# Safer journeys for rural schools


NZ TRANSPORT AGENCY WAKA KOTAHI

Auckland Transport
An Auckland Council Organisation

Safer Journeys

New Zealand Government


**NZ Transport Agency**
**Safer journeys for rural schools**

ISBN 978-0-478-41921-4 (online)

Copyright:February 2014
NZ Transport Agency

For more information, call our contact centre on 0800 699 000 or write to us:

NZ Transport Agency
Private Bag 6995
Wellington 6141.

This publication is also available on NZ Transport Agency's website at **www.nzta.govt.nz**


**The NZ Transport Agency is part of, and contributes to, the Safer Journeys programme.**
Safer Journeys is the government's strategy to guide improvements in road safety over the period 2010–2020. The strategy's vision is a safe road system increasingly free of death and serious injury.
It is a coordinated effort across partner agencies to improve each aspect of road safety – better behaviours, a safer road environment, safer speeds and higher vehicle standards.

For more information visit **www.saferjourneys.govt.nz**

# Foreword

Our children, their families and their communities in both rural and urban areas have the right to expect that their journeys to and from school will be as safe as possible. We can be thankful that the actual risk of death or serious injury associated with school journeys is relatively low. Rural schools, however, face distinctive risks compared to urban schools. These often include proximity to high-speed roads, limited infrastructure, and lack of awareness by passing motorists. Such concerns need a coordinated response.

*Safer journeys for rural schools* is a practical guide to making the journey to and from a rural school safer. Consistently with the principle of shared responsibility, it promotes a partnership approach between rural school communities, road controlling authorities, the Police and other stakeholders such as school bus companies.

The guide provides a systematic way of assessing the immediate school environment, and journeys to and from school for road safety risk. By using consistent assessment tools across the country we can promote appropriate prioritisation of investment, acknowledging that resources are usually more constrained than we'd like them to be. The guide then sets out a comprehensive toolbox of countermeasures for responding to identified risk. Both the assessment methodology and the countermeasures reflect best practice in New Zealand and internationally.

I am also pleased that this guide was developed by a strong partnership involving the NZ Transport Agency, the Ministry of Education, Auckland Transport, the New Zealand Local Authority Traffic Institute (TRAFINZ) and the New Zealand Police. A draft guide was issued in October 2013. My thanks go to the organisations which took the time and trouble to contribute to this published version.

To assist school communities to work effectively with road controlling authorities a non-technical companion guide[1] has also been published.

My best wishes to all of you in your endeavours to improve road safety for rural schools.

Ernst Zöllner
Director Road Safety
NZ Transport Agency

[1] *Safer journeys for schools: Guidelines for school communities*; www.nzta.govt.nz/resources/safer-journeys-for-schools.

# Table of contents

# Glossary

| | |
|---|---|
| **NZAA** | New Zealand Automobile Association |
| **AT** | Auckland Transport |
| **Austroads** | National Association of Australian Road Authorities |
| **CAS** | Crash Analysis System, which is managed by the Transport Agency. Decisions regarding the system itself are made by a governance group comprising the Transport Agency, the Police and the Ministry of Transport |
| **Collective risk** | The total risk for all people. It can be expressed as the total number of crashes expected involving the students of a particular school per year |
| **Countermeasure** | An action or type of physical work that addresses a certain issue |
| **EOTC** | Education outside the classroom |
| **GPS** | Government Policy Statement |
| **Harm minimisation speed** | Grounded in the Safe System. These impact speeds are expected to significantly reduce the chance of a fatal or serious injury outcome (figure 2-1). Further information can be found in the Transport Agency's *High-risk rural roads guide* |
| **Harm reduction speed** | A posted speed limit based on using a balance between the current speed limit and a harm minimisation speed |
| **HRIG** | Safer Journeys *High-risk intersection guide* |
| **HRRRG** | Safer Journeys *High-risk rural roads guide* |
| **High-severity crashes** | Fatal and serious crashes |
| **IRS** | Investment and Revenue Strategy |
| **Journey to school** | Any part of the network within the school's catchment area that a school child will use as part of their travel to and from school |
| **LTP** | A city or district council's long term plan |
| **MoE** | Ministry of Education |
| **MoT** | Ministry of Transport |
| **Transport Agency** | NZ Transport Agency |
| **OECD** | Organization for Economic Cooperation and Development |
| **Personal risk** | The average risk for each individual person. It can be expressed as the probability of an average student at a particular school being involved in a crash in a year |
| **RCA** | Road controlling authority (local councils, the Transport Agency, unitary authorities) |
| **Risk** | The potential realisation of the unwanted or adverse consequences of an event from which there is no prospect of gain (Austroads , 2010) |

