The role of safety in school travel plans

Final Report
Prepared for the Land Transport Safety Authority

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November 2004

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1. Introduction

1.1 Purpose

The purpose of this project is to develop an understanding of the role that road safety issues play in school travel plans, including

- The school or councils' decisions and motivations to undertake school travel plans (STPs)
- The types of problems and barriers that are found in school communities
- The interventions identified and implemented as solutions to the problems
- The effect that the implemented solutions have on travel behaviour and road safety
- The role and relationship of school travel plans with other projects and programmes (such as Safer Routes, RoadSense and Walking School Buses)

And, consequently to advise the Land Transport Safety Authority as to how school travel plans can be:

1. Developed or otherwise targeted to address safety-related issues
2. Integrated with or operate alongside other safety-related programmes.

The primary source of information for this project has been the international case studies of school travel work undertaken in mainland Europe, the United Kingdom, Australia and New Zealand. Supplementing this, we canvassed the available literature (including published articles and reports, internet-based information and unpublished material).

1.2 Report structure

The remainder of the paper is structured as follows:

- Section 2 – outlines our project methodology
- Section 3 – outlines our findings with respect to the role of safety in school travel plans
- Section 4 – develops a framework to consider how school travel plans can be developed or targeted to address safety issues
- Section 5 – presents our conclusions and recommendations

The report also has 2 appendices:

- Appendix 1 – Literature review summary
- Appendix 2 – Detailed individual case studies.

2. Methodology

2.1 Introduction

As stated in section 1, the findings of this report are based on two main components: international case studies and an international "literature" review. Each of these is discussed separately below.

2.2 Case studies

2.2.1 Selection

The case studies focus on school travel work undertaken in mainland Europe, the United Kingdom (UK), Australia and New Zealand.

The UK is undoubtedly "the" leading nation in terms of school travel plan (STP) development and implementation, having piloted the concept in 1997 and 1998 and begun a massive "roll out" in 1999. The Department for Transport (DFT) recently reported that approximately 3,100 STPs (covering 15% of all schools) had been implemented in England by 2003, while a further 2,800 (extending the coverage to 28% of all schools) were expected to be implemented by 2006 (DFT, 2004).

The European Platform on Mobility Management (EPOMM) has also had a significant work stream addressing school-related mobility management initiatives in the past 5 years, although it has been directed towards the collection of best practices in Europe rather than the development and implementation of school travel plans *per se*.

In New Zealand and Australia, experience with school travel plans is very limited. North Shore City Council began developing its first two STPs in 2002, and had three in place by the end of 2003. Currently there are at least another 20 school travel plans being developed in Auckland region. Victoria, Australia commenced its ambitious pilot to develop 34 school travel plans early in 2003. While official "sign-off" of all 34 STPs only occurred in May 2004, the implementation of the plans began in January 2004, with the establishment of Walking School Buses, walking and cycling clubs and carpooling registers.

2.2.2 Gathering the case study material

The material for the case studies was gathered through personal contact with the organisations involved in the development and implementation of the STPs. This was supplemented by published and unpublished reports, documents and papers prepared about these projects.

To generate an overview on school travel planning in mainland Europe, Elke Bossaert (of Langzaam Verkeer vzw, an organisation leading school travel work in Belgium and parts of Europe) made contact with several organisations / schools known to be involved in school transport projects over the last few years:

- Belgium:

  - Staff responsible for school transport projects (involved in the EU TAPESTRY project) in the Municipalities of Geel and Mol
  - City of Ghent were requested to select an interesting case study of the 30 schools they have already guided in developing an STP. Contact was made with school management of De Piramide in Gent.
  - School management of primary school in Handzame.

- Austria: FGM-AMOR (private non profit organisation, very active in the field of bicycle training and school mobility projects in Austria and Europe): results from school project during TAPESTRY project.

- France: Energie Cités (network of city's energy agencies); Targeting (consulting organisation) and ADEME (national energy agency of France). Targeting provided us with results from a transport & mobility week with the evaluation of a Walking school bus (Le Pédibus).

- Sweden: Trivector (private company, involved in EU MOST project) and the city of Lund provided results from their campaign 'walk and cycle to school'. This project is not comparable to an STP as it is only 1 week of stimulating walking and cycling.

- Switzerland: Synergo reported on one Walking School Bus (the first one on mainland Europe in the city of Lausanne) – no known STPs

- Italy: Öki-institut provided results from one school project. Fit Consulting reported with information on bicycle training projects and awareness raising campaigns in schools.

- Several consultants and organisations involved with mobility and/or traffic safety programmes in schools in The Netherlands, Rome (Italy), and Germany but no projects comparable to an STP had been set up.

In the UK, Adrian Davis (TRL Limited) made contact with known key contacts across the UK. This included:

- Welsh Assembly: lead officer on School Travel Plans

- Northern Ireland: Sustrans staff based in Northern Ireland

- Scotland:

  - Sustrans staff based in Scotland
  - STP officers from Perth and Kinross Council, and Highland Council

- England:

  - STP Officers at Hertfordshire County Council, City of York Council, West Sussex County Council, Hampshire County Council, Surry County Council, Senior Planner at London Borough of Camden Council
  - Sustrans staff
  - The UK LAST (Local Authority School Travel) officers from across the UK via an e-group request
  - Department for Transport funded Regional School Travel Advisers

In addition, via liaison with the Project Manager for a Department for Transport contract 'Making School Travel Plans Work', Adrian gained permission for use of materials from this, as yet, unpublished Government report (Adrian being a member of that research team too). He also received additional data from a database generated for that contract.

Material for the New Zealand case studies came from a variety of sources, including various North Shore City and Auckland Regional Council officers, school travel plan co-ordinators, and a range of documents and reports. Brian Peddie, Project Manager, TravelSmart Education, Department of Infrastructure, Victoria provided the information for the Victorian case studies, both from his experience in developing the plans and the reports he had prepared about their development.

2.3 Literature Review

The initial search for literature focused on identifying published and unpublished articles, papers, reports and other documents on school travel plans. We included some of the “guides” providing information about “how to” develop and implement school travel plans, but these were considered largely peripheral to our investigation given that we were seeking to establish the “cause and effect” of school travel planning on safety and modal shift.

We found very little published information directly related to STPs and safety or even their impacts on modal shift and what we did find (for example, conference papers on various examples of the European school mobility management [MOST] work) has generally been incorporated into our case studies. Two references stand out with respect to our project goals, chapter 4 in the recently released DFT (July 2004) document *Smarter choices – Changing the way we travel* and the material obtained by Adrian Davis from the yet-to-be-released DFT document “Making School Travel Plans Work”

We expanded our search efforts to include material addressing particular measures and their effect on the risk of child and adolescent injury to supplement the case study material and to assist in providing the framework for the “best practice” assessment.

3. Key findings

3.1 Introduction

This section brings together the material from the case studies and the literature review to report on the key findings with respect to:

- The safety and other motivators for developing school travel plans (section 3.2)
- The identified safety and other barriers to using environmentally-friendly travel modes (namely walking, cycling and public transport) (section 3.3)
- The various initiatives / measures identified as part of school travel plans (section 3.4)
- The impact on safety and travel mode of school travel plans (section 3.5).

3.2 Motivation for developing STP

There are a number of different motivators for developing school travel plans.

3.2.1 Schools

Safety is a key motivator for primary schools / school communities to take part in the development of a school travel plan. In many school communities there are few actual road crashes or accidents involving children. However, there is still a concern about children's safety in the face of vehicle congestion around schools; dangerous parking behaviour of drivers on streets around the school; fast moving and high volumes of traffic on the roads that children must traverse to gain access to the school.

A second motivator is the desire to reduce the use of the car for the journey to school and, consequently, the congestion on the roads around the school – the "chaos at the school gate". Halcrow (2002) analysed 507 STPs implemented in the UK in 1999 to determine the main objectives targeted and found that these were:

- Sustainability / reducing reliance in the car (33%)[1]
- Road safety / reducing accidents (25%)
- Reducing traffic congestion (12%)
- Overcoming personal safety concerns (2%).

While there is limited experience with STP development in secondary schools (either internationally or among the case studies generated for this report), it appears that the reasons for their involvement tend to be more related to concerns about the congestion around the school and the effects of this on the surrounding neighbours. This is possibly due to the fact that secondary schools tend to have a much bigger student population than most primary schools.

[1] The percentages do not total 100% as only the main objectives are reported here.

3.2.2 Government agencies / entities

While schools may become engaged in school travel plan work through safety concerns more than any other mechanism, the driver in policy terms comes through a combination of congestion, safety and health (including learning independence and so on) factors. Part of the reason for this may be that, from a government agency perspective, the safety issues for *any given school* are often perceptual, that is perceived danger with few or even zero casualties. Thus, in some cases, the authority may be more concerned with addressing the morning peak period congestion, which parents contribute to by driving their able-bodied children over short distances to school, than with addressing the (perceived) danger concerns that lead parents to drive their children in the first place.

Hence, there are varying reasons for undertaking STPs from the perspective of local or roading authorities and other government agencies:

- In England, the national government has established an objective calling for all schools to have travel plans by 2010. More specifically, *Traveling to School: An Action Plan* (DFT and the Dept Education and Skills, 2003) identify three policy areas they are seeking to contribute to in their school travel work: reducing motor traffic congestion; decreasing pollution; and promoting physical activity / reducing health problems associated with physically inactive lifestyles.
- In England, there is currently a grouping of Ministers called ACT (Activity Coordination Team) whose objective is to promote physical activity across Government departments.
- Gent, Belgium, has a commitment to sustainable transport and chooses 10 schools per year (based on safety issues) to develop and implement an STP
- Belgium: if they undertake school travel work at schools were a regional road crosses the school environment, local governments are entitled to special funding (Module 10) from regional government for identified engineering measures
- Australia: the Department of Infrastructure, Victoria had a policy to pilot school travel plans in the state in order to encourage walking and cycling to school as an initiative under the Victorian Greenhouse Strategy, designed to reduce greenhouse gas emissions, in this case, from transport. Schools were selected on a set of criteria that included: a high number of students living within walking / cycling distance; the awareness / presence of an access problem at the school; and a positive interest shown by the school to address the problem. Hertfordshire had similar criteria for selecting schools, plus a consideration of the number of casualties around the school, although it did not have a greenhouse gas emissions reduction objective.
- In other areas the environment (Italy and Merseyside) and health (Merseyside) concerns generated interest in STP development.

This creates some tension between different agencies as well as between agencies and schools. For example in England, many STP officers have been taken on, not as part of road safety teams, but in "TravelWise" or other units where safety is not a primary factor.[2] The subsequent actions of the STP officers to encourage children to walk and cycle raises concerns by the more 'traditional' road safety officers who fear that greater exposure of vulnerable road users will lead to greater casualties. While it is true that the *absolute* number of crashes *may* increase, there is accumulating evidence internationally (e.g. Jacobsen, 2003) that the *rate* of casualties / fatalities per kilometre (or per capita) will decline with increasing numbers of pedestrians and cyclists. This "safety in numbers" effect is discussed in greater detail in section 3.5.2.4.

3.3 Identified barriers to using environmentally friendly modes

The safety and other barriers to walking, cycling and public transport identified by parents and other members of the school community appear to be common to all countries.

3.3.1 Safety barriers

Without exception, communities (parents, teachers, children and local authorities) will identify "dangerous" or unsafe travelling routes as creating barriers for children as pedestrians or cyclists. The issues most commonly named include:

- Inadequate or no crossings for children to access the school
- Inadequate or no footpaths / cycle paths (lanes)
- Roads near the school are considered to have either or both of high volumes and fast moving vehicle traffic
- Parking or stopping of cars (usually by parents) near the school entrance(s) is undertaken in a careless fashion, potentially endangering pedestrians and/or cyclists.

