion of trips from school are likely to include legs to other activities, such as shopping.

2.3 Factors Influencing Travel Choices

Woodside *et al* (2002) identified six main factors affecting mode choice (particularly use of car) for school travel:

1. Topography/geography;
2. Weather conditions;
3. Parents detouring on the way to work;
4. Stranger danger;
5. Road Safety; and
6. Socio-economic factors.

Edwards and Tsouros (2006) also identified status as a contributing factor in travel choices. Cars are generally perceived as having a higher status than alternative modes such as Public Transport or walking and cycling. Their research was based on travel choices for adults. Insofar as children are often taken to and from school as part as an adult's trip somewhere else, their findings are likely to be applicable to many school trips. However, it may be that children prefer more independent modes, and it is therefore possible that children give travelling independently a higher status than travelling with parents.

A family's travel habits often become routine. Families may therefore be more ready to change travel habits at times of change, such as moving house or changing jobs (Sullivan and O'Fallon, 2006, Maat, 2002). New entrants or families moving to the school may therefore be receptive to the possibility of changes in family travel habits.

A number of factors have been identified as having an influence on both school and general travel patterns. These include Road Safety, Distance to travel, Urban Form,

Convenience, Complexities of family travel requirements, and School Travel Plans. These are detailed below.

2.3.1 Road Safety

Wigmore *et al* (2006) suggest that high traffic volumes and speed are amongst the main concerns of children and their parents when considering school travel. High traffic density, moving quickly, typically, results in decreased safety levels for pedestrians, unless accompanied by specific pedestrian safety measures, such as traffic signals. They also identified that the visibility of children is a significant factor in child pedestrian safety.

Motorists are accustomed to identifying other vehicles on or near the road as potential hazards. Children are much smaller than other vehicles, and are mostly off the road. They are easily obscured by parked vehicles and other obstructions, such as vegetation, signs, etc. A single child on the side of the road is therefore quite easy for a motorist to overlook, particularly if there are high levels of concentration required of the motorist. Situations such as complex intersections or the presence of turning and manoeuvring vehicles (such as often occurs outside schools) are likely to demand high levels of concentration of a motorist. This in turn may result in drivers making errors, which can lead to accidents.

2.3.2 Distance from Home to School

Morris *et al* (2001) identified increasing travel distances as the second main reason for the increase in children being driven to school. Two factors have been identified as contributing to an increase in average distances between home and school.

Firstly, there has been a trend in recent decades to rationalise schools. Small local schools were closed or amalgamated to create larger schools. Larger schools are economically more viable. They can also have educational advantages, such as the ability to offer a greater range of subjects, and extra curricular activities. However children who attend, and live close to, schools which have been closed are likely to need to travel further to

their new school. This may result in additional transportation costs and can translate to equity impacts, particularly if the schools which have been closed are low decile schools.

Another contributing factor to the increasing distance between home and school is a desire on the part of parents to get the best education possible for their children. Anecdotal evidence and the reported desire for parents to live in the zones of some schools suggest that many parents consider that a particular school (which may be some distance away) will give a superior education than that offered by their local school.

2.3.3 Urban Form

Bean (2006) notes that a mix of land uses, density of development, and connectivity can enable the practical use of modes other than private motor vehicle. A combination of these factors means that people live within comfortable walking and cycling distance of many of their day to day activities. They also mean that it is viable to run good quality, frequent Public Transport systems (Gilbert and O'Brien, 2005). However, Urban Form factors, on their own, are unlikely to result in a significant change in behaviour in a society with high car usage.

A study by Maat (2002) in the Netherlands indicated that a strong increase in a community's compactness was accompanied by only a small reduction in Vehicle Kilometres Travelled (vkt). In most urban areas a significant proportion of activities would still be located outside of a compact mixed use area.

Many families have more than one adult working. It is possible that the work place of one adult in the household could be some distance away from that of the other. Even if the family home was located close to one workplace, the other partner may still need to travel to work.

It is likely that people are attracted to neighbourhoods which suit their lifestyle. Those who have a propensity towards walking would prefer to live in a neighbourhood in which it is safe and pleasant to walk to a number of the activities they wish to take part in. Those with a disposition towards car use would prefer to live in a neighbourhood which suits car

use (Richardson and Bae, 2004). However, if there are no neighbourhoods available with reasonable walking and cycling facilities, then those who would chose to walk will be forced to take another mode (probably private car).

A study of five San Francisco neighbourhoods (Bagley and Mokhtarian, 2001) found that:

> "Results suggest that when attitudinal, lifestyle, and socio demographic variables are accounted for, neighbourhood type has little influence on travel behaviour."

There is an international trend towards cities being organised around multiple centres or "edge cities" around the outer suburbs (Stough, 2004). The Christchurch experience reflects this trend towards workplaces locating in the suburbs rather than in the CBD. As a consequence, the proportion of workers travelling to the CBD to work has reduced. This has been accompanied by an increase in the proportion of workers travelling across town to work (Buchanan *et al*, 2006). At the same time the proportion of mothers in the workforce has also increased. It is therefore likely that in many households two adults are travelling across town in different directions to work.

2.3.4 Complexities of Family Travel Requirements

The travel requirements of families have become increasingly complex. On a typical weekday, families can have combinations of the following travel requirements:

- Two or more adults, each going in different directions to and from work;
- A single parent, travelling to and from work;
- Primary school pupils travelling to and from school;
- Secondary school pupils travelling to and from school;
- Pre school children travelling to activities; and
- Family members travelling to a variety of after school or work activities.

Often, many of the activities family members take part in are located significant distances from each other, and trips between them need to be carried out in tight time frames.

Members of the focus groups carried out by Bean (2006) indicated that car travel gave them independence and enabled them to juggle complex social lives, family lives, and work commitments through time and space. Private cars enabled complex trip chaining to take place However, they also dispersed their networks, and so made some of the juggling they faced necessary.

The complexities of travel decisions for families with children were summed up thus by one participant in Bean's study (2006):

> *"Yeah, we always find it's just such a balancing exercise, you always feel that it's nibbling away at each end of the day, that somebody has to make a bit of a concession and go in a little bit later, or leave a little bit earlier. It's always a little bit of tension as to you know, you've gotta negotiate "What have you got on at the moment?" and "Can you do it?" and you know, "How are things running?" You're almost like you're fitting in with all your other workmates as well, I mean you've gotta really factor in a lot of people into the equation when you're making the decision as to who's going to do the late run, who's going to do the early run."*

Bean (2006) also noted that the age of children had an affect on family travel choices. As children get older, they tend to take part in more activities, which are often located further away from home. As a result, older children can tend to be driven more often than younger ones.

2.3.5 School Travel Plans

School travel plans assist a school to put in place programmes to encourage alternative modes of travel to and from school. The effectiveness of school travel plans has been varied. Hinckson and Badland (2006) carried out an evaluation of school travel plans. They concluded that overall the implementation of school travel plans resulted in a

reduction of car usage for school travel. However, at an individual school level, the results varied from a reduction in car usage of 13% to an increase of 4%.

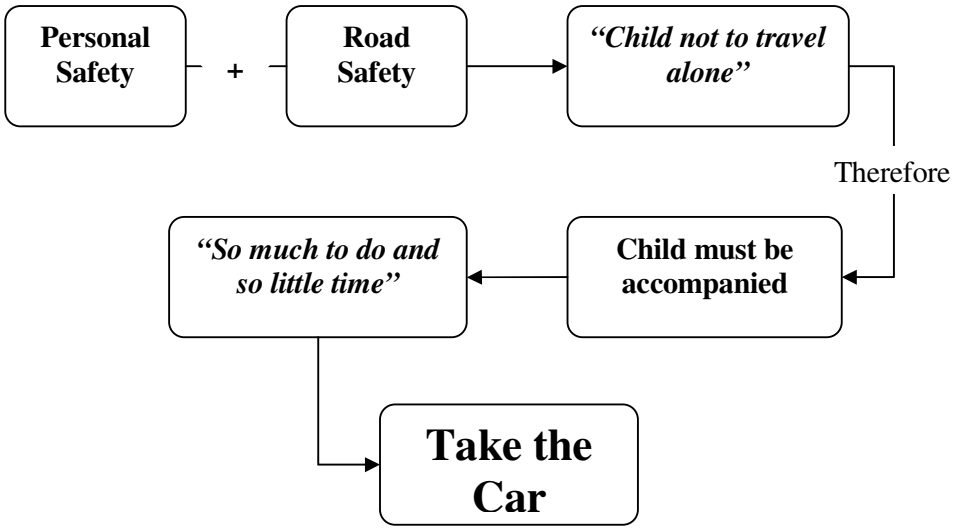
The implementation of school travel plans seems to be dependant on well connected, articulate parents (Hosking, 2005). They are therefore more likely to be implemented at higher decile schools. Hosking further argues that children from low decile schools are more likely to suffer from poor health than those from high decile schools. A counter argument is that since greater car use is typically associated with higher socio economic areas than in lower ones, there is greater need to address travel patterns at high decile schools. However the results of the school travel survey carried out for this study do not show reduced car use in low decile schools, other than decile 1 schools. These results also show reduced car use at decile 10 schools.

2.3.6 Summary

Safety distance and convenience have been identified as the major factors influencing primary school travel decisions. The influence that school travel plans have had in influencing school travel decisions has been quite variable.

The travel decisions in many homes can be summarised as shown on Figure 1, below. Once it is decided that a child is not to travel alone, then the time pressures on the accompanying adult often mean that car travel is seen as the only viable mode available.

Figure 1 Outline Household travel Decision



2.4 Household Travel Decision Making Process

The presence and ages of children in a household tend to have an impact of family travel patterns. Car usage in a household increases with the arrival of children, and as they get older (Bean, 2006, and Buchanan *et al*, 2006). This suggests that parents tend to chauffeur their children to various activities including school.

The travel requirements of the primary school pupil(s) in a household are not considered in isolation when families make travel choice decisions. Families often face significant time pressures, particularly if two parents need to get to work, and a number of children need to get to different schools or day care. Household travel decisions are influenced by factors such as location of parents work, parents work hours, location and start and finish times of other activities of both parents and children, and vehicle availability in the house.

2.4.1 Timing of Decisions

Some travel decisions are made well in advance of travel time, while others are made immediately before travel. Decisions which are made at leisure, in advance of the time of implementation often involve a different decision making process than decisions which are made under pressure immediately before implementation. Consequently a carefully thought out family transportation strategy can often be discarded when a decision needs to be made quickly (for example, if a family member is ill or the family slept in).

This may partly explain some of the differences between stated preference and revealed preference surveys. The carefully thought out family travel strategy is likely to reflect the family's stated preference for travel. However, there will be occasions when the strategy needs to be amended due to circumstances on the day. The revealed preference will include these occasions.

Car travel tends to be more flexible, and therefore better able to cope with circumstances which change at the last minute.

Doherty *et al* (2002) surveyed families' activity and travel decision making processes (refer section 2.7). They found that because school was a routine activity, families were

more likely to schedule school travel in advance rather than impulsively. However, school travel decisions were amended on the day due to factors such as weather, timing on the day, and other activities.

Other activities had a greater impact on travel home from school than on travel to school. This corresponds to a likelihood that after school activities would be more impulsive than before school activities.

Households make long term lifestyle decisions regarding the location of home, employment, and school (Waddel and Gudmunder, 2004). These decisions affect the short term travel decisions made by the family. Families with homes located close to both work and school are likely to have a greater number of practical travel choice options (including walking and cycling) than those living further away.

There are three groups of dynamics which influence travel decisions, namely:

- Long term dynamics such as socio demographic and urban design factors;
- Day to day dynamics such as conditions on the previous day(s); and
- Within day dynamics such as constraints and opportunities which present themselves on the day. (Das, 1998).

Further, the greater the complexity of a family's travel demands, the more likely that car travel will be the mode that most fully meets those demands.

2.4.2 School Travel and Household Income

Typically, increasing income is associated with an across the board increase car use. However, there is some evidence to suggest that this is not always the case with school travel.

If a household has school age children, and one adult who earns a high income then there may be less financial pressure for the other adult to work than in a household with two

adults who have the ability to earn a moderate or low income. It has been observed that an individuals own share of income has an affect on the value that individual places on private goods, and that the "value of time is much less than proportionally related to income" (Algers, 1998).

There is a tendency for individuals to value leisure time highly, and to value it more highly, the less of it they have (Jara-Diaz, 1998). Consequently, a stay at home parent may value leisure time less highly than a working parent.

Based on those observations, it is possible that in a high income, two parent household with only one parent working, the non working parent (often the mother) may place a lower value on time, and a higher value on the cost of operating a vehicle than would normally be expected for that income group. There may therefore be a higher proportion of high income households in which one parent walks the child(ren) to school, than would be expected based only on household income.

2.5 Impacts of School Travel Choices

2.5.1 Safety

The vast majority of parents will go to remarkable lengths to protect their children. This phenomenon is observable in animals as well as in humans. It can be observed in the smallest bird protecting its chicks through to a mother bear protecting her cubs. If parents believe that there is a threat to their children's safety they will take whatever steps they see as necessary to protect them.

Abley (2006) carried out a transport appraisal of Thorrington School, in Beckenham, Christchurch. He reported that 72% of parents felt "absolutely concerned about traffic safety". He also found that 83% of pupils felt safe travelling, and 15% sometimes felt safe. Only 2% reported not feeling safe travelling. Of those who did not feel safe travelling, 50% travelled by car. It is possible that some of the children, particularly younger children, who responded did not fully understand the question.

Road safety and personal safety have been identified as the areas most likely to contain threats to the safety of children travelling to and from school.

Pedestrians are amongst the most vulnerable groups of road users. Their lack of speed and small size, when compared to motor vehicles, make them more susceptible to accident and injury when compared to motorists. Children, in turn, are amongst the most vulnerable of pedestrians. They lack the cognitive skills to make safe decisions regarding approach speed of vehicles and suitable gaps to cross in front of vehicles. Their small size may put them below a motorist's line of vision and make them less conspicuous (Wigmore *et al*, 2006).

School travel is a major component in child pedestrian accidents. Wigmore *et al* (2006) state that accidents during the trip to school account for 40% of child pedestrian hospitalisation.

They also suggest that, when compared to overseas practice, New Zealand lacks emphasis on slowing vehicles at locations where children congregate.

2.5.1.1 Individual vs. Community Safety

Parents' desire for their children to be safe can result in a cycle of car use developing. A perception that the route to school is less than safe, either from a road safety or personal safety perspective, will be one of the factors which encourages parents to drive their children to school.

The effects of increased vehicle numbers associated with the trip to school are particularly pronounced near to school. Many schools were built prior to the big increase in car usage for the trip to school in the 1980s or 90s. The parking and traffic management features at these schools are often not designed to cope with the volume of vehicles arriving at and leaving school at school start and finish times. There are often insufficient car parking spaces available. Many school carparks have limited manoeuvring space, and children need to walk amongst manoeuvring vehicles.

A number of schools have accesses on quiet residential streets. Like the schools that many of these streets serve, the streets themselves were built before the large numbers of vehicles arriving at and leaving school. They are often narrow, and have limited parking and turning facilities. Parked cars can often obscure children about to cross the road, and children can walk behind vehicles reversing to complete a turning manoeuvre.

Cycle and pedestrian accident rates (accidents per kilometre travelled) tend to reduce with increasing numbers of cyclists and pedestrians. There appears to be a safety in numbers. (Turner, *et al*, 2006, Hosking, 2005) Motorists become more aware of pedestrians and cyclists if they see them regularly. If a motorist is aware that pedestrians and cyclists may be in the vicinity they will be more likely to notice pedestrians and cyclists and react as necessary. If a motorist encounters a very small number of pedestrians or cyclists they are more likely to be taken by surprise if one appears, and not be prepared to take evasive action.

A parent driving their child to school has the effect of increasing the safety of that child, but reducing the overall safety level for pedestrians and cyclists on the route to school in two primary ways. Reducing the numbers of pedestrians and cyclists out and about on the

route to school reduces the level of personal safety for those pedestrians and cyclists who continue to walk or cycle. Increasing the numbers of cars also reduces the level of road safety for the pedestrians who continue to walk or cycle (Hosking, 2005).

With each child who is no longer walking or cycling on the route to school, the safety in numbers effect that is gained from having a group walking or cycling is reduced. The safety in numbers effect for children travelling to school relates to both road safety and personal safety. However a large number of pupils need to change mode in order to outweigh the impacts for one child of the increased risk from walking or cycling (Hosking, 2005). There consequently remains a spiral of the pedestrian and cycling environment becoming incrementally less safe as a result of fewer pedestrians and cyclists. This in turn encourages more parents (one by one) to change the mode of their walking or cycling children.

There is an apparent paradox in the emphasis on safety. In attempting to improve safety at the individual child level, the overall safety of other children is reduced.

2.5.2 Environmental

Increasing motor vehicle traffic results in increasing levels of pollution overall. The three main environmental impacts of motor vehicle pollution are air pollution, water pollution, and noise pollution. Refer to sections 2.2, and 2.5.3.2 for discussion on mode choice and the health impacts of environmental degradation.

2.5.2.1 Pleasant Environment

The negative environmental effects of motor vehicles combine to reduce the "pleasantness" of the environment adjacent to concentrations of motor vehicles. Pleasantness is a very subjective concept, and therefore very difficult to quantify or compare. Members of Bean's focus groups (2006) indicated that walking is a pleasant mode when lots of people are about, and that conversely, the pleasantness of walking was inversely proportional to the number of cars about.

2.5.3 Health

The correlation between school travel habits and children's health levels is not directly measurable. Hosking (2005) suggests using proxies to estimate health benefits for school travel plans. It is generally accepted that increased physical activity levels improves health outcomes. Changing travel mode away from car use results in increased activity levels. It is therefore assumed that a change away from car use for school trips will result in improved health levels for school children.

2.5.3.1 Activity Levels

There is wide agreement that lack of physical exercise is a contributing factor in a number of adverse health outcomes. These are often associated with being overweight or obese and include diabetes, heart and lung conditions, and lack of self respect.

There is currently a high level of concern and discussion about obesity levels in New Zealand. Part of that discussion concerns an apparent increase in obesity levels in school children. This concern is reflected in the research by Barnfather (2004) into childhood obesity.

Low levels of physical activity have been identified as a possible contributing factor in increasing rates of childhood obesity. A number of programmes have been proposed to increase the activity levels of children.

Hosking (2005) cites a number of studies into the correlation between children's mode of transport to school and overall physical activity levels. There was no agreement between the studies which suggested a clear correlation.

2.5.3.2 Environmental Health

The environmental impacts of motor vehicles are well known, and include Carbon Dioxide, and other emissions. These pollutants have adverse health effects. These effects may be particularly pronounced in the developing bodies of school children. (Gilbert and O'Brien, 2005).

Many trips carried out to and from school are likely to be comparatively short, and include a high proportion of cold engine running. Cold engines are less efficient, and produce more emissions, than warm engines.

There is some evidence to suggest that the concentrations of air pollutants are greater inside a car in congested traffic than they are on the footpath adjacent to the busy road, or even in a cycle lane (Briscoe, 2000, Gilbert and O'Brien, 2005).

An increased concentration of vehicles at school entrances at the start and end of the school day is likely to have an impact on the health of children arriving at or leaving school.

2.5.4 Classroom Concentration

Hosking (2005) cites a UK study of school teachers. 87% of the teachers felt that walking to school gave pupils a better chance to wake up than if they were driven to school, while 60% felt that children who walked to school were more settled in class than those who travelled by car.

2.5.5 Independence and Responsibility

As noted in section 2.5.1, the safety of their children is one of the primary concerns of parents. However, there is a growing body of opinion that protecting children from all possible risk is not in their best interests.

Unger (2007) believes that modern western societies are overprotective of children. He says:

> *"… In our mania to provide emotional life jackets for our kids, helmets and seat belts, approved playground equipment, after school supervision, an endless stream of evening programming, and no place to hang out but the local mall, we parents are accidentally creating a generation of youth who are not ready for life…."*

If parents feel that their children are in danger whenever they are alone in the world, then they become reluctant to let their children out unsupervised. Consequently, in many communities, the informal, independent play of a group of children playing tag or kicking a ball around at a local park or school grounds has been replaced by organised, supervised after school programmes. Children need to travel to these organised activities. If parents feel that their child(ren) cannot travel independently, it then falls on a parent to accompany them. This further adds to the time pressures faced by the adults in a household. Car travel then becomes the only viable way to get children to school and all the other activities in the time available.

Bean (2006) suggests that car travel is something of a two edged sword for school children. It gives them mobility, but at the same time reduces the safe places that they can walk to. She quotes UK figures which indicate that in 1971 80% of 7 to 8 year olds travelled to school independently, while in 1990, only 9% did.

Over reliance on car travel can hinder the independent mobility of a child, resulting in effects on their mental, emotional, and physical development. Travel modes such as walking and cycling provide a richer environment for children to explore and enquire, and to develop their sense of neighbourhood and community. This can result in improved spatial recognition (Gilbert and O'Brien, 2005, Hosking, 2005).

The development of children is enhanced by them experiencing appropriate levels of risk and responsibility (Unger, 2007). Independent travel is one way risk and responsibility can be experienced by children. The level of risk can be reduced by ensuring that:

- Children travel in groups. Children who know each other, and are friends will tend to look out for each other;
- There are no major roads to cross; and
- All portions of the route are open and visible.

Children and parents seem to be getting a message that it's a big, evil, and dangerous world out there. As a consequence, children may be missing out on some of joy and wonder of the world.

2.5.6 Travel Choices in Later Life

There is strong evidence to suggest that habits set in childhood are carried through into adulthood. Orsini (2005) surveyed six Vancouver high school pupils who regularly cycled to school. He found that parents were the primary influencing factors in the choice by the pupils to cycle to school. The parents of these pupils had typically modelled regular bike usage, and had resisted pressure to chauffer their children to destinations which were accessible by bike.

2.5.7 Summary

There is strong evidence to suggest that the increase in car travel for trips to school has resulted in an increase in air pollution, and a reduction in physical activity for school children. This in turn is likely to have had negative impacts on the health of children.

It is also likely to have resulted in an overall reduction in child road casualties, whilst, ironically increasing the level of risk to those children who still walk and cycle.

2.6 Factors Influencing School Travel Safety

As noted in sections 2.3 and 2.5.1, safety is a major factor in the decisions of parents regarding their children's school travel choices. The choice of many parents to drive their child(ren) to and from school does improve the safety for their child, but ironically it may reduce the level of safety for children not being driven to school.

A number of measures are available to improve the safety level of children walking or cycling to school. Increasing the numbers of children walking and cycling reduces the overall road safety risk associated with walking and cycling in two ways. It reduces the number of vehicles on the road, particularly near to the school, and increases the visibility of walking and cycling as modes. (Turner *et al*, 2006).

Increasing pedestrian and cyclist numbers to and from the local school, possibly including parents, results in more people out and about in the neighbourhood. If a number of people are out and about in the neighbourhood, they will be more likely to know each other, and be aware of what is normal in the neighbourhood. By being able to watch out for each other, consciously or unconsciously, they will improve the levels of personal safety in the neighbourhood.

Bean (2006) cites a reduction in pedestrian casualties since the 1970s. This reduction has not matched the reduction in pedestrian travel time over the same period. She therefore argues that the level of risk to individual pedestrians has increased. She further argues that strategies pursued over recent decades to make cars safer have resulted in drivers becoming less aware of, and responsive to, pedestrians, therefore making pedestrians more vulnerable.

School children make up a large proportion of pedestrian and cycle numbers, and total pedestrian and cycle travel distance. They are also a very vulnerable pedestrian and cycle group. Gilbert and O'Brien (2005) therefore suggest that the needs of young pedestrians and cyclists should be considered the most important in the design and implementation of pedestrian and cycle facilities.

2.6.1 Speed

Speed is widely regarded as a critical factor in road safety. This is particularly true of the environment near to a school. The greater the speed:

- The greater the distance a vehicle travels in the time it takes for a driver to see and react to a hazard on the road (such as a child stepping in front of the vehicle);
- The greater the distance the vehicle needs to safely complete an evasive action (such as stopping or swerving); and
- The more severe the injuries that will be inflicted on a pedestrian (particularly a child) who is hit.

Speed increases both the likelihood, and severity, of an accident. Reducing vehicle speed at or near schools will increase the level of road safety at the school.

2.6.2 Summary

There is evidence to suggest that pedestrian safety rates, as a factor of pedestrian kilometres travelled, may have declined in recent years. Factors contributing to this could include increased vehicle numbers, and reduced pedestrian numbers resulting in a reduction in awareness of pedestrians by drivers.

2.7 Survey Development

Two aspects of a school travel survey were considered. The first was a survey to establish the mode choices and household factors of the pupils. The second was a survey to identify the school and neighbourhood factors.

Woodside *et al* (2002) carried out a survey of mode choice at three Ulster secondary schools. They produced a "simple two page self completion questionnaire" which was provided to the secondary school pupils. The questions covered the pupils' current patterns of travel to school, the reasons behind their travel choice, and the alternative modes they would consider.

They factors they identified as having significant impact on the mode choices of the pupils surveyed included:

- Seasonal – Parents were more reluctant to let their children walk to school during winter months. Weather conditions and the safety aspects associated with walking during dark winter mornings were identified as possible factors;

- Distance – Children who lived a closer to school were more likely to walk than those who lived further away; and

- Socio Economic – Children from higher socio economic areas were more likely to be driven to school.

Gallin (2001) produced guidelines for assessing pedestrian Levels of Service in Perth, Western Australia. She considered factors which were relevant to overall pedestrian users, rather than a specific group such as primary school pupils.

Her guidelines classified pedestrian Level of Service factors into design, location, or user factors. The factors considered in each of those classifications are listed below:

Design Factors:

- Path Width;
- Surface Quality;
- Obstructions;
- Crossing Opportunities; and
- Support Facilities.

Location Factors:

- Connectivity;
- Path Environment; and
- Potential for Vehicle Conflict.

User Factors:

- Pedestrian Volume;
- Mix of Path Users; and
- Personal Security

2.8 Model Development

Only one model for school travel mode has been discovered in the literature review. Ewing *et al* (2004) have estimated a multinomial logit model to explain school mode choice for K-12 (primary and secondary) students. This model was based on data from two travel diary surveys conducted in Gainesville, Florida, USA.

They found that distance to school was a significant factor in determining mode choice, and argued that this supports smaller neighbourhood schools serving their local area. Their research indicated that the built environment did have an impact on school travel mode choice, but were unable to identify specific aspects of the built environment which were influencing travel choices. They argued that their findings should be confirmed through further research,

Laird and Nicholson (1994) estimated a Multinomial Logit Model for mode choice for travel to and from Canterbury University.

The Operations Research/Education Laboratory (OR/Ed. Lab) of the Institute for Transportation Research and Education, North Carolina State University provides school districts with mathematically optimal solutions that minimise transportation distance (Tsai and Millar, 2005). These solutions consider factors such as school size, grade structure, and demographic and socio economic factors.

Woodside *et al* (2002) have investigated the effect of socio economic factors on mode choice for travel to secondary schools in Larne, Northern Ireland.

A mode choice model is a mathematical representation of decisions made by individuals. Mode choice models have tended to be utility based models. The utility of each mode is estimated based on the variables applicable to each individual. The preferred mode for each individual is assessed as that with the highest estimated utility value. The variables used to estimate mode utility include mode specific variables such as cost, time, and individual specific variables such as income, distance, and car ownership.

An economic (or utility) model is dependent on a number of assumptions regarding the decision making process of individuals (de Palma, 2004). These include:

- The individual knows their own preferences, and the full set of alternatives which are available to them;
- The individual is able to recognise and measure the variables which are applicable to their mode choice decision; and
- The individual has a perfect ability to store, retrieve, and compute information

Few, if any, individuals have all the attributes listed above. Consequently, individuals (or families) do not assess the utility of their travel choice options with mathematical precision. In addition, there is an emotional component to the travel choice decision making process. It is likely that the emotional component increases when making decisions regarding children's travel.

Ethical considerations are also included in a family's travel decision making (McFadden, 1998). Some ethical and emotional considerations around child transport can be conflicting. For example, there is a strong emotional drive for parents to do the best for, and ensure the safety of their children. This may result in an inclination to drive the children to school. This may be in conflict with the ethical demand to care for the environment.

Given the imperfect access to relevant information, and ability to process it, along with the emotional and ethical drivers in the decision making process, it is therefore unlikely that travel decisions are always totally rational.

Doherty *et al* (2002) challenged utility modelling processes on the basis that they isolate a small part of the decision making process, and concentrate on the outcome rather than the process. This is a valid criticism of modelling based on the utility of the factors influencing the decision.

However, a model which considers the process involved in reaching a decision is likely to be much more complex, and require a higher level of data from each respondent. Therefore, the number of likely respondents is smaller than for a survey which requires less information and therefore less time and effort to complete. The advantages of having excellent data from a small number of respondents need to be weighed against those of having lower quality data from a large number of respondents.

The level of data required for a model which considers the process is indicated by the data collection approach used by Doherty *et al*. They produced a model of the process households use to schedule their weekly activities and travel. All respondents were issued with a laptop computer. They were required to schedule all their weekly activities and travel at the start of the week, and then update it daily. The average time commitment was 16 minutes per day for each adult plus 9 minutes per day for each child. Such a time requirement, plus a requirement to be computer literate is likely to limit the sample size willing to take part in the survey, and introduce a bias towards those with available time, technical ability, or an interest in transportation.

The irrational component of an individual's decision making is likely to be shaped, in part at least, by their personal preferences and inclinations. It is therefore likely that across a number of individuals the irrational component of their decision making will tend to be cancelled out. Individual irrationality is not necessarily an indicator of aggregate irrationality.

Chapter 3

STUDY METHOD

3.1 Introduction

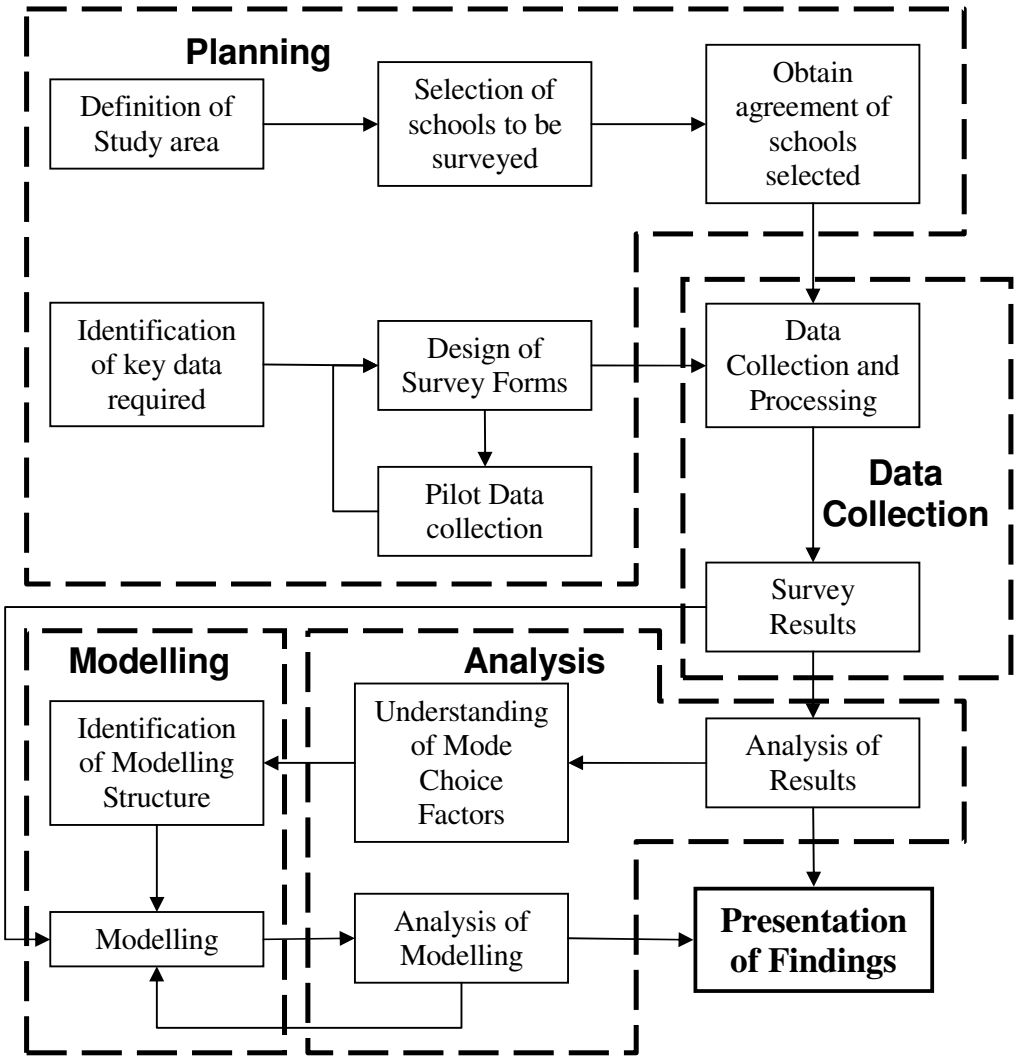
The Literature Review identified no survey of primary school travel patterns, and analysis of factors influencing school travel based on the revealed patterns. The steps described in this chapter are an attempt to provide a study method to address the lack of information addressing the issues specific to primary school travel.

The study methhod falls into five broad phases, namely Planning, Data Collection, Data Analysis, Modelling, and Presentation of Findings. There are a number of individual components within each phase.

This chapter describes the research method employed in the planning and data collection phases at a general level. It covers how participating schools are to be selected, the survey questionnaires, school participation, survey format, and the process to be used to assess factors affecting travel choices of school pupils.

A flow chart of the study method is shown in Figure 2, below

Figure 2 Flow Chart of Study Method



3.2 Planning

3.2.1 School Selection

The purpose of the process used to select schools to participate in the pupil travel survey is to provide a representative cross section of primary schools, and of urban environments in the study area.

The following criteria are recommended to select schools to participate in the survey:

3.2.1.1 Socio Economic Factors

It is widely agreed that there is a correlation between socio economic factors and travel choices. Higher socio economic indicators tend to be accompanied by higher motor vehicle usage. It is therefore considered likely that socio economic factors are important considerations in school pupil travel choices.

3.2.1.1.1 School Decile Rating

School decile rating is a measure of socio economic factors in the school community. Schools are rated from decile 1 to decile 10. Decile 1 is the lowest socio economic rating, and decile 10 the highest. An explanation of the decile rating system is included in Appendix C. A wide representation of decile groups is recommended for the survey.

3.2.1.2 School Size

It is expected that the number of pupils enrolled at the school will have an impact on the travel choices of pupils. A school with a large roll is likely to have a larger proportion of their pupils living outside of comfortable walking distance of the school than a school with a small roll. It is therefore likely that a larger school will have a greater proportion of pupils driven to school than a smaller school. Schools with a range of pupil numbers should be chosen.

3.2.1.3 Neighbourhood Urban Form

There is some debate over whether high density, mixed use neighbourhoods reduce car dependency (Refer to Chapter 2). It is therefore valuable to compare school travel choices for as wide a variety of neighbourhood urban form as possible within the study area.

3.2.2 Design of Survey Forms

3.2.2.1 Parents Survey Forms

A copy of the parents' survey form used in the case study is included in Appendix A.

These survey forms are directed at a wide cross section of society. The following guidelines are used when designing the survey forms:

- The survey form is to be designed to achieve a large sample size of responses in preference to a large amount of data from each respondent.
- The language in the survey is to be able to be understood by as wide a section of society as possible. Jargon, technical terms, and complex language are to be avoided wherever possible.
- The survey is to be short enough to be completed in a few minutes.
- The questions are to be able to be answered with a minimum amount of writing on the respondent's part.

The parents' survey form is divided into four sections, namely: Introduction; Household information; School Pupil Travel Choices; and Factors Influencing Travel Choices. A panel has been included at the end of the survey for those willing to be interviewed about their travel choices to provide contact details. Each of the sections will be described below.

3.2.2.1.1 Introduction

This section takes the form of a letter to the parent or caregiver, and opens with a personal introduction, and then the purpose of the survey is briefly outlined. A statement about how the information provided will be used, and instructions about how to complete the form are then provided.

3.2.2.1.2 Household Information

This section seeks information about the nature of the household being surveyed.

A map of an area approximately 2.5km square, centred on the school being surveyed is included. Parents are asked to mark the approximate location of their home on that map. Those whose home falls outside the map area are asked to write the name of the street they live in.

The following questions are then asked:

- How many primary school aged children live in your home?
- How many primary school aged children attend ….. School?
- What are the ages of the ….. School pupils?
- How many cars are available for day to day use in your home?

