IPENZ TRANSPORTATION GROUP CONFERENCE 2008

HOW WE GOT TO SCHOOL
A Study of Travel Choices at Christchurch Primary Schools

Bill Rice (NZCE, DipHE, MET)
Senior Transportation Engineer
Opus International Consultants Ltd
Email: Bill.Rice@opus.co.nz

ABSTRACT
In recent decades there has been a noticeable increase in the number of pupils being driven to school, and a reduction in active modes such as walking and cycling. Traffic volumes associated with school trips have increased, resulting in increased congestion near schools, and schools have been identified as making a significant contribution to total traffic volumes.

A case study involving the pupils of twenty two Christchurch primary schools was carried out. The study found that between 55% and 60% of pupils surveyed travelled 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.

The results further indicate that:

- A smaller proportion of pupils walk to large schools;
- A larger proportion of pupils walk to very low or very high decile schools. This is contrary to the widely accepted understanding that increasing affluence is usually accompanied by increased car usage;
- The quality of the walking environment had negligible impact on walking numbers;
- The longer the distance between home and school, the smaller the proportion of pupils who walk;
- Crossing major roads has a significant impact on the number of pupils who walk to school, even when accompanied by an adult;
- Decisions made by families regarding children's school travel are complex and involve interaction between a number of often contradictory demands; and
- The number of pupils travelling to school by car can be reduce dramatically with a formal School Travel Plan.

1 INTRODUCTION

This paper is a summary of the findings of a thesis prepared for a Master of Engineering – Transportation degree. The thesis was entitled “How We Got to School”, and was a study of primary school travel patterns. A literature review was carried out, and the travel patterns at twenty two Christchurch primary schools were surveyed.

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 (Ministry of Transport Household Travel Survey Fact Sheet, 2007). 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, there appears to be an increase in the proportion of pupils who travel with an adult, even when they walk, cycle or scooter. 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.

2 STUDY OBJECTIVES

The purpose of this study was to explore 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 study has definitely answered the first question. 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 discussed in the following paragraphs.

3 STUDY PROCESS

Twenty Two schools were surveyed. These schools 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.

Pupils and parents were surveyed at each school.

3.1 Parents Surveys

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 parents placed on a number of factors which may influence children's travel choices.

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.

The parents surveys were kept simple 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 intrusive.

3.2 Pupils Surveys

The pupils were surveyed to give an indication of the extent to which the parents' surveys were representative of the school pupils. It was considered possible that parents who were concerned about environmental or transportation issues may be more likely to complete a survey on school travel, resulting in a possible bias towards active modes. The parents surveys indicated that 59% of pupils travelled to school by car, and 55% travelled home by car. This compared with 60% and 57% respectively from the pupils surveys. The magnitude of this difference is considered small.

3.3 Neighbourhood Surveys

Surveys were carried out in the neighbourhood of each surveyed school. These surveys were used to establish the quality of the pedestrian environment surrounding each of the schools. The survey methodology was based on a Western Australian pedestrian rating system developed by Gallin (2001). Gallin's methodology was modified to better suit a pedestrian environment used by primary school pupils. The survey method used considered Connectivity, Path Width, Surface Quality, Obstructions, Crossing Opportunities, Support Facilities, Path Environment, Vehicle Conflict, and Personal Security.

4 FINDINGS

This study shows that there is a complex interrelationship between a number of factors influencing school travel choices. 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.

However, 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:

4.1 Overall Results

Between 57% and 60% of the pupils surveyed travelled to school by car, 32% to 34% walked or scootered, 7% biked, and 1% travelled by bus, 54% to 57% travelled from school by car, 35% to 38% walked or scootered, 7% biked, and 2% travelled by bus.

The larger proportion of pupils travelling to school by car, than travelling home, may reflect greater time pressures for families in the morning than in the afternoon.

Fewer pupils travelled by car on Wednesday. This may be influenced by the “Walking and Wheeling Wednesday” initiative promoted by Christchurch City Council in conjunction with schools.

Between 84% and 85% of the pupils surveyed travelled to school with an adult, while 80% to 82% travelled from school with an adult. The larger proportion travelling to school with an adult is consistent with the larger proportion of pupils travelling to school by car.

4.2 Factors Influencing Travel Choices

None of the factors which influence primary school travel choices operate in isolation. Instead, there is a complex interaction between 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.

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 above, 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.

4.2.1 Safety Concerns

Parents rank road safety and personal safety as the two most important factors in their decisions regarding school travel choice. Increases in traffic volumes tend to result in an overall reduction in the safety levels of children travelling to and from school.

There is also 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 so feel that is necessary to accompany them.

Road Safety

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.

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.

The study suggested that increases in the number of major roads between home and school tend to result in an increased likelihood that a child will travel to and from school by car.

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. This was a subjective assessment of the extent to which the environment contributed to a feeling of safety.

Based on this assessment, no obvious correlation between pedestrian environment and school travel choices was evident in the case study.

Individual vs Community Safety

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

Turner, Roozenburg and Francis (2006) suggest that the safety levels for pedestrians and cyclists increase with increasing numbers of pedestrians and cyclists. With each child who is walking or cycling on the route to school this safety in numbers effect is increased. Safety in numbers for children travelling to school relates to both road safety and personal safety. However a large number of pupils need to start walking or cycling in order to outweigh the impacts for one child of the perceived increase in risk associated with walking or cycling. 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.