Concerns about personal safety, such as "stranger danger" or the fear of bullying, generally are in second place to the matter of dangerous routes. In the UK, there is a strong view that parental concerns about personal security (specifically the possibility of abduction, murder, bullying and theft) are out of proportion with reality due, in part, to media attention given to such issues. The *Travelling to school: a good practice guide* (DFES and DFT, 2003) observes that it is 40 times more likely that a child will be killed in a road traffic accident than abducted and killed by a stranger.

The position of various UK organisations has been, therefore, to set the perceived risk into context: that is, to show that road traffic poses a far greater risk of injuring children than "strangers", through items such as the Sustrans Information Sheet (FS02, 2002) and videos. Hence, very little has been done to address this specific concern within school travel work, apart from such initiatives as walking school buses (where adults supervise children walking to school) and other programmes of that nature.

[2] Indeed, the Sustainable Transport Initiatives Branch – not Road Safety Division – leads the STP work in the UK Department for Transport. Of course the two divisions liase, but their 'drivers' are somewhat different. Within the Sustainable Transport Initiatives Branch, congestion seems a more important focus than safety while, almost by the day, health issues press on politicians, who are requested to do something about the overweight/obesity problems among children (and adults).

3.3.2 Other barriers

One of the key barriers for parents with respect to letting their children walk or cycle to school is that it is seen as more convenient to drive them in the car, itself reflective of growing vehicle ownership including second cars. Many parents are apparently dropping their children off on the way to work, so the car may be leaving the house anyway. Ironically, it is not necessarily quicker to take children in the car – in Australia, particularly, it was found that parents were arriving up to 40 minutes before school was let out in order to obtain a parking spot near the school. At some schools in the UK, parents (eventually) realised that it was actually quicker to walk their child to school, return home, and then drive their car into work.

School rules can affect alternative mode use. In Belgium, parents are often obliged to accompany their children till the age of 7 on the school-ground; they cannot simply drop them of at the school gate. In New Zealand, it is not uncommon for schools to have a "rule" that children under the age of 10 cannot cycle to school. Some New Zealand (particularly private schools) and UK schools have a complete ban on cycling, while in Austria, the law states that children under 12 must be accompanied by an adult, although if the child engages in special training, they can cycle on their own from the age of 10. While in some cases, this type of rule is well justified; there is no doubt that this forms a considerable barrier to cycling as an alternative mode. Although identified in the early stages of STP development in the UK (see, for example DFT 1999), banning of cycling is now increasingly recognised as a barrier to physical activity at a time when issues of overweight and obesity among young people are receiving growing attention.

Given the decreasing numbers of children cycling to school over the last few decades, many schools have either allowed their cycling facilities to deteriorate through lack of maintenance or removed them altogether. This has resulted in parents and children identifying the lack of adequate bicycle storage facilities as one barrier to cycling – in Victoria, the construction or refurbishment of bicycle shelters is the most commonly requested expenditure, in 26 of 34 schools implementing travel plans. Parents also considered that their children required road safety training in order to be able to cycle to school.

A generation ago, children went to the "local school" as a matter of course. In recent times, parental choice with respect to schools means that there is a longer journey to school for some students, increasing the potential or need for car use. Hence, a commonly cited barrier, even for children attending their local school, is that the child is too young or lives too far away from the school to walk or cycle. Parental perception varies as to what is too far: in Victoria, this notion was explored in parent focus groups, where it was found that "too far" could mean 500 metres for some parents. In Auckland (Researchsolutions, 2003), a survey of 509 parents with children in school found that most parents felt that the *only* suitable option for a five-year old was to be driven to school (no other mode was even acceptable to one-third of the parents surveyed), with walking / cycling becoming acceptable around the age of eight or nine.

The reasons for not using the bus are not generally safety related. Instead, buses are often considered inconvenient and schedules may not fit in with before or after school activities. There may also be resistance on cost grounds.

In secondary schools, and sometimes primary schools, a commonly cited barrier to children walking or cycling is the weight of their school bags, caused by the number of books students are required to carry. Apparently, there are many secondary

schools that do not provide secure lockers for students to store their books in, with the result that they carry them to and from school every day. In Victoria, schools are investigating various options, including providing more storage, "e-homework" and scheduling fewer classes in a day, to try to alleviate the loads students carry.

3.4 Measures identified within STPs

Various guides to developing school travel plans provide reasonably detailed lists and/or descriptions of the possible measures that form part of an STP "toolkit" (see for example, DFT (1999), *School travel strategies and plans: a best practice guide for local authorities;* or, more recently, EECA (2003) *Draft school travel plan coordinators' guide* and DFES and DFT (2003) *Travelling to school: a good practice guide*.

The measures identified to address the barriers to environmentally friendly mode use can be broadly categorised as follows:

- Walking initiatives
- Cycling initiatives
- Public transport initiatives
- Engineering measures
- Enforcement measures
- Education programmes – pupils and parents
- Promotional activities
- Others

In the following sections we discuss the most common initiatives found within our case studies.

3.4.1 Walking initiatives

The Walking School Bus (WSB) is the single most common initiative to appear in school travel plans internationally. In New Zealand, a Walking School Bus is described as follows:

> A Walking School Bus usually has at least two adult volunteers (a "driver" at the front and the "conductor" at the rear) who walk along an agreed route, collecting all children waiting at designated 'bus stops' and walking them to school. After school, they walk back along the same route. There is a maximum of 8 children per adult.

Having adults available to walk with children along a set route, which has usually been "vetted" by the local authority, many parental concerns about their child's safety can apparently be alleviated. The Walking School Bus also provides an opportunity for children to learn road safety rules ("learning by doing") in preparation for independently walking to school later on.

Other common initiatives include:

- Establishing a regular day of the week (often Walking Wednesday – known in the UK as WOW days) where children are encouraged to walk (and sometimes cycle) to school. Incentives are often offered for walkers, for the class with the most walkers, or for the most improved class.

- Establishing walking or cycling "clubs" where children are awarded prizes for attaining walking / cycling milestones
- Establishing sign-posted, "recommended" routes to school, usually with some training provided for children to learn how to use it

3.4.2 Cycling initiatives

The most universal cycling initiative is to introduce or improve cycle training at schools. Apart from this, there is some variation in what is done, for example:

- In the UK, it is quite common to construct or improve cycle paths / routes to schools, often linking them with the National Cycling Network
- In Belgium, "bicycle pools" (essentially a Walking School Bus on cycles) are increasingly common. There are also some in the UK.
- In Victoria, the construction or refurbishment of cycle shelters was the most frequently requested expenditure item in recently completed school travel plans. This also reflected in many UK school travel plans and is one of the items always raised in the development of STPs in Belgium.

3.4.3 Public transport initiatives

Possibly because fewer school travel plans have been implemented in secondary schools where students generally live further away and public transport is more justified, very few of the case studies in this project identified public transport measures. There was a wide variation in the measures introduced:

- In East Grinstead, a concessionary fare scheme resulted in a 50% reduction in the number of children arriving at the school by car, but the bus operator withdrew the service after one year because it did not generate enough revenue for them
- In Belgium, children are being encouraged to use public transport by organising field trips to teach how to use it. Moreover in some Belgian cities (e.g. Gent, Hasselt) children can use PT for free. This encourages parents to let their children use PT services. In larger cities, such as Gent, the WSB principle is applied on the usage of PT (adults accompany small groups of children).
- In Victoria, two schools have sought funding to improve bus shelters near the school in an effort to encourage bus use.

3.4.4 Engineering measures

3.4.4.1 Treatment of engineering measures within the STP rubric

Engineering or infrastructure measures associated with school travel plans are treated in several different ways internationally. In Belgium, it has been a condition of "Module 10" funding for STPs that infrastructure modifications be undertaken to increase the physical safety of the environment. However, engineering measures are largely determined and undertaken by the road maintenance authority (either local, provincial, regional or federal), independently of the actual STP development and implementation, as not all schools in Belgium qualify for this type of funding. Recent legislation, applying to all Belgian cities, requiring the establishment of 30 km/h zones in streets where a school is situated (by September 2005), implies that such

engineering measures will continue to be outside the STP programme. Other engineering measures in Flemish cities get funding within the urban transport plan. These can also improve school environments but not include the development of an STP.

In Victoria, the implementation of engineering measures is not an integral part of the STP programme. The Department of Infrastructure focus was reducing car use and encouraging walking and cycling, and provided funding for "minor" infrastructure additions or improvements, such as cycle shelters, installing flashing lights for school crossings, and signposting recommended routes to schools. The inclusion and/or funding of more significant engineering measures depend largely on the school's relationship with its local council, who will be funding the infrastructure changes. It was observed that some schools are using Department of Infrastructure STP funding for STP as leverage with councils (e.g. the school is offering to make a financial contribution to the infrastructure project in order to reduce the council's costs).

The identification of engineering measures is an integral part of the STP development process in Auckland, New Zealand. However, on the North Shore (where the three NZ-based travel plans have been implemented), the Council makes the decision about which ones will be executed[3], using a specially devised prioritisation process to ensure that funding targets safety projects that have the most safety benefits. A Council traffic engineer prioritises the (generally) large number of engineering projects identified by children, their parents, and the community through the STP development (e.g. 64 at Vauxhall School and 52 at Bayswater School) using the following method:

- Identify all possible perceived & "actual" problem sites. This includes those identified through the actual STP process as well as LTSA records on crashes, particularly pedestrian and cycle crashes; observations by the traffic engineer, including route "audits" and observations of traffic, pedestrian and cyclist behaviour at school start and finish times.
- Prioritise each project for safety and exposure risks. This includes:
    - Assessing a "safety rating" (based on who identified the problem and other available data quantifying the potential hazard or risk)
    - Assessing an exposure rating (based on number of children and vehicles past a site)
    - Assigning a "priority rating" to the site. This is calculated by multiplying the safety rating by the exposure rating
- Create an implementation spreadsheet, assigning responsibility and funding source for each site.

In the United Kingdom, school travel work initially "focused on physical street improvements, such as traffic calming, 20 mph zones, cycle lanes and safe crossings" (DFT, 2004, p. 67). This was generally done through "safe routes to schools" schemes. Over time the approach has evolved to become more community-oriented, involving consultation with the local community and the school, generally with a view to developing school travel plans. The measures targeted have evolved as well: there is more emphasis on information and education, road safety training,

[3] How the engineering measures identified will be treated by the 3 other city councils in Auckland Region has not been investigated as these Councils are in the preliminary stages of school travel plan development.

and initiatives such as walking school buses, cycle trains and encouraging bus use (DFT, 2004). The shift in focus has probably come about with increasing concern about congestion and health impacts in light of increasing car use for the journey to school. Both safe routes to school and school travel plans programmes continue to operate in the UK.

3.4.4.2 Engineering measures commonly associated with STPs

A wide range of engineering measures are undertaken around schools, whether as part of a school travel plan, safe routes to school or other local authority projects.

The implementation of traffic calming measures, particularly "school speed zones" of 20 mph (UK) / 30 km/h (Belgium and Sweden), which often involve the introduction of traffic calming measures such as speed bumps or speed tables at dangerous cross-junctions, are much more common in the European context than in either New Zealand or Australia. The exception to this is the 40 km/h school zones programme in Christchurch, which establishes electronically-signed part-time speed limits at schools meeting specific criteria. Within our case studies we found various treatments of traffic speed around school areas:

- Only Sweden directly considered the speed zone as part of a school travel plan
- In the UK they are more commonly part of a safe routes to school initiative or an initiative in a wider local area traffic management plan
- In Belgium, they were formerly part of local mobility plan funding but are now a legislated requirement
- In Christchurch the criteria is set independent of school or community involvement.