Neighbourhood information is to be applied to each household based on its location. Refer to Section 3.2.2.1.3 for a description of the information obtained for each neighbourhood. Section 3.3.4 describes the neighbourhood survey process.

3.2.2.1.3 Neighbourhood Information

Based on each household's location, additional information is obtained on their local neighbourhood. The neighbourhood information includes the following:

- Distance from school;

- Pedestrian Distance from school;
- Road Distance from school; and
- Neighbourhood Pedestrian Rating.

Straight line distance from school is measured from the location of the household, as shown on the map provided.

Pedestrian and road distance to school is to be estimated for each household by multiplying the straight line distance by the pedestrian and road connectivity factors for the area the household is located.

The Pedestrian Ratings applied to each household are the ratings established from the Neighbourhood Survey (Section 3.3.4)

3.2.2.1.4 School Pupil Travel Choices

This section seeks information on the typical travel choices of the school pupils over a week.

A table is provided with columns for travel to and from school for each weekday (Monday to Friday). Rows are provided for each travel choice option, and parents are asked to indicate which option their children typically use on each day of the week.

The following options are given:

Car: As part of another trip (eg to or from work)
As a special trip to school

Bus: On a dedicated school bus
On a scheduled public bus service

Bike: With a parent or caregiver
With other school pupils
Alone

Scooter: With a parent or caregiver
With other school pupils
Alone

Walking: With a parent or caregiver
In an organised group (eg walking school bus)
With other school pupils
Alone

3.2.2.1.5 Factors Influencing Travel Choices

This section asks parents to rank the importance of the following factors when making decisions regarding their children's travel choices:

- Distance to School;
- Weather Conditions;
- Convenience;
- Safety – "Stranger Danger";
- Safety – Road Safety;
- Cost;
- Exercise is healthy;
- Condition of Footpaths;
- Pleasant Walking or Cycling Environment; and
- Other Factors.

Parents are asked to rate the importance (between 0 and 5) they placed on those factors when deciding how their children travel to school (0 indicated the factor was not important, 5 that it was very important).

3.2.2.2 Pupils' Survey Forms

The pupils' survey is used only as a means of verifying the extent to which the parents' survey is representative of the entire school body. It is, therefore, recommended that pupils are surveyed only on how they travel to and from school. Pupils are surveyed regarding their mode of travel on each day of a week. They are also asked what their favourite mode is.

The ages of pupils completing the forms will range from 5 years to 11 years. The surveys should therefore be kept as simple as possible. Cartoon style representations of each mode choice are shown, and pupils asked to circle the mode they use to and from school on each day. A copy of the pupils' survey sheet is attached in Appendix B.

3.3 Data Collection

3.3.1 School Briefing

As noted above, the study will survey the travel choices of pupils from a number of schools. Once a school agrees to take part in the survey, a visit should be made to the school principal. The following matters will be discussed at this visit:

- The survey process, including parent and pupil questionnaires;
- The time commitment likely from the school;
- Any transportation and travel concerns present at the school;
- Any matters specific to the school, or its community which might affect the survey;
- Any changes to the survey questionnaire or process which would suit the school;
- The timing which would best suit the school; and
- The age of the school and its surrounding community.

Because the survey requires quite a commitment from the schools in terms of time and resources, it is wise to give the schools the flexibility to carry out the surveys at a time, and in a manner which suits them.

3.3.2 Parents' Survey

Parents from each school are surveyed. Generally, survey forms are to be sent home with the school newsletter. Parents are asked to complete the form and return it to the school.

3.3.3 Pupil Survey

There is a concern that there may be a tendency for the parents' survey responses to be biased towards families who have an interest in transportation or sustainability.

A survey of pupils, carried out in class, is likely to have a response rate of close to 100%. A comparison of pupil travel modes and parents travel choices can then be made for each school. This will enable the extent to which parents responses are representative of the school community to be assessed.

3.3.4 Neighbourhood Survey

For the purposes of identifying neighbourhood factors for each household, the neighbourhoods of each school are divided into eight radial sectors, relating to points of the compass (North, North East, East, South East, South, South West, West, and North West). Each sector is further divided into two portions, namely, 0-500m, and 500m – 1.0km from school. Pedestrian Ratings are established for each portion of each sector. The process used to establish these factors is outlined below.

3.3.4.1 Assumptions

A number of assumptions are made in order to produce the pedestrian ratings for each neighbourhood. These assumptions are discussed below.

It is assumed that pedestrian and road connectivity factors, and pedestrian ratings, are consistent throughout the portions of each sector. Because the sectors used are radial sectors the width of each sector increases with distance from school. Therefore, the likelihood of these factors being consistent across each sector decreases with increasing distance from school.

At a distance of 1km from school, each sector is approximately 760m wide. The assumption that the general form of the neighbourhood is consistent over that distance is considered to be a reasonable assumption for this distance from the school.

Beyond 1km from school it is considered that distance from school is likely to be the overriding factor determining school travel mode, and that the importance of connectivity and pedestrian environment decreases. It is therefore considered that although the nature of the neighbourhood of each sector is likely to be quite variable beyond this distance, this is unlikely to have a significant effect on the overall results.

Connectivity Factors and Pedestrian Ratings are identified for the neighbourhood of each school. The methods for establishing the Connectivity Factors and Pedestrian Ratings are described below.

3.3.4.2 Connectivity Factor

Eight radial sectors are identified and marked on aerial photographs of the school and its neighbourhood. The eight sectors are North, North East, East, South East, South, South West, West, and North West.

Points are identified at each of these sectors at distances of 500m and 1km from the school, as the crow flies. Pedestrian and road routes to each of the points are then identified on an aerial photograph, and pedestrian and road distances measured for each of the points in each of the sectors. A typical "*connectivity factor*" for both driving and walking for 0-500m and 500m to 1km from school is estimated for each sector. An example of an aerial photograph used to establish connectivity factors is included in Appendix D.

3.3.4.3 Pedestrian Rating

An on site pedestrian rating survey is carried out for each school. Pedestrian Ratings are estimated for the first 500m of the pedestrian routes between the school and a point in the centre of each of the sectors identified above. The assessment process consists of walking each of the routes, and scoring the route on a number of factors. These factors are discussed in section 3.3.4.3.1, below.

Pedestrian Ratings are assessed for the portion of each radial sector between 500m and 1km from the school. The assessment consists of driving through the area to determine if the pedestrian environment is similar to the route 0 to 500m from school.

3.3.4.3.1 Pedestrian Rating Factors

The pedestrian rating system used is based on Gallin (2001). A copy of her assessment sheet is included in Appendix E. Gallin's assessment is a general pedestrian assessment suitable for all pedestrian groups. Changes have, therefore, been made to Gallin's rating

system so as to better reflect the specific requirements of primary school children in the pedestrian environment. A copy of the assessment sheet as used is included in Appendix F

3.3.4.3.1.1 Connectivity

Connectivity is measured separately (see section 3.3.4.2, above), so is not included in the pedestrian rating assessment.

3.3.4.3.1.2 Pedestrian Volume

Gallin rated pedestrian volumes in excess of 350 per day lowest (0 points), and less than 80 per day highest (4 points). This suggests that a pedestrian environment with few pedestrians is more desirable than one with a number of pedestrians. This may not necessarily be the case in a pedestrian environment for primary school pupils. A number of pedestrians, particularly those associated with the school community, can provide a level of informal oversight and supervision to child pedestrians, particularly those unaccompanied. This, in turn improves both the road safety and personal safety levels of the pedestrian route for school children.

The measurement or assessment of pedestrian volumes over the entire length of each sector at school start or finish times would involve a number of trips to the school in the morning or evening. Given the unclear correlation between pedestrian volume, and the suitability of the pedestrian environment for primary school age pedestrians, it is considered that the measurement and recording of pedestrian volumes on each of the sectors at school start and finish times is not justified. This section is therefore omitted from the pedestrian rating carried out.

3.3.4.3.1.3 Mix of Path Users

Gallin rated an environment in which the majority of path users are non pedestrians lowest (0 points), with an environment with pedestrians only highest (4 points). It is considered that the mix of users in pedestrian environments at school start and finish times is likely to be similar throughout an urban study area.

Like an assessment of pedestrian volumes, an assessment of the mix of path users would require a number of trips to the school at school start and finish times. Given the expected low level of variability in the mix of footpath users in an urban study area, it is considered that an assessment of path user mix is not justified. This section is therefore omitted from the pedestrian rating to be carried out.

3.3.4.3.1.4 Factor Weightings

Modifications have been made to the weightings of some factors from those proposed by Gallin. These modifications are based on the ratings given by parents to the various factors which influenced their choice of travel mode for their children (Refer Chapter 5, Section 5.4.2). The modifications are outlined below: Parents were asked to rate the factors from 1 to 5, 1 being the lowest, and 5 the highest.

1. The weighting of "Path Width" is changed from 4 to 3. With the exception of areas immediately outside schools or local suburban shopping areas, the footpaths in a given urban study area are likely to be of a consistent width. Parents were not asked to rank path width as a factor in their decision making, but it is considered to be indirectly related to the quality of the pedestrian environment. The average rating of "Footpath Quality" by parents was 2.2 out of 5.

2. The weighting of "Surface Quality" is changed from 5 to 3. This factor is directly related to footpath quality, which had an average score of 2.2 out of 5

3. The weighting of "Obstructions" is changed from 3 to 2. Again this factor is considered to be indirectly related to footpath quality.

4. The weighting of "Crossing Opportunities" is unchanged at 4.

5. The weighting of "Support Facilities" is unchanged at 2.

6. The weighting of "Path Environment" is unchanged at 2.

7. The weighting of "Potential for Vehicle Conflict" is increased from 3 to 4. The number of conflicts that pedestrians have with motor vehicles is one of the major determinants in road safety for pedestrians. Other factors include vehicle volume and speed, and intervisibility between pedestrians and motorists. "Road Safety" achieved the highest average ranking by parents at 4.5 out of 5.

8. The weighting of "Personal Security" is increased from 4 to 5. Personal security (or "Safety – Stranger Danger") achieved an average ranking of 4.2 out of 5 from parents.

Chapter 4

CASE STUDY

4.1 Introduction

Chapter Three described the general form of the survey method to be used in the case study. This chapter describes specific issues related to the case study in Christchurch, and to particular schools or locations. There are some features of some schools, or their neighbourhoods, which made them of particular interest in this study. Those features are described.

Travel habits of pupils at twenty two Christchurch primary schools were surveyed for this thesis. In addition, factors which may influence travel habits at each school were assessed. The parents of 2,124 pupils responded and provided information on travel choices over the course of one week. Information on a total of 10,129 trips to school and 10,105 trips from school was obtained.

This chapter also discusses the responses of schools when approached to take part in the study, Finally, this chapter comments on some findings in the neighbourhood pedestrian rating surveys.

4.1.1 School Selection

As described in Chapter 3, Section 3.2.1, Schools representing a wide cross section of Christchurch urban schools were selected. 2007 roll numbers and Decile Ratings for surveyed schools are listed in Table 2 below:

Table 2 Schools Surveyed

School Name	Decile	Roll
Addington School	3	204
Aranui School	1	304
Avondale School	2	528
Beckenham School	6	470
Belfast School	5	341
Freeville School	4	353
Ilam School	9	515
Kendal School	6	129
Lyttelton Main School	7	84
Lyttelton West School	8	87
Opawa School	5	487
Paparoa Street School	10	587
Parkview School	4	288
Redwood School	8	449
Rowley Avenue School	1	118
Roydvale School	9	286
Spreydon School	3	311
St Anne's School (Woolston)	2	145
St Joseph's School (Lyttelton)	8	30
Waimairi School	10	437
Wairakei School	7	174
Windsor School	8	597

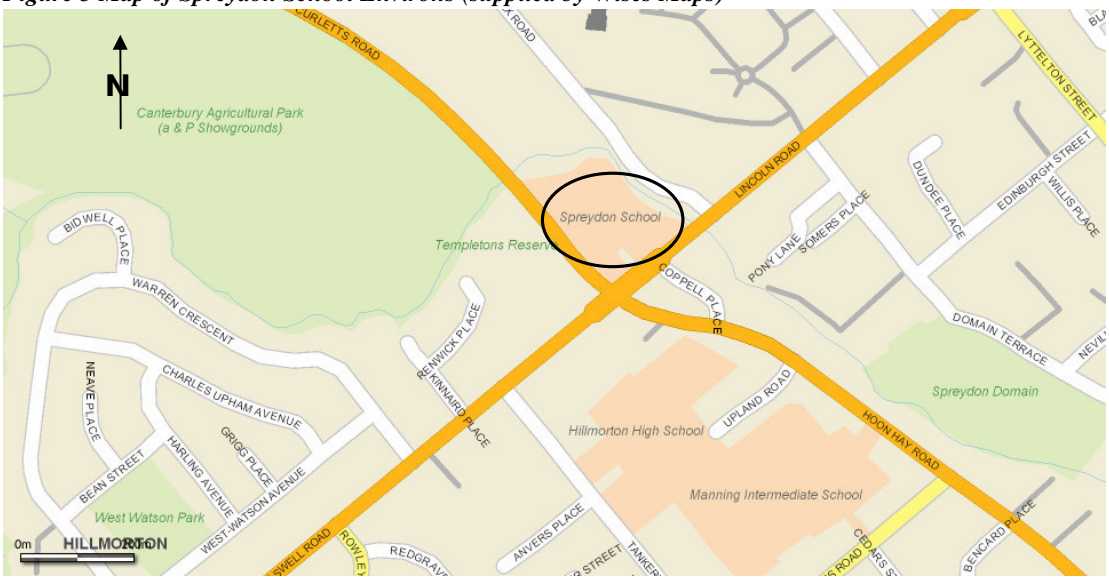
4.1.2 Special Features

In addition to the factors listed above, some schools were selected because of specific features of the school or its environment. These are listed below:

4.1.2.1 Spreydon School

Spreydon School is located at the intersection of Curletts Road, Lincoln Road, Hoon Hay Road and Halswell Road (refer Figure 3 below).

Figure 3 Map of Spreydon School Environs (supplied by Wises Maps)



The school is bounded on the south eastern side by Lincoln Road, which forms part of an arterial radial route between the south eastern suburbs and the central city. Lincoln Road, near the school carries approximately 24,000 vehicles per day (vpd) (2005 Christchurch City Council (CCC) traffic count). This road would have been in place at the time the school was built in the early 1900s. All accesses to the school are from Lincoln Road

Curletts Road forms the south western boundary of the school. This is a link from the Southern suburbs to the Christchurch ring road. Outside the school it carries approximately 11,500 vehicles per day (vpd) (2005 Transit New Zealand (TNZ) count) Curletts road was built in the 1970s, long after the school was built.

The Heathcote River forms the north western and north eastern boundaries of the school. Land beyond the river includes the former Hillmorton hospital site. A new residential subdivision is currently being developed in part of the hospital grounds. Beyond the hospital site is the Christchurch Southern Motorway, and a large block of industrial land.

There are very few residential properties within 2km of the school, on the school side of Curletts Road and Lincoln Road.

This school was selected to be part of the study in an attempt to determine if its isolation from its pupil community affected the travel behaviour of its pupils.

4.1.2.2 Roydvale and Ilam Schools

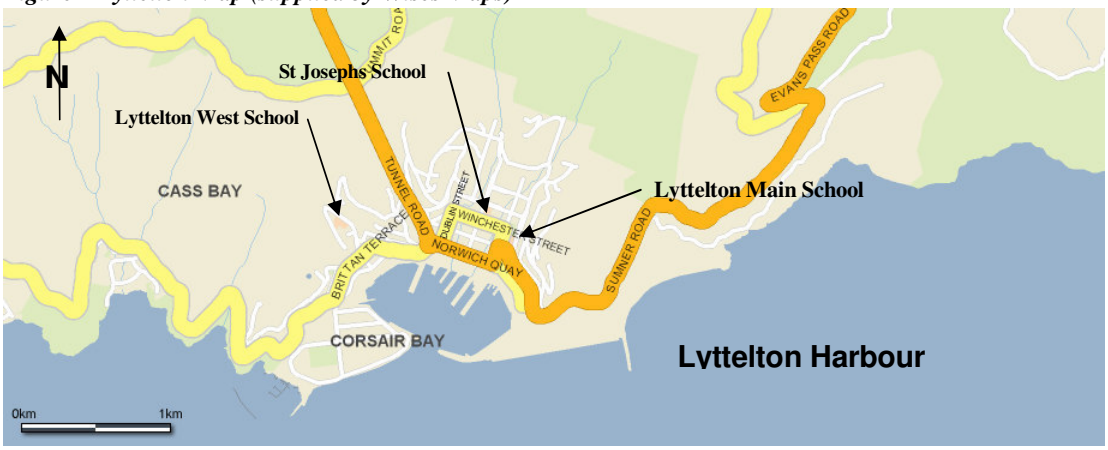
Both of these schools are immediately adjacent to major employment generators. Ilam school backs onto the University of Canterbury. The university employs approximately 1,500 staff. In addition, it was thought that a number of students may have children at the school.

Roydvale School is adjacent to the William Pickering Business Park.

4.1.2.3 Lyttelton Schools

Lyttelton is an historic port village. It is located on the hillsides of the flooded volcanic cone which forms Lyttelton Harbour (refer Figure 4).

Figure 4 Lyttelton Map (supplied by Wises Maps)



Lyttelton was originally a town to service the port. It was cut off from the growing settlement of Christchurch, on the northern side of the Port Hills. Its residents were largely port workers. The compact, isolated nature of the town, and its steep terrain, are likely to have resulted in walking being the dominant transportation mode in early Lyttelton.

The topographical and access constraints have meant that Lyttelton remains a compact and comparatively cut off community. The steep, narrow winding streets and pedestrian short cuts of early Lyttelton are still present.

All three Lyttelton schools were chosen to enable a comparison to be made between the school travel choices of a compact constrained community and those of a suburban environment.

4.2 Responses

4.2.1 School Responses

In the first instance twenty schools were identified as best meeting the criteria above. The principals of those schools were approached to take part in the survey. The majority of schools agreed to take part. However, some felt that their work load and programme meant that it was not feasible for them to take part. Additional schools which best met the criteria were identified and approached. This process continued until twenty two schools were recruited. The additional schools arose because it was decided to include all three schools in Lyttelton. The three Lyttelton schools are all small, with rolls of 28, 82, and 103 pupils. It was therefore considered that the additional decile 7 and 8 schools would not result in a bias in the results.

4.2.2 Parent Response Rate

Prior to carrying out the survey, school principals spoken to indicated that based on responses to previous surveys, they would expect a response rate of between 15 to 20% of parents surveyed. Overall parents of 34% of the total number of children at the schools surveyed responded. This suggests a high level of interest in school pupil travel.

4.3 Neighbourhood Urban Form

There are few high density mixed use neighbourhoods in Christchurch. However, there are different neighbourhood forms in the wider city area.

Many of the older residential areas built in the late 1800s and early 1900s near to the city centre were built prior to widespread car use. They therefore tend to be designed for pedestrians, and often feature higher population densities than the newer suburban areas. These older areas often have good levels of street connectivity.

During the mid Twentieth Century, public transport, particularly trams, became more widespread. The city no longer needed to be compact enough to allow people to live within walking distance of work. The urban areas built during this time tended to be built around tram routes. Residential sections increased in size, giving rise to Austin Mitchell's description of New Zealand as the "Half Gallon Quarter Acre Pavlova Paradise" in 1972.

As the Twentieth Century progressed, the private car became the dominant form of transportation, and the urban form changed to accommodate it. A hierarchy of streets was developed, ranging from arterial roads to local roads. Local traffic was removed from arterial roads and through traffic removed from local roads wherever possible. Through movement on local roads was often minimised by the use of cul-de-sacs in many subdivisions. Occasionally pedestrian paths were provided linking cul-de-sacs, but often there was no linkage, resulting in low levels of pedestrian connectivity.

Some schools seem to be located on a border between an older urban area and a newer area. It appears that at the time these schools were built, they were located on the edge of the town. Some years, or even decades, later, development occurred beyond the schools, and they were surrounded by houses. It may be that land on the edge of town is cheaper for educational authorities to purchase and build on than land more centrally located.

The schools participating in this survey have been chosen to provide variety in surrounding urban form.

4.4 Pedestrian Rating Results

Overall, the quality of the pedestrian environment for routes to and from school was fairly consistent. 67% of the households surveyed were located in areas with an assessed pedestrian rating for the route to school of between 50 and 70 out of a possible total of 100. 94% were in areas with ratings between 40 and 80.

Observations regarding some of the factors used to assess pedestrian ratings are discussed below.

4.4.1 Footpath Width

With a few exceptions, footpaths located in road reserves were consistently 1.5m wide. This reflects a Christchurch City Council standard footpath width of 1.5m across the board.

Schools generate a large number of pedestrians (including those walking to and from parked vehicles) immediately outside the school. It is considered desirable for footpaths immediately outside schools to have additional width to cope with the number of pedestrians generated by schools.

Two of the twenty two schools surveyed had footpath widths of less than 1.5m outside one entrance. Five schools had footpath widths between 1.5 and 2.0m outside all of their entrances. Sixteen schools had footpath widths greater than 2.0m outside at least one entrance, and six had footpath widths greater than 2.0m outside all of their entrances.

The schools with footpath widths between 1.5 and 2.0m at all entrances were located on minor roads. However, minor roads are often busy outside schools at school start and finish times.

4.4.2 Surface Quality

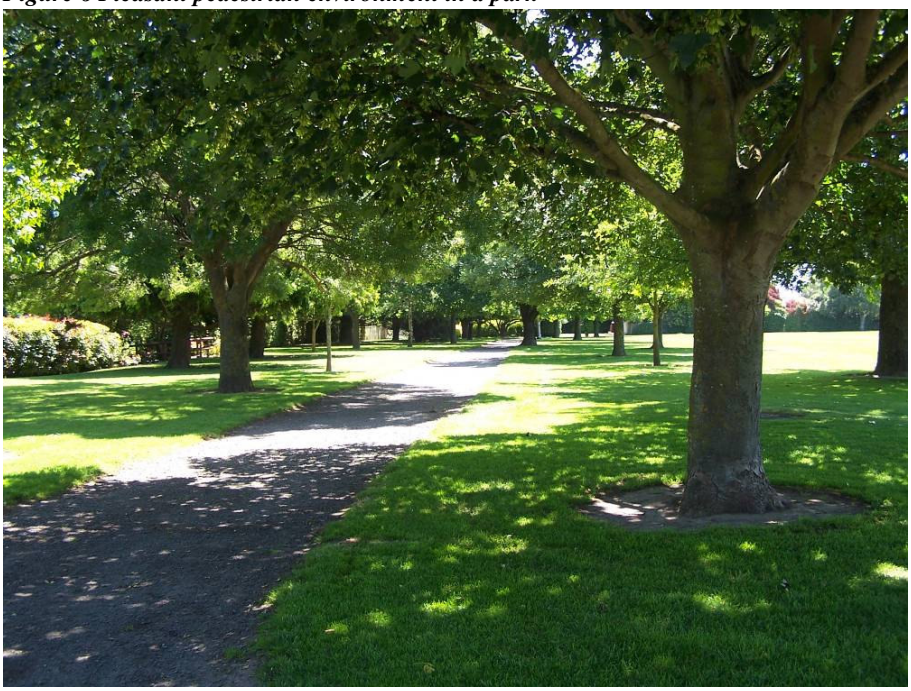
The quality of the sealed surface of footpaths in the road reserve was typically of moderate to excellent quality.

However, footpaths outside building sites were often in poor condition. Heavy vehicles need to access building sites, and footpaths are not designed to stand up to the loads imposed by construction traffic. Consequently the footpath surface breaks up and becomes very uneven. Damaged footpaths remain unrepaired for the duration of the construction, which can take some months. Pedestrians are inconvenienced, and there is an increased risk of tripping or falling on footpaths left in this condition (refer Figure 5).

Figure 5 Damage to footpath outside building site

A number of school pedestrian routes pass through parks and reserves. Often paths in parks and reserves are not sealed. Instead they have a loose metal surface. Generally, these surfaces are of a reasonable quality and well maintained. However, a loose surface can make pushing a pram or pushchair with small wheels difficult. Despite a sometimes less than ideal path surface quality the overall pedestrian environment in these areas is often excellent (refer Figure 6).

Figure 6 Pleasant pedestrian environment in a park



4.4.3 General Pedestrian Environment

A number of general observations were made of the overall pedestrian environment near to schools. These are listed below

a) Often otherwise adequate pedestrian facilities seem to have been let down by poor detail design. Refer Figure 7 and Figure 8

Figure 7 Lack of continuity of pedestrian facilities

Figure 8 Barriers to access pedestrian facilities

b) Repairs to footpaths, including those following installation of utilities such as telecommunications and power were often done to a poor standard. Refer Figure 9.

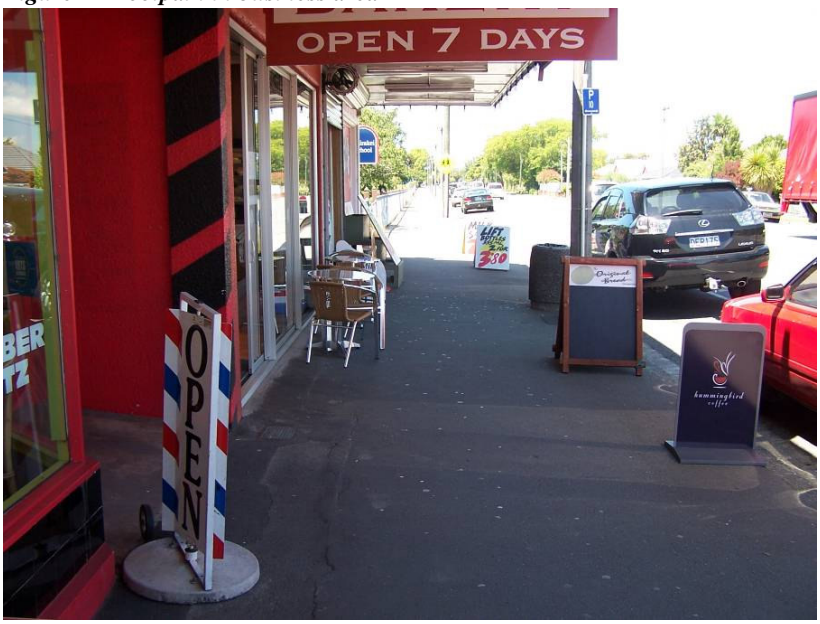
Figure 9 Poor footpath repairs following installation of utilities

c) Power poles often limit the effective width of a footpath (refer Figure 10). Footpaths in Christchurch are typically 1.5m wide. However, power poles are often located in the footpath, particularly in many older suburbs. The effective width of the footpath at power pole locations is reduced, often to approximately 1.0m.

Figure 10 Power poles limiting effective footpath width

d) Footpaths in retail areas are often obstructed by signs, rubbish tins, and seating (refer Figure 11). Footpath widths in these locations are generally generous. However, the presence of obstructions can reduce the effective width significantly. In addition, these obstructions are often located on opposite sides of the footpath, resulting in pedestrians needing to take a "slalom" course to avoid the obstacles.

Figure 11 Footpath in business area



e) Design of pedestrian facilities often seems to take a low priority when roads and intersections are upgraded. Figure 12 shows the limited visibility of traffic turning for pedestrians using the pedestrian crossing point. There is a primary school with a roll of 450 pupils, and a special needs school with a roll of 130 within 0.5km of this intersection. The main road carries 11,500 vehicles per day (vpd), and the side road carries 3,500 vpd.

Figure 13 shows limited visibility for pedestrians crossing the cross road, and limited waiting room for pedestrians crossing the main road at traffic signals. The clear waiting space between the face of kerb and fence is approximately 1m at its narrowest for pedestrians crossing the main road. There is a primary school with a roll of 500, an intermediate school with a roll of 800, and a high school with a roll of 750 pupils within a radius of 500m of this intersection. All three schools are on this side of the cross road. The main road carries 15,500 vpd, and the cross road carries 8500vpd.

Figure 12 Limited visibility at pedestrian crossing point

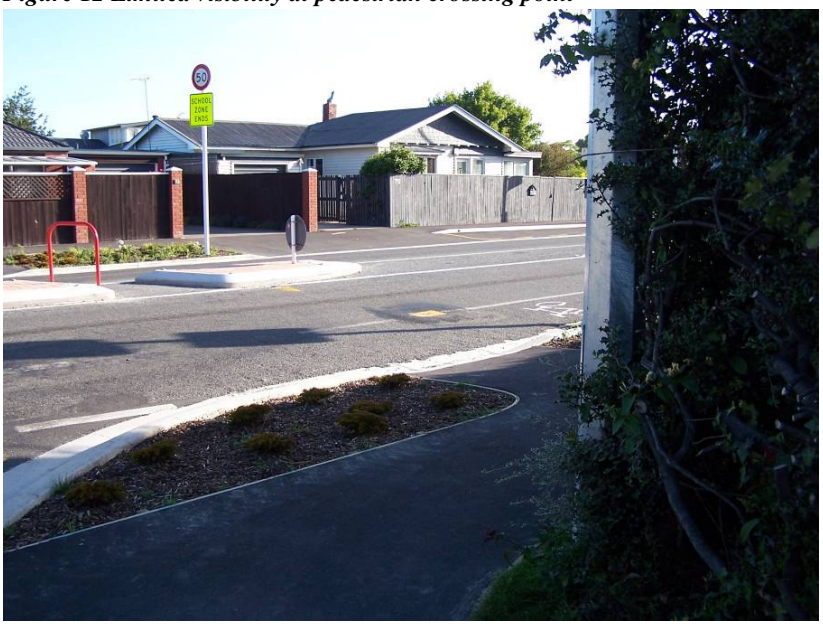


Figure 13 Narrow Pedestrian Waiting Area at Traffic Signals

4.4.4 Summary

This case study surveyed the travel choices and household, school, and neighbourhood environments of over twenty schools. School trip data was obtained for approximately 20,000 trips to or from school.

The data from those schools, neighbourhoods, household, pupils and trips was collated and analysed to identify trends in school travel choices.

Chapter 5

CASE STUDY RESULTS

5.1 Introduction

This chapter describes the results of the case study, described in chapters 3 and 4, Correlations between school travel mode choice and school, neighbourhood, and household factors are explored. Correlations between mode choice, and the importance placed by parents on the factors identified as influencing travel choice are also explored.

5.1.1 School Factors

The school factors considered include:

- School Roll; and
- School Decile Rating.

Information on each of these factors was obtained from the school or Ministry of Education.

5.1.2 Neighbourhood Factors

The neighbourhood factors include:

- Quality of pedestrian environment;
- Distance from school;
- Pedestrian Connectivity between home and school;
- Pedestrian Distance;
- Major roads to cross between home and school; and
- Number of schools closer to home.

Information on these factors was obtained from the neighbourhood survey described in Chapter 3, Section 3.3.4. Using the household location provided in the household section of the parent's survey, the neighbourhood information was applied to each household.

5.1.3 Household Factors

The household factors considered include:

- Number of children attending the school;
- Age of the youngest child attending the school; and
- Number of cars in the household.

This information was obtained from the household section of the parent's survey from.

5.1.4 Influencing Factors

The factors which parents were asked to rate the importance of in influencing school travel choices in the survey included:

- Distance to School;
- Weather Conditions;
- Convenience;
- Safety – "Stranger Danger"
- Safety – Road Safety;
- Cost;
- Exercise is Healthy;
- Condition of Footpaths; and
- Other Factors

Parents were asked to rank the importance of each of these factors on a scale of 0 to 5. The factors were listed in a random order (as above) on the questionnaire.

5.2 Overall Mode Choice Results

5.2.1 Introduction

Results of pupils travel choices for trips both to and from school were collated for all schools. The overall results for all schools are considered first. The results are then compared with each of the factors identified.

Responses were received from a total of 1,589 parents, representing 2,263 pupils attending the schools surveyed. 3,497 responses were received from pupils. The sum of all of the rolls of the schools surveyed was 6,396 pupils. Response rates of 35% for parents and 55% for pupils were achieved.

The responses received covered trips to and from school over the period of a week. Some pupils were absent at some stage during the week of the survey at their school, and some respondents did not provide data for all trips to and from school. Results for a total of approximately 20,000 trips to or from school have been included.

Schools were able to choose the timing of their surveys, in order to suit each schools specific programme. Consequently, the results shown do not refer to the same week.

Parents' surveys were not conducted at Rowley Avenue School. This is a decile 1 school with a very high proportion of parents for whom English is a second language. The school suggested that many of these parents would struggle with the parents' survey forms, and was reluctant to place that additional burden on their parents.

Therefore, only Pupils' surveys were carried out at Rowley Avenue School. The results from the Rowley Avenue pupils' surveys indicated similar trends to those evident at Aranui School, which was the other Decile 1 school surveyed. These are discussed in section 5.6.2.1.

The results from Waimairi School have not been included in the overall school results. Waimairi School has had a travel plan operating since 2005, and employs a part time travel co-ordinator. The Waimairi School results are significantly different to the results of the other schools surveyed. An average of 31% of Waimairi respondents travelled to

school by car, and 61% by scooter or walking. This compares with an average for all other schools surveyed of 58% and 33% respectively. It was considered that Waimairi School is atypical of the schools surveyed, due in part to the travel initiatives in place at the School

A more detailed discussion of the Waimairi School results is included in section 5.9.

5.2.2 Comparison of Parents and Pupils' Responses

A possibility that responses from parents could be biased towards those parents who took an interest in transportation or environmental issues was identified. It was therefore decided to survey pupils on mode choice, and compare pupils' mode choice responses with parents' responses. Both pupils and parents were surveyed at the schools taking part. The pupils' survey was much less detailed than the parents' survey, and did not consider factors influencing mode choice decisions (refer to appendix A & B for copies of both parents and pupils' surveys).

Table 3 and Table 4 below compare the mode choice responses of pupils and parents. These tables suggest a slight bias towards active and environmentally friendly modes in the parents' responses. This is consistent with parents who have an interest in transportation or environmental issues being more likely to take part in a travel survey than those who have little interest in such issues. However, the magnitude of this bias is considered small.

Table 3 Parents Mode Choice Responses (%)

PARENTS	Mon		Tue		Wed		Thu		Fri		Avge	
	To	Fr	To	Fr	To	Fr	To	Fr	To	Fr	To	Fr
Car	60	55	59	57	57	54	59	55	58	54	59	55
Bus	1	2	1	2	1	2	1	2	1	2	1	2
Bike	7	7	7	7	7	7	7	7	7	6	7	7
Scooter	3	3	4	3	4	3	3	2	4	3	4	3
Walk	29	34	29	32	30	34	30	33	30	35	30	33
	100	100	100	100	100	100	100	100	100	100	100	100

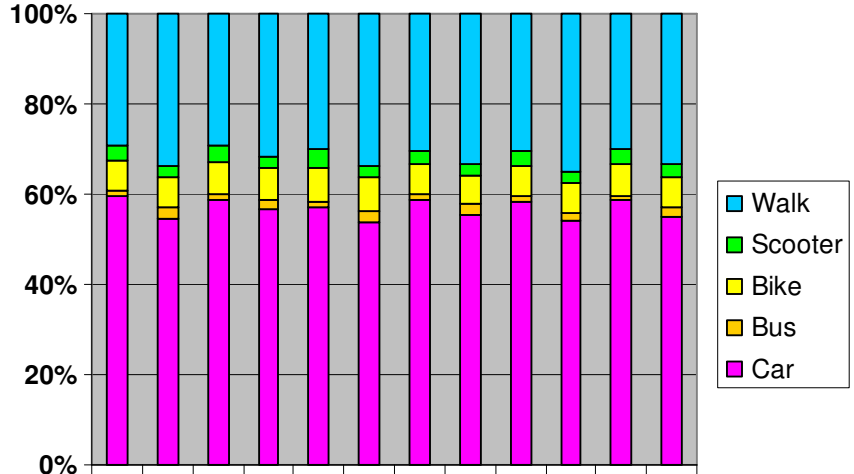
Table 4 Pupils Mode Choice Responses (%)

PUPILS	Mon		Tue		Wed		Thu		Fri		Avge	
	To	Fr	To	Fr	To	Fr	To	Fr	To	Fr	To	Fr
Car	58	56	62	60	57	55	62	58	60	57	60	57
Bus	2	3	2	3	2	3	2	3	2	3	2	3
Bike	7	7	7	6	8	7	7	7	6	7	7	7
Scooter	4	4	4	4	5	3	4	4	4	4	4	4
Walk	28	30	25	27	28	31	25	30	27	30	26	30
	100	100	100	100	100	100	100	100	100	100	100	100

5.2.3 Parents Responses

Figure 14 below shows the percentage of pupils using each mode using the results from the parent surveys. The results shown are for the trips to and from school for each week day and the average of the trips to and from for all week days. A more detailed breakdown of each mode is included in Appendix G.