4.2.2 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 the activity, that a family is involved in often mean that car travel is the only travel alternative that will enable everything to be fitted in.

4.2.3 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. The case study 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 the safety of their children.

Furthermore, the 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.

For the purposes of the case study a major road was defined as one which carried in excess of 10,000 vehicles per day (vpd)

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.

4.2.4 Distance from School

As expected, case study results indicate that increased distance between school and home 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.

4.2.5 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 who live 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 than small schools.

4.2.6 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, 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.

4.2.7 School Travel Plan

Hinckson & Badland (2006) suggest 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. 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 in 2005. A significant part of the Travel Plan, included employing a part time Travel Plan co-ordinator. Trips by car to Waimairi School have reduced from 52% to 32% of total trips since the inception of the School Travel Plan. This suggests that the implementation of a School Travel Plan, when combined with a person to promote the Travel Plan, may have significant impacts on school travel patterns.

4.2.8 Proximity to Major Employment Centres

Roydvale and Ilam Schools are located close to major employment centres. Roydvale is adjacent to the William Pickering Drive / Sheffield Crescent Business area, and Ilam is

adjacent to Canterbury University. The survey indicated that both of these schools had a greater proportion of pupils who live further away than at comparable schools. This suggests that some parents choose these schools for their children because they are close to their place of work or study.

However, only Roydvale School showed a greater proportion of trips by car, while Ilam had a lower proportion travelling by car. This may be due to the fact that a number of parents of pupils at Ilam School are students or staff at Canterbury University. There appears to be a strong emphasis on sustainability, including sustainable transport at the university.

There is, therefore, 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.

4.2.9 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.

There appears to be some correlation between school decile and the proportion of pupils who travel independently. 45% to 50% of decile 1 pupils travelled alone, while 11% to 15% of decile 9 and 10 pupils did. This result appears to support Unger’s (2007) argument that middle and upper middle class families tend to be very protective of their children.

Independent travel at the other decile schools varied between a low of 13% at the decile 2 schools, and a high of 30% at the decile 6 schools. Some of that variability may be explained by high car usage associated with large rolls at some schools.

4.2.10 Summary

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

5 MODELLING

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.

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.

5.1 Mode Choice Model

The following models have been estimated for school travel mode choice in the Christchurch urban area at school level:

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

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

Where:

N_{Car} = *Number of pupils travelling by Car;*
N_{Other} = *Number of Pupils Travelling by Other modes;*
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:

5.1.1 Utility Factor - To School

$$U_{Car} = 1.0157 \quad \textbf{Equation 3}$$

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

5.1.2 Utility Factor - From School

$$U_{Car} = 1.232 \quad \textbf{Equation 5}$$

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

Where:

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

When applied to the schools surveyed, this model correctly predicted 91% of the mode choices. Superior levels of accuracy (95% to 98%) 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. These models are presented below:

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

5.1.2.1.1 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***

5.1.2.1.2 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.*

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.

5.2 Independent Travel Model

The following models were estimated for independent travel to and from Christchurch urban schools:

Equation 13

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

Equation 14

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

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)
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

5.2.1.1 Utility Factors – To School

Equation 15

$$U_{Ad} = 6.957$$

Equation 16

$$U_{Al} = 0.730AA - 0.0024R$$

Where:

AA = Average Age of pupils
R = School Roll

5.2.1.2 Utility Factors – From School

Equation 17

$$U_{Ad} = 6.664$$

Equation 18

$$U_{Al} = 0.708AA - 0.0018R$$

When applied to the schools surveyed, this model correctly estimated 95% of the independent travel choices..

6 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, poor reinstatement following installation or repair of utilities.

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.

7 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 was experienced in 2007.

8 RECOMMENDATIONS

The recommendations arising from this research fall into three broad categories, namely recommendations regarding further research, those regarding school and local planning, and those regarding infrastructure near to schools.

8.1 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 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.

8.2 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.

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.

8.3 Transportation Infrastructure at and near Schools

The following recommendations are made regarding the planning and design of transportation infrastructure and facilities 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 is provided near schools.

9 REFERENCES

GALLIN, N. (2001), Quantifying Pedestrian Friendliness – Guidelines for Assessing Pedestrian Level of Service, *Australia: Walking the 21st Century*, February 2001, Perth

HINCKSON, E., & BADLAND, H. (2006), Auckland Regional Transport Authority, School Travel Plan Evaluation – 2006,

MINISTRY of TRANSPORT (New Zealand) (2007) *Household Travel Survey Fact Sheet*

Turner, S., Roozenburg, A., & Francis, T. (2006) *Predicting Accident Rates for Cyclists and Pedestrians*, *Land Transport New Zealand Research Report 289*, Land Transport New Zealand, Wellington

Unger, M. (2007) *Too Safe For Their Own Good*, McClelland and Stewart, Ontario

10 ACKNOWLEDGEMENTS

This paper is based on research carried out for a thesis for the Master of Engineering – Transportation degree. I acknowledge the same group who supported me in my thesis. These include my wife, Helen, my supervisor, Dr Andre Dantas and associate supervisor, Alan Nicholson, the principals, staff, pupils and parents of the twenty two schools who took part in the survey, my employer, Opus, and Fred Pedroso and Aline Lang.