Within school travel plans, the engineering measures identified and implemented could largely be considered as "minor" infrastructure improvements. The most commonly considered and adopted roading-related minor measures include:

- Improvements or installation of crossings to access the school – these could be "kea" crossings; zebra crossings; improved signage
- Improvements to footpaths and/or cycle paths / lanes to access the school. In some instances, these may be shared pedestrian and cycle paths
- The creation of drop-off zones near the school entrance, including changing parking restrictions; creating "kiss-and-ride" lanes (where parents can pause to let their children out, but may not leave the car unattended)
- Establishment of sign-posted "recommended" routes to school
- Establishment of "park and walk" sites – this does not necessarily involve infrastructure modification, but may require obtaining permission from the owner of the parking site and the installation of signs
- Improved street lighting

A further (non-roading) engineering measure commonly adopted is the Improvement or installation of bicycle shelters / cycle storage facilities.

In the UK context, some of the above measures would possibly be part of safe routes to school work. In Flanders (Belgium), they would also be a component in the general local mobility plan that is part of the Covenant-policy (general subsidy policy on transport and mobility in the Flemish region).

In Belgium, there is a view that 'minor' engineering measures are more acceptable to parents and school staff than more major measures, as minor measures are often easily implemented and have an effect in short term. Thus when implementing engineering measures within an STP, parents prefer re-painting of zebra crossings or the installation of flash lights at cross-junctions to large engineering measures that will only have effect once their children have left primary school.

3.4.5 Enforcement measures

In the early days of implementing new traffic management rules, enforcement by police officers is often used to help establish new behaviour patterns. Often this enforcement is not on-going, but may be repeated at specific schools if it is perceived there is a need to do so. Sometimes children are used to manage enforcement: for example, at one Belgian school, children give out red tickets to those are parked incorrectly and green ones to those obeying the "rules."

Many schools publish regular reminders to parent about expectations and rules in their school newsletters.

In case studies associated with MSTPW (DFT, forthcoming), where safety improvements were related to parking restrictions, several schools commented on enforcement problems (notably Hillside Avenue Primary). In some cases, it was noted that general increases in traffic had, to some extent, eroded the safety gains achieved by school travel work (for example, at Priory and Perse). In the case of Penryn Junior, traffic increases were sufficiently substantial that it was felt that parents would not perceive travel to school had become safer, despite the introduction of safety measures. Lack of enforcement can mean that engineering changes do not always have the desired effect of either increasing perceived safety, shifting congestion away from the school or changing children's mode use. Also, "normal" traffic growth may negate an otherwise positive safety outcome (as well as "mask" any savings in car trips made by the school community).

3.4.6 Education / information programmes

Again there are a wide variety of educational programmes offered through or alongside an STP. In some jurisdictions, mobility and traffic education is compulsory in schools, including the UK, Belgium, and Austria. In others, schools can "opt in" for road safety education programmes, such as RoadSense in New Zealand. In Australia, a curriculum-based programme "TravelSmart" has been piloted for year 5 and 6 students and will be rolled out on a larger scale in the future. From the perspective of students, TravelSmart is more focused on sustainable transport modes (i.e., mode shifting and greenhouse gas emissions reduction) rather than safety issues, although some safety education is provided as part of the programme.

Most schools either expand on existing education programmes or add in further training as a result of developing an STP, particularly with respect to cycle training. In Belgium the tradition of transport and mobility education has to shift from *ex cathedra* methods to actual training on school ground and on the streets in real life traffic situations. Many schools regularly publicise aspects of the STP or re-iterate health and safety messages through their school newsletters, school assemblies, posters or flyers. Hertfordshire County Council has a year round publicity campaign to encourage walking to school.

In the New Zealand, Scotland and some Belgian case studies, the schools have developed promotional materials and/or family induction packages for new entrants and their parents to inform them about elements of the school travel plan and to encourage walking or cycling to school.

3.4.7 Promotional activities

There are a wide range of promotional activities undertaken to encourage children to walk or cycle to school (and to encourage their parents to allow them to do it!), including:

- Establishing “car free” weeks or months
- “I walk to school” “Walk to School” weeks
- International Walk to School Day

In Belgium, the “Traffic Snake Game” is played in 300 primary schools over a one-week period where children are encouraged to use sustainable modes of transport. When they do so, they earn points for the class. When enough points are gained, the class can place their card on the snake banner. The objective is to fill the whole snake in by the end of the week. If this is achieved all of the children win a prize.

Some schools are quite successful in the use of the media to promote their school travel plan initiatives.

3.4.8 Other

In Victoria and Hertfordshire, there is a definite strategy to establish carpooling or car sharing as an alternative mode of travel to and from school.

Several authorities in the UK also encourage “park and walk” schemes, usually using the car park of a business, public house, or church hall located within a reasonable distance of the school, where parents can park and then walk their child the rest of the way. This removes some of the congestion at the school entrance, while still allowing parents the “convenience” of their car. It also affords children the opportunity to be included in any walking incentive scheme that they might otherwise be excluded from.

As mentioned earlier (see section 3.3.2), secondary schools in Victoria are considering a number of options to reduce the weight of school bags.

3.5 Impact of school travel plans

This section discusses the impact of school travel plans on students’ mode share, particularly with respect to car trips, and safety. Improvements in safety are related to such things as reduced crash risk (both as a result of engineering improvements and reduced traffic congestion around schools) and the increased road safety awareness of children. Other impacts are also possible, including:

- Improved environment (reduced emissions)
- Improved access
- Improved health and fitness of children
- Increased self-esteem and independence of children

- Improved social cohesion / increased community interaction
- In-graining "good habits" by creating an awareness or experience of travel options – physically active children become physically active adults
- Improved learning / better concentration / increased attention-span of children in school
- New infrastructure – creates opportunities for mode switching across the neighbourhoods in general
- Enhanced liveability of neighbourhoods.

However, a discussion of these impacts is beyond the purview of this report.

3.5.1 Impact on mode share

Unfortunately, impact evaluation of school travel plans is rather unevenly carried out – and for some schools, such as the 34 in Australia and 2 in New Zealand, it is too soon for monitoring to have taken place. Furthermore, in Europe, an impact evaluation has often been completed for a specific event (for example, the trial of a Walking School Bus in France or an educational campaign in the 26 schools of Geel and Mol, Belgium) rather than for the STP itself. In the UK, where the greatest amount of school travel planning activity has occurred, there has been extensive monitoring of the *process* (e.g. what works and what does not) and *uptake* of different school travel schemes (use of advisors and funding options) but much less focus on the overall effect of the work itself.

The information on the changes in children's modal share from our cases studies (where it was available) is summarised in Table 1 below. The table reveals that for these schools, the *absolute* change[4] in students' mode share of car trips ranged from zero up to 16%, and had in fact been maintained for a considerable period of time (for example, six years in Derby and five years in East Grinstead and Cornwall).

Table 1 Absolute change in children's mode share occurring following implementation of an STP (source: project case studies)

School location	No. Of schools	Car	Walking	Cycling	Comment
Sweden	1	-5%		+6%	After 2 years
Italy	1	- 6%	+6% (combined)		After 1 year
Scotland	1	- 16%	+12%	+1%	After 3 years
Merseyside	1	-3%	+4%	+1%	Car use only down on Walking Wednesday, not ordinary days
E Grinstead a.m. p.m.	1	-10% -6%	+7% +6%	+4% +4%	After 5 years
Cornwall	1	-4%	+6%	--	After 5 years
Derby	1	-16%	+11%	+2%	Bus: +2% - after 6 years
Hertfordshire	18	13 schools have stable or declining car use (in most the decrease in mode share was <5%; 2 schools had >10%)			Varying timing - Reasons given for other 5 schools & lack of change

[4] The *absolute* change in mode share is determined by subtracting the old mode share value from the new value (e.g. if the mode share for cars was 40% prior to the STP development and 35% after its implementation, the absolute change in mode share is 35% - 40% = -5%). By contrast the *relative* change in mode share compares the absolute change against the original mode share; thus, the *relative* change in mode share (where it was originally 40% and is now 35%), would be the absolute change (35% - 40%) divided by the original share (40%), or 12.5%.

New Zealand	1	Slight decrease	+2%	0%	After 1 year – some discrepancy in car use reporting; main change in after school trips
Handzame, Belgium	1	- 5%	+3.5%	+2.5%	Less than 1 year – Before survey in winter, after survey in summer
Geel & Mol, Belgium	26	-10.5%		+10%	Less than 1 year – Not directly related to STP, following campaign

The section of the DFT's (2004) *Smarter Choices* document on school travel plans reports that many "engaged" schools (schools where school travel work had taken place) achieved a *relative* change in students' mode share of car trips of 8 – 15% on average[5]. Some had achieved 20% reductions in the relative mode share of car trips; a few had achieved greater than 50%. Based on their sample, the authors estimate that a high proportion of schools actively engaging in such work will achieve positive modal shift away from car use – about 60 – 90% of the schools involved. This finding is substantiated by the "Making School Travel Plans Work" (MSTPW) project (DFT, forthcoming), where, of 80 schools responding to the MSTPW survey, 76% reported mode shifts away from car.

However, the authors also note that the schools reporting in both of these projects were self-selected, and hence were quite likely to be biased towards having had positive outcomes associated with their school travel plans. While the authors discount this bias (noting such things as the fact that many schools simply do not monitor outcomes and that there is a positive synergy associated with more and more schools becoming involved in school travel work, implying that results will be greater over time), it is important to remember that these results reflect the experiences of only 4% of all schools that have developed and implemented school travel plans in the UK.

The change in student mode share discussed in this section does not necessarily reflect any change in (parental) *car driver* trips, which may or may not still be made once a child has begun to walk or cycle to school. Parental driving habits or patterns are likely to have a definite impact on the volume of traffic on roads around the school. This is an issue that has had "little direct investigation" (DFT, 2004), apart from trying, in some cases to ascertain what proportions of the journeys are home-school-home trips as opposed to home-school-work trips. Monitoring of parental travel patterns was identified as an issue early in 2004 in New Zealand and a programme to monitor such behaviour has recently been devised.

3.5.2 Impact on safety

If monitoring the impact of school travel plans on modal share has been difficult and spasmodic, the monitoring of safety impacts, particularly crash data and pedestrian injury rates, is even more so. As a result of our investigations, we considered three approaches, measuring the impact at an individual school level; across a larger local authority area; and of specific programmes (e.g. encouraging cycling; road safety; etc.), whether or not the impact was monitored in the context of a school travel plan. Note that the survey of impact of specific programmes does not purport to be exhaustive, rather selected materials were reviewed to gain key information in this regard.

Each of the three approaches to considering impact on safety is discussed separately below.

[5] In most schools this would reflect an absolute change of between 3% and 10%.

3.5.2.1 At an individual school level

Generally speaking, the sphere of influence of an individual school is reasonably small (in terms of the surrounding traffic) and the number of child pedestrian injuries directly associated with it is usually relatively low. This combines to make it almost impossible to gather sufficient crash data on accidents associated with education-related trips in order to estimate the impact of a school travel plan on children's physical safety on the journey to and from school.

An example from North Shore City Council (Auckland, New Zealand) illustrates the point. Using LTSA crash data, the Council established that, based on a primary school population of just over 100,000 children, the accident rate for the North Shore is around 0.3 per 1000 children. Thus, they estimated that for a school the size of Vauxhall or Bayswater (both with less than 300 students), an accident every 10 years could be expected. For a large school like Browns Bay, accidents would likely happen from time-to-time. It would be virtually impossible to detect any change in crash rates around these schools, never mind find any direct relation between the implementation of the school travel plan and crash rates.

Sometimes it is feasible, if one takes a broader look (say over a longer time frame and including children of all ages), to find a change in crash rates that may be associated with some aspect of school travel work. For example, Wilbury Junior School (Hertfordshire, UK) had, in three years prior to the establishment of traffic calming and other Safe Routes to School measures around / at the school, seven injury accidents; while in the three years subsequently there have been none. Note, however, that these figures refer to all accidents for all age groups in the area around the school, not simply children on the school journey, making a direct association with the school travel work difficult.