Figure 14 Overall Mode Choice - Parents Responses (%)



	To	Fr	To	Fr	To	Fr	To	Fr	To	Fr	To	Fr
	Mon		Tue		Wed		Thu		Fri		Avge	
Walk	29	34	29	32	30	34	30	33	30	35	30	33
Scooter	3	3	4	3	4	3	3	2	4	3	4	3
Bike	7	7	7	7	7	7	7	7	7	6	7	7
Bus	1	2	1	2	1	2	1	2	1	2	1	2
Car	60	55	59	57	57	54	59	55	58	54	59	55

The data shown above indicates the following trends in travel patterns for the schools surveyed:

1. Car usage tends to decrease and walking increase for the trip from school when compared with the trip to school. Many parents have indicated that time is an important factor in deciding their child's mode choice. In many homes, time pressures are greater in the morning than in the afternoon. Family members need to get ready for school and work, have breakfast, and travel to school or work in the morning. Many of those pressures are not present in the afternoon. These factors may account for the greater numbers of pupils travelling to school by car when compared to those travelling home by car.

2. A very small proportion of pupils of the schools surveyed used buses for the trip to or from school. With the exception of the Lyttelton schools, none of the schools surveyed had dedicated school buses. No specific research was done into public

bus routes serving the schools surveyed. Typically, Christchurch bus services operate on radial routes serving the central business district. Primary schools are not necessarily located on the radial bus routes Those routes that do pass a local primary school generally pass through the school catchment in a more or less straight line, and only a small proportion of the school pupils would be likely to live on the bus route. Therefore, radial routes are not likely to provide a good service to and from local primary schools.

3. A small number of pupils at the schools surveyed used scooters. Scooter usage is quite variable from school to school. Not all surveys given to schools had the scooter category included in the survey form. The scooter category was added to surveys at the suggestion of a principal whose school had a comparatively high scooter usage.

4. There is a small decrease in car usage and increase in scooter and walking for the trip to school, and, to a lesser extent, from school, on Wednesdays. A number of the schools surveyed take part in the "Walking Wednesday" initiative promoted by Christchurch City Council.

More detailed graphs and tables of the following mode choice options are included in Appendix G:

- Car – Trip Chain;
- Car – Special Trip;
- Bus – Dedicated School Bus;
- Bus – Scheduled Public Bus Service;
- Bike – With Parent or Caregiver;
- Bike – With other School Pupils;
- Bike – Alone;
- Walking – With Parent or Caregiver;
- Walking – In an Organised Group (eg Walking School Bus);

- Walking – With other School Pupils; and
- Walking – Alone.

5.2.4 Pupils Responses

Figure 15 below shows the percentage of pupils using each mode, based on data from the pupils' survey responses. As noted in section 5.2.2 above, the pupils' responses are very similar to the parents responses, but with a slightly larger percentage indicating car usage.

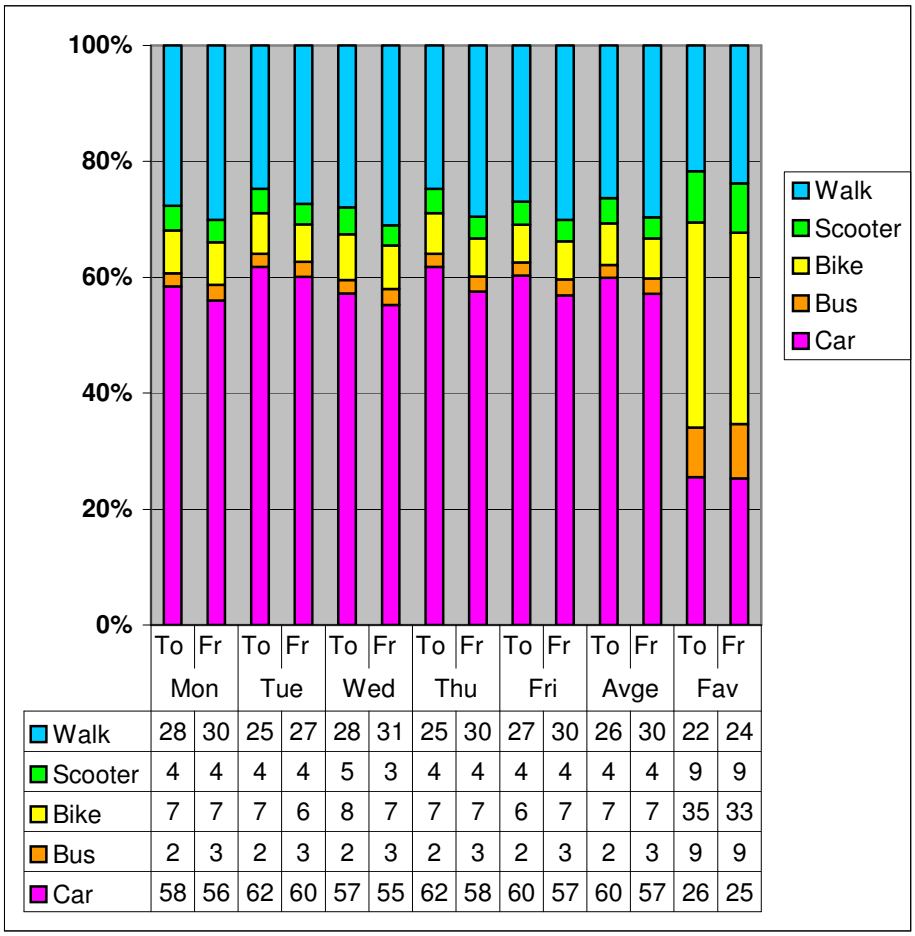
As noted in section 5.2.3 above, scooter usage is variable from school to school, and the scooter option was not included on all school surveys.

Pupils were also asked "*If I could choose, the way of getting to (or from) school I like best is by….*" The responses to this question are shown in the "*Fav*" (favourite) column of Figure 15 below. Pupils identified biking as their favourite mode choice, followed by car, walking, scooter, and bus.

Care needs to be exercised in interpreting pupils' choice of their favourite mode. Many pupils identified a different mode to that which they normally used, as their favourite mode. It is possible that many of them have little experience with the mode they have identified as favourite. In many instances it may be a case of *"the grass being greener on the other side of the fence"*.

Notwithstanding the rider above, there appear to be a significant number of pupils who travel to and from school by car who would rather be travelling some other way.

Figure 15 Overall Mode Choices - Pupils Responses (%)



	To	Fr	To	Fr	To	Fr	To	Fr	To	Fr	To	Fr	To	Fr
	Mon		Tue		Wed		Thu		Fri		Avge		Fav	
Walk	28	30	25	27	28	31	25	30	27	30	26	30	22	24
Scooter	4	4	4	4	5	3	4	4	4	4	4	4	9	9
Bike	7	7	7	6	8	7	7	7	6	7	7	7	35	33
Bus	2	3	2	3	2	3	2	3	2	3	2	3	9	9
Car	58	56	62	60	57	55	62	58	60	57	60	57	26	25

5.3 Overall Independence Results

5.3.1 Introduction

An assessment has been made of the degree of independence which children experience on the trip to and from school. School travel was divided into two broad categories of independence, namely travelling with an adult, and travelling alone.

The following mode choices were included in the "With Adult" independence category:

- Car trips, both as part of another trip, and as a special trip to school;
- Bike, scooter, and walking trips with parents; and
- Organised walking trips.

The following mode choices were included in the "Alone" independence category:

- Bus trips, both special school bus, and scheduled public bus trips; and
- Bike, scooter and walking trips either with other pupils or alone.

The pupils' surveys did not include sufficient detail to allow assessment of independent travel. Consequently, no comparison has been made between independent travel rates for parents and children.

5.3.2 Independence Results

Table 5, below, shows the overall results for independent travel for trips to and from school, for each day of the week.

Between 3% and 5% fewer pupils travel to school independently than travel from school. This could be due in part to time pressures experienced in many households in the mornings (refer section 5.2.3 for discussion on time factors). Parents may take children by car in the morning because it is quicker and more convenient.

Table 5 Overall Independence Results

	Mon		**Tue**		**Wed**		**Thu**		**Fri**	
	To	Fr	To	Fr	To	Fr	To	Fr	To	Fr
Adult	85%	80%	85%	82%	84%	81%	84%	80%	84%	81%
Alone	15%	19%	15%	19%	16%	19%	17%	20%	16%	19%

5.4 Overall Weighting of Influencing Factors

5.4.1 Introduction

Parents were asked to "…*indicate the importance you place on the following factors when deciding how your children travel to school. 0 indicates that the factor is not important at all. 5 indicates that the factor is of critical importance.*" The factors identified in the survey were:

- Distance to School;
- Weather Conditions;
- Convenience;
- Safety – "Stranger Danger"
- Safety – Road Safety;
- Cost;
- Exercise is Healthy; and
- Other.

5.4.2 Overall Influencing Factors Weightings

Table 6, below shows the average weighting given by parents to factors influencing their children's travel choices.

5.4.2.1 Safety

As expected, road and personal safety, at 4.5 and 4.2 respectively, are the most important factors identified by parents as influencing travel choices for their children.

5.4.2.2 Exercise

The next most important factor is "*Exercise is Healthy"*, at 3.9. This is surprising given the high proportion of pupils who travel by car. It may be that some parents have rated "*Exercise is healthy*" highly on the basis that they agree with the statement, rather than on the importance it has to their children's travel choices. Some parents have stated that they

agree with the statement that "*exercise is healthy",* but that they consider that their children get adequate exercise in ways other than travel to and from school.

5.4.2.3 Distance, Weather, Convenience

Distance, weather, and convenience received similar rankings at 3.4, 3.3, and 3.2 respectively. This suggests that these factors play a moderate roll in school children's travel choices.

5.4.2.4 Walking Environment

The condition of footpaths and the pleasantness of the walking environment received the comparatively low rankings of 2.2 and 2.9. Parents do not seem to put a high level of importance on the quality of the walking environment. This is borne out by the absence of any clear trends when comparing mode choice results against pedestrian rating (refer to section 5.7.1).

The condition of the footpaths and the quality of the walking environment on roadside footpaths is typically pretty consistent across the neighbourhoods of the schools surveyed. Some locations had very good walking environments in parks, reserves, and other locations remote from roads. It may be that many parents take reasonable quality footpaths and walking environment for granted, and do not consider them when making decisions on their children's travel choices.

Footpaths were non existent, and the walking environment poor in some locations in Lyttelton. Parents rated the importance of footpaths and walking environment significantly higher in these locations than in other locations.

Table 6 Average Influencing Factor Weightings

Distance	3.4
Weather	3.3
Convenience	3.2
Safety – Stranger	4.2
Safety – Road	4.5
Cost	1.6
Exercise is Healthy	3.9
Condition of Footpaths	2.2
Pleasant Environment	2.9

5.4.2.5 Other Factors

Parents were given the opportunity to list other factors which have an influence on travel decisions for their children. 277 parents listed an "*other*" factor. Many of these were elaborations on factors listed above, such as "*safety for walking",* and "*Cars going through the lights when the "man" is green"*. Many others were one off factors which were specific to the household concerned. There were, however, four factors which were repeated more than ten times. These were time, age, environmental concerns, and location.

5.4.2.5.1 Time

There were one hundred mentions of time under "*Other Factors"*. This suggests that time is an important factor in pupils travel choices. This is consistent with the high proportion of pupils who travel by car. It is also consistent with the higher proportion who travel by car in the mornings, when there is likely to be greater time pressures than in the afternoon.

5.4.2.5.2 Age

Age of pupils was mentioned nineteen times in the other factors section. Many parents felt that their five or six year old children were too young to travel independently. Others felt that their younger children were too young to walk a significant distance, or would be too tired after school.

5.4.2.5.3 Environmental

Nineteen parents mentioned environmental issues, including climate change, pollution, and carbon footprint, in the other factors section. Typically the children of these parents travelled to school by modes other than car.

5.4.2.5.4 Location

Issues related to location were mentioned fifteen times in the other factors section. These included comments such as "*too far away to walk*" through to "*too close to take the car*".

A number of parents commented that ability to walk to school was one of the factors they considered when choosing their home. Others commented that their children continued to attend their old school after they moved house. These children were now living too far from school to be able to use modes other than car.

A small number of parents stated that they chose their children's school on the basis of the quality of the education, even if it meant a long trip to school.

5.5 Impact of Local Environment Factors

5.5.1 Introduction

As outlined in section 5.1, information on a number of school, household, and neighbourhood factors was collected in the parents' surveys. This section considers the correlation between each of these local environment factors and mode choice, degree of independence of travel, and the factors identified by parents as influencing mode choices for their children. For the purposes of identifying a correlation, these local environment factors have been considered independently from one another.

However, these factors do not operate in isolation from one another. The Multinomial Logit Models which are described in Chapter 6 have considered the interrelationships between the local environment factors.

5.6 Impact of School Factors

5.6.1 School Roll

The numbers of pupils enrolled at any particular school at a given times varies. with new entrants starting and pupils moving to or from other schools. At the time the travel surveys were carried out the rolls of the schools surveyed varied from 28 to 626.

For the purpose of assessing the impact of school roll on travel choices, roll size was divided into seven categories, with increments between categories of 100 pupils. The categories were: less than 100 pupils through to 600 to 700 pupils.

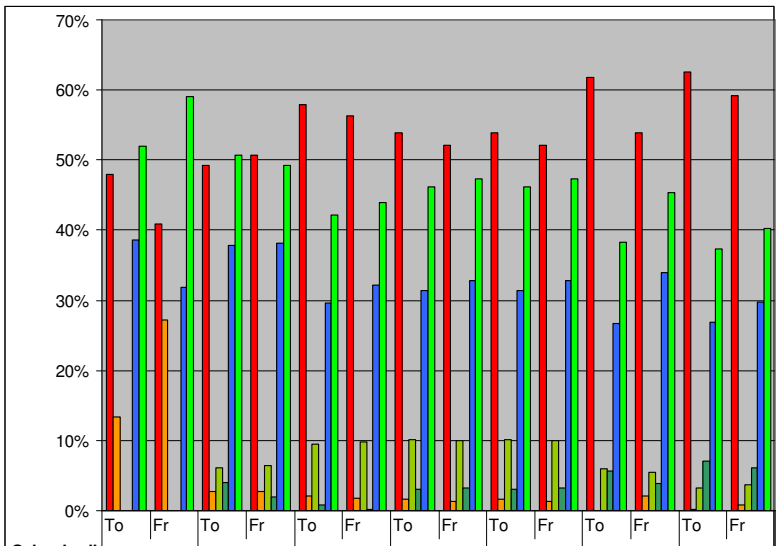
5.6.1.1 School Roll and Mode Choice

Figure 16, below, shows the relationship between school roll and school travel mode choice. This graph indicates that there is a tendency for the proportion of car trips to increase and other modes to decrease with increasing school rolls. Car trips account for 49% and 41% of trips to and from school respectively for schools with less than 100 pupils. This compares with 63% and 59% for schools with between 600 and 700 pupils. Schools with between 200 and 300 pupils recorded 58% and 56% car trips to and from school, while those with between 300 and 400, and 400 and 500 pupils recorded 54% and 52% car trips.

The rates of car usage are significantly higher for schools with 200 to 300 pupils than for schools with 100 to 200 or 300 to 400 pupils. Roydvale School was one of the schools with 200 to 300 pupils. The number of people working close to Roydvale School may be a contributing factor in the car usage rates for schools with 200 to 300 pupils.

Roydvale School accounted for 38% of the returns for schools with 200 to 300 pupils. Roydvale School is located immediately adjacent to the William Pickering Drive business area. This area is a significant employment zone. Car usage rates of 72% and 68% for trips to and from school were recorded at Roydvale School. Refer to section 5.7.4 for further discussion on the impacts of proximity to employment zones on travel choices.

Figure 16 School Roll vs Mode Choice



School roll	<100 To	<100 Fr	100-200 To	100-200 Fr	200-300 To	200-300 Fr	300-400 To	300-400 Fr	400-500 To	400-500 Fr	500-600 To	500-600 Fr	600-700 To	600-700 Fr
Car	48%	41%	49%	51%	58%	56%	54%	52%	54%	52%	62%	54%	63%	59%
Bus	13%	27%	3%	3%	2%	2%	2%	1%	2%	1%	0%	2%	0%	1%
Bike	0%	0%	6%	6%	9%	10%	10%	10%	10%	10%	6%	6%	3%	4%
Scooter	0%	0%	4%	2%	1%	0%	3%	3%	3%	3%	6%	4%	7%	6%
Walk	39%	32%	38%	38%	30%	32%	31%	33%	31%	33%	27%	34%	27%	30%
Tot Other	52%	59%	51%	49%	42%	44%	46%	47%	46%	47%	38%	45%	37%	40%

Car usage increasing with school roll size is consistent with the likelihood that a greater proportion of the pupils of a small school are likely to live within comfortable walking or cycling distance of school than those of a large school.

Table 7, below shows a comparison between school roll and the proportion of pupils who live within each of the distance bands from school.

This table suggests that typically, a greater proportion of school pupils from large schools live further away from school than do those from small schools. Schools with less than 100 pupils, between 200 and 300, and between 500 and 600 pupils do not appear to conform to this trend. Factors specific to schools in each of those school roll bands are discussed below.

All of the schools with less than 100 pupils are located in Lyttelton. Each of these schools has pupils who live in the rural areas surrounding Lyttelton. Consequently, these schools have a greater proportion of pupils who live further away.

The 200 to 300 pupil roll band includes Roydvale School, and the 500 to 600 band includes Ilam School. Both of these schools are located adjacent to major employment centres. Roydvale School is adjacent to the William Pickering business area, and Ilam School to Canterbury University.

There is an indication that proximity to their workplace and the accompanying convenience of combining work and school travel is a factor in the choice of school for some parents of pupils at these schools. Refer to Section 5.7.4 for further discussion on the impacts of proximity to employment zones on travel choices.

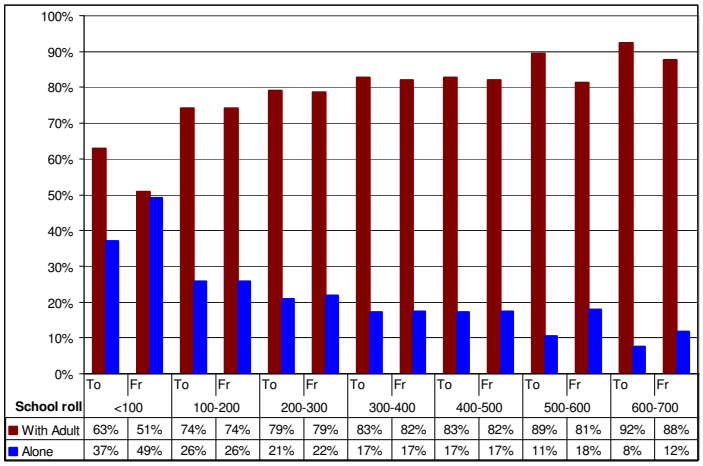
Table 7 School Roll and Distance from School

		School Roll						
		<100	**100-200**	**200-300**	**300-400**	**400-500**	**500-600**	**>600**
Distance (km)	**<0.5**	38%	43%	23%	30%	33%	15%	26%
	0.5-1.0	27%	29%	46%	36%	30%	28%	35%
	1.0-2.0	24%	19%	17%	19%	22%	35%	22%
	2.0-5.0	3%	4%	10%	10%	9%	18%	13%
	>5.0	8%	4%	4%	4%	6%	4%	3%

5.6.1.2 School Roll and Independent Travel

Figure 17 below shows the relationship between School Roll and the percentage of pupils travelling with and adult or independently.

Figure 17 School Roll vs Independent Travel



School roll	To	Fr	To	Fr	To	Fr	To	Fr	To	Fr	To	Fr	To	Fr
	<100		100-200		200-300		300-400		400-500		500-600		600-700	
With Adult	63%	51%	74%	74%	79%	79%	83%	82%	83%	82%	89%	81%	92%	88%
Alone	37%	49%	26%	26%	21%	22%	17%	17%	17%	17%	11%	18%	8%	12%

The data shows a degree of correlation between independent travel and school roll size. The small schools surveyed tended to have a higher proportion of pupils travelling independently than the larger schools.

As noted in 5.6.1.1, above, a greater proportion of pupils of small schools are likely to live a short distance from school than are pupils of large schools. Their route to school is also more likely to be within their immediate neighbourhood. The likelihood of encountering a major road also increases with increasing distance between home and school. See Section 5.7.3 for a discussion on the relationship between distance from school and major roads to cross.

These factors mean that pupils of small schools are likely to be travelling through an area in which they know, and are known by, many of the people in the area. They are also less likely to need to cross major roads or encounter heavy traffic volumes.

These factors combine to make the route to school safer from both a personal safety and a road safety perspective. Parents of pupils at a small school are therefore more likely to be comfortable letting their children travel alone.

5.6.1.3 School Roll and Significance of Influencing Factors

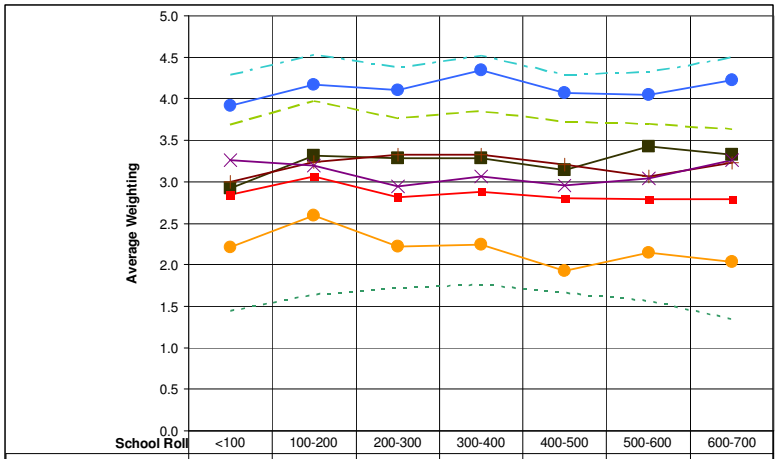
Figure 18, below shows the relationship between School Roll and the weight given by parents to the factors identified as influencing travel choices.

This data suggests that there is little correlation between the size of a school and the factors which parents consider to be important in decisions regarding their children's travel to and from school.

The weightings of all factors except "*Convenience*" were lowest for schools with rolls of less than 100. These schools are all located in Lyttelton, which is a small community. A greater proportion of the pupils live within walking distance of school. Many of those who live beyond walking distance live in the rural areas or townships close to Lyttelton. A school bus is available for these pupils.

The average weighting of "*Condition of Footpaths*" varied by 0.7, from 1.9 to 2.6. It became marginally less important with increasing school rolls. No other average weighting varied by more than 0.5.

Figure 18 School Roll vs Factors Influencing Travel Choice



School Roll	<100	100-200	200-300	300-400	400-500	500-600	600-700
Distance	2.9	3.3	3.3	3.3	3.1	3.4	3.3
Weather	3.0	3.2	3.3	3.3	3.2	3.1	3.2
Convenience	3.3	3.2	2.9	3.1	3.0	3.0	3.3
Safety - Stranger	3.9	4.2	4.1	4.3	4.1	4.1	4.2
Safety - Road	4.3	4.5	4.4	4.5	4.3	4.3	4.5
Cost	1.4	1.6	1.7	1.8	1.7	1.6	1.4
Exercise is Healthy	3.7	4.0	3.8	3.9	3.7	3.7	3.6
Condition of Footpaths	2.2	2.6	2.2	2.2	1.9	2.1	2.0
Pleasant Environment	2.8	3.1	2.8	2.9	2.8	2.8	2.8

5.6.1.4 Summary

From the data obtained from these school travel surveys it appears that there is a moderate to strong relationship between school roll and the travel choices of school pupils.

A greater proportion of the pupils of the small schools surveyed were likely to travel to and from school independently, using modes other than car.

5.6.2 Decile

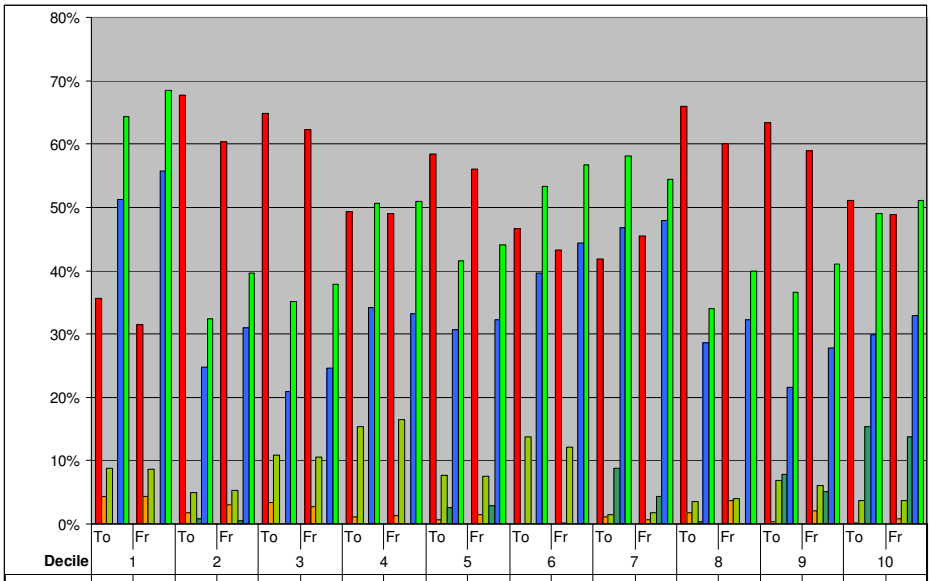
As noted in Appendix C, the decile rating of a school is determined by five factors, namely: Household income; Occupation; Household Crowding' Educational Qualifications; and Income Support. The decile rating is measured from 1 at the lowest to 10 at the highest.

5.6.2.1 Decile and Mode Choice

In most transportation environments there is a clear positive correlation between income and car usage. Increasing income is generally accompanied by increasing car usage. There does not appear to be a similar correlation between decile rating and car usage for school travel.

Figure 19, below, shows the relationship between decile and school travel mode choice.

Figure 19 School Decile vs Mode Choice



Decile	1 To	1 Fr	2 To	2 Fr	3 To	3 Fr	4 To	4 Fr	5 To	5 Fr	6 To	6 Fr	7 To	7 Fr	8 To	8 Fr	9 To	9 Fr	10 To	10 Fr
Car	36%	31%	68%	60%	65%	62%	49%	49%	58%	56%	47%	43%	42%	46%	66%	60%	63%	59%	51%	49%
Bus	4%	4%	2%	3%	3%	3%	1%	1%	1%	1%	0%	0%	1%	1%	2%	4%	0%	2%	0%	1%
Bike	9%	9%	5%	5%	11%	11%	15%	16%	8%	7%	14%	12%	1%	2%	4%	4%	7%	6%	4%	4%
Scooter	0%	0%	1%	0%	0%	0%	0%	0%	3%	3%	0%	0%	9%	4%	0%	0%	8%	5%	15%	14%
Walk	51%	56%	25%	31%	21%	25%	34%	33%	31%	32%	40%	44%	47%	48%	29%	32%	22%	28%	30%	33%
Tot Other	64%	69%	32%	40%	35%	38%	51%	51%	42%	44%	53%	57%	58%	54%	34%	40%	37%	41%	49%	51%

Car usage in excess of 60% was observed at the Decile 2,3,8 and 9 schools, between 50% and 60% at the Decile 5 schools, and less than 50% at the Decile 1, 4, 6, 7, and 10 schools.

As noted in section 5.2.1 above, Rowley Avenue and Waimairi School results have not been included in these results. Average car usage recorded from pupils' surveys at Rowley Avenue (Decile 1) was 20%. At Waimairi School (Decile 10) average car usage was 33%.

Observed school trip car usage is low at either extreme of the socio economic spectrum, and quite variable in the centre. Factors which could be influencing this phenomenon have been explored, and are discussed below.

5.6.2.1.1 School Roll

As discussed in section 5.6.1 above, bigger schools are likely to have a greater proportion of pupils using cars for school journeys.

Table 8, below, lists the size of the sample for each Decile group; calculates the sample size as a percentage of the total sample; lists the size of the roll for the schools in each Decile group, and calculates the average roll for each decile group. The average roll is then assessed as Low (L), Medium (M), or High (H), where:

- Low (L) < 300 pupils;
- Medium (M) 300 to 450 pupils; and
- High (H) > 450 Pupils.

The school trip car usage is assessed as Low (L), Medium (M) or High (H) where:

- Low (L) < 50% car usage;
- Medium (M) 50% to 60% car usage; and
- High (H) > 60% car usage.

Table 8 Decile Group Sample Size and Roll Numbers

	Decile									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Sample Size	55	251	147	131	323	147	94	443	225	208
Sample % of Total	3%	12%	7%	6%	16%	7%	5%	22%	11%	10%
Roll 1	288	151	204	292	362	111	103	444	295	601
Roll 2		506	309	357	468	470	196	626	520	
Average Roll	288	329	257	325	415	291	150	535	408	601
	L	M	L	M	M	L	L	H	M	H
Car Usage	L	H	H	L	M	L	L	H	M	L

Comparing the average roll assessment and the car usage assessment for each decile group suggests that there is some correlation between the school roll and observed car usage in most instances.

However, the Decile 3 schools have a “low” average roll and “high” car usage, while the Decile 10 schools have a “high” average roll and “low” car usage. The Decile 2 and 4 schools have “medium” average roll, and “high” and “low” car usage, respectively.

5.6.2.1.2 Parent Occupation and Education

Factors considered in the decile rating include the proportion of parents in the lowest skilled occupational groups, the proportion with no tertiary or school qualifications, and the proportion receiving a benefit.

Decile 1 schools are likely to have a large proportion of parents on a benefit, and very low household incomes. Many households in this group may find the expense of running a car prohibitive, but there may be more time available to accompany children to and from school on foot.

At the other extreme, Decile 10 schools are likely to have a large proportion of parents in highly skilled occupations, requiring tertiary qualifications. These sorts of occupations tend to have more flexible work arrangements than low skilled or manual occupations.

It is also possible that Decile 10 schools have a higher proportion of two parent families where the income of one parent is sufficient to enable the second parent to not work, or to work only limited hours.

The travel choice options for pupils at low to medium decile schools may be more constrained by financial or time factors than pupils at very high decile schools.

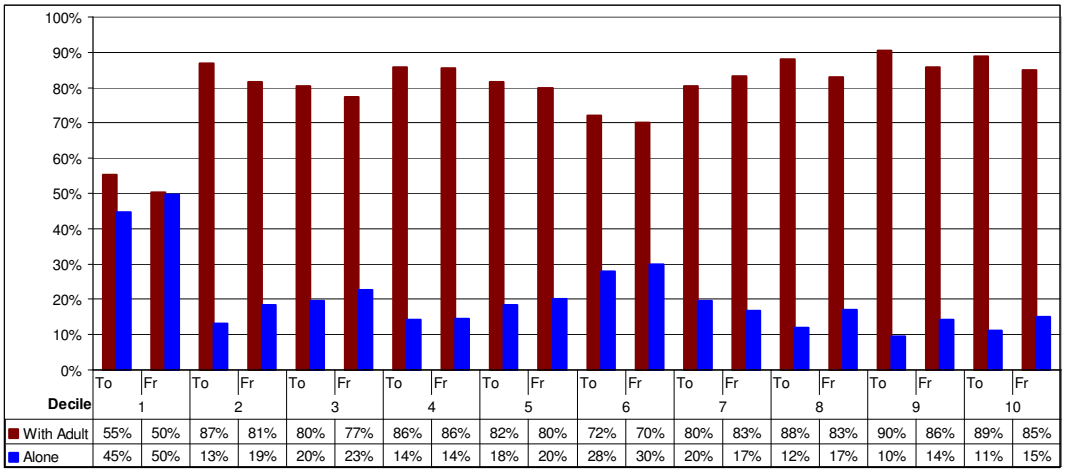
5.6.2.1.3 Scooter Usage

Information for scooter usage is only available for nine of the schools surveyed. This information is therefore not as comprehensive as the information for the remainder of the case studies. However, based on the information available, there appears to be a trend suggesting that scooter usage is much more pronounced at high decile schools than at low decile ones.

5.6.2.2 Decile and Independent Travel

Figure 20 below shows the relationship between School Decile and the percentage of pupils travelling with and adult or independently.

Figure 20 School Decile vs Independent Travel



Decile	1 To	1 Fr	2 To	2 Fr	3 To	3 Fr	4 To	4 Fr	5 To	5 Fr	6 To	6 Fr	7 To	7 Fr	8 To	8 Fr	9 To	9 Fr	10 To	10 Fr
With Adult	55%	50%	87%	81%	80%	77%	86%	86%	82%	80%	72%	70%	80%	83%	88%	83%	90%	86%	89%	85%
Alone	45%	50%	13%	19%	20%	23%	14%	14%	18%	20%	28%	30%	20%	17%	12%	17%	10%	14%	11%	15%

There is a relationship between independent travel and car usage for school travel. All primary school pupils who travel by car must be driven by an adult.

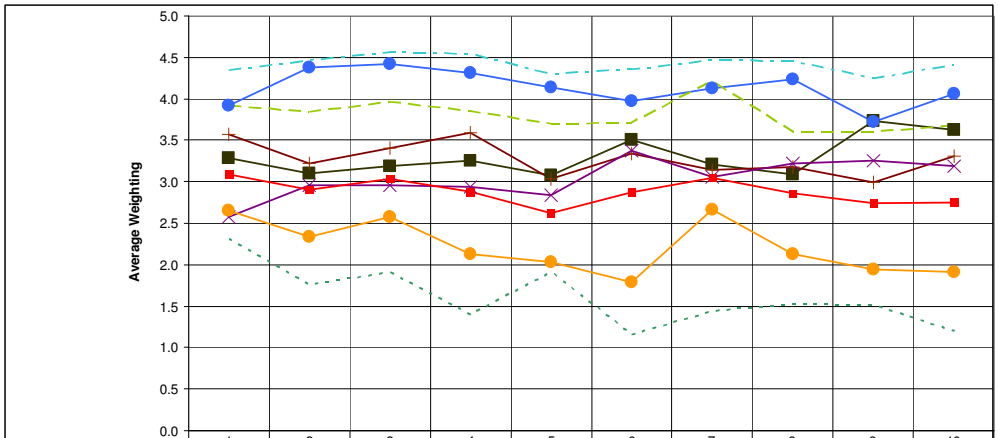
This relationship between car usage and independent travel is reflected in the high levels of independent travel at the Decile 1 schools, and the moderate levels at the Decile 6 schools. However, it is not reflected in the low levels of independent travel at the Decile 10 schools.

Unger's argument that middle and upper middle class families tend to be very protective of their children (refer Chapter 2, section 2.5.5) seems to be borne out by the comparatively high levels of independence observed at the Decile 1 school, when compared to other schools surveyed.

5.6.2.3 School Decile and Significance of Influencing Factors

Figure 21, below shows the relationship between School Decile and the average weight given by parents to the factors identified as influencing travel choices.

Figure 21 School Decile vs Factors Influencing Travel Choice



Decile	1	2	3	4	5	6	7	8	9	10
Distance	3.3	3.1	3.2	3.3	3.1	3.5	3.2	3.1	3.7	3.6
Weather	3.6	3.2	3.4	3.6	3.0	3.3	3.1	3.2	3.0	3.3
Convenience	2.6	3.0	3.0	2.9	2.8	3.4	3.1	3.2	3.2	3.2
Safety - Stranger	3.9	4.4	4.4	4.3	4.1	4.0	4.1	4.2	3.7	4.1
Safety - Road	4.3	4.5	4.6	4.5	4.3	4.4	4.5	4.5	4.2	4.4
Cost	2.3	1.8	1.9	1.4	1.9	1.2	1.4	1.5	1.5	1.2
Exercise is Healthy	3.9	3.8	4.0	3.9	3.7	3.7	4.2	3.6	3.6	3.7
Condition of Footpaths	2.7	2.3	2.6	2.1	2.0	1.8	2.7	2.1	1.9	1.9
Pleasant Environment	3.1	2.9	3.0	2.9	2.6	2.9	3.0	2.9	2.7	2.7

This data suggests that there is little correlation between the decile rating of a school and the factors which parents consider to be important in decisions regarding their children's travel to and from school.