| | |
|---|---|
| **RoNs** | Roads of national significance |
| **RTF** | Road Transport Forum |
| **Rural road** | A road with a posted speed limit of 80km/h or more |
| **Rural school** | Any school that has an access (vehicle or pedestrian) or frontage which is located on a rural road |
| **SASTA** | An independent national group representing professionals working in or contracted by local government to aim promote national best practice in community activities that seek to improve safety and sustainability on our transport network. The groups originated from the Road Safety Coordinators Association |
| **SAWS** | Speed-activated warning signs |
| **School bus stop** | When these guidelines refer to 'school bus stops', they mean stops where students are being picked up by dedicated school buses (rather than general bus services, where passengers include other members of the public) |
| **SJRSG** | *Safer journeys for rural schools guide* |
| **Speed zone** | A posted speed limit which has been based on the drivers' 85$^{th}$ percentile operating speed of that road. i.e. a posted speed limit may have been calculated at 100km/h for a typical rural area however due to other factors, ie a restrictive alignment, the actual speeds of vehicles may be lower. A speed zone reflects that lower speed limit |
| **TERNZ** | Transport Engineering Research New Zealand |
| **The guide** | *Safer journeys for rural schools guide* |
| **TCR** | Traffic crash reports (completed by the Police and the Transport Agency |
| **TA** | Territorial authority |
| **Treatment** | An action or type of physical work that addresses a certain issue |

# Note

This *Safer journeys for rural schools* guide has primarily been developed to provide technical guidance for road controlling authorities and consultant engineers so that they can determine the level of priority and provide operational recommendations to address key issues for rural schools.

An additional companion document called *Safer Journeys for schools: guidelines for school communities* has been developed to provide higher level guidance on issues and treatments for rural schools primarily for use by the school community, educators and road safety coordinators.

School intervention priority is identified through a three stage process, incorporating a national priority threshold calculation process, regional-based analysis, and a detailed on-site assessment to ensure all key issues and concerns by the school community are considered. As a result, specific recommendations can be developed by using a toolbox of measures that have been specifically designed for rural school environments as well as other measures that are designed for rural roads in general. [2]

It is important that all key stakeholders work together to determine rural school road safety issues and develop a robust set of appropriate recommendations which consider not only the school gate but also the entire journey to school along with the wider rural road network around rural schools.

[2] For the purpose of this guide, a rural road is a motorway, state highway, expressway, local road or private road with a speed limit of 80km/h or more. However, in some documents such as the *NZ Traffic control devices manual* (Transport Agency, 2008), this has been defined as being 70km/h or more.

# 1 Introduction and overview

## 1.1 Purpose

The *Safer journeys for rural schools guide* (SJRSG or 'the guide') has been prepared by the New Zealand Transport Agency (the Transport Agency) and Auckland Transport to provide guidance efforts to improve safety on the journey to, from and at rural schools.

The objective is to provide practitioners, policy makers, schools and their communities, with best practice guidance to identify, target and address key road safety issues at rural schools. In addition to providing rural school specific guidance, the guide provides links to a number of road safety resources and other guidance for planning, funding and evaluating safety projects and programmes.

Specifically, the guide is intended to provide:

- details of a safe system approach to school road safety, including safe roads and roadsides , safe speeds, safe road use, and safe vehicles
- a discussion of key crash issues in the vicinity or along the routes to rural schools
- tools to help identify and prioritise risk around rural schools, as well as planning an intervention approach
- a safe system toolbox of intervention options for road controlling authorities (RCA) and schools in rural environments, to help develop appropriate remedial treatments
- guidance for developing, prioritising and funding road safety infrastructure, speed management and education programmes
- references to further and more detailed information.

The guide has also been developed to provide national consistency regarding the prioritisation of risk around rural schools and the application of proven countermeasures.

The guide provides a mechanism for RCAs to manage the safety of rural schools on their road networks. Although a process for prioritising risk around schools is presented within this guide, districts will need to further the prioritisation around schools in their area based on more detailed local knowledge. Guidance on funding is discussed in section 2.4.

It is important to remember that rural school road safety issues overlap with wider network considerations. Therefore, in addition to this guide, the *High-risk rural roads guide* and the *High-risk intersection guide* are also likely to be useful resources when considering rural school road safety.

## 1.2 Scope

The guide refers to a number of appropriate policies, standards and guidelines applicable to New Zealand practice. Specifically, the guide supports and references:

- Safer Journeys 2020, New Zealand's Road Safety Strategy 2010–2020 (March 2010).
- The Safer Journeys Action Plan 2013/15 (2013).
- Policies and guidelines containing information on schools and buses developed by the Ministry of Education.
- New Zealand legislation, in particular the Land Transport Act 1998 and rules made pursuant to that Act, including the Land Transport (Road User) Rule, the Land Transport Rule: Traffic Control Devices, and the Land Transport Rule: Setting of Speed Limits.