In the course of preparing the case studies, some of the people we contacted suggested that a potential indicator of *perceived* improvement to safety could simply be monitoring the numbers of children walking and cycling to and from school. They argued that if such numbers were increasing, it is highly likely that the community perceives that the environment is safer for children. In addition, should there be sufficient numbers of children walking and cycling, it is likely that safety outcomes would *actually* improve as "safety in numbers" starts to take effect (see section 3.5.2.3 for further discussion of this).

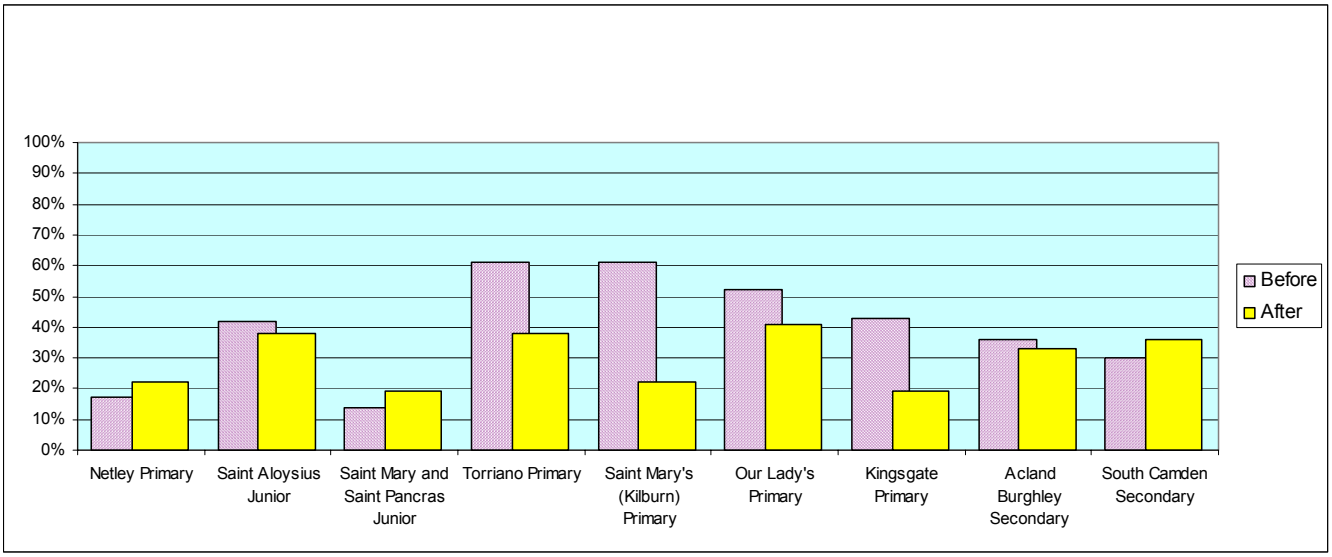
Other methods to measuring safety outcomes have been trailed. At the individual school level, the MSTPW project (DFT, forthcoming) took a subjective approach, asking "key informants" to indicate how they thought parents would perceive changes in safety (much safer / safer / no change / less safe / much less safe / don't know) and to categorise the traffic environment around the school before and since any school travel work (this could be school travel plans and/or safe routes to school work). Of the 30 key informants interviewed, 23 felt that parents would think that the changes had made the school environment safer / much safer. Only 4 thought parents would perceive no change, and 1 thought that parents would think it was much less safe (oddly enough this was due to heightened awareness of the dangers associated with the use of the Underground – brought about due to an education programme).

The results of the categorisation of the traffic environment are somewhat more difficult to interpret, as the categories themselves could possibly benefit from definition refinement. However, about one-half of the informants felt that the traffic environment around their schools had improved, often moving from “major traffic danger with a lack of safety measures” to either “major traffic danger but with some significant safety measures” or “relatively safe but with some traffic safety problems.”

In gathering the material for our case studies, we were given anecdotal information about changes in perception of the level of safety associated with implementing a school travel plan, such as for a school in Handzame, Belgium, where it was observed that, based on reactions from parents, teachers and pupils, the school environment is now perceived as more safe, particularly as a result of the introduction of a 30 km/h zone. In other cases, it was observed that the effect of measures such as cycle training, implementing Walking School Buses, and the provision of safer environments for walking and cycling to school (including crossing treatments) would be to improve the perception of safety and provide positive (if not measurable) effect in reducing child related injuries.

London Borough of Camden (UK) was not able to provide data relating to the relationship between casualties and STPs / safe routes to school schemes as these schemes were not necessarily based in locations where there was a problem with road traffic collisions. However, they had some information regarding the change in perception of safety, based on student responses to a survey question “are any roads hard to cross on your way to school?” before and after the implementation of engineering measures associated with safer routes to school schemes (see Figure 1).

Figure 1 A comparison of pupils who find roads hard to cross on their way to school before and after engineering changes (source: London Borough of Camden – note that sample sizes are relative small, so the results are indicative only)



Information provided by Camden Council officers advised that, as all safe routes to school schemes involve various engineering measures to the roads, they could infer that the change in perception could be due, in part, to the engineering measures, but that they could not pinpoint which measures had made the difference. They also observed that there could be just cause for negative changes in perception, for example where road works were being carried out in an area that may have made roads harder to cross.

Currently, Pinnacle Research has been working with Auckland Regional Council and the Energy Efficiency and Conservation Authority to develop a survey for parents that incorporates questions to monitor how their perception of children's safety on the route to school is affected by the school travel plan. Questions include parent's rating the safety of their child's route to school, identifying at what age it is appropriate for a child to walk, cycle or have cycle training at school, and so on. This survey process is currently being piloted in schools where an STP is to be developed. The intention is to repeat the same questions in the post-implementation survey and assess whether there has been any change in perception, with accompanying change in behaviour (i.e. their children's mode of travel changes to walking or cycling

Accompanying this could be a pre-development "school safety audit" documenting current school routes and the conditions children face in using them (e.g. maintenance of footpaths, drivers' behaviour and speed, traffic volumes, availability of crossings, etc). The three North Shore schools that are now implementing their STPs completed a road safety-engineering audit, including observations at the main school entrance in the morning and afternoon, as part of the STP development process. In England, the local highway authority will conduct a child pedestrian safety audit for an "official" walking bus (i.e. one with local authority support), but audits are not customary in STP development.

What is being suggested here may be a little broader than the audits completed for the three North Shore schools, to incorporate route assessments, including observations of driver behaviour, traffic speed and volume, the availability of crossings, the condition of the walking and/or cycling environment. A post-implementation audit could be conducted to examine what changes have occurred and an assessment made of the likely impact on safety, given available evidence.

3.5.2.2 At a local authority level

If a large enough area has been involved in school travel planning and other school travel work, the overall data may be sufficient to establish safety outcomes. Hertfordshire, in the UK, is one such area, where 515 of its 635 schools have been engaged in "school travel work", including developing and implementing safer routes to school schemes and/or "fully fledged" school travel plans. A significant component of the work has been the introduction of 30 km/h (20 mph) zones around schools as part of an area wide traffic management plan.

Hertfordshire has been able to demonstrate that the safety of all modes is improving (see Table 2). It should be noted that progress is not always consistent as accident totals vary from year to year due to their relative infrequency.

Table 2 Totals of all child casualties (fatal, serious and slight) on the school journey (source: DFT, forthcoming)

	1998-2000	1999-2001	2000-2002	Change
Pedestrian	196	173	161	-18%
Cyclist	53	39	35	-34%
Car user	140	121	116	-17%
Public service vehicle	72*	19	35	-51%
All	461	352	348#	-25%

* Figure strongly affected by one minibus crash
\# One moped accident added to the total

Other local authorities involved in the "Making School Travel Plans Work" project were also able to provide, at a county level, data to illustrate the effects of their existing school travel work (not all of this work was related to the development and implementation of STPs):

- Devon: accident statistics were steady from 2000-2002 for most schools (and in 2003 as well for some), despite an increasing number of children walking to and from school. At the same time, complaints from parents about safety have reduced at schools where school travel plans are in place. All but one of the schools involved reported a drop in car use averaging approximately 10-15% in this period.

- York: "school safety zones" (generally self-enforced 20 mph zones) have been established since around 2000 and have had a significant impact on the number of self-reported accidents that children are involved in. For example, in 2002, the number of year 5 and 6 students reporting that they had been involved in an accident at primary schools with safety zones was 3.6%, compared with 6.0% at all primary schools.

- Greater Nottingham: A mix of traffic calming, speed enforcement (cameras) and road safety education has been combined with safe routes to school schemes that introduced improvements to pedestrian and cycling conditions around some of the local schools. Table 3 shows the resulting decline in child pedestrian and cycling casualties. Note that there is insufficient data to be able to assess changes in cycling casualties on the school journey; hence the assessment is across all journey purposes.

Table 3 Child pedestrian and cycling casualties in Greater Nottingham per annum (1994-2002) (data sourced from DFT, forthcoming)

Type of injury	Pedestrian (injuries on school journey		Cyclist (injuries across all journey purposes)	
	1994-98	2002	1994-98	2002
Minor injuries	48	28	--	--
Serious injuries			23	8
Fatalities	16	16	1	0

The literature review found further evidence of the positive effects of area-wide and/or school speed zones in the UK. On average, 30 km/h zones reduce all casualties by up to 70% and child casualties even more (Sustrans, 2002: based on TRL research). In North Tyneside, UK, 6 schools with 20 mph zones and other road safety improvements had reduced child casualties from an average of 21 per annum in the 1990s, to 11 in 2001 (Sustrans, 2002). In Hull, 20 mph zones have achieved 74% reduction in child pedestrian accidents, while in Gloucester, a DFT-funded 5-year Safer City project involved extensive speed management and physical speed reduction measures – resulting in 24% decline in child pedestrian casualties between 1996 and 2000 (DFT, 2004).

A review of studies evaluating a broad range of health promotion approaches designed to prevent injuries in children and young adolescents (Towner et al 2001) found that, in addition to reducing casualties, evidence suggests that area-wide engineering schemes (including, but not limited to, restricting traffic speeds) and traffic calming measures are cost effective.

3.5.2.3 At the individual programme level

Measures to encourage cycling

Towner et al. (2001) found some evidence that cycle tracks reduce cyclist – car user crashes, but may increase cyclist – cyclist and cyclist – pedestrian injury crashes. They suggested more study was required.

In considering bicycle training schemes, Towner et al (2001) found that there is evidence that such schemes can improve safe riding behaviour, particularly if the training includes experience "on-road" or in the actual cycling environment (as opposed to in a playground or off-street site) and assist to reduce injury crashes.

Pedestrian / road safety skills training programmes

Towner et al's (2001) analysis of 10 studies found that pedestrian skills training programmes improved children's skills, both for individual skills such as timing and finding safe places to cross and a combination of specifically targeted skills. Practical roadside experience is stated as an "essential ingredient" of pedestrian skills training. A more recent review of 15 pedestrian safety education programmes by Dupperrex et al (2004 – reported in Wong et al 2004) concluded that safety education can improve children's knowledge and change their observed road crossing behaviour. However, as with Towner et al (2001), Dupperrex et al (2004) and Liabo and Curtis (2003) noted that there was little or no evidence regarding the effectiveness of education programmes on injury reduction in children. This suggests, perhaps, that changes to traffic patterns and/or motorist behaviour may be more important / relevant in addressing child injury rates.

Towner at al (2001) determined that road safety programmes combining educational and environmental measures in an integrated package showed some evidence of improving children's skill and injury reduction, but observed that more rigorous research is required in this area.