As expected, the importance of cost in travel choices reduces with increasing decile rating. The average weighting of cost for decile 1 schools is 2.3. This reduces to 1.2 for decile 10 schools.

The weightings of all other factors are quite variable, with few readily discernable trends.

5.6.2.4 Summary

The travel choices of the primary school pupils surveyed do not follow the widely accepted understanding that car usage increases with increasing socio economic indicators. Car usage reduces at both extremes of the socio economic spectrum, and follows no clear pattern in the centre.

Employment and time flexibility may be a factor in the reduction in car usage for Decile 10 schools.

The changes in car usage observed in the centre decile groups may be partially attributable to other factors such as school roll.

5.6.3 School Travel Plans and Walking School Buses

The school travel plan implemented by Waimairi School appears to have had a significant impact on the travel choices of the school. Waimairi School is discussed further in Section 5.9.

Less than 1.5% of pupils surveyed (excluding those from Waimairi School) travelled to or from school by Walking School Bus. By contrast approximately 5% of Waimairi pupils surveyed travelled by Walking School Bus. The low numbers of pupils travelling by Walking School Bus at other schools is consistent with comments from a number of school principals.

Many principals commented that the impetus of the Walking School Bus programme at their schools was often lost when enthusiastic parents left the school. These parents were often the ones who had set up the programme, and had organised the individual "buses". They generally moved on from the school when their children left. Often there was no succession programme in place to replace them and their enthusiasm.

5.6.4 Trip Chaining

The results in Appendix G indicate that approximately 40% of pupils surveyed are dropped off at school as part of another trip, and approximately 20% as a special trip. Between 30% and 35% are picked up from school as part of another trip, with between 22% and 24% as a special trip.

This would indicate that there is significantly more combining of trips in the morning than in the evening. This is consistent with there being more time constraints in the morning in many households than in the afternoon. Schools typically start at approximately 9:00am and finish at around 3:00pm. 9:00am is much closer to most work places start time than 3:00pm is to their finish time. It is therefore often much easier for a full time worker to take children to school on the way to work than it is to pick them up on the way home.

There is evidence to suggest that many mothers work part time when their children are at primary school. Part time work often finishes before school closing time at 3:00pm. It is therefore possible that some part time workers are able to return home at the conclusion of their working day. They then make a special trip from home to pick up their children from school.

5.7 Impact of Neighbourhood Environment Factors

5.7.1 Pedestrian Rating

An assessment of the pedestrian environment of routes to and from each school was carried out as described in Chapter 3 section 3.3.4.3.1. The following factors were considered as part of the pedestrian environment assessment:

- Footpath width;
- Footpath surface quality;
- Path obstructions;
- Crossing Opportunities;
- Support Facilities;
- Path environment;
- Conflict Points; and
- Personal Security.

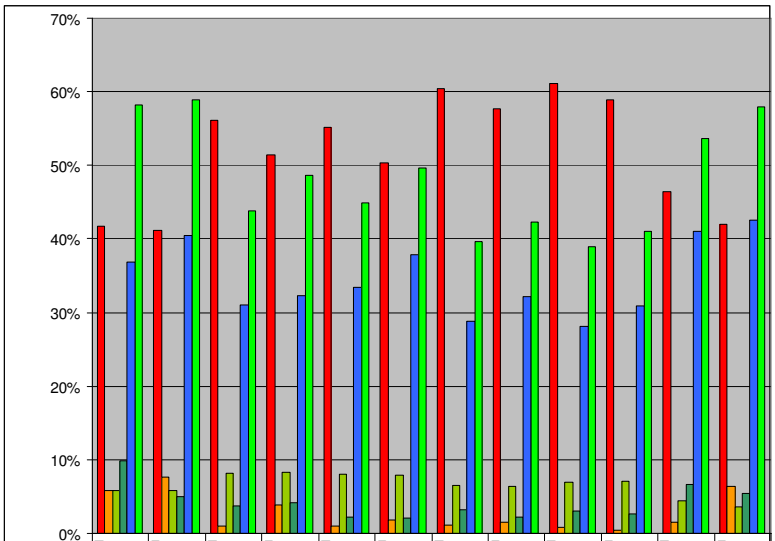
Connectivity has not been included in the neighbourhood pedestrian rating. It has been considered as a separate factor, and is discussed in section 5.7.2

Pedestrian ratings were carried out for routes between the school and eight "compass points" (North, North East, East etc to North West) 1km radius from the school.

5.7.1.1 Pedestrian Rating and Mode Choice

Figure 22 below shows the relationship between pedestrian rating and mode choice. These results show low levels of car usage in environments with both a very low and a very high pedestrian rating. As shown in Table 9, 69 and 67 households had pedestrian ratings of less than 40 or greater than 80 respectively, making up 4 % each of the total sample for each category. Due to these small sample sizes it is considered that the results for these pedestrian environments should be viewed with some caution.

Figure 22 Pedestrian Rating vs Mode Choices



Ped Rating	< 40		41 - 50		51 - 60		61 - 70		71 - 80		> 80	
	To	Fr	To	Fr	To	Fr	To	Fr	To	Fr	To	Fr
Car	42%	41%	56%	51%	55%	50%	60%	58%	61%	59%	46%	42%
Bus	6%	8%	1%	4%	1%	2%	1%	2%	1%	0%	2%	6%
Bike	6%	6%	8%	8%	8%	8%	6%	6%	7%	7%	5%	4%
Scooter	10%	5%	4%	4%	2%	2%	3%	2%	3%	3%	7%	5%
Walk	37%	41%	31%	32%	33%	38%	29%	32%	28%	31%	41%	43%
Tot Other	58%	59%	44%	49%	45%	50%	40%	42%	39%	41%	54%	58%

Considering only neighbourhoods with pedestrian ratings between 40 and 80, there is a slight trend towards greater car usage in neighbourhoods with higher pedestrian ratings. 56% of pupils in neighbourhoods with a pedestrian rating of between 41 and 50 travelled to school by car, while 61% of pupils in neighbourhoods with a pedestrian rating of between 71 and 80 travelled by car.

This suggests that other factors are more important in school travel mode choices than the quality of the walking and cycling environment.

5.7.1.1.1 Distance

Table 9 shows the average distance, pedestrian distance, and road distance for each pedestrian rating category. This shows that there is a greater distance to travel to school associated with the neighbourhoods with higher pedestrian ratings. This factor is likely to result in higher car usage for school travel in those neighbourhoods.

Table 9 Pedestrian Rating and Average Distance

	Ped Rating					
	< 40	41 - 50	51 - 60	61 - 70	71 - 80	> 80
Sample Size	69	218	525	687	235	67
Sample % of Total	4%	12%	29%	38%	13%	4%
Avge Dist (km)	0.8	1.0	1.1	1.2	1.4	1.7
Avge Ped Dist (km)	1.0	1.4	1.5	1.7	1.6	1.9
Avge Rd Dist (km)	1.0	1.7	1.7	2.0	2.1	3.3
Average Decile	7.9	4.8	4.5	6.5	7.2	8.1

5.7.1.1.2 Decile

Table 10, below, shows average decile rating for each pedestrian rating category. Of the schools surveyed, higher decile schools tend to be located in neighbourhoods with higher quality pedestrian environments. As noted in section 5.6.2, the relationship between Decile Rating and mode choice is quite weak apart from low rates of car usage recorded for decile 1 and decile 10 schools.

Table 10 Pedestrian Rating and Decile

		Pedestrian Rating			
		40-50	50-60	60-70	70-80
Decile	**1**	11%	2%	0%	1%
	2	19%	27%	8%	0%
	3	21%	13%	4%	0%
	4	4%	11%	4%	13%
	5	4%	16%	25%	7%
	6	8%	7%	8%	4%
	7	3%	6%	2%	9%
	8	16%	7%	34%	41%
	9	0%	6%	3%	23%
	10	14%	4%	12%	0%

Other factors, particularly distance, appear to take precedence over pedestrian environment in school travel choices. This conclusion is supported by the low weighting

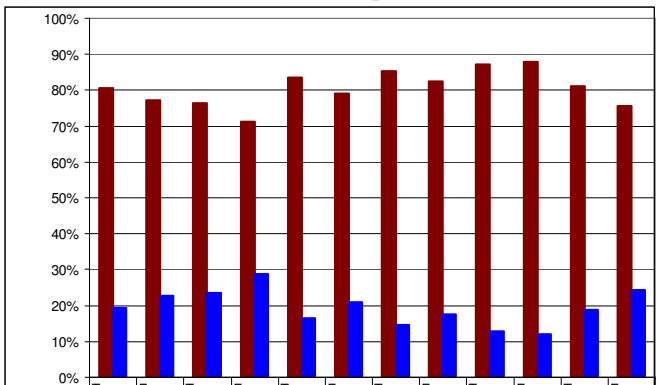
assigned to the "Condition of Footpaths" and "Pleasant Walking or Cycling Environment" in the Factors Influencing Travel Choices in the Parents' survey. The overall weighting out of 5 given to these two factors was 2.2 and 2.9 respectively. By comparison, Distance was given a weighting of 3.4.

5.7.1.2 Pedestrian Rating and Independent Travel

Figure 23 below shows the proportions of pupils who travel with adults or alone for each of six bands of pedestrian ratings. The results shown on this graph indicate that more pupils travel independently in environments with a poor pedestrian rating than in those with good ratings.

School pupil travel independence is influenced by the extent of car usage. The comments in section 5.7.1.1 regarding pedestrian rating, sample size, distance and mode choice are also applicable to independence.

Figure 23 Pedestrian Rating vs Independent Travel



Ped Rating	To < 40	Fr < 40	To 41 - 50	Fr 41 - 50	To 51 - 60	Fr 51 - 60	To 61 - 70	Fr 61 - 70	To 71 - 80	Fr 71 - 80	To > 80	Fr > 80
With Adult	81%	77%	76%	71%	84%	79%	85%	82%	87%	88%	81%	76%
Alone	19%	23%	24%	29%	16%	21%	15%	18%	13%	12%	19%	24%

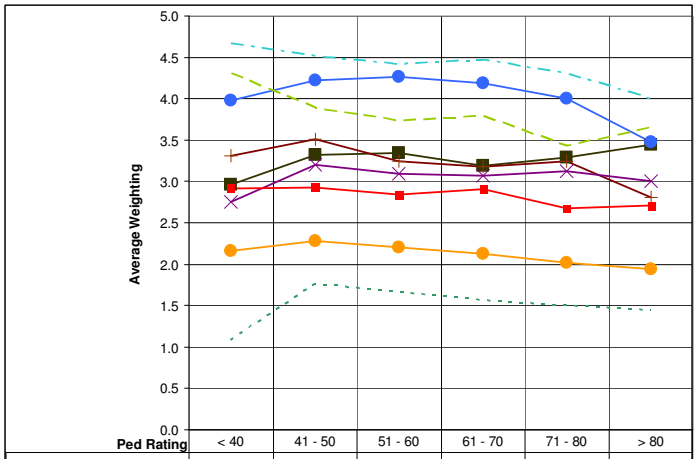
As noted in section 5.7.1.1, the sample sizes were very small for neighbourhoods with pedestrian ratings less than 40 and greater than 80. Those neighbourhoods with pedestrian ratings between 40 and 50 have the highest proportion of pupils travelling independently. 24% of pupils travel independently to school and 29% from in those neighbourhoods. As noted in section 5.7.1.1, this group of neighbourhoods has a low average distance between home and school, and a high proportion of pupils from Decile 1 schools. There is a tendency for pupils from Decile 1 schools to travel independently (refer section 5.6.2.2).

13% of pupils in neighbourhoods with pedestrian ratings between 70 and 80 travelled independently to school, and 12% from.

5.7.1.3 Pedestrian Rating and Significance of Influencing Factors

Figure 24, below shows average weightings of factors influencing travel choice for different bands of pedestrian rating.

Figure 24 Graph of Pedestrian Rating vs Factors Influencing Travel Choice



Ped Rating	< 40	41 - 50	51 - 60	61 - 70	71 - 80	> 80
Distance	3.0	3.3	3.3	3.2	3.3	3.4
Weather	3.3	3.5	3.3	3.2	3.3	2.8
Convenience	2.8	3.2	3.1	3.1	3.1	3.0
Safety - Stranger	4.0	4.2	4.3	4.2	4.0	3.5
Safety - Road	4.7	4.5	4.4	4.5	4.3	4.0
Cost	1.1	1.8	1.7	1.6	1.5	1.4
Exercise is Healthy	4.3	3.9	3.7	3.8	3.4	3.7
Condition of Footpaths	2.2	2.3	2.2	2.1	2.0	1.9
Pleasant Environment	2.9	2.9	2.8	2.9	2.7	2.7

This graph shows that there is little variability in the weighting of factors between the different pedestrian rating bands, particularly for the bands of pedestrian rating between 40 and 80.

5.7.1.4 Summary

Based on this research it appears that the quality of the pedestrian environment is not a significant factor in travel choices for primary school pupils.

5.7.2 Distance from School

This section considers the relationship between the distance a pupil travels between home and school and their mode choice. Two different distances have been considered, namely "Distance", and "Pedestrian Distance".

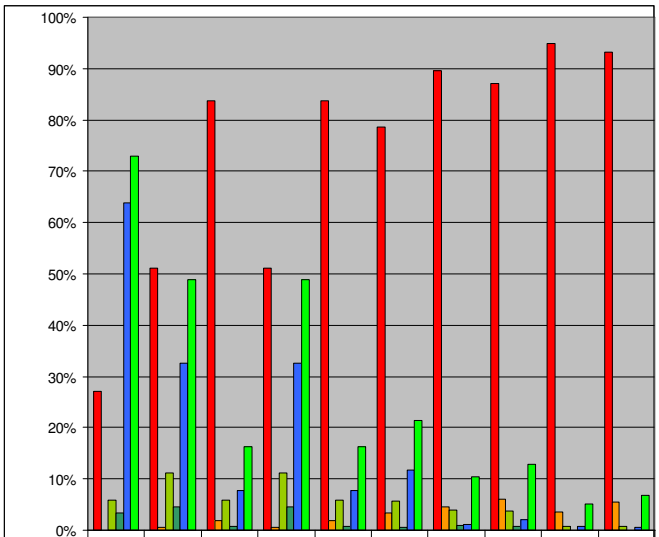
Distance is regarded as the distance between school and home "as the crow flies". Pedestrian Distance is regarded as the distance between school and home using pedestrian routes. The process used for assessing pedestrian distance is described in Chapter 3, Section 3.3.4.2.

Five bands have been used for categorising distance. They are less than 0.5km, 0.5km to 1.0km, 1.0km to 2.0km, 2.0km to 5.0 km, and greater than 5.0km. These bands were chosen because it was considered that only small numbers of primary school pupils would be likely to walk more than 2.0km, or cycle more than 5.0km. It was also considered that only a small proportion of pupils live more than 5.0km from school.

5.7.2.1 Distance and Mode Choice

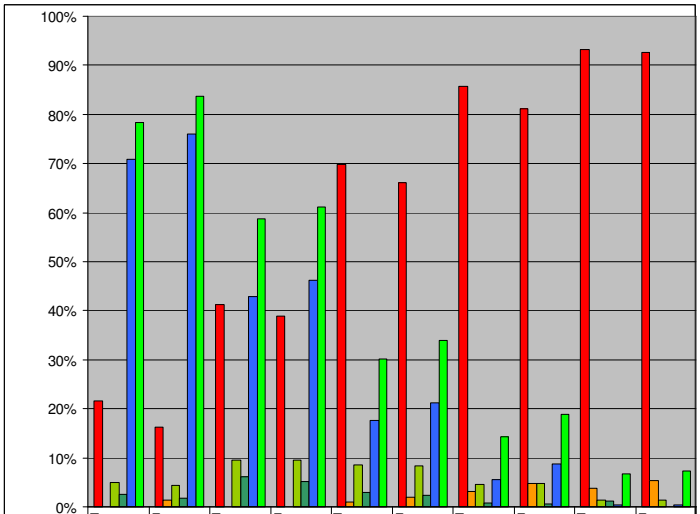
Figure 25 and Figure 26 and show plots of mode choice for distance and pedestrian distance. As expected, these plots indicate that car usage increases with distance between home and school.

Figure 25 Distance vs Mode Choice



Dist to Sch (km)	To	Fr	To	Fr	To	Fr	To	Fr	To	Fr
	0 - 0.5		0.5 - 1.0		1.0 - 2.0		2.0 - 5.0		5.0 +	
Car	27%	51%	84%	51%	84%	79%	90%	87%	95%	93%
Bus	0%	1%	2%	1%	2%	3%	5%	6%	4%	6%
Bike	6%	11%	6%	11%	6%	6%	4%	4%	1%	1%
Scooter	3%	5%	1%	5%	1%	1%	1%	1%	0%	0%
Walk	64%	33%	8%	33%	8%	12%	1%	2%	1%	1%
Tot Other	73%	49%	16%	49%	16%	21%	10%	13%	5%	7%

Figure 26 Pedestrian Distance vs Mode Choice



Pedestrian Dist (km)	To	Fr	To	Fr	To	Fr	To	Fr	To	Fr
	0 - 0.5		0.5 - 1.0		1.0 - 2.0		2.0 - 5.0		5.0 +	
Car	22%	16%	41%	39%	70%	66%	86%	81%	93%	93%
Bus	0%	1%	0%	0%	1%	2%	3%	5%	4%	5%
Bike	5%	4%	10%	10%	9%	8%	5%	5%	1%	1%
Scooter	3%	2%	6%	5%	3%	2%	1%	1%	1%	0%
Walk	71%	76%	43%	46%	18%	21%	6%	9%	0%	0%
Tot Other	78%	84%	59%	61%	30%	34%	14%	19%	7%	7%

There is a smaller proportion of journeys by car to school than from school for the distance band 0 to 0.5km (22% to school, 31% from school). All other distance bands show more journeys by car to school than from school. In the 0 to 0.5km Pedestrian Distance band there is a slightly higher proportion of car journeys to school (22%) than from school (16%). All other pedestrian distance bands show a greater proportion of car trips to school than from school.

5% of trips to school for the 0 to 0.5km distance band are special car trips, and 23% are trips walking with other pupils or alone. However, 20% of the trips from school in that band are special car trips, and 12% are walking with other pupils or alone.

The corresponding proportions for the 0 to 0.5km **pedestrian distance** band are 4% special car trips, and 28% walking with pupils or alone to school, and 6% special car trips and 32% walking with pupils or alone from school.

The children from a number of families who live just beyond 0.5km walking distance from school walk to school alone, but are driven home.

Table 11, below shows the sample sizes of pupils in each of the distance and pedestrian distance bands. This table indicates that the majority of the school pupils surveyed (85%) live up to 2.0km from the school, and that a very small proportion (4%) live more than 5.0km from the school they attend.

Table 11 Sample Size of Distance and Ped Distance Bands

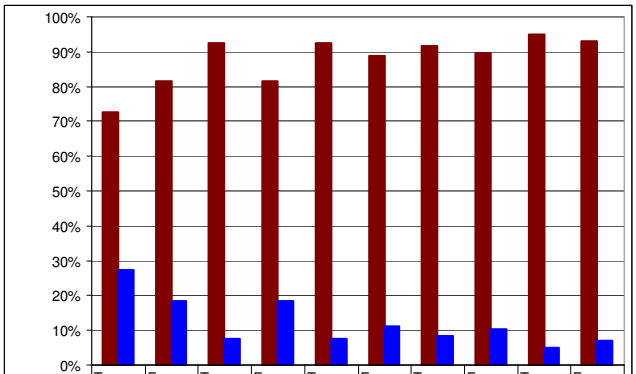
	Distance (km)					**Ped Distance (km)**				
	0 - 0.5	**0.5 - 1.0**	**1.0 - 2.0**	**2.0 - 5.0**	**5.0 +**	**0 - 0.5**	**0.5 - 1.0**	**1.0 - 2.0**	**2.0 - 5.0**	**5.0 +**
Sample Size	553	621	446	208	72	310	535	559	393	85
Sample % of Total	29%	33%	23%	11%	4%	16%	28%	30%	21%	4%

5.7.2.2 Distance and Independence

Figure 27 and Figure 28 below show plots of independent travel for each of the bands of distance to school and pedestrian distance to school. As expected, independent travel decreases with distance between home and school.

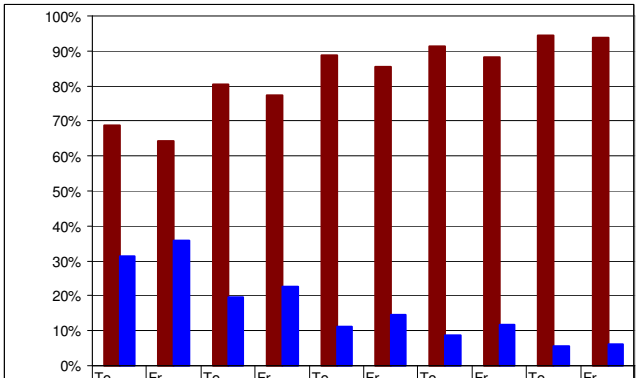
27% and 19% of pupils travel independently to and from school respectively for the 0 to 0.5km distance band. This compares with 31% and 36% travelling independently for the 0 to 0.5km pedestrian distance band. This suggests that a walking distance of approximately 0.5km is the maximum that many parents will allow their children to walk alone.

Figure 27 Distance vs Independent Travel



Dist to Sch (km)	To	Fr	To	Fr	To	Fr	To	Fr	To	Fr
	0 - 0.5		0.5 - 1.0		1.0 - 2.0		2.0 - 5.0		5.0 +	
With Adult	73%	81%	92%	81%	92%	89%	92%	90%	95%	93%
Alone	27%	19%	8%	19%	8%	11%	8%	10%	5%	7%

Figure 28 Pedestrian Distance vs Independent Travel



Ped Dist (km)	To	Fr	To	Fr	To	Fr	To	Fr	To	Fr
	0 - 0.5		0.5 - 1.0		1.0 - 2.0		2.0 - 5.0		5.0 +	
With Adult	69%	64%	81%	77%	89%	85%	91%	88%	94%	94%
Alone	31%	36%	19%	23%	11%	15%	9%	12%	6%	6%

5.7.2.3 Distance and Significance of Influencing Factors

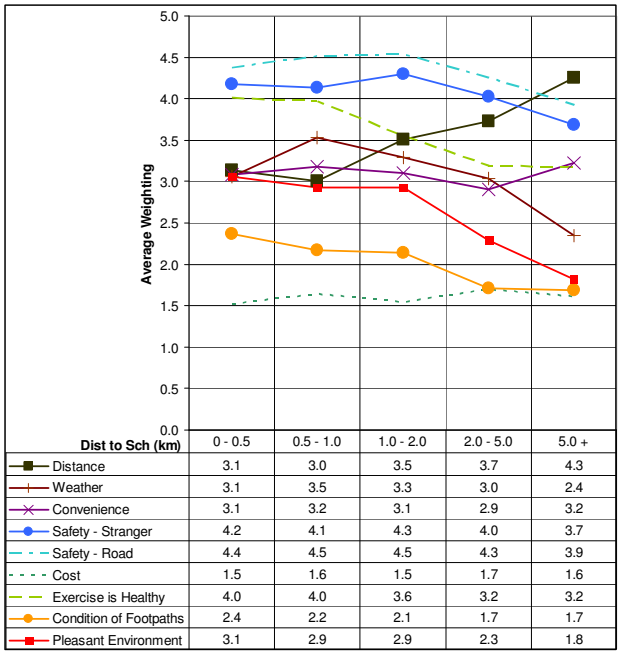
Figure 29 and Figure 30 show average influencing factor weightings for distance and pedestrian distance bands. These graphs show little change in the importance of most factors for distances up to 2.0km. Beyond 2.0km the importance distance increases significantly, while the importance of road and personal safety, footpath condition, pedestrian environment and weather decline. The importance of exercise declines with distances in excess of 1.0km.

The increase in the importance of distance is consistent with car travel being seen as the only practical option for longer school trips. Many parents commented along the lines of "*Because we live so far from school, car is the only option.*"

If car travel is the only practical option, then other factors become less relevant. Children are considered to be protected from road and personal safety hazards and from adverse weather conditions when they are in a car with their parents. They are also remote from unpleasant footpath and environment conditions in a car.

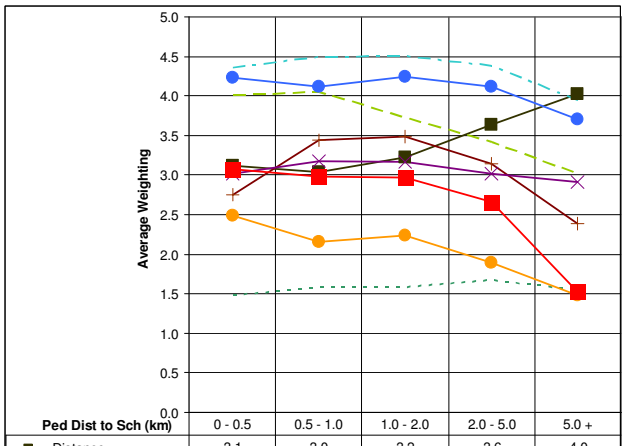
It is probable that parents who rank exercise as very important in their children's travel choices will chose to live in a location where their children can comfortably walk, bike, or scooter to school. This is consistent with an average weighting of 4.0 for exercise is healthy for families less than 1.0km from school.

Figure 29 Distance vs Influencing Factor Weightings



Dist to Sch (km)	0 - 0.5	0.5 - 1.0	1.0 - 2.0	2.0 - 5.0	5.0 +
Distance	3.1	3.0	3.5	3.7	4.3
Weather	3.1	3.5	3.3	3.0	2.4
Convenience	3.1	3.2	3.1	2.9	3.2
Safety - Stranger	4.2	4.1	4.3	4.0	3.7
Safety - Road	4.4	4.5	4.5	4.3	3.9
Cost	1.5	1.6	1.5	1.7	1.6
Exercise is Healthy	4.0	4.0	3.6	3.2	3.2
Condition of Footpaths	2.4	2.2	2.1	1.7	1.7
Pleasant Environment	3.1	2.9	2.9	2.3	1.8

Figure 30 Pedestrian Distance vs Influencing Weighting Factors



Ped Dist to Sch (km)	0 - 0.5	0.5 - 1.0	1.0 - 2.0	2.0 - 5.0	5.0 +
Distance	3.1	3.0	3.2	3.6	4.0
Weather	2.8	3.4	3.5	3.1	2.4
Convenience	3.0	3.2	3.2	3.0	2.9
Safety - Stranger	4.2	4.1	4.2	4.1	3.7
Safety - Road	4.4	4.5	4.5	4.4	3.9
Cost	1.5	1.6	1.6	1.7	1.6
Exercise is Healthy	4.0	4.0	3.7	3.4	3.0
Condition of Footpaths	2.5	2.2	2.2	1.9	1.5
Pleasant Environment	3.1	3.0	3.0	2.7	1.5

5.7.2.4 Summary

Not surprisingly trips by car both to and from school increase with distance between school and home. There are a smaller proportion of car trips for the trip to school than for

the trip home from school for households very close to school. For households further from school, the proportion of car trips to school become greater than for the trip home from school.

Many of the children walking less than 0.5km to and from school do so alone or with other pupils.

Parents who live further away from school tend to regard distance as a more important factor in their children's travel choices. There is a corresponding decrease in the importance of factors such as safety, exercise, and the quality of the pedestrian environment with increasing distance.

5.7.3 Major Roads to Cross

This section considers the impact that having to cross major roads between school and home has on pupils travel choices. Crossing of major roads is a significant road safety issue for school children. Children often do not judge speed and distance of approaching vehicles well.

For the purposes of this assessment, a major road is defined as a road which has and AADT (Average Annualised Daily Traffic) of more than 10,000 vehicles per day (vpd). Christchurch City Council 2005 count data was used to determine traffic volumes.

There is a relationship between the distance between home and school and the likelihood of encountering a major road. The greater the distance, the greater the likelihood of encountering a major road.

The impacts of crossing major roads have been assessed using data from households located less than 1.0km from school.

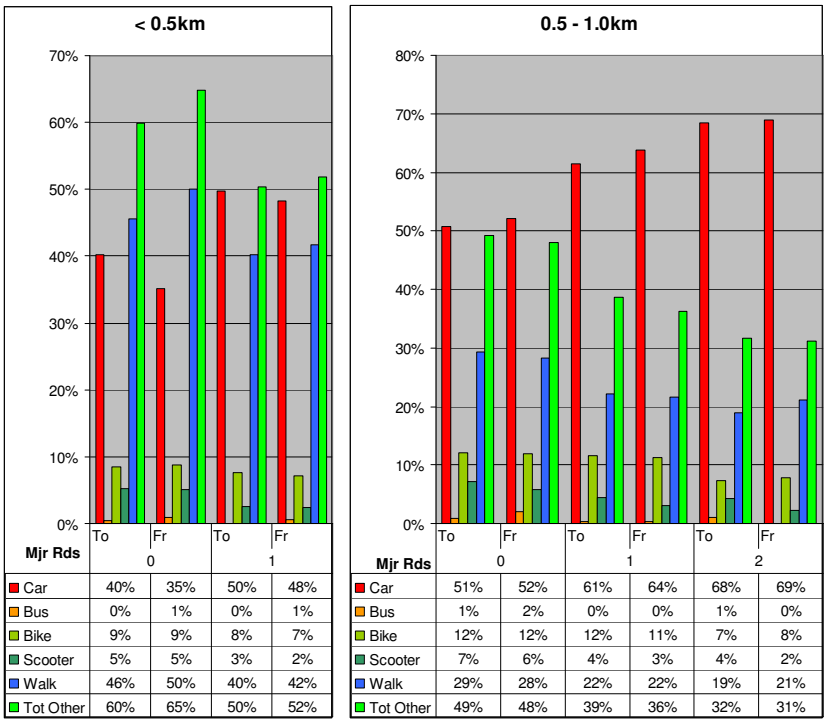
5.7.3.1 Major Roads to Cross and Mode choice

Figure 31 below compares mode choices against the number of major roads to cross between school and home for households located less than 0.5km, and between 0.5km and 1.0km, from school. Only ten of the households located less than 0.5km from school had two roads to cross (refer Table 12). For this reason comparisons were only made between zero and one roads to cross for the less than 0.5km distance from school.

There is a clear relationship between mode choice and the number of major roads to cross between school and home. Trip to school car usage increased from 40% for no roads to cross to 50% for one road to cross when considering households located less than 0.5km from school. A similar increase was observed for households 0.5km to 1.0km distance from school with trip to school car usage increasing from 51% for no roads to 68% for two roads

Similar increases in car usage were observed for the trip from school. Car usage increased from 35% to 48% and from 52% to 69% respectively.

Figure 31 Major Roads to Cross vs Mode Choice (< 0.5 and 0.5 to 1.0km)



Mjr Rds	0 To	0 Fr	1 To	1 Fr
Car	40%	35%	50%	48%
Bus	0%	1%	0%	1%
Bike	9%	9%	8%	7%
Scooter	5%	5%	3%	2%
Walk	46%	50%	40%	42%
Tot Other	60%	65%	50%	52%

Mjr Rds	0 To	0 Fr	1 To	1 Fr	2 To	2 Fr
Car	51%	52%	61%	64%	68%	69%
Bus	1%	2%	0%	0%	1%	0%
Bike	12%	12%	12%	11%	7%	8%
Scooter	7%	6%	4%	3%	4%	2%
Walk	29%	28%	22%	22%	19%	21%
Tot Other	49%	48%	39%	36%	32%	31%

Table 12 Roads to Cross Sample Sizes

No of Roads to Cross	0	1	2
0 to 0.5km			
Sample Size	492	159	10
Sample % of 0 to 0.5km	74%	24%	2%
0.5 to 1.0km			
Sample Size	631	268	95
Sample % of 0.5 to 1.0km	63%	27%	10%

5.7.3.1.1 Spreydon School Mode Choices

Spreydon School was included in the survey partly because of it's location on the intersection of two major roads (refer Chapter 4, Section 4.1.2.1). The majority of Spreydon's pupils need to cross at least one of the major roads to access the school. Spreydon is a decile 3 school with a roll of 311. Mode choice results for Freeville and Parkview Schools have been compared with Spreydon. Freeville is a Decile 4 school with a roll of 353, and Parkview is a Decile 4 school with a roll of 288.

Table 13, below, shows a comparison of Spreydon School with Freeville and Parkview Schools. This table shows that a much smaller proportion of pupils at Spreydon School need not cross a major road to access school than those at the other schools (6% vs 78% and 93%). This would appear to have an impact on the proportion of pupils travelling by car. 67% of respondents at Spreydon travelled to school by car, with 61% travelling home by car. This compares with 46% and 44% at Freeville, and 51% and 52% at Parkview.

17% of respondents at Spreydon travelled to school independently, and 23% travelled from school independently. 12% and 13% of Freeville respondents travelled to and from school independently, and 15% of Parkview respondents travelled both ways independently.

The higher proportion of pupils travelling independently at Spreydon School is not expected. 6% of Spreydon School respondents walked to school with other pupils, and 9% walked home. This compares with 1% both ways at Freeville, and 1% to 0 from at Parkview. This accounts for most of the difference in independent travel between Spreydon and the other schools. However, there are no obvious factors which explain why more Spreydon School pupils travel with other pupils than at the other schools.

Table 13 Comparison of Schools with Major Roads to Cross

	Spreydon		Freeville		Parkview	
Roll	311		353		288	
Decile	3		4		4	
Mjr Rds						
0	6%		78%		93%	
1	49%		13%		0%	
2	35%		3%		0%	
3	4%		0%		0%	
4	1%		0%		0%	
5+	5%		2%		3%	
	To	**Fr**	**To**	**Fr**	**To**	**Fr**
Car Chain	52%	43%	31%	20%	33%	31%
Car Specl	15%	18%	15%	14%	18%	21%
Car Total	**67%**	**61%**	**46%**	**44%**	**51%**	**52%**
Bus School	0	0	0	0	0	0
Bus Public	2%	2%	2%	3%	0	0
Bus Total	**2%**	**2%**	**2%**	**3%**	**0**	**0**
Bike Parent	7%	5%	5%	5%	11%	10%
Bike Pupils	3%	2%	2%	2%	2%	3%
Bike Alone	4%	6%	7%	7%	4%	5%
Bike Total	**14%**	**13%**	**14%**	**14%**	**17%**	**18%**
Scoot Prnt	NA	NA	NA	NA	NA	NA
Scoot Ppl	NA	NA	NA	NA	NA	NA
Scoot Aln	NA	NA	NA	NA	NA	NA
Scoot Tot	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Walk Prnt	9%	11%	35%	36%	22%	22%
Walk Org	1%	1%	0	0	1%	0
Walk Ppl	6%	9%	1%	1%	1%	0
Walk Aln	2%	4%	1%	1%	8%	7%
Walk Tot	**18%**	**25%**	**37%**	**38%**	**32%**	**29%**
Walk+Sct	**18%**	**25%**	**37%**	**38%**	**32%**	**29%**

5.7.3.2 Major Roads to Cross and Independent Travel

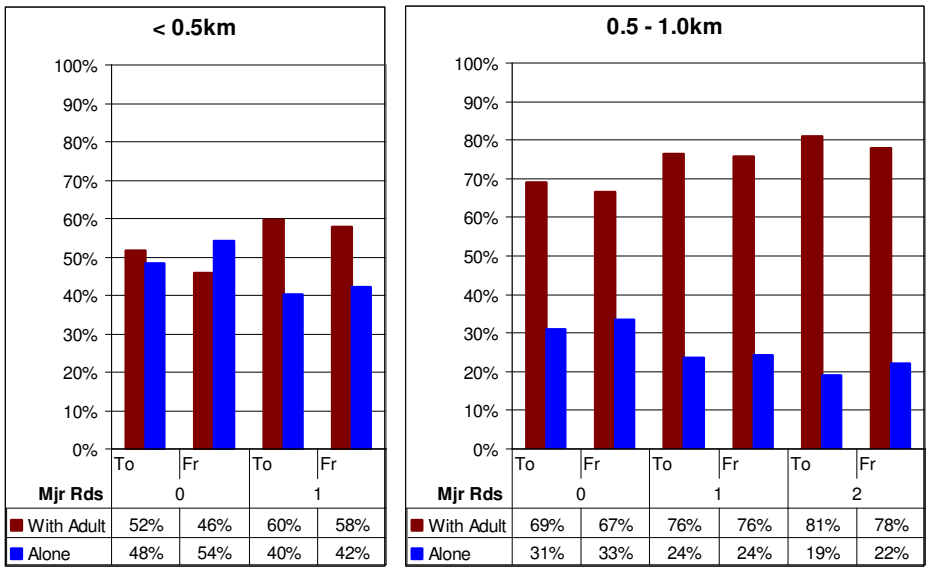
As shown on Figure 32, below the presence of major roads to cross has a similar impact on the independent travel of pupils as it does on mode choice.

For distances up to 0.5km from school, 8% fewer pupils travel independently to school and 12% from school when they need to cross one major road. This compares with 10% and 13% fewer pupils travelling by modes other than car.

For distances between 0.5 and 1.0km 12% and 11% fewer pupils travel independently to and from school respectively when needing to cross two major roads, 17% fewer pupils travel by modes other than car in both directions when needing to cross two major roads.

When major roads are crossed, the change in mode choice towards car travel is greater, by up to 6%, than the change in independent travel. This suggests that not only are parents reluctant for their children to cross major roads alone, but that parents themselves may be reluctant to cross major roads. A number of parents have made comments to this effect.

Figure 32 Major Roads to Cross vs Independent Travel (< 0.5km and 0.5 to 1.0km)

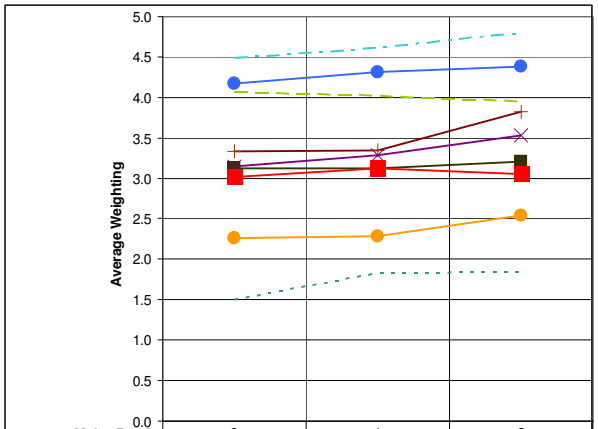


5.7.3.3 Major Roads to Cross and Significance of Influencing Factors

Figure 33 shows the average weighting given to the factors influencing travel decisions by households with 0, 1, or 2 major roads to cross between home and school. All of these households are located less than 1km from their school.

There is little difference in the weightings given to most factors when considering the number of major roads to be crossed. The significance of all factors increases by 0.5 or less. Weather had the largest increase.

Figure 33 Major Roads to Cross vs Weighting of Influencing Factors (0 to 1.0km)



Major Roads	0	1	2
Distance	3.1	3.1	3.2
Weather	3.3	3.3	3.8
Convenience	3.1	3.3	3.5
Safety - Stranger	4.2	4.3	4.4
Safety - Road	4.5	4.6	4.8
Cost	1.5	1.8	1.8
Exercise	4.1	4.0	3.9
Footpaths	2.3	2.3	2.5
Environment	3.0	3.1	3.1

5.7.4 Proximity to Major Employment

Two of the schools surveyed are located adjacent to areas of major employment. Roydvale School backs onto the Sir William Pickering Drive and Sheffield Crescent business area. Ilam School is bound on two sides by the University of Canterbury campus.

Table 14 below compares survey results of Ilam and Roydvale Schools with results of similar sized schools not located close to a major employment centre. Factors compared include distance travelled to school, and mode choices.

Ilam is compared with Windsor and Avondale Schools. Ilam is a Decile 9 school with a roll of 520 pupils. Windsor and Avondale are Decile 8 and 2 respectively, and their respective rolls are 626 and 506 pupils.

Roydvale is compared with Parkview and Wairakei Schools. Roydvale is a Decile 9 school with a roll of 295 pupils. Parkview and Wairakei are Decile 4 and 7 respectively, with rolls of 292 and 196 pupils each.

Table 14 shows that both Roydvale and Ilam have a greater proportion of their pupils who live further away than the schools they are compared with. 28% of Ilam pupils live more than 2.0km from school, compared with 20% and 17% of Windsor and Avondale pupils. 19% of Roydvale pupils live more than 2.0km from school, compared with 6% and 5% of Parkview and Wairakei pupils.

It is possible that some parents who work or study in the areas adjacent to Ilam and Roydvale Schools have chosen to send their children to these schools because the school is close to work or study rather than close to home.

5.7.4.1 Employment Proximity and Mode Choice

Interestingly, Ilam School has a smaller proportion of its pupils who travel to and from school by car than Windsor or Avondale Schools. 55% and 51% of Ilam pupils surveyed travelled by car to and from school respectively. This compares with 72% and 68% for Windsor, and 66% and 56% for Avondale. This is despite the fact that a greater proportion of the Ilam respondents lived further away from school than at the other schools.

One explanatory factor could be that a significant proportion of the Windsor School pupils need to negotiate a roundabout at the intersection of two major roads (QE11 Drive and Burwood Road). A number of Windsor School parents commented that they felt

uncomfortable negotiating the roundabout as pedestrians, let alone letting their children negotiate it.

A greater proportion of the pupils surveyed travelled to Roydvale School by car than to Parkview or Wairakei Schools. 72% and 68% travelled to and from Roydvale respectively. This compares with 51% and 52% at Parkview and 39% and 40% at Wairakei.

Both Roydvale and Ilam schools are Decile 9 schools. It would therefore be expected that the households represented at the schools experience similar socio-economic conditions. However, it is possible that the schools have different weightings on the factors which make up the decile ratings. For example, the proximity to the university may mean that Ilam School includes a higher proportion of parents with tertiary qualifications, and a lower proportion of very high income parents, when compared to Roydvale School. It is also likely that Ilam School includes a number of children of students at the university.

These may be contributing factors to the comparatively low car usage at Ilam School.

Table 14 Comparison of Schools Located close to Major Employment

	Ilam		Windsor		Avondale		Roydvale		Parkview		Wairakei	
Roll	520		626		506		295		292		196	
Decile	9		8		2		9		4		7	
Dist <0.5km	13%		22%		17%		21%		26%		53%	
0.5 - 1.0km	31%		30%		26%		32%		52%		28%	
1.0 - 2.0km	28%		27%		40%		28%		16%		14%	
2.0 - 5.0km	20%		17%		16%		17%		2%		0%	
>5.0km	8%		3%		1%		3%		4%		5%	
	To	**Fr**	**To**	**Fr**	**To**	**Fr**	**To**	**Fr**	**To**	**Fr**	**To**	**Fr**
Car Chain	36%	23%	52%	46%	46%	30%	43%	36%	33%	31%	30%	26%
Car Specl	19%	28%	19%	22%	20%	26%	29%	32%	18%	21%	8%	14%
Car Total	**55%**	**51%**	**72%**	**68%**	**66%**	**56%**	**72%**	**68%**	**51%**	**52%**	**39%**	**40%**
Bus School	0%	2%	0%	0%	0%	1%	0%	0%	0%	0%	2%	1%
Bus Public	0%	1%	0%	1%	0%	0%	0%	1%	0%	0%	0%	0%
Bus Total	**0%**	**3%**	**0%**	**1%**	**0%**	**1%**	**0%**	**1%**	**0%**	**0%**	**2%**	**1%**
Bike Parent	6%	4%	2%	3%	3%	2%	5%	5%	11%	10%	0%	0%
Bike Pupils	0%	0%	0%	0%	1%	1%	0%	1%	2%	3%	1%	1%
Bike Alone	2%	2%	0%	0%	2%	2%	1%	0%	4%	5%	2%	2%
Bike Total	**7%**	**6%**	**3%**	**4%**	**5%**	**5%**	**6%**	**6%**	**17%**	**18%**	**2%**	**3%**
Scoot Prnt	9%	5%	0%	0%	1%	0%	1%	0%	0%	0%	2%	5%
Scoot Ppl	2%	1%	0%	0%	1%	1%	1%	0%	0%	0%	0%	0%
Scoot Aln	2%	2%	0%	0%	0%	0%	0%	0%	0%	0%	3%	0%
Scoot Tot	**12%**	**9%**	**0%**	**0%**	**1%**	**1%**	**2%**	**1%**	**0%**	**0%**	**5%**	**5%**
Walk Prnt	21%	23%	20%	20%	18%	21%	11%	15%	22%	22%	25%	24%
Walk Org	0%	0%	0%	0%	1%	1%	0%	0%	1%	0%	13%	9%
Walk Ppl	0%	3%	0%	3%	6%	11%	4%	5%	1%	0%	3%	5%
Walk Aln	4%	5%	3%	5%	3%	4%	2%	5%	8%	7%	7%	9%
Walk Tot	**25%**	**30%**	**24%**	**27%**	**28%**	**36%**	**18%**	**24%**	**32%**	**29%**	**48%**	**47%**
Walk+Sct	**37%**	**39%**	**25%**	**27%**	**29%**	**37%**	**20%**	**25%**	**32%**	**29%**	**53%**	**52%**

5.7.4.2 Employment Proximity and Independent Travel

A greater proportion of Ilam School pupils travelled independently than Windsor School, but less than Avondale. 9% of Ilam School pupils surveyed travelled to, and 17%

travelled from school independently. This compares with 5% and 9% respectively for pupils from Windsor School, and 11% and 19% for Avondale School.

Less Roydvale School pupils travelled independently than either Parkview or Wairakei School pupils. 9% of pupils from Roydvale School surveyed travelled to, and 11% travelled from, school independently. 15% of Parkview School travelled both to and from school independently, and 17% of Wairakei pupils travelled to, and 18% travelled from school independently.

5.7.4.3 Summary

These results suggest that proximity of a school to a major employment source may increase the numbers of pupils who live further away from school. It also suggests that a school which is located close to a business source of employment may have greater car usage than one which is located close to an academic employment source.

However, a sample of two schools is not considered large enough to draw these conclusions confidently. It is therefore recommended that further research is carried out into the relationship between schools located close to major employment and the mode choice of pupils.

5.8 Impact of Household Environment Factors

5.8.1 Age of Youngest

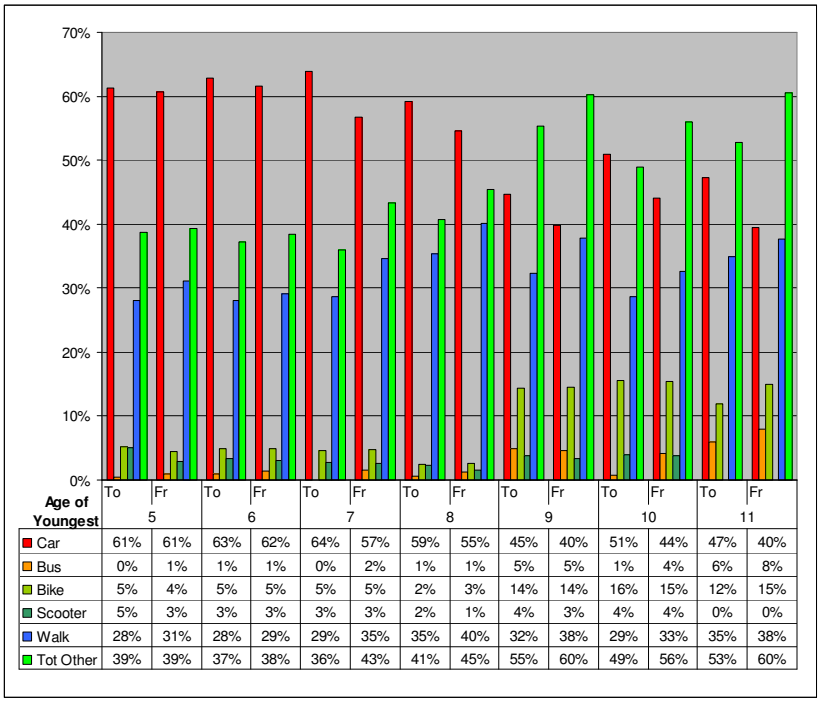
This section considers the impact that age has on pupils travel choices. The ages of the children in the household who attended the school being surveyed were recorded for each household.

Children gain more physical dexterity, endurance, and ability to cope with complex situations as they get older. Older children are therefore more able to walk longer distances and deal with traffic and other hazards than younger children. It was therefore considered that, in households with more than one child attending the school, the age of the youngest child would be a more significant factor in the children's travel choices than the age of the older children.

5.8.1.1 Age of Youngest and Mode Choice

Figure 34, below shows the relationship between the age of the youngest child attending the school and school travel mode choice.

Figure 34 Age of Youngest vs Mode Choice



Age of Youngest	To 5	Fr 5	To 6	Fr 6	To 7	Fr 7	To 8	Fr 8	To 9	Fr 9	To 10	Fr 10	To 11	Fr 11
Car	61%	61%	63%	62%	64%	57%	59%	55%	45%	40%	51%	44%	47%	40%
Bus	0%	1%	1%	1%	0%	2%	1%	1%	5%	5%	1%	4%	6%	8%
Bike	5%	4%	5%	5%	5%	5%	2%	3%	14%	14%	16%	15%	12%	15%
Scooter	5%	3%	3%	3%	3%	3%	2%	1%	4%	3%	4%	4%	0%	0%
Walk	28%	31%	28%	29%	29%	35%	35%	40%	32%	38%	29%	33%	35%	38%
Tot Other	39%	39%	37%	38%	36%	43%	41%	45%	55%	60%	49%	56%	53%	60%

This figure indicates that car usage is similar for trips to and from school for 5 and 6 year old pupils, but that car usage is 5% to 7% less for the trip from school for other age groups. Car usage to school increases from 61% for 5 year olds to 64% for 7 year olds, but from school it decreases from 61% to 57%.

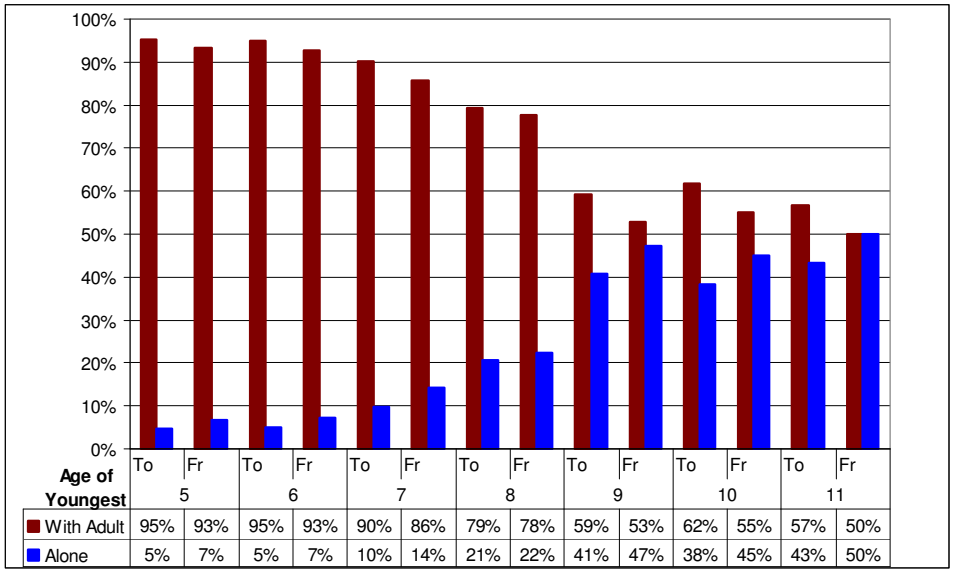
One possible explanation for this is that as the youngest child attending school gets older, there is an increased likelihood that that child is the youngest in the family (that is, there is not another pre school child in the family). The likelihood of the mother returning to work increases with the age of the youngest child in the family. There is a tendency for some mothers, when they first return to work after having children, to start with part time work. The increase in car usage for trips to school, and reduction for trips home at age 7 may reflect mothers returning to the workforce, but in part time positions finishing before school finish time.

The proportion of bike trips is reasonably consistent at 3% to 5% for ages 5 to 8. It increases to 12% to 15% for ages 9 to 11. This may reflect the fact that many schools do not allow pupils to travel by bike without an adult below age 9.

5.8.1.2 Age of Youngest and Independent Travel

Figure 35, below shows the relationship between age of the youngest school child in the family and the percentage of pupils travelling independently or with an adult. As expected, the proportion of pupils travelling independently increases from 5% at age 5 to 50% at age 11.

Figure 35 Age of Youngest vs Independent Travel



Age of Youngest	To 5	Fr 5	To 6	Fr 6	To 7	Fr 7	To 8	Fr 8	To 9	Fr 9	To 10	Fr 10	To 11	Fr 11
With Adult	95%	93%	95%	93%	90%	86%	79%	78%	59%	53%	62%	55%	57%	50%
Alone	5%	7%	5%	7%	10%	14%	21%	22%	41%	47%	38%	45%	43%	50%

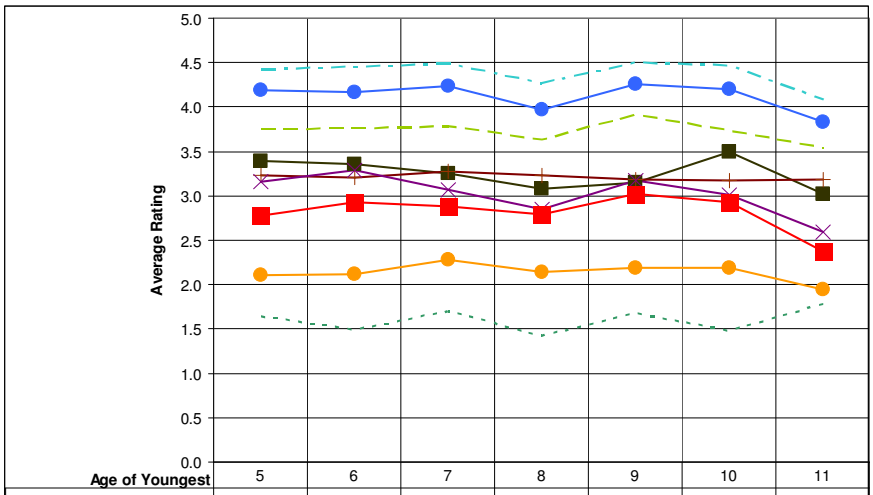
5.8.1.3 Age of Youngest and Significance of Influencing Factors

Figure 36, below shows the relationship between the age of the youngest child and the factors influencing travel choices. Safety factors, exercise, cost, convenience, and distance show a slight reduction in importance at age 8, but increase again at age 9. This is unexpected and difficult to explain.

All factors except weather and cost show reductions in importance at age 11. This may reflect a feeling amongst some parents that by 11 children are much more able to fend for themselves in the world, and need less protection.

Apart from the exceptions noted above, the importance given to factors influencing travel choice was reasonably consistent across age groups.

Figure 36 Age of Youngest vs Factors Influencing Travel Choice



Age of Youngest	5	6	7	8	9	10	11
Distance	3.4	3.4	3.3	3.1	3.1	3.5	3.0
Weather	3.2	3.2	3.3	3.2	3.2	3.2	3.2
Convenience	3.2	3.3	3.1	2.8	3.2	3.0	2.6
Safety - Stranger	4.2	4.2	4.2	4.0	4.3	4.2	3.8
Safety - Road	4.4	4.5	4.5	4.3	4.5	4.5	4.1
Cost	1.6	1.5	1.7	1.4	1.7	1.5	1.8
Exercise is Healthy	3.8	3.8	3.8	3.6	3.9	3.7	3.5
Condition of Footpaths	2.1	2.1	2.3	2.1	2.2	2.2	1.9
Pleasant Environment	2.8	2.9	2.9	2.8	3.0	2.9	2.4

5.8.2 Number of Cars

This section considers the importance that the number of cars in a household has on the school travel choices of children of that household. Parents were asked how many cars were available for everyday use in their household. The categories available were 0, 1, 2, or 3 or more cars.

Only 56 households (3% of total) had no car available, 748 (37%) had one car, 1107 (55%) had two cars, and 115 (6%) had three or more cars available.

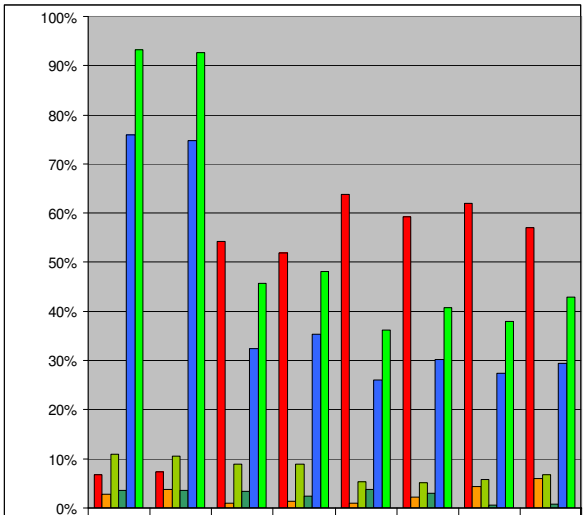
5.8.2.1 Number of Cars and Mode Choice

Figure 37, below shows the relationship between the number of cars in a household, and school travel mode choices. As expected, car usage tends to increase with the number of cars available.

7% of pupils with no car available travelled to school by car. Comments from some parents indicate that they were given lifts to school by friends and neighbours. There was a very small decrease in car usage for households with three cars when compared with

households with two cars. Due to the small sample size for zero and three cars available, care should be exercised with these figures.

Figure 37 Number of Cars and Mode Choice



Number of Cars	To 0	Fr 0	To 1	Fr 1	To 2	Fr 2	To 3	Fr 3
Car	7%	7%	54%	52%	64%	59%	62%	57%
Bus	3%	4%	1%	1%	1%	2%	4%	6%
Bike	11%	10%	9%	9%	5%	5%	6%	7%
Scooter	4%	3%	3%	2%	4%	3%	1%	1%
Walk	76%	75%	32%	35%	26%	30%	27%	29%
Tot Other	93%	93%	46%	48%	36%	41%	38%	43%

5.8.2.2 Number of Cars and Independent Travel

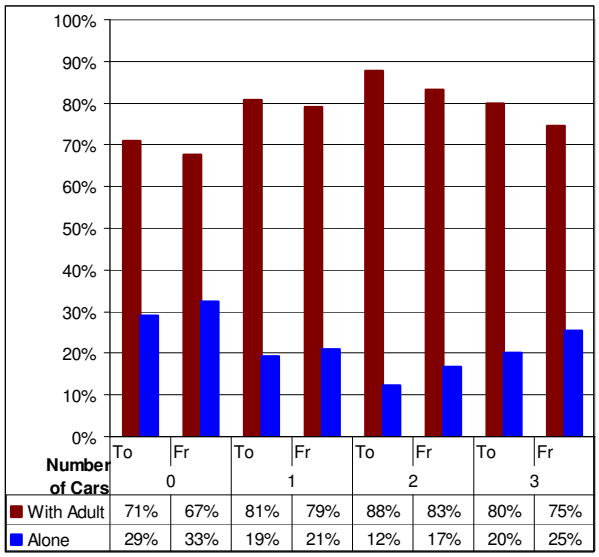
Figure 38 shows the relationship between the number of cars in a household and the percentage of pupils travelling independently. The percentage of pupils travelling independently decreases from 29% to and 33% from for households with no cars to 12% to and 17% from for households with two cars. The proportion travelling independently increases to 20% and 25% for households with three cars.

The reduction in independent travel for households with one and two cars is consistent with a higher proportion of pupils travelling by car in those households.

Pupils from decile 1 schools are more likely to be from households with no cars. As observed in section 5.6.2.2, pupils from decile 1 schools are more likely to travel independently than pupils from other schools.

As noted in section 5.8.2.1, there are very small sample sizes for households with zero cars and three cars.

Figure 38 Number of Cars vs Independent Travel



5.8.2.3 Number of Cars and Significance of Influencing Factors

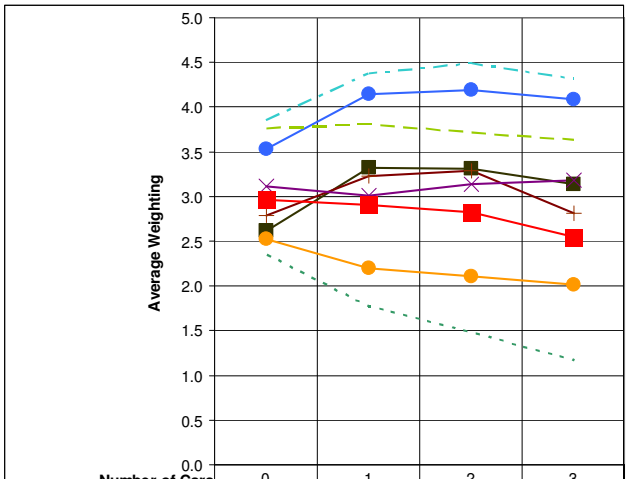
Figure 39, below shows the relationship between the number of cars in a household and the average weighting given by parents to the factors influencing their children's travel choices.

The weightings given to all factors except cost were similar for households with either one or two cars. The importance of cost declined steadily from 2.3 for households with no cars to 1.2 for households with three cars.

Both safety categories, along with distance, and weather were ranked lower for households with no cars than for other households. Conversely, footpath condition, pedestrian environment and cost were ranked higher for those households. Households with no cars were the only category in which "*Exercise is healthy*" achieved a higher ranking than "*Safety – Stranger danger*". This may suggest that for some households the choice to have no car is a lifestyle choice rather than an economic one. These households may rank other factors more important than the advantages gained by car usage.

However, the small sample size of carless households makes it difficult to verify that possibility.

Figure 39 Number of Cars vs Influencing Factors



Number of Cars	0	1	2	3
Distance	2.6	3.3	3.3	3.1
Weather	2.8	3.2	3.3	2.8
Convenience	3.1	3.0	3.1	3.2
Safety - Stranger	3.5	4.1	4.2	4.1
Safety - Road	3.9	4.4	4.5	4.3
Cost	2.3	1.8	1.5	1.2
Exercise is Healthy	3.8	3.8	3.7	3.6
Condition of Footpaths	2.5	2.2	2.1	2.0
Pleasant Environment	3.0	2.9	2.8	2.5

5.8.3 Number of Pupils at School

This section considers the effect that family size has on school travel choices. Information was obtained on pupils in the household who attend the school being surveyed. No information was obtained on pre-school children, children attending other primary schools, or children older than primary school age in the household. The number of pupils referred to in this section is only the number of pupils in the household who attend the school being surveyed. It gives an indication of the size of family.

There were only eight pupils from two households with four or more pupils in the household.

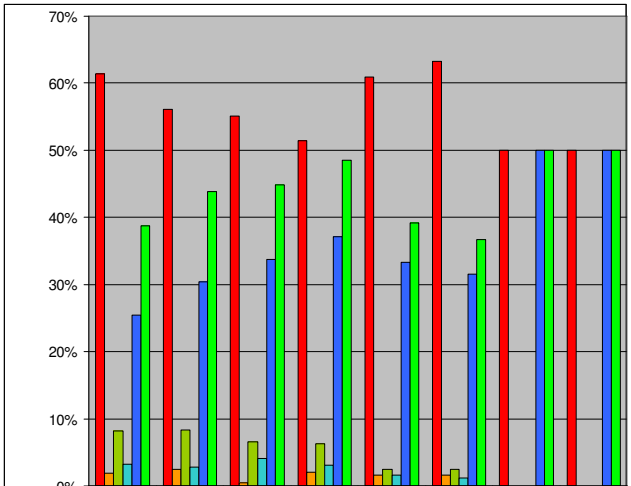
5.8.3.1 Number of Pupils and Mode Choice

Figure 40 shows the relationship between the number of pupils in the household and the school travel mode choice.

The proportion of pupils travelling by car is higher for the trip to school than the trip home for households with one or two pupils. The proportion is lower for the trip to school than the trip home for those households with three pupils at school There is an increased likelihood that the children in a household with three school age children will have different after school activities on different days. There is therefore likely to be an increase in the number of days in a week on which at least one child will have an after school activity. This may be a contributing factor in the higher proportion of car trips for households with three children.

Car usage declines from 61% to, and 56% from, school for households with one pupil at school to 55% and 52% respectively for households with two pupils at school. Car usage increases to 61% and 63% for households with three pupils at school. This suggests that there is no clear correlation between the number of children from a household who attend a particular school and the travel choices of those children.

Figure 40 Number of Pupils vs Mode Choice



Number of Pupils	1 To	1 Fr	2 To	2 Fr	3 To	3 Fr	4 To	4 Fr
Car	61%	56%	55%	52%	61%	63%	50%	50%
Bus	2%	2%	0%	2%	2%	2%	0%	0%
Bike	8%	8%	7%	6%	2%	2%	0%	0%
Scooter	3%	3%	4%	3%	2%	1%	0%	0%
Walk	25%	30%	34%	37%	33%	32%	50%	50%
Tot Other	39%	44%	45%	48%	39%	37%	50%	50%

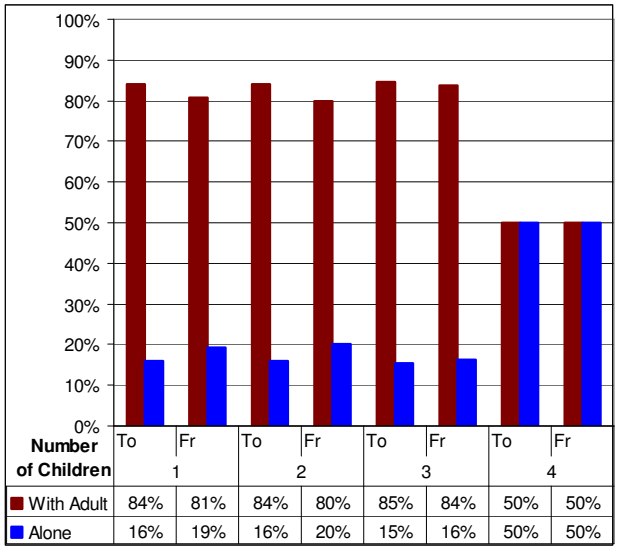
5.8.3.2 Number of Pupils and Independent Travel

Figure 41 shows the relationship between the number of children in a household who attend the school being surveyed and the proportion of pupils who travel independently. There is very little difference between the proportion of pupils who travel independently for households with one or two pupils at the school. (16% to and 19% from for one pupil vs 16% to and 20% from for two pupils).

There is a very slight reduction to 15% travelling independently to school in households with three pupils. This reduction is more pronounced for the trip from school, with 16% of those with three pupils travelling independently, compared with 20% with two, and 19% with one pupil.

The consistent level of independent travel for households with one or two pupils at school, when compared with the reduction in car travel for households with two pupils at school suggests that a number of parents in households with two pupils at school are walking, biking or scootering to school with their children. This is consistent with fewer mothers of families with multiple children at primary school returning to work.

Figure 41 Number of Pupils vs Independent Travel



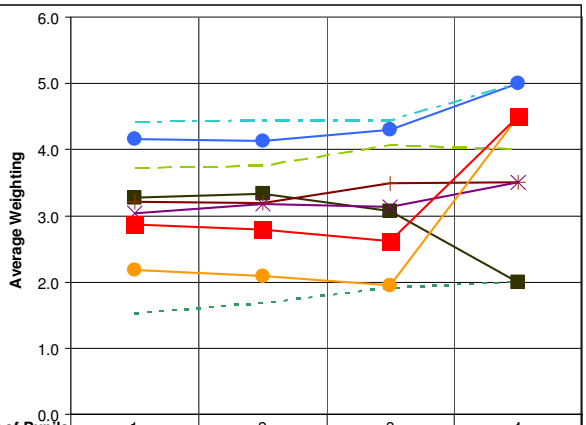
Number of Children	To 1	Fr 1	To 2	Fr 2	To 3	Fr 3	To 4	Fr 4
With Adult	84%	81%	84%	80%	85%	84%	50%	50%
Alone	16%	19%	16%	20%	15%	16%	50%	50%

5.8.3.3 Number of Pupils and Significance of Influencing Factors

The relationship between the number of pupils in each household attending the school being surveyed, and the weightings given to factors influencing travel choices is shown on Figure 42 below. As noted in section 5.8.3, only two households surveyed had four or more pupils at school. The weightings given by households in this category should therefore be treated with caution. The average weighting given to "*Exercise is healthy*" increases from 3.7 for households with one or two pupils to 4.1 for those with three. The average weighting given to "*Cost*" increases from 1.5 for households with one pupil to 1.9 for those with three. The difference in average weightings given to all other factors by households with one to three pupils is less than 0.4.

It is therefore considered that the numbers of children attending school does not have a significant impact on the attitudes of parents to school travel.

Figure 42 Number of Pupils vs Influencing Factors



Number of Pupils	1	2	3	4
Distance	3.3	3.3	3.1	2.0
Weather	3.2	3.2	3.5	3.5
Convenience	3.0	3.2	3.1	3.5
Safety - Stranger	4.2	4.1	4.3	5.0
Safety - Road	4.4	4.4	4.4	5.0
Cost	1.5	1.7	1.9	2.0
Exercise is Healthy	3.7	3.7	4.1	4.0
Condition of Footpaths	2.2	2.1	2.0	4.5
Pleasant Environment	2.9	2.8	2.6	4.5

5.9 Waimairi School

5.9.1 Introduction

The travel patterns at Waimairi School are significantly different from those of other schools surveyed. Almost 25% fewer pupils travel by car to and from Waimairi School than the average of all other schools surveyed.

Waimairi School is a Decile 10 school. It's main vehicle access is via Tillman Avenue, which is a 100m long cul de sac. In addition, it has two pedestrian accesses via the school grounds. The east boundary of the school is adjacent to the South Island Main Trunk Railway line, and a parallel pedestrian and cycle way. One of the pedestrian entrances to the school provides access from the pedestrian and cycle way and from a pedestrian overbridge across the railway line.

Waimairi School implemented a School Travel Plan in mid 2005. A copy of the plan is included in Appendix H.

5.9.2 Key Points of Travel Plan

The Waimairi School Travel Plan was agreed between, and signed by, representatives of the school staff, Board of Trustees, Parent Teacher Association (PTA), and pupils, along with Christchurch City Council, and local police.

The key aims of the travel plan included:

1. Reduce cars/congestion in Tillman Avenue;
2. Encourage healthy alternatives to car transport;
3. Reduce car use;
4. Improve safety of routes to and from school;
5. Increase awareness of road safety issues; and
6. Consider other safety issues.

The actions to meet those aims included education measures to increase awareness of the consequences of car usage, and to encourage use of alternatives, and physical measures to make pedestrian routes more pleasant, increase safety overall, but particularly of pedestrian and cycle routes, and provide cycle and scooter facilities at the school. Responsibilities for implementing the actions have been allocated to each of the groups who have agreed to and signed the travel plan.

A part time travel plan co-ordinator was appointed to oversee the implementation of the travel plan.

5.9.3 Results of Travel Plan

As noted in section 5.2.1, the mode choices of Waimairi School pupils were significantly different from those of other schools. Table 15 shows a comparison of Waimairi School travel choices before and after the implementation of the School Travel Plan (STP), and with typical school mode choices.

Car travel to Waimairi School reduced by 20% from 52% of respondents to 32% following the STP. Car travel from school reduced by 23%, from 56% to 33%. Biking accounted for only 1% of the move from car travel for both the journey to and from school. Walking and scootering accounted for the remainder of the reduction.

Prior to the STP, car travel to Waimairi School was slightly less than the average of other schools surveyed, but car travel from the school was slightly higher.

Table 15 Comparison of Waimairi and Typical school Mode Choices

Mode	Typical		Waimairi School					
			Pre STP		Post STP		Change	
	To	From	To	From	To	From	To	From
Car	58%	54%	52%	56%	32%	33%	-20%	-23%
Bus	1%	2%	0	0	0	0	0	0
Bike	7%	7%	4%	4%	5%	5%	+1%	+1%
Scooter	3%	3%	18%	15%	23%	20%	+5%	+5%
Walk	30%	33%	26%	25%	40%	41%	+14%	+16%

The results of the implementation of a travel plan at one school do not provide a large enough sample size to draw definitive conclusions from. However, the experience at Waimairi School suggests that a well formulated travel plan, combined with a person who has the energy, enthusiasm and time to implement it, can have significant impacts on school travel choices.

Chapter 6

MULTINOMIAL LOGIT MODELLING

6.1 Introduction

The overall purpose of estimating a series of Multinomial Logit (MNL) models was to provide a suite of tools to estimate the mode choices of primary school pupils. These tools could be used to estimate vehicle and pedestrian numbers associated with schools.

In addition, the MNL models can assist in estimating the respective influence of a number of independent variables on mode choice.

This information can be used to identify the impacts of schools on the transportation system, and to inform decisions regarding transportation infrastructure and other facilities at or near to schools.

Multinomial Logit Models (MNL) were estimated, based on data from the results of the case study of twenty two Christchurch primary schools, as detailed in Chapters 3 and 4.