Walking School Bus

Wong et al (2004) recently attempted to evaluate the extent to which Walking School Buses have a positive impact on child pedestrian safety. Unfortunately, the quantitative assessment of the possible impact was inconclusive, as the 95% confidence intervals for rates of injury calculated for the years 2001 and 2003 overlapped, for both sets of data used, indicating that there was no change in the risk of child pedestrian injury in these areas prior to and after the implementation of the WSB programmes. The researchers suggest a number of alternative means of monitoring the impact of the WSB on the number of child pedestrian injuries, such a area-wide crash data monitoring; participant observation; or the adherence of WSB groups to the guidelines and practices of the WSB programme.

In the absence of quantifiable data, Wong et al (2004) explored other ways of considering the impact of Walking School Buses on child pedestrian safety. Examining the known risks of child pedestrian injuries, Wong et al (2004) observed that a WSB provides supervision to and from school which could ameliorate such risks as a child dashing out in front of a car; and reduce congestion at the school entrance, thus reducing the risk of car/pedestrian altercations.

They also felt that the involvement of the local authority in establishing WSBs provides the opportunity to ameliorate other risks, for example if speed reduction initiatives or parking restrictions are introduced or if the volumes of vehicle traffic are reduced because children are walking to school. However, they do not provide comment on the potential modification of the risk factors associated with age, as the

children in the highest risk group (5-9 year olds) tend to be the ones who are most likely to participate on a Walking School Bus.

3.5.2.4 "Safety in numbers" effect of encouraging walking and cycling

While traffic calming and school speed zones may be a factor in reducing the risk of injury to cyclists and pedestrians, there is also good evidence internationally to show that higher levels of cycling and walking per capita result in lower accident rates (DFT, 2004 – citing various sources):

- In the Netherlands, level of cycle traffic increased by 30% between 1980 and 1990, yet annual cyclists' deaths fell
- In York, investment in traffic calming and cycling infrastructure over a 10-year period, reduced casualties by 30%, while peak-hour cycling increased by 10%
- An international survey of travel by 10-14 year olds, using comparable data from 8 countries, shows that higher levels of cycling among this age group is linked with fewer accidents per km cycled.

Jacobsen (2003) used data sets from 68 Californian cities; 47 Danish towns; 14 or 8 European countries (14 where cycling kilometres and trips was concerned; 8 where walking trips was considered); the UK and the Netherlands to examine the relationship between the numbers of pedestrians and cyclists and the crash rates between motorists and pedestrians or cyclists. He found that the multiple independent data sets supported the conclusion that "a motorist is less likely to collide with a person walking and bicycling when there are more people walking or bicycling" (p.208) – suggesting there is safety in numbers.

Jacobsen modelled the relationship as a "power curve", with the result that "at the population level, the number of motorists colliding with people walking or bicycling will increase at roughly 0.4 power of the number of people walking or bicycling" (p.208). Hence, if the community doubled the number of people walking or cycling, you could expect there would only be a 32% increase in injuries, rather than a 100% increase. Alternatively, if the risk to the person walking or cycling is considered, the individual's risk of injury (declining at roughly –0.6 power) in a community with twice as much walking and cycling, is 66% less than what it would have been previous to the increased numbers walking and cycling.

Jacobsen analysed the likely causes for this relationship, identifying possible explanations as changes in human behaviour, social mores, laws and roadway design. He suggested that social mores, laws and roadway design were "implausible" reasons, given that they generally change quite slowly, while time series analysis of the "safety in numbers" effect indicates that it comes into place quite quickly. Hence, Jacobsen concluded that *motorist behaviour* largely determines the likelihood of collisions with pedestrians and cyclists. He cites further evidence in the literature supporting the view that motorists drive more slowly and/or give more consideration to pedestrians and cyclists when there are greater numbers of them present.

Jacobsen did not (or perhaps could not given the available resources and/or information sources) consider what influence traffic management and safety measures had on the "safety in numbers" effect. It seems inherently logical that the implementation of traffic management measures, such as school speed zones and traffic calming, that encourage vehicle traffic to slow down and prompt increased walking and cycling activity, will also result in reduced accident rates per kilometre or per capita for pedestrians and cyclists. Similarly, as pedestrian and cyclist numbers

increase, there will be the demand for more pedestrian and cyclist “facilities” (e.g. footpaths, crossings, cycle lanes, etc.). The provision of these facilities could also affect casualty rates while attracting further people to walk and cycle.

Jacobsen (2003) noted that a limitation of the study lies with the data collection, insofar as much of the data is collected by surveys and children may be underrepresented.

4. Safety and school travel work: towards "best practice"

4.1 The challenge

We were asked to identify "best practice" in developing and implementing school travel plans that are likely to have a road safety benefit, based on the literature review and case studies. We have assumed that the Land Transport Safety Authority's primary interest will be in *tangible* safety benefits – i.e. those that have a quantifiable positive impact in reducing child injuries.

While there is reasonably strong evidence that STPs can result in *student* modal shifts away from car, the impact of this on the actual volumes of motor traffic around a school and on overall car use by the driving population of adults is unclear. Furthermore, establishing unambiguous "cause and effect" with respect to school travel plans and safety outcomes has proved to be difficult. This is especially true if impacts are considered at the individual school level where, generally speaking, there will be insufficient history of injury accidents for safety improvements to be monitored. Instead, reliance has been on changes in *perceptions of safety* by children, parents, local authorities and/or school staff. Because cause and effect cannot be clearly established, it is then very difficult to comment on "best practice" in achieving road safety benefits within school travel planning development.

With respect to specific measures or programmes, there is good evidence of safety improvements in terms of reduced crash injuries, particularly with respect 20 mph / 30 km/h speed zones and/or traffic calming (resulting in lower vehicle speeds). There is also reasonable evidence to suggest that the presence of larger numbers of cyclists and pedestrians in the traffic will have a positive impact in reducing crash rates per head of population, as will the establishment of cycle lanes / paths. Education and training programmes have been shown to improve children's behaviour when in the traffic environment, but there is insufficient evidence to demonstrate a reduction in crash injuries. In most cases, the evidence comes from examples where the programme has occurred on a reasonably large scale (e.g. a local community or suburb). Where these programmes or measures form part of a school travel plan, they are unlikely to provide demonstrable safety benefits given the smaller scale of a school community.

Another confounding factor in identifying "best practice" for school travel plans is that various jurisdictions "blur" the boundaries between different school travel work programmes. In the UK, safer routes to school and school travel plans are often discussed in the same breath and the measures adopted by the two programmes appear to overlap considerably. In the MSTPW project (DFT, forthcoming), researchers used the term "school travel work" because it was not always possible to distinguish between the programmes. In mainland Europe, "mobility management" programmes have sometimes included a mix of school travel planning and other measures, and it is not always clear what has been evaluated when reporting is undertaken.

4.2 A "best practice" framework

Given the lack of an overt relationship between school travel plans *per se* and tangible safety benefits, we developed a framework to consider best practice based on known child injury risk factors as identified in the literature. We selectively chose papers that were systematically reviewing the results of other work to identify and assess these risk factors.

As Table 4 shows, there are a wide variety of risk factors associated with childhood injury in the transport environment. However, there is also considerable agreement among researchers that the *primary* risk factors are:

- Age: children between 5 and 9 years old (and up to 12 years old)[6]
- Low socio-economic status

- Volume of motor traffic on the road
- Child behaviour / roadside conditions: particularly "dashing out" onto the road from between parked cars
- Traffic speeds driven.

The first two factors, "age" and "low socio-economic status" define particular population groups that need to be targeted in order to improve road safety outcomes, while the other three factors point to potential changes, either to behaviour or the environment or both, that could contribute to the improved safety outcomes for these target populations.

While we did not undertake an exhaustive search, there was some evidence in the literature to suggest that the risk associated with "low socio-economic status" related to the increased exposure of such children to traffic, as they generally walk or cycle more often and also that average vehicle speeds are often higher than speeds in higher socio-economic areas (CICH, 1998). Children of solo parents and/or non-white or immigrant families have been shown to cross more roads and experience higher accident rates than those in 2 parent families and/or who may be European descent (Roberts and Pless, 1998; CICH, 1998). The contributing factors to the risk associated with "low socio-economic status" are an area for further investigation.

Table 4 Known childhood traffic injury risk factors (sources: as indicated)

Source	**Risk factors* (including magnitude where provided)**
Child risk factors	
Assailly 1997 Malek, M; Guyer B, Lescohier I. 1990. Wazana A; Krueger, P; Parminder, R; Chambers, L. 1997 Wong et al 2004	**5-9 yr olds (5-12 yr olds – Wazana et al**.) – 5 yr old > risk than 9 yr old 8-12 yr – rate of injury per km of time spent on the road or per road crossing = 2x that of 3-7 or 13-17 yr olds Boys -2-3 x more likely than girls CICH (1998) reports much greater variation in age
Assailly 1997 Malek, M; Guyer B, Lescohier I. 1990.	**Road crossing (especially mid-block)** **–** Dashing out onto the street between parked cars (reduced driver visibility due to parked cars)

[6] We acknowledge that the 0-14 year old category, in its entirety, is the age group at highest risk of pedestrian injury – what is shown here is a sub-group within this that is at the *greatest* risk.

Retting et al. 2003 Anderson et al 2002 CICH 1998 Wong et al 2004	– Child stops, looks both ways, has a clear view of traffic, but doesn't notice approaching vehicle & steps into its path
(Child) socio-cultural factors	
Wazana A; Krueger, P; Parminder, R; Chambers, L. 1997 Roberts and Pless 1998 Roberts, Norton and Taua, 1996 Assailly 1997 CICH 1998 Wong et al 2004	**Exposure level to motor traffic through number of roads crossed** A number of factors contribute to this exposure level: *Car ownership* –Children from households with fewer cars tend to cross roads at nearly double the rate of those in households with 1 car; and at 2.8 times the rate of those with 2 cars *Low socio-economic status* **–** Poverty: children in lowest quarter income bracket cross roads at a rate 50% higher than children in the highest quarter income bracket – Solo parent households (90% in the UK are mothers) – associated with poor housing, and social isolation – children from such households experience a 50% higher risk of pedestrian injuries – Lack of parental supervision and education: associated with large families and/or single parent families *Immigrant / non-white* – in NZ, children from Pacific Island households crossed roads at 2.6 times the rate of European children
Physical environment factors	
Wazana A; Krueger, P; Parminder, R; Chambers, L. 1997 Anderson et al 2002 CICH 1998 Wong et al 2004	**Volume of traffic**:>750 vehicles per hour 14 x increase risk of child accident than streets with volume <250 vehicles per hour **Speed of traffic**:>50 km/h have 1.26 x risk of child pedestrian accidents than <40 km/h 3 x more likely to be injured on main road than urban, unclassified roads 2 x more likely to be injured on roads with > 2 lanes
Wazana A; Krueger, P; Parminder, R; Chambers, L. 1997 CICH 1998	Rainy days (v. clear days) Darkness (v. daylight) Seasonal (likely due to weather & daylight hours)

* **bolding** indicates that this is considered to be a *primary* or significant risk factor – contributing to a greater share of injuries than others

What are the implications of these childhood traffic injury risk factors for school travel work, generally, and school travel plans in particular? First of all, they suggest that primary school children (5-12 year olds) are the population group with the greatest safety risks among children. Hence, *as a first preference*, school travel work with a safety component should specifically target this age group rather than secondary schools. Secondly, within the primary school age group, school travel work should aim to reduce motor traffic volumes and speed and to reduce the likelihood of mid-block crossings (particularly from between parked cars) in order to incur the most significant safety gains.

Based on this framework, one could conjecture that combining such traffic management measures as school or neighbourhood speed zones (30 km/h being the ideal in terms of reduced death and serious injury) and traffic calming with school travel plans – which address site-specific safety issues as well as provide education and encouragement for the school community to walk and cycle – would deliver the greatest overall benefit to the school community, as well as the wider community and the local authority.