This chapter outlines the purposes of the models, and the methodology used to produce them. It presents the models which have been estimated, and assesses the reliability of the models.

6.2 Modelling Estimation

Models have been estimated at both aggregate, family, and disaggregate, school, levels. They include models which estimate both mode choice and extent of independence of children travelling to and from school. Separate models have been estimated for both the journey to and the journey from school.

6.2.1 Recorded Data

The data used to estimate the MNL models was obtained from stated choice surveys of parents of pupils from twenty two Christchurch primary schools. The school survey is described in Chapters 3 and 4.

6.2.1.1 Mode Choice Estimates

Mode choice models were estimated at a disaggregated, family level, and at an aggregated school level.

Less than 2% of total trips were recorded as bus trips. The factors likely to result in a pupil travelling by bus were considered to be very similar to those likely to result in car travel. Bus trips were therefore included in the "Car" category for the purposes of producing the models.

A number of models were trialled using separate categories for bike, scooter and walking trips. These models had a low level of accuracy in predicting each of those modes. Additionally not all schools had a "scooter" category in their survey forms. These three modes were therefore combined into one overall "*other"* mode.

There were very few trips recorded in which members of the same family used different modes to travel to or from school. In those few instances where members of the same family recorded different modes, they were generally using a mode other than *"Car"* (for example one would cycle and one walk). All the pupils of the family therefore fell into the *"Other"* category.

The school level models considered school specific mode choice parameters, such as school roll, school decile, and average age of pupils. The family models considered the school specific parameters plus family and household specific mode choice parameters, such as distance between home and school, number of children in the home, and number of cars in the home.

The estimated models and results for both the school and family levels are described below

6.2.1.2 School Level Mode Choice Model

The school level models were produced by estimating utility factors for *"Car"* and *"Other"* mode choices for each of the trips to and from school.. These utility factors were then applied to each school to estimate the total numbers of pupils using each mode for travel to and from school.

The number of pupils travelling to or from a particular school by each of "C*ar*" or *"Other"* was estimated using the following formulae:

$$N_{Car} = R\left(\frac{\exp(Ud_{Car})}{\exp(Ud_{Other}) + \exp(Ud_{Car})}\right) \qquad \textbf{\textit{Equation 1}}$$

$$N_{Other} = R\left(\frac{\exp(Ud_{Other})}{\exp(Ud_{Other}) + \exp(Ud_{Car})}\right) \qquad \textbf{\textit{Equation 2}}$$

Where:

N_{Car} = *Number of pupils travelling by Car;*
N_{Other} = *Number of Pupils Travelling by Other;*
R = School Roll;

Ud_{Car} = Utility Factor relating to Car Mode Choice for direction (to or from School); and
Ud_{Other} = Utility Factor relating to Other Mode Choice for direction (to or from School).

Estimated Utility Factors for Mode Choice for *"Car"* and for *"Other"* for the trips to and from School on a school level basis are shown below:

6.2.1.2.1 Utility Factor - To School

$$U_{Car} = 1.0157$$ ***Equation 3***

$$U_{Other} = 0.0357De + 0.0855AA - 0.000771R.$$ ***Equation 4***

6.2.1.2.2 Utility Factor - From School

$$U_{Car} = 1.232$$ ***Equation 5***

$$U_{Other} = 0.0166De + 0.118AA - 0.00227R$$ ***Equation 6***

Where:

De = School Decile;
AA = Average Age of School Pupils; and
R = School Roll.

6.2.1.3 School Level Mode Choice Model Results

Table 16 below shows a summary of the results of the model estimate for mode choice on a school level basis. The percentage correct quoted was established by estimating pupil numbers travelling by each mode for each of the schools surveyed, and comparing these with the recorded numbers travelling by each mode at each school. The percentage correct was the total number of trips which were estimated correctly divided by the total number of trips.

The full model estimate results for mode choice on a school level basis are included in Appendix I

Table 16 Model Results – Mode Choice – School Level

		To School			From School		
Parameter	**Mode**	**Value**	**Std Error**	**t Test**	**Value**	**Std Error**	**t Test**
Constant	Car	1.0157	0.142	7.112	1.232	0.141	8.709
School Roll	Other	-0.000771	0.000169	-4.562	-0.000227	0.000168	-1.355
Decile	Other	0.0357	0.0100	3.575	0.0166	0.00984	1.683
Avge Age	Other	0.0855	0.0141	6.044	0.118	0.0140	8.438
Rho^2		0.0441			0.0259		
Adj Rho^2		0.0433			0.0250		
% Correct		91.9%			91.5%		

Figure 43 to Figure 46 show scatter graphs of predicted vs recorded pupil numbers for individual schools using each mode for trips both to and from school. Each point on the graph indicates the results for one school.

These graphs show a good fit between the numbers of pupils recorded and those estimated by the models using each mode. Figure 43 and Figure 45 show that the trips by car estimated for trips both to, and from, school is within ± 20% of the recorded car trips for the bulk of the schools surveyed. Generally the schools in which the estimated trips are outside of ± 20% have less than 250 recorded trips.

Figure 44 and Figure 46 indicate that there are a greater number of schools for which the estimated number of trips by modes other than car is outside of ± 20% of the recorded trips than is the case for the car mode choice. However, in the majority of those cases, there are less than 250 trips by other modes recorded at the school.

Figure 43 Mode Choice "Car" - To School - Predicted vs Recorded - School Level Results

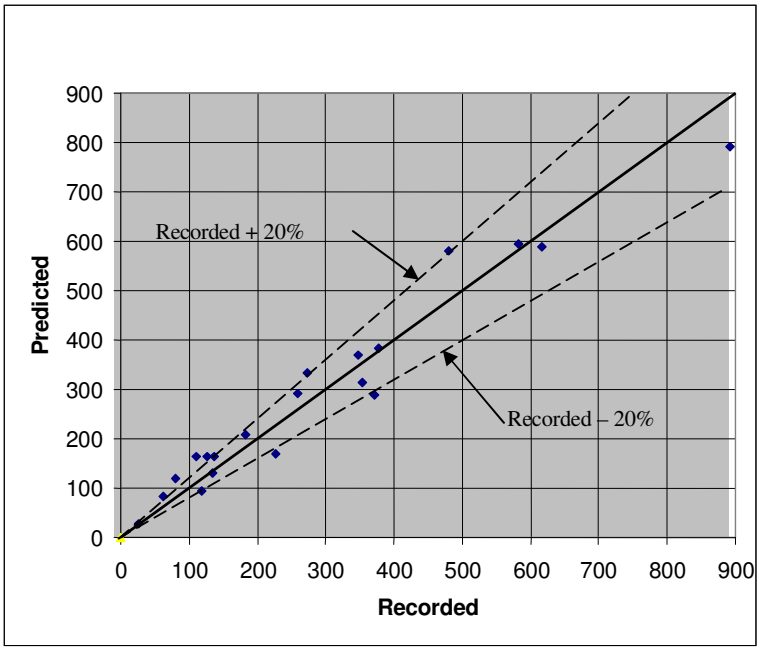


Figure 44 Mode Choice "Other" - To School - Predictded vs Recorded - School Level

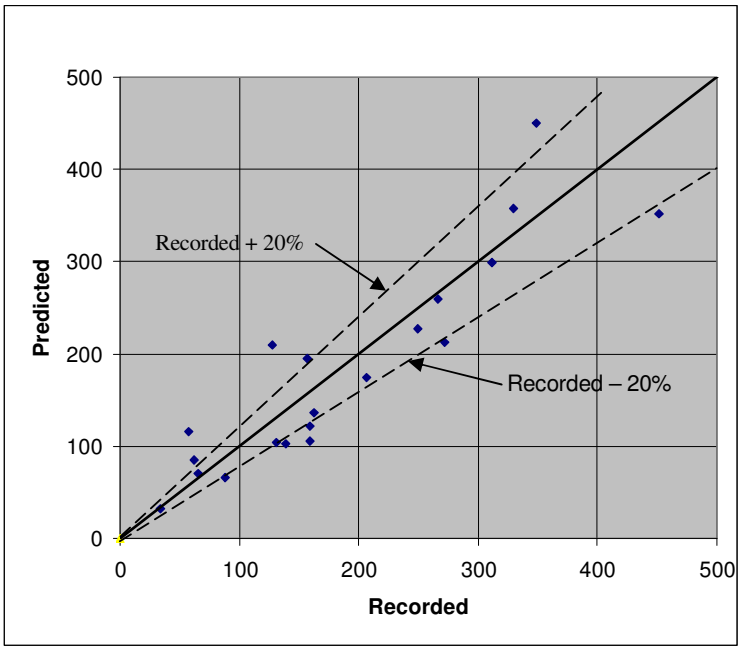


Figure 45 Mode Choice "Car" - From School - Predicted vs Recorded - School Level Results

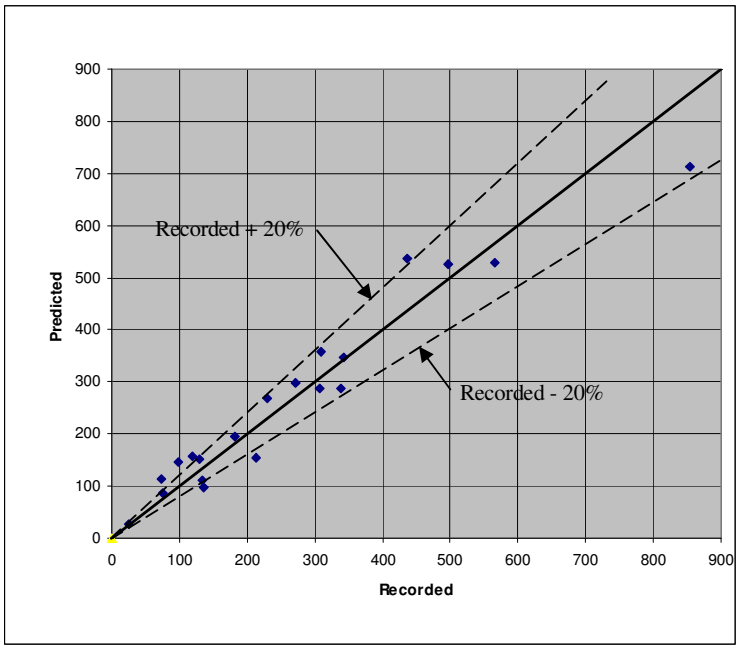
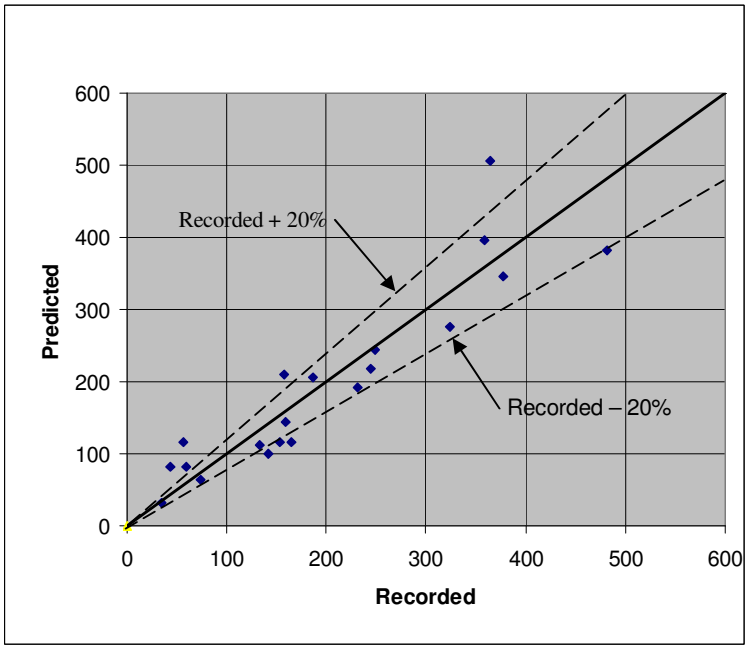


Figure 46 Mode Choice "Other" - From School - Predicted vs Recorded - School Level Results



6.2.1.3.1 Model Parameter Assessment

6.2.1.3.1.1 School Roll

The School Roll multiplier is negative for the *"other"* mode choice for trips both to and from school. This indicates that the use of modes other than car tend to decrease with increasing school size. This is consistent with the findings of Chapter 4, Section 4 5.6.1.1, in which use of other modes tended to decrease with increasing school roll.

Larger schools tend to have larger catchment areas, and therefore a greater proportion of pupils who live further away from the school than smaller schools. Pupils who live further from the school are more likely to travel by car.

The negative value of the School Roll multiplier for *"other"* mode choice is therefore consistent with increasing car usage associated with increasing school size.

The value of the School Roll multiplier is between 0.1% and 2.2% of the values of the decile and average age multipliers. With the exception of the Lyttelton schools, the school roll values are between 100 and 600 pupils. This compares with less than 10 for the values of both school average age and school decile.

The magnitude of the school roll multiplier is not considered inconsistent with the values of the school decile and school average age multipliers.

6.2.1.3.1.2 Decile

The Decile multiplier is positive for the *"other"* mode choice for trips both to and from school. This indicates that car trips to and from school decrease with an increasing school decile rating. This runs contrary to the widely accepted understanding, that in most transportation environments, car usage increases with income. Some factors in the school transportation environment which may contribute to car trips decreasing with decile rating include:

1. Decile rating is not a measure of income alone. It also takes into account occupation (the percentage of parents in low skilled occupations), household crowding, educational qualifications and income support. In addition to a higher income level, a high decile school would typically have a large proportion of parents in skilled occupations, requiring high educational qualifications. Flexible working arrangements tend to be more common in these sorts of occupations than in low skilled occupations requiring few educational qualifications.

2. If one partner in a household is in a high paid high skilled occupation, there may be less pressure for the other partner to work.

These two factors could mean that there are more parents from high decile schools with the time available to accompany their children if the children are walking, biking or scootering to school. As noted in Chapter 5, Section 5.4.2.5, 322 parents identified "other factors" in their travel choice decisions. Of these, 88 identified time as a factor.

The findings of Chapter 5, Section 5.6.2.1 regarding a correlation between school decile and car usage were not clear cut. Very high and very low decile schools tended to have lower car usage than other schools. There appeared to be little consistency in the results for the other schools.

6.2.1.3.1.3 t Test

The t Test values for the "*To School"* model estimation suggest that the statistical significance of each of the parameters of School Roll, Decile, and Average Age is of a similar magnitude. However, the significance of the School Roll and Decile parameters is much less than that of the Average Age parameter for the *"From School"* model.

The parents' survey indicated that safety and time were significant factors in determining children's travel choices.

Time demands are generally heaviest for families in the morning. All family members need to have showers, and have breakfast. One (or both parents) need to get to work, and children need to get to school.

There are likely to be less time constraints for the trip home from school in the afternoon than for the trip to school in the morning.

6.2.1.4 Family Mode Choice Model

The family models were produced by estimating utility factors for *"Car"* and *"Other"* mode choices for each of the trips to and from school. These utility factors were then applied to each family to estimate the probability that members of that family would use one mode or the other.

The probability of members of a family travelling to or from school by each of "C*ar*" or *"Other"* was estimated using the following formulae:

$$\Pr_{Car} = \frac{\exp(Ud_{car})}{\exp(Ud_{car}) + \exp(Ud_{other})}$$ ***Equation 7***

$$\Pr_{Other} = \frac{\exp(Ud_{Other})}{\exp(Ud_{car}) + \exp(Ud_{other})}$$ ***Equation 8***

Where:

PR_{Car} = *Probability of family members travelling by Car;*
Pr_{Other} = *Probability of family members travelling by Other;*
Ud_{Car} = *Utility Factor relating to Car Mode Choice for direction (to or from School); and*
Ud_{Other} = *Utility Factor relating to Other Mode Choice for direction (to or from School).*

Estimated Utility Factors for Mode Choice for *"Car"* and for *"Other"* for the trips to and from School on a family level basis are shown below.

6.2.1.4.1 Utility Factor – To School

$$U_{Car} = 0.1670 + 0.5RD$$ ***Equation 9***

$$U_{Other} = 0.000041R + 0.0157De - 0.513PD + 0.00128PR - 0.931MRC + 0.211MRk + 0.207CS + 0.113AY - 0.007AO$$

Equation 10

6.2.1.4.2 Utility Factor – From School

$$U_{Car} = 0.221 + 0.546RD$$ ***Equation 11***

$$U_{Other} = 0.000084R + 0.0121De - 0.526PD + 0.00079PR - 0.858MRC + 0.231MR + 0.0272CS + 0.143AY - 0.0351AO$$

Equation 12

Where:

AO = Age of Oldest Child;

AY = Age of Youngest;

CS = Number of Children at the School from that home;

De = Decile;

MRC = Major Roads to Cross;

MRk = Major Roads per km;

PD = Pedestrian Dist;

PR = Pedestrian Rating;

R = School Roll; and

RD = Road Distance.

6.2.1.5 Family Mode Choice Model Results

Table 17 below shows a summary of the results of the model estimate for mode choice on a family basis. The mode choices for the children belonging to each family were estimated using the model.

The "percentage correct" quoted in Table 17 is the percentage of trips in which the estimated mode choice matched the recorded choice. Typically there would be five trips to and five trips from school for each child, excluding absences etc. 73.8% of trips to school, and 74.9% of the trips from school were estimated correctly.

The total number of estimated car trips to school was 98.6% of the total number of car trips recorded. The estimated car trips from school was 96.0% of those recorded. The estimated other trips to and from school were 102.2% and 105.5% respectively of those recorded.

The model is more accurate in estimating the total numbers of pupils likely to use each mode than it is in predicting the mode an individual family is likely to use.

The full model estimate results for mode choice on a family basis are included in Appendix J

Table 17 Model Results – Mode Choice – Family

		To School			From School		
Parameter	**Mode**	**Value**	**Std Error**	**t Test**	**Value**	**Std Error**	**t Test**
Constant	Car	0.167	0.221	0.755	0.221	0.217	1.0172
Age Oldest	Other	0.00703	0.0365	0.193	0.0351	0.0345	1.019
Age Yngst	Other	0.113	0.0363	3.112	0.143	0.0344	4.164
Chn School	Other	0.207	0.0808	2.565	0.0272	0.0742	0.366
Decile	Other	0.0157	0.0118	1.331	-0.0121	0.0118	-1.0173
Mjr Rd Crss	Other	-0.931	0.0733	-12.706	-0.858	0.0715	-11.996
Mjr Rd/km	Other	0.211	0.0367	5.748	0.231	0.0395	5.840
Ped Dist	Other	-0.512	0.0717	-7.143	-0.526	0.0701	-7.504
Ped Rating	Other	0.00128	0.00229	0.556	-0.00079	0.00230	-0.342
Sch Roll	Other	-0.00004	0.000205	-0.201	0.00084	0.000206	4.070
Road Dist	Car	0.501	0.0671	7.466	0.547	0.0660	8.277
Rho^2		0.256			0.255		
Adj Rho^2		0.254			0.253		
% Correct		73.8%			74.9%		
Car est		4106			3771		
Car rec'd		4165			3929		
Est/rec'd		98.6%			96.0%		
Othr est		2689			3024		
Othr rec'd		2630			2866		
Est/rec'd		102.2%			105.5%		

6.2.1.5.1 Model Parameter Assessment

6.2.1.5.1.1 Age of Oldest and Age of Youngest

Both the Age of Oldest and Age of Youngest Child multipliers are positive for the *"Other"* mode choice for trips both to and from school. Age is a significant determinant in mode choice. Older children are more likely to be able to walk reasonable distances than younger children. A positive sign for the age multipliers is consistent with older children being more likely to walk.

The t Test values are much higher for the Age of Youngest parameter than for the Age of Oldest. This suggests that the age of the youngest child attending school is a more significant determinant of mode choice than the age of the oldest child attending the school. In families where one child attends the school, the age of the child was recorded as the age of both the youngest and oldest.

The t Tests for both age parameters are both stronger for the trip from school than for the trip to school. This suggests that age is a stronger determinant of mode choice for the trip home than for the trip to school. This is consistent with there being fewer time constraints in the afternoon than in the morning for many families. Therefore time related factors take on less importance, and other factors take on greater importance.

The case study results (Chapter 5, Section 5.8.1) found that generally use of other modes increases with the age of the youngest pupil, but that there is a slight decrease in other modes between age 5 to age 7. A positive multiplier for Age of Youngest and Age of Oldest for "other" modes is not inconsistent with the case study results.

6.2.1.5.1.2 Number of Children at the School

The multipliers for the Number of Children at the School parameter are positive for *"Other"* mode choice for both the trips to and from school. An increase in the number of children in the home attending the school will tend to increase the likelihood of that family using a mode other than car to get to and from school. One possible explanation could be that the numbers of families with both parents working decreases with increasing numbers of school age children. The parents' surveys for this study did not have any questions regarding employment status. It is therefore not possible to substantiate that theory.

The t Test values for the Number of Children at the School are much higher for the trip to school than for the trip home. The number of school age children in the home has less of an impact on the *"other"* mode choice for the trip home than for the trip to school. This may also be attributed to the possibility that one parent not working increases with

increasing numbers of children in the home. These families may have a little more time available in the morning than single parent families or families with both parents working.

The results of the case study regarding the number of pupils (Chapter 5, Section 5.8.3.1) indicate that use of other modes increases with increasing numbers of pupils of the school in the household. The positive multiplier for "other" mode choice is consistent with this finding

However, the proportion travelling by other modes is lower for the trip to school than for the trip home for households with one or two pupils. For households with three or more pupils, the proportion using other modes is higher in the morning than the afternoon. This is consistent with a higher t Test value for the trip to school than for the trip home.

6.2.1.5.1.3 Decile

The multiplier for the Decile parameter is positive for the trip to school, and negative for the trip home. Refer to section 6.2.1.3.1.2 for discussion on the decile parameter.

6.2.1.5.1.4 Major Roads to Cross and Major Roads per km

The multiplier for the Major Roads to Cross parameter is negative for the *"Other"* mode choice for trips both to and from school. The multiplier for the Major Roads per km is positive for the *"Other"* mode choice.

The number of major roads to cross on the way to or from school is partially dependant on the distance to school. The number of major roads to cross only becomes a factor in the mode choice decision when the household is within a walking or biking distance from school.

A positive multiplier for Major Roads per km reduces the impact of taking into account both the number of roads to cross and the distance to travel.

The t Test values for both Major Roads to Cross and Major Roads per km are significant and similar for both trips to and from school. This suggests that parents consider these

factors when making mode choices for their children. The correlation between distance and roads to cross and the safety considerations of crossing major roads are consistent with parents being concerned about safety, time and distance.

There was a strong negative correlation between the number of roads to cross and the use of other modes revealed in the case study (Chapter 5, Section 5.7.3.1). A negative multiplier and strong t Test values for "other" mode choice for Major Roads to Cross are consistent with the findings in the case study.

6.2.1.5.1.5 Pedestrian Distance

The Pedestrian Distance multiplier is negative for the *"other"* mode choice both to and from school. The greater the distance a child has to walk, cycle or scooter to school, the less likely they are to use those modes. The t Test value is similar and significant for both directions. This is consistent with parents being concerned about time and distance for the school journey.

The case study results (Chapter 5, Section 5.7.2.1) show a clear negative correlation between increasing distance from school and use of other modes. This is consistent with a negative pedestrian distance multiplier for "other" mode, and with a significant t Test value.

6.2.1.5.1.6 Pedestrian Rating

The Pedestrian Rating multiplier is positive for the *"other"* mode choice for the journey to school, and negative for the journey home. The t Test value for both directions is very small. This suggests that the pedestrian rating has very little impact on parents' mode choice. This is consistent with the low rating given to "Condition of footpaths" in the factors influencing travel choices section of the parent survey.

The results of the case study showed very little correlation between pedestrian rating and mode choice. This is consistent with a very low t Test value for this parameter.

6.2.1.5.1.7 School Roll

The School Roll multiplier is negative for the *"other"* mode choice for trips to school, and positive for trips from school. The t Test value for the trip to school is quite small, while for the trip home, it is significant.

As noted in 6.2.1.3.1.1 above, average distance to school increases with increasing school roll. School roll is not a parameter which will directly influence parents' mode choices. Parameters for pedestrian and road distance have been specifically included in this model estimation.

6.2.1.5.1.8 Road Distance

The Road Distance multiplier is positive for the *"Car"* mode choice for both the trips to and from school. The t Test values are similar and significant for both directions. This suggests that the road distance is a significant positive factor in choosing to use a car for school travel. This is consistent with the high rating achieved by distance and safety in the factors influencing travel choices section of the parent survey.

6.2.1.6 Model Applicability

Using the model above, mode choices for individual families were estimated for the trips to and from School. 74% of the individual families' mode choices were estimated correctly for both trips.

However, for the total trip to school figures, 4106 trips were estimated as car trips. This is 99% of the 4165 car trips recorded. The estimated total car trips from school was 95% of the recorded car trips. The estimated other trips to and from school were 102% and 107% respectively of the recorded other trips to and from school. This compares favourably with the 91.9% and 91.5% accuracy achieved from the school level models for mode choice.

However, the applicability of the family level model is limited when estimating mode choices and trip numbers associated with schools. The level of individual family data required to populate this model is generally not available at a school level.

6.2.2 Degree of Independence

Survey results were divided into two levels of independence, namely "*With Adult"* and *"Independent"*.

As noted in Chapter 3, Section 3.2.2.1.4, the parent surveys were divided into five broad mode choices, namely *"Car", "Bus", "Bike", "Scooter",* and *"Walk"*. Each of these mode choices was further divided into sub choices.

When considering degree of independence, the following assessments were made:

- All Car trips were regarded as *"With Adult"*;
- All Bus trips were regarded as *"Alone"*;
- All Cycle, Scooter, or Walking trips which were *"With Parent or Caregiver"* were regarded as *"With Adult"*;
- All Cycle, Scooter, or Walking trips which were *"With other school pupils"* or *"Alone"* were regarded as *"Alone"*; and
- All Walking trips which were *"In an organised group"* were regarded as *"With Adult"*

MNL models for degree of independence were estimated at a school level for trips both to and from school.

6.2.2.1 School Level Independence Model

Utility functions were estimated for both the *"With Adult"* and *"Alone"* levels of independence. These utility factors were then used to estimate the numbers of pupils at each school who travelled either independently or with an adult, based on the following formulae:

$$N_{Ad} = R\left(\frac{\exp(Ud_{Ad})}{\exp(Ud_{Al}) + \exp(Ud_{Ad})}\right) \qquad \textbf{Equation 13}$$

$$N_{Al} = R\left(\frac{\exp(Ud_{Al})}{\exp(Ud_{Al}) + \exp(Ud_{Adt})}\right) \qquad \textbf{Equation 14}$$

Where:

N_{Ad} = *Number of pupils travelling with an adult;*
N_{Al} = *Number of Pupils Travelling alone;*
R = *School Roll;*
Ud_{Ad} = *Utility Factor relating to travelling with an adult for direction (to or from School); and*
Ud_{Al} = *Utility Factor relating to travelling alone for direction (to or from School).*

Utility Factors for the levels of independence on a school level basis for trips to and from school are shown below.

6.2.2.1.1 Utility Factors – To School

$$U_{Ad} = 6.957$$ ***Equation 15***

$$U_{Al} = 0.730AA - 0.0024R$$ ***Equation 16***

Where:

AA = Average Age of pupils; and

R = School Roll.

6.2.2.1.2 Utility Factors – From School

$$U_{Ad} = 6.664$$ ***Equation 17***

$$U_{Al} = 0.708AA - 0.0018R$$ ***Equation 18***

6.2.2.2 School Level Independence Model Results

Table 18 shows a summary of the model results for the estimation of the degree of independence on a school level basis. The percentage correct quoted was established by estimating pupil numbers travelling by each mode for each of the schools surveyed, and comparing these with the recorded numbers travelling by each mode at each school. The percentage correct was the total number of trips which were estimated correctly divided by the total number of trips.

The full results are included in Appendix J

Table 18 Model Results - Degree of Independence - School Level

		To School			From School		
Parameter	**Mode**	**Value**	**Std Error**	**t Test**	**Value**	**Std Error**	**t Test**
Constant	Adult	6.9567	0.254	27.434	6.664	0.229	29.150
School Roll	Alone	-0.00240	0.000236	-10.195	-0.0018	0.000218	-8.263
Avge Age	Alone	0.730	0.0258	28.272	0.708	0.02331	30.355
Rho^2		0.529			0.459		
Adj Rho^2		0.528			0.458		
% Correct		95.4%			94.2%		

Figure 47 to Figure 50 shows scatter graphs of predicted vs recorded pupil numbers, from individual schools, exercising degrees of independence for trips both to and from school. Each point on the graph indicates the results for one school. The two degrees of independence estimated are "*With an Adult*" and *"Alone"*.

Figure 47 and Figure 49 indicate that at most schools, the estimated numbers of children travelling with an adult are slightly higher than those recorded for both trips to and from school. Less than 250 trips "*With an Adult*" were recorded at schools where the estimated number of trips with an adult was outside of ± 20% of those recorded.

Figure 48 and Figure 50 show that the percentage difference between recorded and estimated independent trips is much higher than for the trips with an adult. The numbers of pupils who travelled independently are much lower than those who travelled with an adult. The same numerical difference between those recorded and estimated will therefore be much larger when expressed as a percentage of those who travelled independently, than as a percentage of those who travelled with an adult.

Figure 47 Independence Level "With Adult" - To School - Predicted vs Recorded - School Level Results

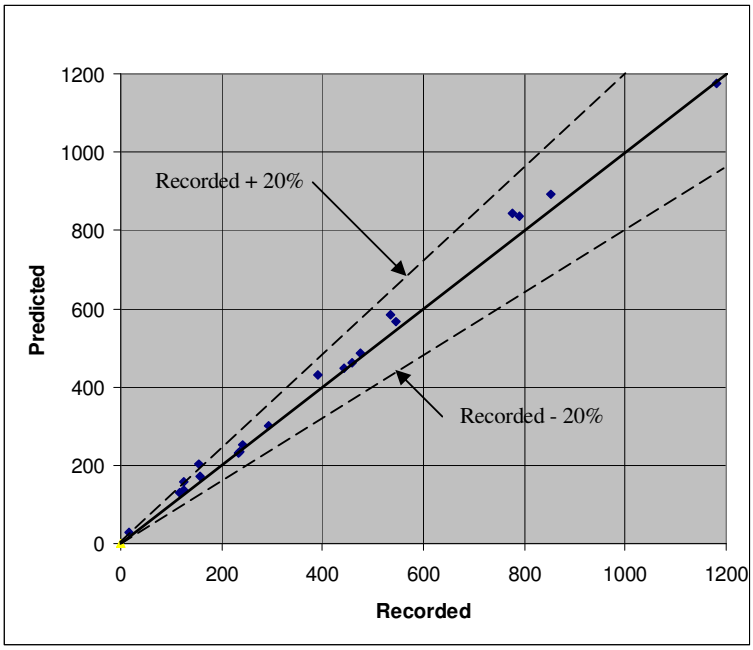


Figure 48 Independence Level "Alone" - To School - Predicted vs Recorded - School Level

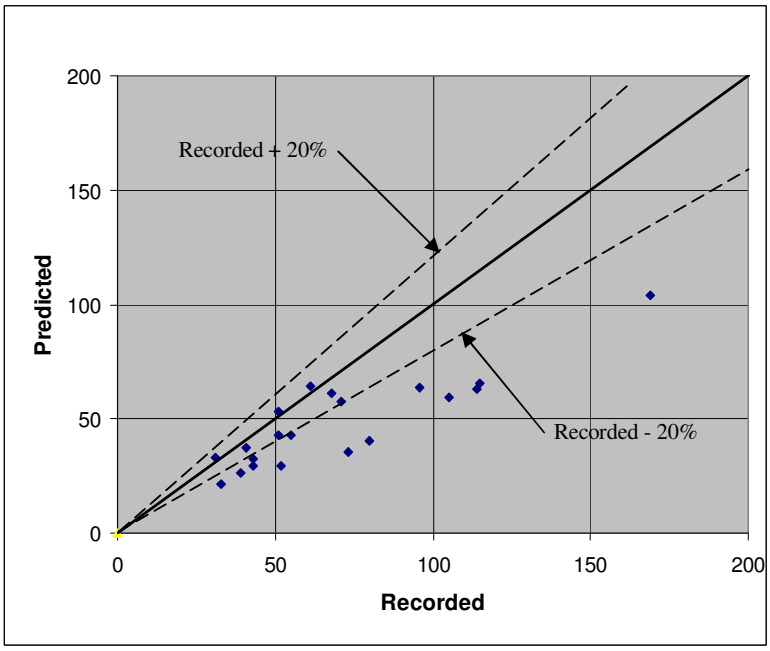


Figure 49 Independence Level "With Adult" - From School - Predicted vs Recorded - School Level

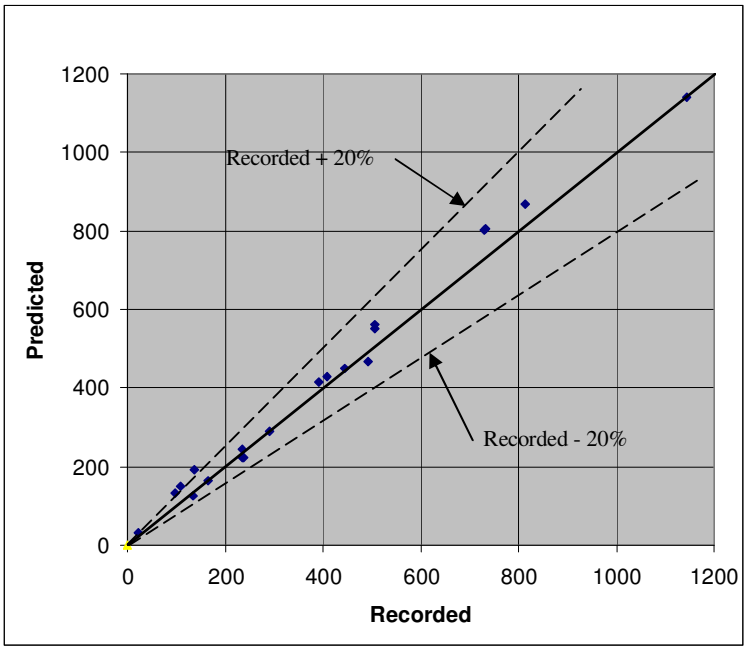
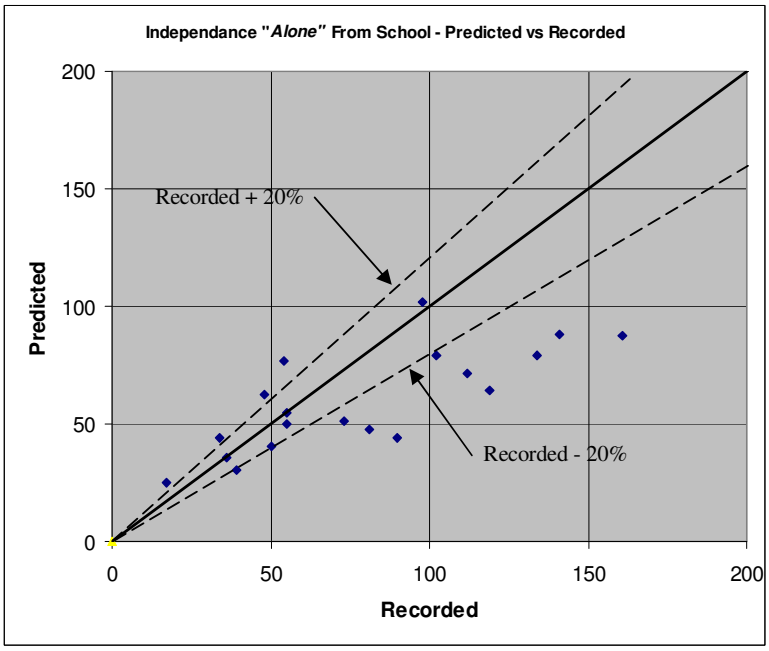


Figure 50 Independence Level"Alone" - From School - Predicted vs Recorded - School Level



6.2.2.2.1 Model Parameter Assessment

6.2.2.2.1.1 School Roll

The school roll multiplier for travel *"Alone"* is a negative value for both the trip to and from school. This indicates that as school rolls rise, the likelihood of pupils travelling independently decreases. Typically schools with larger rolls tend to have longer typical travel distances than schools with smaller rolls. This would tend to mean that more car travel is likely to be associated with larger rolls. In order to travel by car a primary school pupil must be driven by an adult.

Parents are more likely to let their children travel short distances independently than they are long distances. The longer the travel distance, the greater the possibility of encountering some hazard in the journey.

The t Test value for both the trip to, and the trip from school are similar. The magnitude for the trip to school (-10.2) is slightly larger than for the trip from school (-8.3). This suggests that the school roll and the associated distance to travel is more significant in the morning than in the afternoon. This is consistent with both the higher car usage recorded for the journey to school than for the journey home, and with greater time constraints for families in the morning than in the afternoon.

There was a clear negative correlation between School Roll and independent travel revealed in the case study (Chapter 5, Section 5.6.1.2). This is consistent with a negative School Roll multiplier and significant t Test values.

6.2.2.2.1.2 Average Age

The Average Age multiplier is positive for both the trip to and from school. This multiplier is for travel *"Alone"*, and suggests that increasing pupil age is accompanied by increasing levels of independence. This is consistent with children being given greater responsibility as they mature.

The t Test values of 28.3 and 30.4 for the trip to and from school respectively suggest that pupils age plays a slightly less of a roll in the degree of travel independence in the morning than in the afternoon. As noted in section 6.2.1.3, time constraints tend to be more prevalent in the mornings than in the afternoons. It is therefore more likely that parents will drop their children at school on their way to work. There is also more of a likelihood of older children travelling home independently, before either parent gets home from work.

A clear positive relationship was shown between age and the use of other modes in the case study. (Chapter 5, Section 5.8.1.2). This is consistent with the positive Age multiplier and very significant t Test values estimated in the model.

6.3 Model Limitations

The models were developed from data from a number of urban Christchurch schools. Their appropriateness in other environments has not been tested.

It is likely that travel patterns to schools in a rural environment will be significantly different to those in an urban environment. Families of pupils attending rural schools tend to be more scattered than for urban schools, and so travel distances are greater. This results in a greater reliance on car travel and school buses. These models are unlikely to be applicable to schools with a rural catchment.

One distinctive feature of Christchurch when compared to other New Zealand urban areas is its flat topography. This may make walking, cycling, and scootering more attractive options for school trips in Christchurch than in other locations. These models may require modification to be applicable to schools in locations with different topography.

Waimairi School has had a School Travel Plan in place for two years. The travel choices at Waimairi School changed significantly since the implementation of the Travel Plan. Refer Chapter 5, Section 5.9 for a discussion on the travel choices of Waimairi School. The Waimairi School results were omitted from the data used to develop the models. These models may require modification for use in schools which have a School Travel Plan in place.

It is therefore recommended that further research and model development is carried out at rural schools. It is also recommended that verification of the models is carried out for use in schools in different urban locations, and at schools with School Travel Plans in place.

6.4 Summary

Separate Multinomial Logit Models have been developed for school travel mode choice and degree of independence for trips to and from school at both a broad school level, and at an individual family level.

Data from over 20,000 school trips in the urban Christchurch area was used to develop the models. Results from a school which has implemented a School Travel Plan suggest that Travel Plans can make a significant difference to travel behaviour.

These models are applicable to schools in the urban Christchurch area, but it is recommended that further research is carried out into travel behaviour at rural schools and that the models be verified for use in schools in other urban areas, and schools with Travel Plans.

Chapter 7

CONCLUSIONS AND RECOMMENDATIONS

7.1 Introduction

The travel behaviour of New Zealand primary school pupils has changed significantly in recent decades. The proportion of children being driven to school has increased from 34% in 1989 to approximately 60% of school pupils in 2003. This trend is similar to trends which have been observed in countries such as Australia, the United Kingdom, Canada, and the United States.

This has been accompanied by a reduction in the numbers of children who travel independently (that is without an adult). Some reduction in independent travel can be attributed to the increase in car travel. However, of those children who walk, cycle or scooter, there appears to be an increase in the proportion of pupils who travel with an adult. The reduction in independent travel also reflects a trend in Western societies towards much greater levels of supervision and oversight of all aspects of children's activities.

7.2 Achievement of Objectives

The purpose of this study was identified as exploring the factors contributing to primary school pupils' travel choices with a view to helping to identify travel choice patterns. This, in turn, was identified as having the potential to be useful in developing policies and planning initiatives which contribute to achieving an efficient and sustainable transport system.

In particular the study proposed to address two questions, namely:

1. What modes do primary school pupils use for their trips to and from school? and

2. What are the factors influencing their mode choice?

The first question has definitely been answered. The mode choices for 20,000 trips by 2,300 Christchurch primary school pupils have been identified, collated and analysed.

The second question has been answered in part. A number of factors have been identified as having an effect on primary school pupil travel choices. These are listed in Section 7.3.1.

The surveys for the case study were designed to achieve a large sample size of responses in preference to a large amount of data from each respondent. The large response rate indicates that this has been achieved. However, it has meant that some factors which potentially may have an influence on children's travel choices have not been addressed. For example, no information was obtained on the following:

- The number of adults in the home;
- The employment status, or occupation, of those adults;
- The distance between home and work for the adults; or
- The availability of Public Transport for the adults' trip to work.

It was considered that seeking this information would reduce the sample size due to the increased time required to complete the questionnaire. It was also felt that seeking some of this information may be considered a little intrusive.

Even disregarding those additional factors, there is a complex interrelationship between the factors which have been identified. This complex interrelationship between factors has resulted in some instances where normally accepted "Rules of Thumb" do not appear to be applicable to school travel. For example, there is an axiom in transportation that increasing wealth results in increasing car usage. That does not appear to necessarily be the case when considering primary school travel.

The complexity of interrelationships has further meant that it has not been possible to quantify the impact of any one factor on its own.

7.3 Findings

A number of conclusions regarding the travel choices of primary school pupils have been reached as a result of this study. These are outlined below:

7.3.1 Factors Influencing Travel Choices

None of the factors which influence primary school travel choices operate in isolation. Instead, there is a complex interaction between the factors when making family travel decisions. The complexity of each family's travel decisions makes it difficult to accurately quantify the impact of each variable factor on those decisions, particularly at an individual family level.

A number of factors which have a significant impact on the travel choices of primary school pupils have been identified in this study, and are listed below. As noted in Section 7.2, however, there are a number of other factors which may affect a family's overall travel choices which have not been addressed in this study.

7.3.1.1 Safety Concerns

Parents rank road safety and personal safety as the two most important factors in their decisions regarding school travel choice. Children are particularly vulnerable in environments with heavy traffic volumes. Their small size, when compared to both vehicles and adults, makes children less visible to drivers. Children also often lack the cognitive skills required to make safe decisions regarding vehicle speeds and distances. Increases in traffic volumes have resulted in an overall reduction in the safety levels of children travelling to and from school.

As noted in Section 7.1, above there is an increasing level of concern on the part of parents regarding the personal safety of their children.

These safety concerns mean that parents are often reluctant to let their children travel on their own, and feel that is necessary to accompany them.

7.3.1.1.1 Personal Safety

Personal safety issues have been addressed in this study by including the extent to which the pedestrian environment contributed to personal safety in the Pedestrian Rating section of the neighbourhood survey. As noted in Section 7.3.1.6, no obvious correlation between pedestrian environment and school travel choices was evident in the case study.

7.3.1.1.2 Road Safety

Road safety issues were addressed in the case study and modelling by considering the number of major roads to cross as a separate variable. The number of potential vehicle conflict points was also included in the pedestrian rating.

As noted in Section 7.3.1.3, the number of major roads between home and school increases the likelihood that a child will travel to and from school by car.

7.3.1.2 Time

The daily travel requirements of families can be very complex. They often involve two adults and a number of children needing to get to and from different work places, schools, child care facilities, and other activities. The additional pressure parents feel to accompany their children at all times also results in increasing time pressures.

The time constraints of the activities, including travel to and from, that a family is involved in often mean that car travel is the only travel alternative that will enable every thing to be fitted in.

7.3.1.3 Major Roads to Cross

The number of major roads a child needs to cross on the trip to school has a significant impact the mode choice for that child. Both the case study and model results indicate that a child with no major roads to cross is much less likely to be taken to and from school by car than one with major roads to cross For households located between 0.5 and 1.0km

from school, car usage increases from 51% with no major roads to cross to 67% with two major roads to cross. This is consistent with the concern parents indicated for their safety of their children.

Furthermore, the case study results suggest that a parent who is accompanying a child to school is more likely to take the car if there is a major road to cross than if there isn't. This suggests that parents may be concerned about their own ability to cross some major roads safely or in a reasonable time frame.

7.3.1.4 Distance from School

As expected, both case study and model results indicate that increased distance from school increases the likelihood of car travel to and from school. 22% of pupils who live less than 0.5km from school travelled by car, compared to 70% of those who live more than 1.0km from school.

7.3.1.5 School Roll

The size of a school has some influence on the proportion of pupils who travel by car. Large schools have a greater proportion of pupils further away than small schools. As noted above, increasing distance from school increases the likelihood of car travel. As a consequence large schools tend to have a greater proportion of pupils travelling by car.

7.3.1.6 Quality of Pedestrian Environment

This research indicates that, safety aspects excluded, the quality of the pedestrian environment has little impact on the travel choices of primary school pupils.

However, as noted in Section 7.3.1.3, safety aspects, and in particular, the number of major roads pupils are required to cross between school and home do have an impact on travel choices.

7.3.1.7 School Travel Plan

Some of the literature considered in the literature review indicated that the impacts of school travel plans were quite variable from school to school. School Travel Plans were not specifically considered in the case study or modelling. However, the case study results for Waimairi School indicated that the School Travel Plan had had a significant impact on travel at that school.

Waimairi School implemented a school travel plan, including employing a part time Travel Plan co-ordinator in 2005. Trips by car to the school have reduced from 52% to 32% of total since the inception of the school Travel Plan. This suggests that the implementation of a School Travel Plan, when combined with a person with the enthusiasm, energy and time to promote the Travel plan, can have significant impacts on school travel patterns.

7.3.1.8 Proximity to Major Employment Centres

Roydvale and Ilam Schools were located close to major employment centres (William Pickering Drive / Sheffield Crescent Business area, and Canterbury University). Both of these schools had a greater proportion of pupils who live further away than comparable schools. This suggests that some parents choose these schools for their children because they were close to their place of work or study.

However, only Roydvale School showed a greater proportion of trips by car. This may be due to the fact that a number of parents of pupils at Ilam School are students at the university.

There is some evidence to suggest that there may be a correlation between proximity to employment and school travel mode choice. However, this was not conclusively shown at these two schools.

7.3.1.9 School Decile Rating

The relationship between car trips to school and the school decile rating was not as clear as expected. It was anticipated that the increasing income levels and wealth associated with higher decile schools would result in greater levels of car usage at those schools. This was not the case.

The case study found reduced levels of car usage at schools at either extreme of the decile groups, with variable levels at schools in the middle. The modelling produced a slight positive multiplier for Decile Rating for "other" modes, indicating that other modes increase and car usage decreases with higher decile ratings.

This relationship may be influenced by the likelihood that parents at high decile schools will have more flexible working arrangements than those at medium and low decile schools. There may also be some two parent families with a large single income at high decile schools. The non working parent in these families is likely to have more time available to accompany their child(ren) to and from school than a working parent.

7.3.1.10 Summary

Crossing of major roads, distance from school and school roll size play significant roles in school travel choices. It is, therefore, considered valuable that these factors be considered when making decisions regarding school size and location if goals of sustainable transportation are to be reached.

7.3.2 School & Neighbourhood Infrastructure

During the course of the case study the transportation infrastructure at and near to a number of primary schools was surveyed and observed. Commenting on infrastructure near to primary schools was not one of the original objectives of this study, but it is considered valuable to record briefly some of the findings arising from the observations at schools. These are listed below, in no particular order:

1. Many of the schools surveyed, and their surrounding infrastructure were built when car usage made up a much smaller proportion of trips to school than it does today. In many cases, the school entrance and surrounding roads struggle to cope with the volume of vehicles arriving, turning, and leaving at school start and finish times. The potential for conflict between vehicles and pedestrians, particularly children can be high in these situations;

2. Pedestrian and cycle facilities are often let down by one or two poor details, such as sumps at crossing points;

3. Pedestrian and cycle facilities are often "squeezed" when roads are widened and upgraded. This can result in barely adequate width for pedestrians to pass. Large numbers of pedestrians are present near to school (including those walking to or from a parked car). If the facilities are squeezed in these locations, then pedestrians, including children, may need to step onto the road to pass one another; and

4. At intersections pedestrians need to cross near to the intersection. Visibility of vehicles travelling parallel with the pedestrian movement, and then turning left across it is often restricted by fences and hedges if the footpath is located adjacent to the boundary.

7.3.3 Modelling

The results estimated by the Multinomial Logit Model for mode choice at an aggregated school level were acceptable. The variables considered at this level were Decile, Average Age and School Roll.

Superior results were obtained at a disaggregated individual level, using the variables of Age of Youngest, Number of Children at the school from that home, Decile Rating, Major Roads to Cross, Major Roads per km, Pedestrian Distance, Pedestrian Rating, School Roll and Road Distance. If using the model to estimate the mode choices of pupils at an

individual school, it is not considered the effort required to obtain information on these variables is justified. Furthermore, since many of these variables are specific to each family at a given point in time, it is likely that many of them will change from year to year.

It is therefore recommended that a model using the variables of Decile, Average Age, and School Roll be used to estimate mode choices at an individual school.

7.3.4 Looking Forward

This study is a snapshot of school travel choices in Christchurch in 2007. There are likely to be a number of significant world wide political, social, and economic developments which could have major impacts on travel choices generally, including school travel.

These developments could include the following:

- Significant fuel price increases resulting from increasing demand and dwindling supply;
- Increased pressure (political, social and economic) to act "sustainably";
- A political and social reluctance to "build our way out of congestion"; and
- Growing concerns about carbon emissions and climate change.

These developments and other unforeseen developments of similar moment are likely to result in a very different travel "climate" in the future than what we experience in 2008.

7.4 Recommendations

The recommendations arising from this research fall into two broad categories, namely recommendations regarding further research, and those regarding school planning.

7.4.1 Further Research

The following recommendations are made regarding further research into school travel behaviour:

1. That further research is carried out into travel choices at rural schools. The purpose of such a study would be to determine what impacts a more geographically scattered, but possibly socially close knit community have on school travel choices.

2. That surveys are carried out at schools in other New Zealand urban areas to determine if the findings of this research are applicable elsewhere. The surveys to include the following phases:

    a. A case study of school travel choices involving a good cross section of schools and urban environments, and similar to that carried out for this study. The influencing variables to be considered and identified to include Age of Youngest, Number of Children at the school from that home, Decile Rating, Major Roads to Cross, Major Roads per km, Pedestrian Distance, Pedestrian Rating, School Roll and Road Distance. The impact of topography on school travel choices could be assessed by including it in case studies in environments where it is variable; and

    b. A Multinomial Logit Model of school mode choices be estimated using the variables above, and compared with the model produced for this study.

3. That changes in school travel choices be monitored over time by carrying out simplified pupil travel choice surveys at five yearly intervals. The data from these surveys could then be compared with the results from this study.

4. That if significant changes in school travel choices are observed, then more comprehensive surveying and modelling be carried out. The surveying and modelling to include variables of Age of Youngest, Number of Children at the school from that home, Decile Rating, Major Roads to Cross, Major Roads per km, Pedestrian Distance, Pedestrian Rating, School Roll and Road Distance.

5. That further research is carried out into the school travel impacts of schools located close to major employment sources, in order to determine if locating some schools close to employment centres may have transportation advantages when compared to locating all schools in residential areas.

7.4.1.1 School and Local Planning

In order to improve sustainability and increase the mode of active modes of school travel, the following recommendations are made regarding the planning of new and existing school facilities, and surrounding neighbourhoods:

1. That transportation issues are considered early in the process of deciding on school location and size. The issues considered could include:

    a. The geographic size of the school catchment, and the proportion of pupils likely to live within comfortable walking distance.

    b. The level of pedestrian connectivity in the neighbourhood immediately surrounding the school.

    c. The proportion of pupils who will need to cross major roads to access the school.

   d. The ability to provide safe pedestrian and vehicle access at the school gates.

2. That transportation issues are considered when decisions regarding rationalisation or amalgamation of schools are being made. In addition to the issues mentioned above, specific issues to be addressed could include:

   a. The impacts on families if their children have to travel further to school. These include time and economic impacts.

   b. The ability of families from very low decile schools to pay to travel by car or to travel further.

3. That the economic impact of transportation for the entire life of the school be given as much weight as the initial purchase price of school properties.

7.4.1.2 Transportation Infrastructure at and near Schools

The following recommendations are made regarding the planning and design of transportation infrastructure at or near schools:

1. That counts be carried out to identify the numbers pedestrians and cyclists (including, young pedestrians and cyclists) likely to be using the facility. Counts should particularly identify peak numbers at school start and finish times.

2. That sufficient footpath and cycle width be provided to cope with the peak pedestrian and cyclist numbers.

3. That sufficient visibility, be provided at road crossing points near to schools. Children's small size, and lack of cognitive skills should specifically be addressed when considering visibility and stopping distances near to schools

4. That parking which minimises the need for vehicles to turn or reverse in the vicinity to school pupils be provided near schools.

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Appendix A

Parents Survey Form

Travel Survey Abc School

Abc School

Dear Parent or Caregiver at Abc School,

As part of my master's degree in transportation, I am researching the methods primary school pupils travel to and from school. The results of this research will be used to help assess the numbers of vehicles traveling to and from schools. It will also be used to help assess the factors which have an effect on the method school pupils travel to and from school. This information can then be used to help provide facilities in schools and surrounding areas which make the trip to and from school safer and healthier.

I am surveying staff, pupils, and parents from 20 primary schools around Christchurch, including Abc School.

No personal or individual information supplied for this survey will be made available to any other person or organisation.

Please take a few moments to complete this questionnaire, and return it to Abc School

If you have any comments or questions about this project, please do not hesitate to contact me.

Yours Sincerely,

Bill
Senior Transportation Engineer
Opus International Consultants
PO Box 1482, Christchurch
Ph 03 363 5491
Email Bill.Rice@opus.co.nz

Travel Survey Abc School

Please Tick the appropriate boxes

Household

1) Please indicate the approximate location of your home on the map below.

Map Provided by Wises maps

If the location of your home is not shown on the map, please write the name of your street below:

……..

2) How many Primary School aged children live in your home?

☐ **1** ☐ **2** ☐ **3** ☐ **4** ☐ **5** ☐ **6 or more**

3) How many Primary School aged children attend Abc school?

☐ **1** ☐ **2** ☐ **3** ☐ **4** ☐ **5** ☐ **6 or more**

4) Please indicate the ages of each of the Abc school pupils in your home

☐ **5** ☐ **6** ☐ **7** ☐ **8** ☐ **9** ☐ **10** ☐ **11 +**

5) How many cars are available for day to day use in your home?

☐ **0** ☐ **1** ☐ **2** ☐ **3 or more**

Travel Survey Abc School

School Pupil Travel Choices

Please indicate on the table below, how each of the Abc School pupils in your home travel to and from school in a typical week.

In the example column below two pupils got dropped off at school on the way to work, one caught a bus home, and one walked home with other pupils.

		Example		Mon		Tues		Wed		Thurs		Fri	
		To	From	To	From	To	From	To	From	To	From	To	From
Car	As part of another trip (eg to or from work)	2											
	As a special trip to school												
Bus	On a dedicated school bus												
	On a scheduled public bus service		1										
Bike	With a parent or caregiver												
	With other school pupils												
	Alone												
Scooter	With a parent or caregiver												
	With other school pupils												
	Alone												
Walking	With a parent or caregiver												
	In an organised group (eg walking school bus)												
	With other school pupils		1										
	Alone												

Travel Survey Abc School

Factors Influencing Travel Choices

Please indicate the importance you place on the following factors when deciding how your children travel to school. 0 indicates that the factor is not important at all. 5 indicates that the factor is of critical importance.

Not Important **Very Important**

	0	1	2	3	4	5
Distance to school						
Weather Conditions						
Convenience						
Safety – "Stranger Danger"						
Safety – Road safety						
Cost						
Exercise is healthy						
Condition of footpaths						
Pleasant walking or cycling environment						
Other Factors (Please List)						

If you would be willing to be interviewed about the travel choices of your family, please tick here ☐, and write your contact details below

Name…….

Address…….

Telephone Number…….

Email address…….

Appendix B

Pupils Survey Form

School Travel Survey

Abc School

Please circle the ways you got to and from school this week

On **Monday** of this week I came to school by


Car


Bus


Bike


Scooter


Walking.

On **Monday** of this week I went home by


Car


Bus


Bike


Scooter


Walking.

On **Tuesday** of this week I came to school by


Car


Bus


Bike


Scooter


Walking.

On **Tuesday** of this week I went home by


Car


Bus


Bike


Scooter


Walking.

On **Wednesday** of this week I came to school by


Car


Bus


Bike


Scooter


Walking.

On **Wednesday** of this week I went home by


Car


Bus


Bike


Scooter


Walking.

Travel Survey Abc School

On **Thursday** of this week I came to school by

Car Bus Bike Scooter Walking.

On **Thursday** of this week I went home by

Car Bus Bike Scooter Walking.

On **Friday** of this week I came to school by

Car Bus Bike Scooter Walking.

On **Friday** of this week I went home by

Car Bus Bike Scooter Walking.

If I could choose, the way of getting to school I like best is by

Car Bus Bike Scooter Walking.

If I could choose, the way of getting home I like best is by

Car Bus Bike Scooter Walking.

I am ……. years old.

Appendix C

School Decile Rating System

How The Decile Is Calculated

Summary: Information on the method the Ministry of Education uses to calculate school deciles.

Last update: 19-Sep-2006

Contents

A school's decile indicates the extent to which the school draws its students from low socio-economic communities. Decile 1 schools are the 10% of schools with the highest proportion of students from low socio-economic communities, whereas decile 10 schools are the 10% of schools with the lowest proportion of these students. A school's decile does not indicate the overall socio-economic mix of the school.

Census information is used to calculate the decile. A school provides either all or a random sample[1] of its student addresses and these are used to determine which areas its students come from.

The student addresses are assigned to small Census areas called meshblocks. A meshblock contains around 50 households. However, only Census information for household with school-aged children is used. The number and percentage of students from each meshblock is determined and the meshblock is examined against five socio-economic factors.

Note: It is not the general area around the school that is used to calculate the decile, but the specific meshblocks where students live.

The five factors that make up the socio-economic indicator:

1. **household income** - the percentage of households with equivalent income (i.e. adjusted for the number of adults and children in the household and the age of the children) in the lowest 20% nationally. Households with a member who is employed are usually not included in this group nor are all households supported by a benefit (since more than 20% of families are dependent on a benefit).
2. **occupation** - the percentage of employed parents in the lowest skilled occupational groups

i.e. elementary occupations (e.g. labourers) and machine operators and assemblers.
3. **household crowding** - the number of people in the household divided by the number of bedrooms.
4. **educational qualifications** - the percentage of parents with no tertiary or school qualifications.
5. **income support** - the percentage of parents who directly (i.e. not as a partner) received a Domestic Purposes Benefit, Unemployment Benefit or Sickness and Invalid's Benefit in the previous year. This does not include parents receiving Family Support.

Census information is used to calculate these factors for each meshblock. The Ministry does not have access to the individual Census information, only the information for the meshblock as a whole.

The five census factors are weighted by the number of students from each meshblock. This means that meshblocks where only a few of a school's students live will have little impact on its decile.

Schools are ranked in relation to every other school for each of the five factors and receive a score according to the percentile that they fall into. The five scores for each school are added together (without any weightings) to give a total. This total gives the overall standing of a school in relation to all other schools in the country.

Schools are then divided into 10 even groups called deciles.

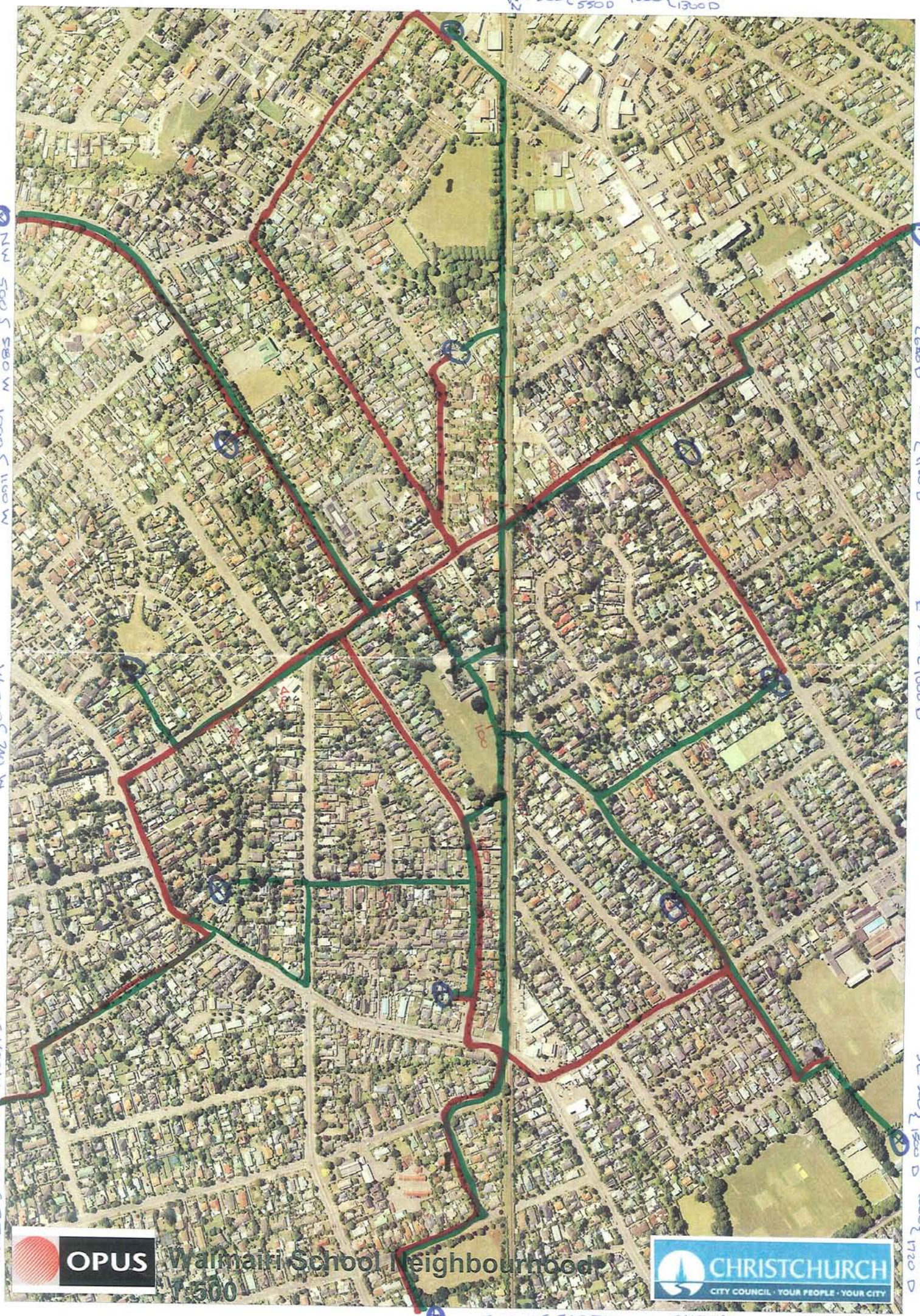
Where to find an individual school's decile

A list of schools with their deciles as well as their contact details is available as a downloadable spreadsheet on Directory of Educational Institutions (web address: www.minedu.govt.nz\goto\directory)

1 Schools with 120 students or less supplied the whole roll, schools with 121-179 students supplied half of the roll and schools with 180 students or more supplied a third of the roll.

Appendix D

Sample Neighbourhood Accessibility Assessment


N 500 { 600 W 550 D 1000 { 1090 W 1300 D
NW 500 { 580 W 580 D 1000 { 1160 W 1160 D
NE 500 { 640 D 1000 { 1160 D
W 500 { 740 W 740 D
E 500 { 1000 D
SW 500 { 750 W 750 D 1000 { 1480 W 1600 D
SE 500 { 820 W 1500 D 1000 { 1680 W 1720 D
S 500 { 540 W 900 D 1000 { 1180 W 1600 D
OPUS
Waimairi School Neighbourhood
1:500
CHRISTCHURCH
CITY COUNCIL · YOUR PEOPLE · YOUR CITY

Appendix E

Pedestrian Rating Survey Form (Gallin)

Category	Factor	Weight	0 points	1 point	2 points	3 points	4 points
Design Factors (Physical Characteristics)	Path Width	4	No pedestrian path	0-1m	1.1 - 1.5m	1.6 - 2.0m	more than 2m wide
	Surface Quality	5	unsealed and/or many cracks/bumps, ie very poor quality	poor quality	moderate quality, i.e. some cracks/bumps etc.	reasonable quality, ie acceptable standard	excellent quality (continuous surface with very few bumps/cracks etc)
	Obstructions	3	more that 21 obstructions per km	between 11 and 20 obstructions per km	between 5 and 10 obstructions per km	between 1 and 4 obstructions per km	no obstructions
	Crossing Opportunities	4	none provided, difficult to cross	some provided but poorly located	some provided and are reasonably well located but more are needed	adequate crossing facilities are provided and are reasonably well located OR none are provided as they are unnecessary	dedicated pedestrian crossing facilities are provided at adequate frequency
	Support Facilities	2	non existent	few provided and poorly located	few provided and reasonably well located	several provided and well located OR absent but unnecessary	many provided and well located
Location Factors	Connectivity	4	non existent	poor	reasonable	good	excellent
	Path Environment	2	unpleasant environment, close to vehicular traffic	poor environment, may be within 1m of kerb	acceptable environment, between 1 and 2m of kerb	reasonable environment, between 2 and 3m from kerb	pleasant environment, pedestrians more than 3m from kerb
	Potential for Vehicle Conflict	3	severe, more than 25 conflict points per kilometre	poor situation, between 16 and 25 conflict points per km	moderate, ie 10 to 15 potential vehicle conflict points per km	reasonable, 1 to 10 or less conflict points per km	no vehicle conflict opportunities
User Factors	Pedestrian Volume	3	More than 350 per day	226 to 350 per day	151 to 225 per day	81 to 150 per day	Less than 80 per day
	Mix of Path Users	4	majority of path users are non-pedestrians	approx 51% to 70% of path users are non-pedestrians	between 21% and 50% non-pedestrian path users	less than 20% non-pedestrians	pedestrians only
	Personal Security	4	unsafe	poor	reasonable	good	excellent security provided

Appendix F

Pedestrian Rating Survey Form (As Used)

Walkability Assessment

School:_____ Sector:_____ Date:_____ Weather:_____

Category	0-100	100-200	200-300	300-400	400-500	500-600	600-700	700-800	800-900	900-1000
Width										
Surface Quality										
Obstructions										
Crossing Opportunities										
Support Facilities										
Path Environment										
Conflict Points										
Personal Security										

Appendix G

Overall Results

Overall Mode Choice

	To														From													
	Car Trip Chain	Car Special Trip	Bus School	Bus Public	Bike Parent	Bike Pupils	Bike Alone	Scooter Parent	Scooter Pupils	Scooter Alone	Walk Parent	Walk Organised	Walk Pupils	Walk Alone	Car Trip Chain	Car Special Trip	Bus School	Bus Public	Bike Parent	Bike Pupils	Bike Alone	Scooter Parent	Scooter Pupils	Scooter Alone	Walk Parent	Walk Organised	Walk Pupils	Walk Alone
Mon	836	381	8	15	61	27	46	49	7.5	8.5	369	24	95	106	650	458	23	23	56	27	53	42	7.5	5.5	404	23	137	120
	1217		**23**		**134**			**65**			**593**				**1108**		**46**		**136**			**55**			**683**			
Pupils per veh or grp	**1.38**		**1.18**		**1.17**			**1.20**			**1.43**				**1.39**		**1.38**		**1.16**			**1.20**			**1.41**			
Percent	41	19	0.4	0.7	3	1.3	2.3	2.6	0.4	0.4	18	1.2	4.7	5.2	32	23	1.1	1.1	2.8	1.3	2.6	2	0.4	0.3	20	1.1	6.8	5.9
Percent	**60**		**1**		**7**			**3**			**29**				**55**		**2**		**7**			**3**			**34**			
Tue	828	370	8	17	62	24	54	55	12	6.5	380	22	94	99	678	470	20	21	57	25	56	39	11	6.5	382	20	120	116
	1198		**25**		**140**			**73**			**594**				**1148**		**41**		**138**			**56**			**637**			
Pupils per veh or grp	**1.38**		**1.18**		**1.17**			**1.20**			**1.43**				**1.39**		**1.38**		**1.16**			**1.20**			**1.41**			
Percent	41	18	0.4	0.8	3.1	1.2	2.7	2.8	0.6	0.3	19	1.1	4.6	4.9	34	23	1	1	2.8	1.2	2.8	1.9	0.5	0.3	19	1	5.9	5.7
Percent	**59**		**1**		**7**			**4**			**29**				**57**		**2**		**7**			**3**			**32**			
Wed	799	356	8	21	77	24	49	57	11	11	372	33	109	98	631	458	18	27	69	29	53	41	9.5	8.5	409	26	133	112
	1155		**29**		**150**			**78**			**612**				**1089**		**45**		**151**			**59**			**679**			
Pupils per veh or grp	**1.38**		**1.18**		**1.17**			**1.20**			**1.43**				**1.39**		**1.38**		**1.16**			**1.20**			**1.41**			
Percent	39	18	0.4	1	3.8	1.2	2.4	2.9	0.5	0.5	18	1.6	5.4	4.8	31	23	0.9	1.3	3.4	1.4	2.6	1.9	0.5	0.4	20	1.3	6.6	5.5
Percent	**57**		**1**		**7**			**4**			**30**				**54**		**2**		**7**			**3**			**34**			
Thu	820	374	8	17	59	24	50	45	9.5	6.5	369	25	105	115	664	453	25	25	52	28	52	36	6	5.5	395	21	142	116
	1193		**25**		**133**			**61**			**613**				**1117**		**50**		**132**			**48**			**673**			
Pupils per veh or grp	**1.38**		**1.18**		**1.17**			**1.20**			**1.43**				**1.39**		**1.38**		**1.16**			**1.20**			**1.41**			
Percent	40	18	0.4	0.8	2.9	1.2	2.5	2.3	0.5	0.3	18	1.2	5.2	5.7	33	22	1.2	1.2	2.6	1.4	2.6	1.8	0.3	0.3	20	1	7	5.7
Percent	**59**		**1**		**7**			**3**			**30**				**55**		**2**		**7**			**2**			**33**			
Fri	795	385	8	16	63	19	53	53	8.5	9	381	26	99	107	604	491	15	22	58	21	51	38	7	6	417	22	147	121
	1179		**24**		**135**			**71**			**613**				**1094**		**37**		**130**			**51**			**706**			
Pupils per veh or grp	**1.38**		**1.18**		**1.17**			**1.20**			**1.43**				**1.39**		**1.38**		**1.16**			**1.20**			**1.41**			
Percent	39	19	0.4	0.8	3.1	0.9	2.6	2.7	0.4	0.5	19	1.3	4.9	5.3	30	24	0.7	1.1	2.9	1	2.5	1.9	0.3	0.3	21	1.1	7.3	6
Percent	**58**		**1**		**7**			**4**			**30**				**54**		**2**		**6**			**3**			**35**			

Appendix H

Waimairi School Travel Plan

Waimairi School – School Travel Plan

Working Group

Philip Harding	Principal & representing Board of Trustees
Georgie Little	Teacher (senior syndicate)
Phillippa Barlow	Teacher (middle syndicate)
Maree Hyde	Chair PTA
Helen McIlhone	Parent & PTA member
Pamela Mercer	Parent & PTA member
Judy Williamson	Parent
Joy Kingsbury-Aitken	Christchurch City Council – Schools Co-ordinator, City Streets Unit
Snr Constable John Hodgen	Papanui Police
Robyn Wells	School Travel Plan Coordinator (& parent)

Acknowledgements

We appreciate the significant support given by the Energy Efficiency & Conservation Authority and the sponsorship of Christchurch City Council at both the plan development and implementation stages. We also thank Educating NZ Ltd for its willing involvement.

Michael Thomson, Cycling and Pedestrian Planner, City Streets Unit, Christchurch City Council provided us with valuable information on safety issues in the local area.

North Shore City Council officers involved in school travel planning generously shared their experiences.

The Waimairi School community willingly participated in the survey process, initiatives such as “walk to school” days and in the consultation opportunities.

Thanks to Dr Ken Hughey, Lincoln University for invaluable assistance with setting up the framework for the survey analysis and to parent Catherine Hurley for her help with writing the plan.