5. Conclusion: the role of safety in school travel plans

The discussion of the case studies and literature review in section 3 reveals that safety already plays a large role in the development and implementation of school travel plans:

- Safety is a primary motivator for undertaking school travel plans, particularly from the perspective of schools: issues identified include motor traffic volumes and speeds, as well as parking conditions around the school. Reducing car use (and congestion around the school) is significant motivator for some (local and national) government agencies. Congestion associated with car use may be seen as a safety risk for children travelling to school – and so the two motivators become inextricably linked. Increasingly, other motivators are being introduced, such as raising children's physical activity levels (in the face of escalating levels of childhood obesity) and reducing greenhouse gas emissions.

  There are sometimes tensions between different agencies and the schools or between the agencies themselves with respect to the objectives in undertaking school travel plans, particularly where there is a view that encouraging children to walk and cycle, as a means of reducing car use and increasing physical activity levels, will expose children to greater risk of injury. This highlights the importance of understanding the link between "safety in numbers" and pedestrian and cyclist injury risk (see further discussion below).

- Identified barriers to children walking and cycling to school usually include safety issues such as "dangerous" routes (traffic volume, unsafe crossing, inadequate pedestrian / cycling paths), as well as non-safety barriers: the convenience of taking children by car; distance from school, lack of cycle storage facilities and weight of school bags

- Measures adopted in school travel plans include a mix of tools to encourage walking and cycling (in order to reduce car use) and to improve the safety of children's routes to school. Some of the measures adopted (such as most education programmes, cycle training and maintenance programmes, Walking School Bus, all types of engineering measures) incorporate a direct safety element within them (e.g. a Walking School Bus has adult supervisors to ensure that children walk and cross roads in a safe manner on the way to and from school) as well as being aimed at increasing the number of children walking and/or cycling to school.

When it comes to reporting the impact of school travel plans, however, the emphasis shifts from safety to the change in children's mode use. This may simply reflect the fact that it is far easier to survey classrooms of children regarding how they travelled to and from school than it is to identify changes in child injury rates. Probably because of this, the impact of school travel plans on children's mode use (in terms of shifting away from car) has been adequately demonstrated, while the impact of STPs on safety, in most cases, has not. Parental driving patterns also remain largely unstudied. Usually, the perception of key stakeholders is that safety has improved in schools where travel plans have been implemented, but there is little substantive evidence to justify this perception, except in cases where there has been extensive engineering work to establish 30 km/h zones (usually on an area wide basis, covering more than one school).

We have suggested that monitoring to identify the safety impacts of a school travel plan could include survey questions to parents (and/or the wider community), prior to developing the STP and subsequent to its implementation, asking about their perceptions of children's safety in the environment. This is currently being piloted at various schools in New Zealand. Accompanying this could be a pre-development "school safety audit" documenting current school routes and the conditions children face in using them (e.g. maintenance of footpaths, drivers' behaviour and speed, traffic volumes, availability of crossings, etc). A post-implementation audit could be conducted to examine what changes have occurred and an assessment made of the likely impact on safety, given known crash reduction factors.

Given the current lack of information and the inherent difficulty in monitoring safety impacts at the school level, our "best practice" framework focuses on identifying school travel work which addresses the most significant childhood traffic injury risk factors as identified in the literature. We assume that, all other things being equal, adopting measures designed to deal with known risks will have positive safety outcomes even if they cannot be calculated.

While there is a slight indecision as to the extent of the age range (being either 5-9 or 5-12 years old), as was stated in section 4.2, clearly the group of children most at risk of injury are those at primary school. Thus, at first preference, efforts to address children's safety through school travel work should focus on primary schools. Internationally, most school travel planning, safer routes to school programmes, walking school buses and "cycle trains" (bicycle pools in Belgium) have been targeting primary schools, even taking into account the ratio of primary to secondary schools.

Secondly, when undertaking school travel work at primary schools aiming to achieve safety benefits, "best practice" would suggest adopting suitable measures to mitigate the most significant childhood traffic injury risk factors know for this age group. The main risk factors and possible interventions are shown in Table 5.

Table 5 Interventions to address significant childhood traffic injury risk factor

Significant childhood traffic injury risk factors	**Interventions**
5-9 yr olds (5-12 yr olds – Wazana et al 1997)	**STP (package of interventions):** targeting age group of children at highest risk, providing education / training, varying degrees of engineering measures and "safe" alternatives such as WSBs, cycle paths, etc. **Safe routes to school (UK model – package of interventions)**: targeting age group of children at highest risk, providing primarily engineering measures and some safety education / training

	programmes **WSB:** generally targeting 5-9 year olds **Cycle trains**: generally targeting 5-12 year olds Patrolled / signalised crossings **Education / training programmes** (e.g. RoadSense) for walking or cycling
Low socio-economic status	**STP:** as a process for prioritising / identifying interventions taking into account community and site-specific conditions, to address safety and other concerns **Safe routes to school (UK programme)**: as a process for prioritising / identifying interventions recognising area-specific transport conditions, primarily safety focused Other contributing factors need further exploration to identify appropriate measures to reduce risk
Volume of traffic (particularly >750 vehicles per hour or 15,000 vehicles per day) **Speed of traffic** (particularly ≥50 km/h)	**STP:** as a process for prioritising / identifying site-appropriate walking, cycling, and PT initiatives designed to reduce numbers of children being driven to school, and *ipso facto*, reduce volumes of traffic around the school **Traffic calming** **School speed zones** (30 km/h appears to be the internationally accepted target) – either "full-time" or during morning & afternoon periods – requires some on-going enforcement activity (this may be self-enforcing, such as speed humps) **Off-road cycle paths** / lanes (removes child from "danger zone" of the road)
Road crossing – particularly dashing out onto the street between parked cars	**STP:** as a process for prioritising / identifying site-appropriate interventions **WSB / cycle trains** – supervised walking / cycling to school **Improvements to footpaths and crossings**, especially introducing patrolled / signalised crossings **Parking restrictions** / park and walk sites / drop-off zones – usually requires some on-going enforcement activity – improves driver's ability to see children **Sign-posted recommended (safe) routes to school** – including teaching the children how to use them **Education / training programmes** (e.g. RoadSense) for walking or cycling

While a number of these interventions could be adopted as programmes in their own right, experience suggests that there are synergies in implementing a "package" of programmes, such as is generally done through STP development in New Zealand. As suggested in section 4.2, the greatest benefit may be derived by combining broader community-based initiatives, such as area-wide low (or school) speed zones (30 km/h), traffic calming and the development of STPs together. Indeed, in the UK, many councils see engineering measures as complementary with the education and promotional components of school travel work (DFT, 2004). They also observed that when placed in the context of school safety zones or safe routes to school (note that STPs in the UK usually focus on "minor" infrastructure improvements), engineering

measures such as traffic calming, 30 km/h speed zones, or the extension of cycle paths appear more acceptable to the wider community.

There is a developing body of robust evidence supporting "safety in numbers" with respect to having greater numbers of children (and/or adults) cycling and walking – insofar as *accident rates per kilometre or per capita decline* as more people participate in these activities (although the actual numbers of accidents may increase somewhat). Hence, various measures commonly adopted in STPs – for example, incentive programmes, promotional events and campaigns, establishing Walking School Bus schemes, reducing the weight of school bags, providing cycle shelters – that are generally considered to be more oriented to reducing car use, should not be discounted in terms of their potential contribution to safety improvements.

The recent DFT report (2004) suggested that, at least in the short term, *modal shift* could be achieved more quickly by prioritising non-engineering measures (education / training; minor-infrastructure improvements; promotion; WSBs, etc). This has been the case in Buckinghamshire. Others argued that undertaking (major) engineering work, such as traffic calming and school speed zones, first – to obtain safety benefits – will deliver longer term effects. York has taken this approach. Unfortunately, neither approach has been in place long enough to be assessed. There would also be problems of attributing causality as, for example, York has pursued a strong traffic restraint policy (30 km/h zones) across the city for over a decade. It could be claimed, therefore, that wider application of traffic calming and other safety measures not directly linked with STPs contributes to declining casualty numbers while walking and cycling numbers and exposure increases.

Based on the international case studies, it is not possible to make recommendations on how to develop and implement STPs that will achieve *quantifiable* safety benefits, apart from introducing area-wide 30 km/h school speed zones accompanied by traffic calming. Instead, we have considered known childhood traffic injury risk factors and developed a framework to illustrate the kinds of measures that, if included in an STP should, other things being equal, achieve safety benefits.

In considering the relationship between school travel planning and other programmes, it is perhaps worth noting that it is quite common internationally for more significant engineering works (such as traffic calming and 30 km/h speed zones) to be undertaken outside of the school travel planning process. In the UK, it is part of the safer routes to school programme; in Belgium and Victoria, local (municipal) authorities are responsible for it. School travel plans are then focused on the more "minor" engineering measures such as improving school crossings, footpath maintenance, and cycle shelters / storage facilities.

At this stage, in New Zealand, the three STPs already implemented considered a wide range of engineering measures, including cycle lanes and traffic calming, suggesting that New Zealand could follow a different model that incorporates both "significant" and "minor" engineering measures. Recognition needs to be made of other available programmes such as the LTSA "Safer Routes" programme which is intended to address identified cycling and pedestrian safety problems at a community level; and Wellington City Council's "Safer Roads" project, which aims to reduce suburban / community traffic speeds to 40 km/h throughout Wellington City.

There are definite synergies between these two programmes and school travel plan development and implementation. Safer Routes is a community-based programme, designed to address identified cycling and pedestrian safety problems. It is

particularly targeting communities where pedestrians and cyclists are shown to be at high risk of injury (i.e. lower socio-economic areas). The intention is to empower local communities and to deliver a programme containing a balanced range of interventions addressing their specific concerns. In some cases, there may be an identified safety risk that primarily affects children, perhaps at a particular school, meaning that it would be efficient and effective to undertake STP development alongside the Safer Routes programme.

However, dependent on the perceived safety issues within the community and the population group(s) affected (e.g. if children feature as a prominent "at risk" group), it may be more sensible to work with the relevant school or schools to develop STPs, rather than adopt a community-wide Safer Routes process. Similarly, a Safer Routes programme may not always include STP development, if the issues do not appear to warrant such action, or if other interventions planned through Safer Routes might fully address the school-related issues.

In conjunction with their Safer Roads programme, Wellington City Council is adopting the New Zealand version of "Safer Routes to School" for schools where there is a community request to address safety issues. The programme is focused primarily on engineering measures (to accompany the 40 km/h speed zone)[7] to improve safety in the walking, cycling and road environments. There is no emphasis on measures to *encourage* walking, cycling, or passenger transport use.

It appears there may be an opportunity for the Safer Roads programme to work in conjunction with an STP development process, as the STP development would identify appropriate engineering safety measures – as does the Safer Routes to School rubric – but it would also educate and encourage children and their parents to actively use and enjoy the improved environment.

[7] It should be noted that it is generally accepted practice internationally to establish area-wide and school speed zones of 30 km/h, rather than the 40 km/h being pursued by Wellington City Council. At 30 km/h, 19 out of 20 children would survive being hit by a vehicle (Liabo and Curtis, 2003). However, in order to reduce speeds to 30 km/h in New Zealand, Councils would have to put in place extensive physical traffic calming measures, greatly increasing the cost of the exercise. Also, there may not (yet) be community support for such actions.