Waimairi School – Putting its best foot forward…

INTRODUCTION

The Waimairi Primary School Travel Plan project began in mid 2004, in response to parents concerns about safety issues and congestion at the school gate. A school travel plan aims to identify and address issues on how children travel to and from school in a comprehensive way. This can result in improved safety on the way to school and at the school gate, healthier and more active children, less pollution, a more pleasant environment and improved energy efficiency.

The Working Group identified the following objective for Waimairi Primary School:

To promote alternatives to car travel for journeys to and from school and to help reduce traffic congestion, while also addressing safety concerns.

The Waimairi Primary School Travel Plan process looked at the following issues:

- Safety: How to improve road safety for our children on the way to school.
- Chaos at the school gate: How to reduce traffic at the main school gate.
- Health and fitness: How to support parents to get their children to and from school other than by car (e.g. by supporting Walking School Buses).

The School Travel Plan is consistent with the school's Environmental Policy which states that the school will "encourage travel to school by non-car modes."

The project has involved extensive consultation with the school community, including the children, to identify current patterns of travel to and from school and key concerns on the safety of local roads. There has also been consultation with Tillman Ave residents.

WAIMAIRI PRIMARY SCHOOL

Waimairi Primary School is a Years 0 to 6 school situated at the end of a short, tree-lined cul-de-sac (Tillman Ave). The school has spacious grounds, and two alternative entrances through the main playing field. One of these entrances, for those on the town side of school, is via a steep, old railway overbridge.

Tillman Ave runs off a busy thoroughfare, Blighs Road, which links Papanui Road and Wairakei Road. A railway line and cycleway cross Blighs Road about 100 metres from the Tillman Ave intersection, on the Papanui Road side. Traffic lights operate at this point. There is a pedestrian crossing at the end of Tillman Ave, on the Wairakei Road side. Sunstrike can make it difficult for drivers to see the crossing.

Waimairi Primary School has experienced significant growth over the last few years, rising from 300 pupils in 2000 to the current grading roll of 436. In 2002 the school adopted a home zone in an effort to contain the school roll.

DEVELOPING THE SCHOOL TRAVEL PLAN

The Working Group was responsible for coordinating the school travel plan process. The following were key steps in the process.

- Discussion with parents and staff involved in school road patrol and previous Walking School Buses at Waimairi Primary School on key concerns.

- Completion of a questionnaire by children on how they travel to and from school and how they would prefer to travel.

- Completion of a questionnaire by parents to find out how children usually travel to and from school, if alternatives would be considered and to identify perceived unsafe areas on children's routes to school.

- Identification of safety issues on children's routes to school, by children and parents, by placing issue cards on a large scale map of the area. This exercise with parents was held on the same day as a Kiwisport Olympic Activity Day at the school.

- Development of a summary of current ways of travel to and from school, current issues and possible actions for consultation with the school community. Parents were encouraged to give feedback by placing green (agree) and red (disagree) stickers against the possible actions on a large display board at the senior school athletics day.

- Development of a more definite set of aims and actions for further consultation with parents, at meetings held in December 2004.

- A short questionnaire was also sent to Tillman Ave residents and a meeting held with them to explain the process and to identify their particular concerns.

Initiatives have occurred at the same time as developing the plan. Of particular success was the international "*iwalktoschool*" day, with almost no cars at the school gate on that day. This was followed by a successful six week Walking Wednesday challenge by the senior classes. The first Walking School Bus under the fledging travel plan has recently commenced, and will soon be joined by others. Waimairi Primary School has also entered the RoadSense programme this year.

SUMMARY OF RESULTS

The return rate for the parent survey was high (68%, 199 responses).

Usual and preferred ways of travelling to school

Table One shows how children usually travel to and from school. Approximately half the children usually travel to and from school by car[1]. The morning and afternoon figures are very similar with a slight increase in car use in afternoon travel. This is not unexpected, with children likely to be going on to after school activities outside the local area.

Table One: Usual way of travel to and from school

	Morning %	Afternoon %
Car	51.1	55.2
Walk	24.5	23.5
Scooter	17.5	14.9
Bike	3.6	3.7
Other	3.3	2.6
TOTAL	100.0[2]	100.0[3]

The most common reasons given for driving to school were:

- 30.3%: Convenience - on the way to/from work or somewhere else
- 19.7%: Distance between home and school is too far to walk or ride
- 12.6%: Too many dangerous roads between home and school
- 11.1%: Personal safety worries

Parents were asked if they would consider alternative modes of transport.

- 47.6% would consider carpooling.
- 44.9% would use a Walking School Bus.
- Nearly 40% of respondents believe 10 is the age at which it is safe to cycle alone or with another child.
- Key actions indicated by parents to allow their children to cycle to school ***under adult supervision***, in order of frequency, were: cycle safety training at school, more cycle paths, more safe places to cross the road, more cycle lanes, slower traffic, secure facilities at school and less traffic.
- 15% would never allow their children to cycle to school, even under adult supervision.
- 30% would use a school bus service

---

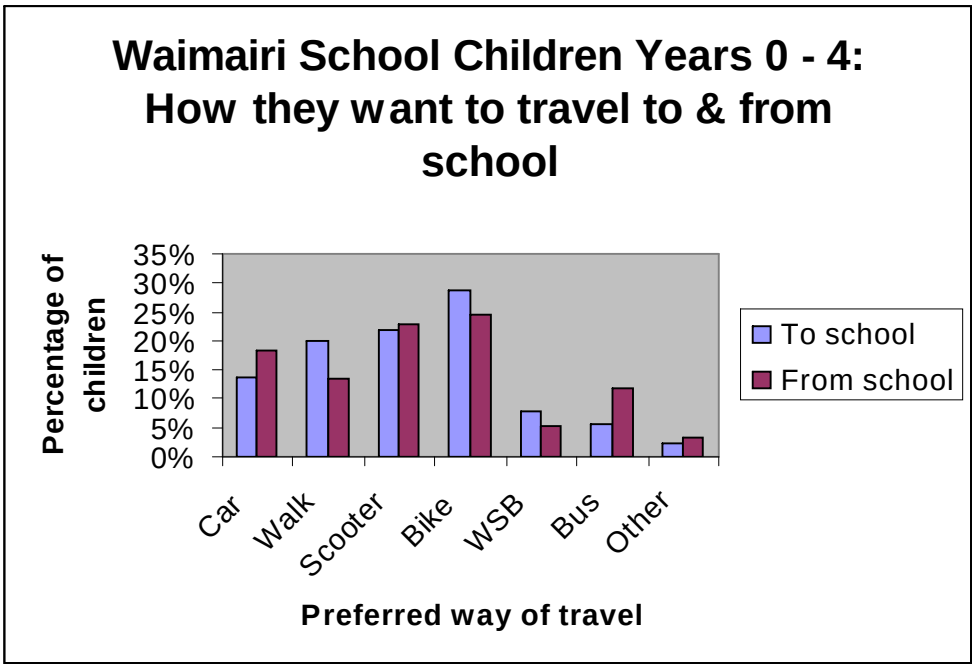
[1] Based on the parents' survey responses. The children's survey responses across all class levels suggest that this figure may be closer to 60%. For Years 0 - 4 the figure is even higher, at around 66%.

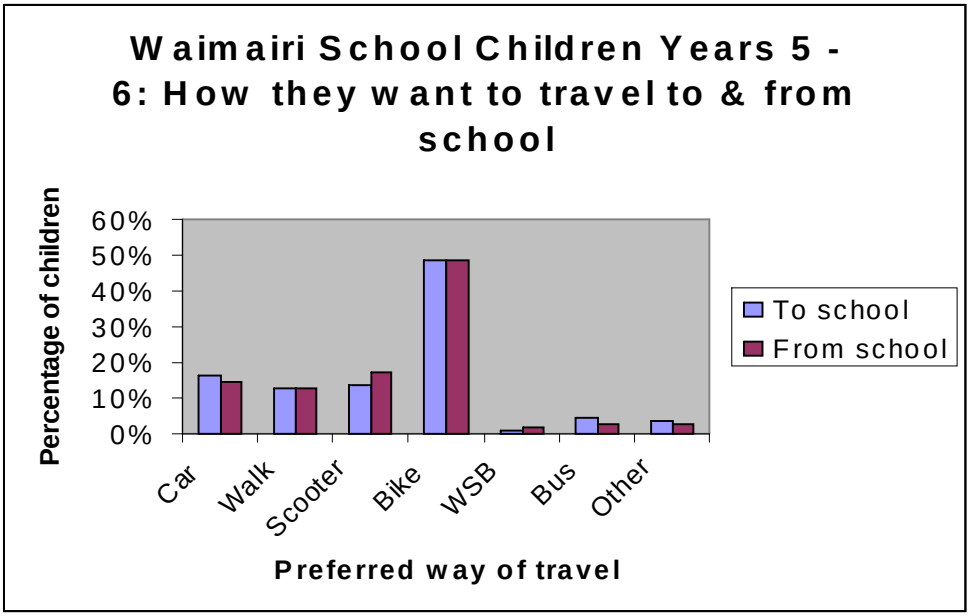
[2] Excludes 6 invalid responses

[3] Excludes 11 invalid or non-responses

Children at Waimairi Primary School were asked how they would like to travel to and from school. As illustrated in the following two figures, cycling is the preferred mode of travel. This is a clear preference for the older children (Years 5 to 6). Scooters are nearly as popular as bikes for the younger children (Years 0 to 4).

Ironically, cycling is likely to be the least preferred choice for parents, given the age of the children and concerns about safety. Police and Council guidance also suggest that cycling, unless accompanied by an adult, would not usually be appropriate until children are at least 10 years old and have sufficient road safety awareness and skills.





Safety issues identified

While 60% of respondents to the parents' survey considered their children's route to school safe or very safe, 21.5% considered it unsafe and a further 1.6% considered it very unsafe. The remaining respondents did not consider it either safe or unsafe.

Those with safety concerns were asked what would make the route safer. The most common responses were:

- 36.9%: More safe places to cross the road(s)
- 16.8%: Slower traffic
- 11.7%: Less traffic
- 8.9%: An adult available to walk or cycle with their child
- 8.4%: Less cars stopping or parking near the school main entrance

Nearly two-thirds of these respondents, together with a number of other parents, identified specific areas perceived to be unsafe. These included issues around Tillman Ave, the pedestrian crossing, Blighs Road and the Blighs Road/Condell Ave and the Blighs Road/Windermere Road intersections, Condell Ave, Windermere Road and Hartley Ave/Hawthorne Street. Parents also raised concerns about the railway overbridge and personal safety issues. The School Travel Plan addresses a number of the concerns. In addition Christchurch City Council has a full list of the concerns raised.

IMPLEMENTING THE PLAN

Waimairi Primary School and Christchurch City Council will jointly implement this plan, with support from Papanui Police on certain initiatives.

MONITORING THE PLAN

The School Travel Plan is a living document that needs to be continuously implemented and reviewed. A School Travel Plan Coordinator has been employed to oversee the initial implementation of the plan. A small committee, including school and Council representatives, will be set up to monitor the plan on an ongoing basis.

Repeating the parent survey on an annual basis will allow the monitoring committee to formally review the aims, objectives and targets and modify them where required. Any significant modifications will be discussed with the school community.

CONCLUSION

The Waimairi Primary School Travel Plan has been developed over a period of a year. It has involved in-depth consultation to identify the concerns of the school community on the safety of local roads and how to support parents to have a wider choice in how their children travel to and from school. The resulting set of actions is comprehensive and success in their implementation will depend on strong commitment by all stakeholders.

The project was a pilot project in Canterbury. We have learnt an enormous amount from the process and hope that our experience will help other schools who develop a

school travel plan. We are pleased to have had the opportunity to work with parents, staff, pupils, Council and the local police to identify a set of actions aimed at helping our children to get to and from school safely, while also contributing to a better environment, healthy families and a strong community.

WAIMAIRI PRIMARY SCHOOL TRAVEL PLAN - ACTIONS

Overall Objective

To promote alternatives to car travel for journeys to and from school and to help reduce traffic congestion, while also addressing safety concerns.

Important Notes on Safety:

We acknowledge that safety must be paramount and that perceived or real traffic danger may be a key factor in parents' decisions to drive their children to and from school rather than walking or cycling with them.

We do not have a view as a school on the appropriate ages for children to walk or scooter to school by themselves. It is the responsibility of individual parents/caregivers to make these decisions. However, we note the following with regard to cycling: NZ Police & Council advise that children under 10 are not generally considered safe to cycle unless accompanied by an adult. Parents/caregivers need to be confident that their children 10 and over are competent if cycling unaccompanied. As Waimairi Primary School is only Year 0 to Year 6, we expect that few children would fall into this category and that Waimairi Primary School children cycling will generally need to be accompanied by their parents/caregivers.

Notes:

1. *The actions are categorised under Aims, but there are overlaps between the Aims.*
2. *Sub-actions underlie the actions in the school travel plan. Ideas on actions and sub-actions are welcomed at all times from the school community.*
3. *CCC refers to Christchurch City Council.*
4. *Key stakeholders means those stakeholders who would have some responsibility for the particular action.*
5. *A number of actions will require consultation with relevant stakeholders.*

Waimairi Primary School Travel Plan

OBJECTIVES	ACTIONS	TIME FRAME	KEY STAKEHOLDERS
AIM 1: Reduce cars/congestion in Tillman Ave **Performance Measure: Reduction in cars in Tillman Ave at morning school time by 10% in the first year**[4]			
Raise and maintain awareness of issues relating to Tillman Ave, including: - *congestion* - *safety* - *driver behaviour*	Encourage no cars to enter Tillman Ave by providing information	Beginning of each school year and each term	School, School Travel Plan (STP) Coordinator
	Provide information about Tillman Ave to new families	Ongoing	School, STP Coordinator
	Translate information about Tillman Ave into Korean	February 2005	CCC
	Incorporate into RoadSense classroom activities	2006 onwards	Lead Teacher RoadSense & staff
	Conduct an incentives and enforcement programme	Initially one in 2005	CCC, NZ Police
	Introduce regular parking warden control	Initially once a term in 2005	CCC
Increase attractiveness and practicality of Tillman Ave as a pedestrian environment	Widen and upgrade footpaths on Tillman Ave and clearly link with the zebra crossing on Blighs Rd	At time of road upgrade - 2007/08	CCC in consultation with the school children, parents/caregivers, staff & local residents
Ongoing monitoring of Tillman Ave	Assess the need to investigate options to restrict car access to and/or parking in Tillman Ave	Regularly in 2005 then to be assessed	School road patrol children & staff, Principal, STP Coordinator,

[4] Based on traffic counts and observational data

OBJECTIVES	ACTIONS	TIME FRAME	KEY STAKEHOLDERS
			parents/caregivers
Encourage use of alternative entrances to school	Improve Westholme Street access by: - improving "school" signage - providing a clear path through the school grounds	- 2005/06 - 2006[5]	School, parents/ caregivers, CCC
	Investigate upgrading or replacing the railway overbridge on Hartley Avenue with either a new bridge or an underpass	2005[6]	School, CCC, (Toll Holdings)
	Provide information about other entrances to: - parents/caregivers - new families	Beginning of each school year and as required	School, STP Coordinator
AIM 2: Encourage healthy alternatives to car transport **Performance Measures:** **1. Reduction in car use as usual way of travel to and from school by 5% after one year[7]** **2. At least two Walking School Buses operating**			
Increase the number of children walking to school	Appoint a paid School Travel Plan Coordinator	Term 2 2005	School
	Establish a Walking School Bus scheme	Term 2 2005	Parents/caregivers, STP Coordinator, CCC, NZ Police
	Instigate safety measures for Walking School Buses: - Training for parents - Routes assessment - Police Education Officer checks route safety and	Prior to the launch of each bus and then as required	Parents/caregivers, STP Coordinator, CCC, NZ Police

[5] If funding available
[6] if replacement of the bridge was recommended it would probably need to be included in the 2006 Long Term Council Community Plan. The school would need to make a submission for this in 2005.
[7] Assessment of the success of reducing car use will be based on a combination of parents' surveys, children's surveys and observational data.

OBJECTIVES	ACTIONS	TIME FRAME	KEY STAKEHOLDERS
	walks with buses periodically		
	Recognise and support parents with children in Walking School Buses	Ongoing	School, CCC, STP Coordinator
	Regularly monitor the progress of the Walking School Buses	Once a term	STP Coordinator
Increase the number of children cycling and scootering to school	Provide secure bike sheds & scooter stands at school	2006[8]	School (maybe with outside funding), PTA
Promote walking, cycling & scootering to school	Hold regular promotions, e.g healthy lunch & bike/walk/ scooter to school day, staff challenge, participation in "*iwalktoschool*" events, certificates for WSB children, link with classroom activities	Ongoing	STP Coordinator, school, CCC, PTA
	Review school's website, prospectus, policies and newsletters to ensure they reflect a healthy school ethos with a commitment to walking/ cycling/scootering	2005	School, STP Coordinator
	Continue to participate in cycle safety training programmes	Annually	CCC, school
Investigate other practical alternatives to car transport	Approach commercial bus companies to check feasibility of changing route to accommodate children	2005	School, STP Coordinator
Involve children in ideas and decision-making on how they travel to and from school	**Children** participate in identifying ideas for promotions, incentives etc	Ongoing	Student Council, STP Coordinator
AIM 3: Reduce car use **Performance measure: refer to AIM 2.[9]**			
Promote and encourage car	Encourage parents/caregivers to car pool to:	At least once a	STP Coordinator,

[8] If funding available

[9] "Park & walking partway" was not specifically asked about in the surveys. It may, therefore, be difficult to measure changes in this.

OBJECTIVES	ACTIONS	TIME FRAME	KEY STAKEHOLDERS
pooling	- school - work/study	year	Council, school
Promote "Park & Walk"	Encourage parents/caregivers to park at a distance from the school and walk partway with their children	Ongoing general promotion and once a term specific promotions	School, PTA
	Investigate links with Walking School Buses	2005 onwards	STP Coordinator
AIM 4: Improve safety of routes to and from school[10] **Performance measure: Reduction in concerns raised by parents in surveys[11]**			
Improve crossing for pedestrians on Blighs Road	Review signage in the vicinity of the pedestrian crossing to: - improve visibility (e.g. fluoro discs) - reduce impact of sunstrike	2005 & at time of Blighs Road upgrade (2007/08)	CCC
	School Road Patrol (SRP): - No unsupervised children allowed down Tillman Ave after school until the SRP is on duty - Review current SRP hours - Investigate extending the use of parents/ caregivers for SRP	2005	School, STP Coordinator
	- Carry out feasibility and safety assessments of the pedestrian crossing on Blighs Rd, e.g.relocate	Ready for the planned	CCC

[10] NOTE: Waimairi School is fortunate that Council had already scheduled a number of roads by the school for upgrade. This has allowed Council to commit to a number of improvements as part of the upgrades already planned. The timeframe for most of the upgrades is, at this stage, expected to be 2007/08.
[11] Note: Many of the concerns relate to roads scheduled for upgrade in 2007/08. It is therefore quite possible that there will be no change in the interim.

OBJECTIVES	ACTIONS	TIME FRAME	KEY STAKEHOLDERS
	crossing to other side of Tillman Ave?	upgrade of Blighs Road (2007/08)	
	Investigate ways of improving visibility on the approaches to the pedestrian crossing on Blighs Road	2005	CCC
	Include provision for the installation of a 40km/h variable speed limit (School Zone) in the upgrading of Blighs Road	When Blighs Road is upgraded (2007/08)	CCC
	Council to instigate any other appropriate safety improvements, e.g. width of the road by the crossing	When Blighs Road is upgraded (2007/08)	CCC
Improve safety in Blighs Road	Investigate safety options at all intersections with Blighs Road	Ready for Blighs Road upgrade (2007/08)	CCC
	Designate cycle lanes on Blighs Road	When Blighs Road is upgraded (2007/08)	CCC
Improve safety of pedestrians at/in Condell Ave	Improve safety of pedestrians crossing at Condell Ave/Blighs Road corner	When Blighs Road is upgraded (2007/08)	CCC
	Investigate safety and traffic calming measures for Condell Ave, including at least one safe crossing point on Condell Ave	2005	CCC

OBJECTIVES	ACTIONS	TIME FRAME	KEY STAKEHOLDERS
	Encourage enforcement of the speed limit in Condell Ave by Police, and utilise speed trailer provided by CCC from time to time.	2005	Police, CCC
Improve safety and the environment at Hartley Ave/ Hawthorne St entrance	Improve/install "school" signage on Hartley Ave and Hawthorne Street	Term 1 2005	CCC
	Investigate installing raised thresholds/cobblestones on the bend and in the carparking area and ways to reduce the speed of traffic	2005	CCC
	Investigate landscaping options to make it family friendly e.g. - fence off footpath area - area for prams, tricycles	2005[12]	CCC
Consider other safety issues raised by parents/caregivers	Liaise with Council over other safety issues raised by parents/caregivers (listed in Appendix)	Ongoing	School, CCC, STP Coordinator
AIM 5: Increase awareness of road safety issues			
Increase the amount of road safety information which is available to parents/caregivers, children and the community	Provide information to new parents/caregivers, e.g. on sunstrike on the pedestrian crossing	Annual at events for new parents/ Caregivers	School
	Provide information on the school travel plan and road safety via the newsletter, prospectus, school web site, at parents evenings etc	Ongoing	School, CCC (which has leaflets available), STP Coordinator
	Join RoadSense programme	2005	School
	Remind the local community to look out for children	Annually	School, CCC, STP

[12] Any minor works identified to be considered for 2006/07 Council budget

OBJECTIVES	ACTIONS	TIME FRAME	KEY STAKEHOLDERS
	on the footpath - e.g. through letterbox drops, kindergartens		Coordinator
AIM 6: Consider other safety issues			
Raise awareness of and enhance personal safety	Install a gate at the bottom of the overbridge on the school side	2005	School
	Review current supervision regime at all school entrances	2005	School
	Police run safety classes re personal safety & traffic safety	2005	Police, school
	Set up a clear process for children and parents with particular safety concerns in the school's local area	2005	School, STP Coordinator
Instigate other safety measures	Trial operation of a "dog" register	2005	School, CCC
	Investigate offering supervision in the school library from 8am	2006	School
Raise parental/caregiver awareness of specific issues	Remind parents to: - avoid the overbridge when trains are passing beneath - avoid non-essential telephone calls to school around school start and finish times - make sure children know to go to the office if their parents are delayed in collecting them	Annually and reminders as required	School

Appendix: Other safety issues raised

- Watford Street/Hawthorne Street intersection
- Windermere Road intersections with St James Ave/Matsons Ave
- Matsons Ave – investigate installing a crossing point
- Harewood Road – crossing by the cycleway
- Aorangi/Wairakei Road intersection
- Hudson Street/Merton Pace – "concealed" sign?
- Main North Road – install cycle lanes
- Drive by Cognitos (Normans Road) – needs to have stop sign or be made obvious
- Railway line corner Wairakei Road/Strowan Road – improve the footpath markings
- Hartley Ave/Normans Road: crossing island?

AGREEMENT ON THE SCHOOL TRAVEL PLAN

We support the Waimairi Primary School Travel Plan 2005.

Name PHILIP HARDING Signature	For School Staff Date 8 June 2005
Name Michael Aitken Signature	For Board of Trustees Date 14 June 2005
Name Maree Hyde Signature	For PTA Date 14 June 2005
Name Anna Morrison Signature Anna Morrison	For the pupils Date 14 June 2005
Name Dan Munro Signature	For Christchurch City Council Date 17 June 2005
Name JOHN HODGEN Signature 541289.	For Papanui Police Date 20 JUNE 2005

Appendix I

Model Results – Mode Choice

Model Results School Level - Trips To School - Mode Choice

		Trips Recorded					Predicted				Correct		Overall	
		Car		Other		Total	Car		Other		Car	Other	Diff (Abs)	% Diff
Roll	28													
Decile	8	26	43%	34	57%	60	28	47%	32	53%	108%	94%	2	4%
Avge Age	10.3													
Roll	82													
Decile	8	118	66%	62	34%	180	95	53%	85	47%	81%	137%	23	13%
Avge Age	8.0													
Roll	103													
Decile	7	62	41%	88	59%	150	83	56%	67	44%	134%	76%	21	14%
Avge Age	7.3													
Roll	111													
Decile	6	81	37%	139	63%	220	118	54%	102	46%	146%	73%	37	17%
Avge Age	8.7													
Roll	151													
Decile	2	228	80%	57	20%	285	169	59%	116	41%	74%	203%	59	21%
Avge Age	8.0													
Roll	196													
Decile	7	126	44%	159	56%	285	163	57%	122	43%	129%	77%	37	13%
Avge Age	7.4													
Roll	204													
Decile	3	135	68%	65	33%	200	130	65%	70	35%	97%	107%	5	2%
Avge Age	5.2													
Roll	288													
Decile	1	111	41%	159	59%	270	164	61%	106	39%	148%	66%	53	20%
Avge Age	8.9													
Roll	292													
Decile	4	183	53%	162	47%	345	209	61%	136	39%	114%	84%	26	8%
Avge Age	7.8													
Roll	309													
Decile	3	353	69%	157	31%	510	315	62%	195	38%	89%	124%	38	7%
Avge Age	7.8													
Roll	357													
Decile	4	137	51%	131	49%	268	164	61%	104	39%	120%	79%	27	10%
Avge Age	8.0													
Roll	362													
Decile	5	273	50%	272	50%	545	333	61%	212	39%	122%	78%	60	11%
Avge Age	7.8													
Roll	444													
Decile	8	377	59%	266	41%	643	384	60%	259	40%	102%	97%	7	1%
Avge Age	7.9													
Roll	468													
Decile	5	616	65%	330	35%	946	588	62%	358	38%	96%	108%	28	3%
Avge Age	8.2													

Model Results School Level - Trips To School - Mode Choice

		Trips Recorded					Predicted				Correct		Overall	
		Car		Other		Total	Car		Other		Car	Other	Diff (Abs)	% Diff
Roll	470													
Decile	6	259	56%	206	44%	465	290	62%	175	38%	112%	85%	31	7%
Avge Age	7.7													
Roll	506													
Decile	2	583	65%	312	35%	895	596	67%	299	33%	102%	96%	13	1%
Avge Age	7.6													
Roll	520													
Decile	9	348	58%	249	42%	597	369	62%	228	38%	106%	92%	21	4%
Avge Age	7.2													
Roll	601													
Decile	10	480	52%	452	48%	932	580	62%	352	38%	121%	78%	100	11%
Avge Age	7.3													
Roll	626													
Decile	8	892	72%	349	28%	1241	791	64%	450	36%	89%	129%	101	8%
Avge Age	7.6													
Total all Schools		5760	60%	3776	40%	9536	5860	61%	3676	39%	102%	97%	773	8.1%

Model Results School Level - Trips From School - Mode Choice

		Trips Recorded					Predicted				Correct		Overall	
		Car		Other		Total	Car		Other		Car	Other	Diff (Abs)	% Diff
Roll	28													
Decile	8	26	43%	34	57%	60	28	47%	32	53%	109%	93%	2	4%
Avge Age	10.3													
Roll	82													
Decile	8	136	76%	44	24%	180	98	54%	82	46%	72%	187%	38	21%
Avge Age	8.0													
Roll	103													
Decile	7	76	51%	74	49%	150	85	57%	65	43%	112%	87%	9	6%
Avge Age	7.3													
Roll	111													
Decile	6	74	34%	141	66%	215	115	53%	100	47%	155%	71%	41	19%
Avge Age	8.7													
Roll	151													
Decile	2	214	79%	56	21%	270	154	57%	116	43%	72%	207%	60	22%
Avge Age	8.0													
Roll	196													
Decile	7	120	44%	153	56%	273	156	57%	117	43%	130%	76%	36	13%
Avge Age	7.4													
Roll	204													
Decile	3	134	69%	59	31%	193	111	58%	82	42%	83%	138%	23	12%
Avge Age	7.8													
Roll	288													
Decile	1	98	37%	165	63%	263	146	56%	117	44%	149%	71%	48	18%
Avge Age	8.9													
Roll	292													
Decile	4	181	53%	159	47%	340	196	58%	144	42%	108%	90%	15	4%
Avge Age	7.8													
Roll	295													
Decile	9	339	68%	157	32%	496	287	58%	209	42%	85%	133%	52	11%
Avge Age	7.1													
Roll	309													
Decile	3	307	62%	186	38%	493	287	58%	206	42%	93%	111%	20	4%
Avge Age	7.8													
Roll	357													
Decile	4	130	49%	133	51%	263	151	57%	112	43%	116%	84%	21	8%
Avge Age	8.0													
Roll	362													
Decile	5	271	53%	244	47%	515	297	58%	218	42%	110%	89%	26	5%
Avge Age	7.8													
Roll	444													
Decile	8	309	49%	324	51%	633	358	57%	275	43%	116%	85%	49	8%
Avge Age	7.9													

Model Results School Level - Trips From School - Mode Choice

		Trips Recorded					Predicted				Correct		Overall	
		Car		Other		Total	Car		Other		Car	Other	Diff (Abs)	% Diff
Roll	468													
Decile	5	565	61%	358	39%	923	527	57%	396	43%	93%	111%	38	4%
Avge Age	8.2													
Roll	470													
Decile	6	229	50%	231	50%	460	268	58%	192	42%	117%	83%	39	8%
Avge Age	7.7													
Roll	506													
Decile	2	496	57%	377	43%	873	527	60%	346	40%	106%	92%	31	4%
Avge Age	7.6													
Roll	520													
Decile	9	343	58%	249	42%	592	348	59%	244	41%	101%	98%	5	1%
Avge Age	7.2													
Roll	601													
Decile	10	437	48%	482	52%	919	538	59%	381	41%	123%	79%	101	11%
Avge Age	7.3													
Roll	626													
Decile	8	855	70%	365	30%	1220	714	59%	506	41%	84%	139%	141	12%
Avge Age	7.6													
Total all Schools		5340	57%	3991	43%	9331	5393	58%	3938	42%	101%	99%	796	8.5%

Appendix J

Model Results – Independence

Model Results School Level - Trips To School - Independence

		Trips Recorded					Predicted				Correct		Overall	
		Adult		Alone		Total	Adult		Alone		Adult	Alone	Diff (Abs)	% Diff
Roll	28													
Decile	8	16	29%	39	71%	55	29	52%	26	48%	179%	68%	13	23%
Avge Age	9.5													
Roll	82													
Decile	8	125	69%	55	31%	180	137	76%	43	24%	110%	77%	12	7%
Avge Age	8.2													
Roll	103													
Decile	7	117	78%	33	22%	150	128	86%	22	14%	110%	65%	11	8%
Avge Age	7.4													
Roll	111													
Decile	6	124	56%	96	44%	220	156	71%	64	29%	126%	66%	32	15%
Avge Age	8.7													
Roll	151													
Decile	2	234	82%	51	18%	285	232	81%	53	19%	99%	104%	2	1%
Avge Age	8.0													
Roll	196													
Decile	7	242	85%	43	15%	285	252	89%	33	11%	104%	76%	10	4%
Avge Age	7.4													
Roll	204													
Decile	3	157	79%	43	22%	200	171	85%	29	15%	109%	68%	14	7%
Avge Age	7.8													
Roll	288													
Decile	1	155	57%	115	43%	270	205	76%	65	24%	132%	57%	50	18%
Avge Age	8.9													
Roll	292													
Decile	4	294	85%	51	15%	345	302	88%	43	12%	103%	83%	8	2%
Avge Age	7.8													
Roll	295													
Decile	9	458	92%	41	8%	499	461	92%	38	8%	101%	92%	3	1%
Avge Age	7.1													
Roll	309													
Decile	3	442	87%	68	13%	510	449	88%	61	12%	102%	90%	7	1%
Avge Age	7.8													
Roll	357													
Decile	4	237	88%	31	12%	268	235	88%	33	12%	99%	107%	2	1%
Avge Age	8.0													

Model Results School Level - Trips To School - Independence

		Trips Recorded					Predicted				Correct		Overall	
		Adult		Alone		Total	Adult		Alone		Adult	Alone	Diff (Abs)	% Diff
Roll	362													
Decile	5	474	87%	71	13%	545	487	89%	58	11%	103%	81%	13	2%
Avge Age	7.8													
Roll	444													
Decile	8	534	82%	114	18%	648	585	90%	63	10%	110%	55%	51	8%
Avge Age	7.9													
Roll	468													
Decile	5	777	82%	169	18%	946	842	89%	104	11%	108%	61%	65	7%
Avge Age	8.2													
Roll	470													
Decile	6	392	84%	73	16%	465	429	92%	36	8%	110%	49%	37	8%
Avge Age	7.7													
Roll	506													
Decile	2	790	88%	105	12%	895	836	93%	59	7%	106%	57%	46	5%
Avge Age	7.6													
Roll	520													
Decile	9	545	91%	52	9%	597	568	95%	29	5%	104%	56%	23	4%
Avge Age	7.2													
Roll	601													
Decile	10	852	91%	80	9%	932	892	96%	40	4%	105%	50%	40	4%
Avge Age	7.3													
Roll	626													
Decile	8	1180	95%	61	5%	1241	1177	95%	64	5%	100%	105%	3	0%
Avge Age	7.6													
Total all Schools		8145	85%	1391	15%	9536	8574	90%	962	10%	105%	69%	443	4.6%

Model Results School Level - Trips From School - Independence

		Trips Recorded					Predicted				Correct		Overall	
		Adult		Alone		Total	Adult		Alone		Adult	Alone	Diff (Abs)	% Diff
Roll	28													
Decile	8	21	35%	39	65%	60	30	50%	30	50%	142%	77%	9	15%
Avge Age	9.5													
Roll	82													
Decile	8	99	55%	81	45%	180	132	73%	48	27%	134%	59%	33	18%
Avge Age	8.2													
Roll	103													
Decile	7	133	89%	17	11%	150	125	83%	25	17%	94%	148%	8	5%
Avge Age	7.4													
Roll	111													
Decile	6	108	49%	112	51%	220	149	68%	71	32%	138%	64%	41	19%
Avge Age	8.7													
Roll	151													
Decile	2	237	83%	48	17%	285	223	78%	62	22%	94%	130%	14	5%
Avge Age	8.0													
Roll	196													
Decile	7	235	82%	50	18%	285	245	86%	40	14%	104%	81%	10	3%
Avge Age	7.4													
Roll	204													
Decile	3	164	82%	36	18%	200	164	82%	36	18%	100%	99%	0	0%
Avge Age	7.8													
Roll	288													
Decile	1	136	50%	134	50%	270	191	71%	79	29%	140%	59%	55	20%
Avge Age	8.9													
Roll	292													
Decile	4	290	84%	55	16%	345	290	84%	55	16%	100%	99%	0	0%
Avge Age	7.8													
Roll	295													
Decile	9	444	89%	55	11%	499	449	90%	50	10%	101%	90%	5	1%
Avge Age	7.1													
Roll	309													
Decile	3	408	80%	102	20%	510	431	84%	79	16%	106%	78%	23	4%
Avge Age	7.8													

Model Results School Level - Trips From School - Independence

		Trips Recorded					Predicted				Correct		Overall	
		Adult		Alone		Total	Adult		Alone		Adult	Alone	Diff (Abs)	% Diff
Roll	357													
Decile	4	234	87%	34	13%	268	224	84%	44	16%	96%	129%	10	4%
Avge Age	8.0													
Roll	362													
Decile	5	491	90%	54	10%	545	468	86%	77	14%	95%	143%	23	4%
Avge Age	7.8													
Roll	444													
Decile	8	507	78%	141	22%	648	560	86%	88	14%	110%	62%	53	8%
Avge Age	7.9													
Roll	468													
Decile	5	730	77%	216	23%	946	801	85%	145	15%	110%	67%	71	7%
Avge Age	8.2													
Roll	470													
Decile	6	392	84%	73	16%	465	414	89%	51	11%	106%	70%	22	5%
Avge Age	7.7													
Roll	506													
Decile	2	734	82%	161	18%	895	807	90%	88	10%	110%	54%	73	8%
Avge Age	7.6													
Roll	520													
Decile	9	507	85%	90	15%	597	553	93%	44	7%	109%	49%	46	8%
Avge Age	7.2													
Roll	601													
Decile	10	813	87%	119	13%	932	868	93%	64	7%	107%	54%	55	6%
Avge Age	7.3													
Roll	626													
Decile	8	1143	92%	98	8%	1241	1139	92%	102	8%	100%	104%	4	0%
Avge Age	7.6													
Total all Schools		7826	82%	1715	18%	9541	8263	87%	1278	13%	106%	75%	554	5.8%