Appendix A: Literature review & references

Author(s). Date. Title & source	Key points
Anderson, C; Boarnet, M; McMillan, T; Alfonzo; M, Day, K. September 2002. *Walking and Automobile traffic near schools: data to support an evaluation of school pedestrian safety programs*. Institute of Transportation Studies, University of California Working Paper (UCI-ITS0-WP-02-17).	• Developing a methodology for determining the pedestrian safety risks (measuring time-trend traffic volume, speeds, behaviour and pedestrian /cyclist counts) around schools for before and after studies of engineering changes • Survey of literature found influence of environmental variables on the risk of pedestrian injury: speed is an important risk factor for injury and an important determinant of injury severity; poor visibility is also a risk factor, as demonstrated by the association of pedestrian injuries among children with the presence of parked cars; education of child pedestrians does not appear effective; factors related to the urban environment contribute to childhood pedestrian safety • Streets with traffic volumes > 750 vehicles per hour associated with a 14-fold increase in the risk of childhood pedestrian accidents compared to streets with traffic volumes <250 vehicles per hour • Traffic speeds >50km/h associated with 1.26 times the risk of childhood pedestrian accidents compared with streets with travel speeds <40 km/h
Federal Highway Administration. December 1999. *Pedestrian Safety in Australia.* US Department of Transportation Publication no. FHWA-RD-99-093	• Victoria: provision of adult crossing supervisors is not a cost-effective road safety measure – consumes about ½ the budget available for pedestrian safety, despite the fact that only a handful of crashes occur at children's crossings or other crossings where crossing supervisors are present • Various states have 40 km/h speed zones on a part-time basis (sign indicates times at which it applies or sign folds out when in operation) – evaluation of 6 p/t speed zones in Victoria found that there were "considerable speed reductions" e.g. within 40 km/h part time school zone, mean speeds fell about 20 km/h % & 85 percentile speeds by 14-18 km/h – over a 6-month period, however, speeds tended to creep upwards & over ½ of the free speed vehicles were exceeding the school zone limit • Different types of crossings have different crash risks: children at school crossing are safer than those at a zebra crossing at same time of day; light-controlled crossings = safest of all • All Australian states and territories have elements of road safety available for teaching in schools – extent to which it is taught is left to schools to decide • SRTS in Australia includes promotion of safest routes; provision of some low cost engineering treatments & education of community in the philosophy behind the route and its safe use (e.g. different than UK SRTS version)
Halcrow. 2002. *Multi-modal studies: soft factors likely to affect travel demands.* Report prepared for the Department for Transport, UK.	• 507 STPs implemented in 1999 were analysed to determine the main objectives targeted and found: - Sustainability / reducing reliance in the car (33%) - Road safety / reducing accidents (25%) - Reducing traffic congestion (12%) - Overcoming personal safety concerns (2%) • Note that other data presented has been superseded by Cairns et al 2004
Researchsolutions. August 2003. *The trip to education*. A market information study for Infrastructure Auckland and the Auckland Regional Council. Auckland, New Zealand.	• Separate interviews with parents and their school children to identify current and possible future mode use; barriers to change; and attitudes

Cambridge, S; Osmers, W; & Francis, T. 2003.*Evaluation of speed trailers in Canterbury*. Report prepared for Christchurch City Council. Accessed from: http://www.ccc.govt.nz/Reports/2003/SpeedTrailer/	• Units to monitor actual travel speed of vehicles are set up on main road near schools in an attempt to slow the traffic to at least the speed limit & increase driver awareness of school zone • Study found that drivers did slow down • No other info on safety impact
Osmers, W. 2002. *The warrant for 40 km/h school zones (electronically-signed part-time speed limits at schools).* Land Transport Safety Authority, Wellington, New Zealand.	• Safety is main driver for use • Outlines how "warrant" was developed based on trials along with the criteria for where the school zones should apply: 1. High level of on-road, school related activity (at least 50 children crossing the road or entering or leaving vehicles at the roadside; and 2. The mean speed of free running vehicles is >45 km/h; or the 85th percentile speed of free running vehicles is >50 km/h; or there have been speed related crashes of any type along roadway outside school in previous 5 years; on-road, school-related activity is occurring on main traffic routes with high traffic volumes • Locations most likely to benefit: arterial routes, multi-lane roads or high speed environments and have on-road, school-related activity at an obscured school frontage • Impact on speed noted – no crash data
Towner, E; Dowswell, T; Mackereth, C; Jarvis, S. 2001. *What works in preventing unintentional injuries in children and young adolescents? An updated systematic review.* Health Development Agency, NHS, UK.	• Review of studies evaluating a broad range of health promotion approaches • Some evidence that school-crossing patrols have reduced road traffic accidents but more evidence is required (1 study) • Good evidence that area-wide engineering schemes and traffic calming measures reduce accidents, particularly for vulnerable road users such as children and cyclists – in addition, evidence suggests that area-wide engineering schemes are cost effective (6 studies) • Some evidence that cycle tracks reduce cycle-car user injuries but may increase cyclist-cyclist & cyclist pedestrian injuries - more research is required (1 study involving 28 Danish cities) • Pedestrian skills training programmes shown to improve children's skills, both for individual skills such as timing and finding safe places to cross & a combination of specifically targeted skills – practical roadside experience considered an essential ingredient of pedestrian skills training (10 studies) – evidence less convincing re: injury reduction • Road safety programmes combining educational and environmental measures in an integrated package show some potential but more rigorous research is required (7 studies) – also observed that young people (11-18 years) are harder to reach and some approaches may *encourage* unsafe behaviour • Some evidence that bicycle training schemes can improve safe riding behaviour (3 studies), particularly if training includes experience "on-road" or in the actual cycling environment (rather than a playground) – reasonable evidence

	of injury reduction
Sustrans. 2002. *Safety on the Streets for Children* (Information sheets FSO2)	• Traffic calming experiences: in general result in 60% reduction in pedestrian and cycle casualties (since 1991, around 300 20 mph zones have been established in England) • On average, 20 mph zones reduce all casualties by up to 70% and child casualties even more (based on 1996 TRL research) • 6.2% reduction in accidents for each 1 mph reduction in vehicle speed (based on TRL research) • North Tyneside SRTS: 6 schools have 20 mph zones and other road safety improvements (in 17 STPs) reduced child casualties from average of 21 in 1990s to 11 in 2001
Corbett-Fox, L; Jakob-Hoff, M; Coggan, C; Hooper R; Daldy, R. 2001. *Evaluation of the Safe Routes to School Programme*. Injury Prevention Research Centre. Centre Report No. 57.	• aim was to determine the effects of the SRTS programme – emphasis on changes to road safety related practices and outcomes in community • established control group of non-SRTS schools • monitored practices & policies (insufficient detail provided), not injuries or elimination of environmental hazards (e.g. engineering changes) – too few recorded incidences of pedestrian injury to be able to establish any trends / changes • found that SRTS programme encouraged SRTS community to become more focused on road safety issues; SRTS schools felt more positive about their approach to road safety; SRTS helped schools formulate road safety policies and to integrate them into school practices
Canadian Institute of Child Health (Hunt, C.). 1998. *Active / Safe Routes to School – a literature review and summary of key informant interviews on child/youth risk factors associated with active transportation to and from school and recommendations to promote safe routes.* Accessed from: http://www.goforgreen.ca/asrts/	• Identifies wide range of risk factors (including attitudes about personal safety) – from perspective of: - Child: cognitive development; physical growth and development (visual, motor and auditory development, age, gender); social development (peer presence, bullying) - Family: family resilience; parent knowledge, attitudes and practices; parent supervision; culture/ethnicity; maternal employment; family income; parent education - Physical environment: neighbourhoods; traffic (congestion / speed, volume, parked cars & mid-block crossing); season and weather, day and time - Driver: speed, action, vehicle • Risk associated with "low socio-economic status" related to the increased exposure of such children to traffic, as due to low car ownership rates - lack of parental supervision (often associated with large families and/or single parent families) and the level of parental education may also be contributing factors • Recommendations to promote SRTS: - Build healthy public policy, both at local authority and school levels - Create supportive environments with respect to routes to school (e.g. Traffic calming) - Strengthen community action (involve community in creating active routes to school) - Develop personal skills through child pedestrian education, parent and driver education
Kearns, R & Collins, D. 2003. *An assessment of walking school*	• Based on 39 WSBs operating in 21 schools in Auckland • largely qualitative evaluation of WSBs from perspective of school principals & some parent coordinators

buses in the Auckland Region. A report to Auckland Regional Council, Auckland, New Zealand.	• Schools that have adopted WSBs tend to be located in wealthier areas, notwithstanding the fact that child pedestrian injury rates are likely to be higher in poorer, more deprived, areas. Schools with the highest 'Decile 10' ranking are the most likely to adopt a WSB. • Establishing a WSB can create leverage for other interventions to improve the walking environment (e.g. footpath & crossing improvements). An example of this is Gladstone Primary, which successfully lobbied for traffic calming measures on Asquith and Martin Avenues through its Safe Journeys Coalition (SJC). • Recommends that schools be encouraged to establish road safety groups like the SJC that can provide ongoing support for WSBs & address a range of safety issues in the neighbourhood at large. • WSBs should "be regarded as a necessary but not sufficient intervention to promote child pedestrian safety and to reduce traffic congestion. WSBs are a tool to begin, rather than complete, the journey towards safer routes to school for children." (p. 22)
Department for Transport (UK). 1999. *School travel strategies and plans: a best practice guide for local authorities.*	• Provides advice on developing STPs, including a step-by-step process, a toolkit of initiatives, methods of monitoring and evaluation, sources of funding and case studies • (some of our earlier case study material is drawn from here)
Energy Efficiency and Conservation Authority. 2003. (draft) *School Travel Plan Coordinators' Guide*	• step-by-step guide to developing STPs, including tool kit of measures, resources for coordinators and schools • Includes background case study material (on 3 Auckland case studies)
Jacobsen, PL. 2003. Safety in numbers: more walkers and bicyclists, safer walking and bicycling. *Injury Prevention* 2003 (9):205-209	• Used five different data sets from 68 Californian cities; 47 Danish towns; 14 or 8 European countries; the UK and the Netherlands to examine the relationship between the numbers of pedestrians and cyclists and the crash rates between motorists and pedestrians or cyclists. • Found that the multiple independent data sets supported the conclusion that "a motorist is less likely to collide with a person walking and bicycling when there are more people walking or bicycling" • A limitation of the study lies with the data collection, insofar as much of the data is collected by surveys and children may be underrepresented. • Motorist behaviour largely determines the likelihood of collisions with pedestrians and cyclists - literature supports the view that motorists drive more slowly and/ or give more consideration to pedestrians and cyclists when there are greater numbers of them present.
Rowland, D; DiGuiseppi, C; Gross, M; Afolabi, E; Roberts, I. 2003. Randomised controlled trial of site specific advice on school travel patterns. *Archives of Disease in Childhood* 88:8-11.	• Aim to evaluate effect of site specific advice from a school travel coordinator on school travel patterns • Clustered randomised control of 21 primary schools (11 intervention schools; 10 control) – pre-intervention survey 1997; intervention 2000?; post-intervention survey 1 year after intervention • 9 of 11 schools had STPs in place after 1 year; 0 of 10 control schools did • Proportions of children walking, cycling or using PT were similar in both groups; parental worry about traffic danger was similar – although after adjusting for confounding factors, parental worry in intervention schools may have

	was similar – although after adjusting for confounding factors, parental worry in intervention schools may have declined "modestly" • Conclude that presence of coordinator increased production of STPs but no evidence about changed travel patterns or in parental fears (NOTE: timeframe very short) • Schools which had STPs had implemented far more activities (e.g. walking buses; drop off zones; requesting minor infrastructure modifications from local authority; applying for external funding) than had control schools
Wong, G; Patterson, P; Fill, J; Richards, G. June 2004. *Evaluation of Walking School Bus programme.* Centre Report No. 95. Injury Prevention Research Centre, Auckland, New Zealand.	• Identified perceptions of key stakeholder groups of the risk and value of WSBs as they relate to child pedestrian safety • Attempted to quantitatively assess the impact of WSB on child pedestrian safety but the data was inconclusive • Literature review to compare known risk factors for child pedestrian injury with potential protective factors within the WSB model • Discussed possible monitoring tools for ongoing assessment of the impact of WSBs on child pedestrian safety.
Dupperrex, O; Bunn, F; Roberts, I. 2002. Safety education for injury prevention: a systematic review of randomised controlled trials. *BMJ(*324): 1129-1134.	• Systematic review of randomised control trials on pedestrian education programmes for all ages • 15 trials assessed – 14 on children: none assessed the effect on pedestrian injury rates, but 6 considered effects on behaviour • Safety education can improve children's knowledge & change observed road crossing behaviour but whether this reduces the risk of pedestrian motor vehicle collision and injury occurrence is unknown. • Evidence that changes in safety knowledge and observed behaviour decline with time suggesting that safety education must be repeated at regular intervals.
Retting, R; Ferguson, S; McCartt, A. 2003. A Review of Evidence-Based Traffic Engineering Measures Designed to Reduce Pedestrian-Motor vehicle Crashes. *American Journal of Public Health* 93 (9) 1456-1463.	• Based on search within TRIS database, considered engineering measures (three categories – speed control, separation of pedestrians from vehicles, and measures that increase the visibility and conspicuity of pedestrians) • Pedestrian crashes involving a child most often result from the child's error – lack the cognitive skills to judge vehicle distance and dash out into the street. • Modification of the built environment can substantially reduce the risk of pedestrian –vehicle crashes. • Greatest potential: single-lane roundabouts, sidewalks, exclusive pedestrian signal phasing, pedestrian refuge islands and increased intensity of roadway lighting
Wazana A, Krueger P, Parminder R, Chambers L. A review of risk factors for child pedestrian injuries: are they modifiable? *Injury Prevention* 1997; 3: 295-304.	• Systematic literature review to examine risk factors in childhood injuries • Child risk factors: age (5-12), sex (boys), race (non-white) • Social & cultural factors: socio-economic status (low); crowding (more); family environment (less supervision) • Physical environment risk factors: time of day (not so clear, but afternoon); weather (rainy); roads (main); lanes (>2); speed limit (increasing); play areas • Driver risk factors • 3 most important risk factors: 1) physical environment – high volume of traffic, 2) social and cultural – lower income & 3) child – younger age.

	• Other important factors: higher speed limits, absence or lack of protection of play area, high proportion of curb side parking, crowding, high mean vehicle speed, shared driveway, risky behaviour, and lack of preventive behaviours.
Assailly, JP. 1997. Characterization and Prevention of Child Pedestrian Accidents: An Overview. *Journal of Applied Developmental Psychology* 18: 257-262.	• Considers which children in European countries become involved in accidents & causation factors • Children most at risk are 5-9 year olds • Boys have higher pedestrian accident rates than girls • Low socio-economic children and immigrant children are over represented. • Common scenario: returning from school, child dashes out between parked cars on streets familiar to the child and often having relatively low traffic densities. • Other (less) common scenario: child stops at the curve, looks both ways, and has a clear view of traffic, but doesn't notice approaching vehicle& steps into its path
Malek, M; Guyer B, Lescohier I. 1990. The epidemiology and prevention of childhood pedestrian injuries. Accident Analysis and Prevention 22(4):310-313.	• Children aged 5-9, boys, low socio-economic are most at risk • Accidents occur close at home & most frequently while at play • Mid-block dart out is most frequent type • Notes that programmes (incl. Education & engineering) of various types have met with modest success.
Canadian Institute of Child Health (CICH – Dr Cindy Hunt). 1998. Active / safe routes to school. Canada: GoforGreen / CICH. Accessed from: http://www.goforgreen.ca/asrts/	• Extensive literature review and summary of key informant interviews on child/youth risk factors associated with active transport modes to and from school & recommendations for safe routes to school • Identifies wide range of risk factors (including attitudes about personal safety) – from perspective of child, family, physical environment (including traffic congestion / speed, volume, parked cars & mid-block crossing), driver – gives quantitative info where feasible • Risk associated with "low socio-economic status" related to the increased exposure of such children to traffic, as due to low car ownership rates - lack of parental supervision (often associated with large families and/or single parent families) and the level of parental education may also be contributing factors • Recommendations on engineering, education, enforcement tools to promote SRTS
Roberts, I, Norton, R. and Taua, B. 1996. Child pedestrian injury rates: the importance of "exposure to risk" relating to socio-economic and ethnic differences, in Auckland, New Zealand. J*ournal of Epidemiology and Community Health* 50:162-165	• Examines how child pedestrian risk exposure varies by indices of "material disadvantage" and ethnicity – measure used = mean number of streets crossed • Questionnaire for children at 40 schools in Auckland, NZ chosen by probability cluster design – distributed 3388 surveys – 2873 (85%) returned • Mean number of streets crossed at 6 years old = 2.19 & 2.80 at 9 years – mean for boys was similar to girls • Pacific Island children crossed a mean of 4.87 – 2x that of (predominantly) European children • Children from families without a car crossed a mean of 5.34; one car – 2.90; and 2+ cars – 1.97 • Conclusion: large differences in pedestrian exposure risk with respect to ethnic group & car ownership rates – may explain ethnic & socio-economic differentials in child pedestrian injury rates (NB: doesn't establish relationship between PI / European & level of car ownership)

Roberts, I. and Pless, B. 1995. Social policy as a cause of childhood accidents: the children of lone mothers. *British Medical Journal* 313:925-928	• 1 in 5 UK mothers is a "lone mother" – their children have injury rates 2x that of two parent families • paper examines this link • finds poverty, poor housing conditions and social isolation as explaining factors and day care provision as a solution • risk of pedestrian injury is >50% higher for children of lone mothers • association between injury and poverty particularly strong for traffic accidents – number of road crossing is key determinant of injury: children in lowest quarter income bracket cross roads at a rate 50% higher than children in the highest quarter income bracket • 1/5 of pedestrian accidents are very young children being injured by vehicle backing out of driveway •
Liabo, K and Curtis, K. *Traffic calming schemes to reduce childhood injuries from road accidents and respond to children's own views of what is important.* What Works for Children Group Evidence Nugget, April 2003. Accessed from: www.whatworksforchildren.org.uk/docs/Nuggets/pdfs/Trafficcalming230703.pdf	• lit review • traffic calming schemes reduce child injuries up to 15% (25% on residential streets & 10% on main roads) due to road accidents by slowing traffic – reduces severity of injury in crashes & makes it easier for drivers to avoid accidents • lack of studies as to which traffic calming measures are most effective – need at a minimum signs warning drivers of lower speed limits & some changes to the road • since poorer children more likely to be injured in road traffic accident, this intervention has potential to reduce inequalities in child health • child deprivation strongly associated with child pedestrian injuries: children from social class V are 5x more likely to be killed in a road traffic accident than children from social class I • risk of accident increases with traffic volume, high levels of kerbside parking • speed of traffic: 40 mph impact – one in 20 children will survive; 20 mph impact – 19 of 20 will survive • while effectiveness of reducing pedestrian injuries from traffic calming has been shown, beneficial effects on injury reduction from education programmes are less clear • has some info about what measures cost (in GB£)
Department for Education and Skills (DFES) and Department for Transport (UK). 2003. Travelling to school: an action plan. DFES, Darlington, UK.	• Provides background information on trends in school travel and, using case studies, identifies a range of measures that have been implemented at both primary and secondary schools • Establishes its targets (and timetable) including hiring new school travel advisers, establishing new funding base, and having 10,000 school travel plans in place by 2006 • Assistance being provided to schools and local authorities
DFT (Cairns, S; Sloman, L; Newson C; Anable J; Kirkbride, A; Goodwin P.) 2004. *Smarter choices – Changing the way we travel".* Chapter 4. Final Report to the Department for Transport, London,	• Initially interest generated by concerns about children's safety & loss of independent mobility, then also increasing concern about congestion impacts and creation of sustainable patterns of travel behaviour in children. Newer concern is childhood obesity • Safety benefits of engineering work: Hull, 20 mph zones have achieved 74% reduction in child pedestrian accidents; Gloucester, DFT-funded 5-year Safer city project involved extensive speed management and physical speed reduction measures – resulting in 24% decline in child pedestrian casualties between 1996 and 2000.

UK.	• Higher levels of cycling seem to result in lower accident rates: Netherlands, level of cycle traffic increased by 30% between 1980 & 1990, yet annual cyclists' deaths fell. York: investment in traffic calming and cycling infrastructure over a 10 year period, has seen casualties reduce by 30%, while peak-hour cycling increased by 10% • Wardlaw (2002) cited: "cycling gets safer as it becomes more popular" & that "there is no known example in recent decades when an increase in cycling has lead to an increase in cycle deaths. • Christie et al (2004): international survey of travel by 10-14 year olds, using comparable data from 8 countries, shows that higher levels of cycling among this age group is linked with fewer accidents per km cycled • In 2003, about 3100 STPs implemented in the UK (15% of all schools – by 2006, expect that 28% will have STPs – this project examined 3 local authorities as case studies (Buckinghamshire, Merseyside, and York) & drew on the separate project "Making School Travel Plans Work" which involves 23 local authorities • Considered effects of school travel work (note: this is broader than just STPs) on car use to "all" schools: found quite varying results, in terms of some increase in car use, some stable, some declining. Of interest is that Buckinghamshire has prioritised non-engineering measures while York has focused on "safer routes work" (essentially infrastructure) – Buckinghamshire has had an overall decline in car use while York has had an increase in car use. York's approach is justified on safety grounds and the expectation of delivering longer term effects – cannot yet assess the relative long term impact of the two approaches • When considering "engaged" schools (schools where school travel work had taken place), found that high proportion of these had achieved modal shift, calculated to be, on average, 8 – 15% reduction in car trips by students – some had achieved 20% reductions; a few had achieved greater than 505. The authors estimate that a high proportion of schools actively engaging in such work will achieve positive modal shift – about 60 – 90% of the schools. (Note, however, that Buckinghamshire had a total car use decline of "at least 5%" in 4 schools and Merseyside, where engagement was considered to be less, had "at least 3%" across 39 schools). Of 80 schools responding to responding to MSTPW survey, 76% reported mode shifts away from car. • Some evidence to suggest that prioritising awareness raising and incentive schemes may be more effective at delivering short-term modal shift, than engineering work designed to improve safety. Engineering work can, however, be seen as an awareness raising mechanism too. • Basically no work to determine the proportion of car journeys which will still be made because the parent continues to make the trip – estimates of the nature of this trip vary considerably • "school safety zones" introduced in York around primary schools have halved the number of children reporting that they've been involved in accidents (6% to 3.6%). • School travel work can improve student's road safety skills – e.g. walking incentive schemes are associated with pedestrian training and cycle trains are associated with cycle training, etc. • Other effects: increased independence for children; health and fitness benefits; improved attendance and ability to learn; greater knowledge of environmental and citizenship issues; community benefits ; increased social inclusion;

	increased awareness of the potential for change • Road safety measures are commonly seen as complementary with school travel work: ST work can increase the acceptability of such hard measures – people more inclined to support traffic calming or extension of cycle paths in context of an STP • Some investment in engineering measures are seen as an important part of a local authorities work with schools: "they are needed as a way of engaging schools, allaying (justified) parental concerns about road safety, maximising the effects of softer measures and locking in long-term benefits" (p. 94) [Note DFT distinction: 'micro' infrastructure such as cycle shelters; safe routes infrastructure such as traffic calming and cycle lanes

Note that many other articles, papers and reports were canvassed in the preparation of this report. In particular, most material about school travel plans has been incorporated into the actual case studies themselves, alleviating the need to repeat the material here. In other cases, such as various earlier reports / documents prepared by the Department for Transport (UK) on school travel plans, the material has been superseded by more recent publications (e.g. two very recent reports by the DFT (2004) *Smarter choices: changing the way we travel* which includes a section on school travel plans, and a yet-to-be-released document "Making School Travel Plans Work").