- General polices contained in Austroads guides (Guides to traffic management, road design, road safety) and other Austroads technical guides.
- New Zealand and, as appropriate, Australian standards, codes of practice and guidelines.

The guide is intended to provide a nationally consistent approach to improving safety on the journey to and from rural schools. However, at a local level practitioners should always apply sound judgement when identifying and installing any countermeasures to ensure the best possible safety outcomes. The reasons for any departures from recommended practice should be documented.

All schools are different and are likely to have their own unique set of issues. A great deal of expertise has been developed through recent rural school safety initiatives, both at a national and a local level. If you are uncertain how to use of this guide, it is advisable to check with the Transport Agency or other organisations such as SASTA, who can provide a link to further expertise to confirm the right approach to solving rural school safety issues.


*The photos are sourced from (left to right): www.teara.govt.nz; www.googlemaps.co.nz; www.nzta.govt.nz; www.omnibus.org.nz*

## 1.3 Target audience

The principles presented in the guide are relevant to rural roads in both the state highway network and local roads. The guide aims to help a range of technical practitioners and key stakeholders including:

- state highway and local roads engineers
- Ministry of Education
- Police
- ACC
- road controlling authorities

- regional councils
- road safety coordinators
- other road safety partners – Automobile Association, Road Transport Forum, New Zealand Bus and Coach Association, Cycle Advocates Network
- school communities who want to learn more about the issues around rural schools. In addition, a companion guide to this document has been developed for use by schools and the local communities (see box below).

**School communities companion guide**

In addition to this guide, the *Safer Journeys for schools: guidelines for school communities companion guide* is targeted to parents/caregivers, students, school staff and boards of trustees to improve road safety in their local community. It contains a clear process that school communities can follow, guidance on how to communicate with relevant road controlling authorities and a 'toolbox' of good practice solutions that may be used to address school road safety issues.

This companion guide is not intended to provide comprehensive technical information. Instead it is a user-friendly guide that explains the issues related to school road safety, describes a process that school communities can take to address their concerns and issues and provides a toolbox of intervention options to explain the range of options available.

A school road safety risk questionnaire is also included so that schools can fully understand all the areas that need to be considered at their school, as they begin the communication process with their road controlling authority.

## 1.4 Risk management

Risk management describe the processes and systems used to deal with risk. The risk in this instance is crashes involving rural school children on the journey to, from or at schools.

The objective of this guide is to improve safety and reduce crashes in the vicinity of New Zealand rural schools. It takes into account both the consequence and likelihood of crashes occurring.

In defining and prioritising risk at rural schools this guide provides a mixture of information (refer section 5) ranging from identifying high-risk environments in which schools are located (through modelled systems) and the methodology to assist RCAs and school communities in further defining the risk.[3]

It is important to note that communication and consultation are key components of risk management and should be considered at all stages of the process. For example, after modelling the level of risk based on a formula, the actual risk can be further refined from site visits and consultation with the school community and general public, and other road user groups. Once routes and sites have been determined, further

[3] Further information on risk management, communication and consultation and recording the risk management process can be sourced from *AS/NZA ISO31000: 2009 Risk management: principles and guidelines* and chapters 3 and 9 of SAA/SNZ HB 436:2004 *Risk management guidelines*.

consultation can be undertaken with the community and road user groups to better understand the risks, and the best methods of addressing them. This is explained further in sections 5 and 6.

The user of this guide should document the identification, analysis, treatment and monitoring process for rural schools. This is important for recording the right level of information for the decision-maker and the person responsible for taking action.

## 1.5 Definition

In this guide:

- Risk is derived from:
  - > initially using the prioritisation process explained in section 4, (step 1)
  - > then using the prioritisation process explained in section 4, where further investigation (steps 2 and 3) identifies on-site road safety issues that warrant urgent attention.

Note: this definition is currently being re-evaluated so that the identification of the highest priority schools is consistent with the development of the model.

## 1.6 Structure of the document

The guide is divided into eight main sections:

| | | |
|---|---|---|
| Section 1 | **Introduction and objectives** | Outlines the key terms, objectives and structure of the document. |
| Section 2 | **Strategic context** | Outlines the varying strategies and priorities of the government. It includes descriptions and background information on the Safer Journeys strategy and the Safe System approach, and the implications for rural schools. |
| Section 3 | **Background/key Issues** | Provides information regarding crash data and key issues and perceived versus actual risk in New Zealand. |
| Section 4 | **Identifying risk at rural schools** | Describes the process for identifying risk at rural schools both at national and a regional level. |
| Section 5 | **Understanding the issues** | An overview of the considerations for road safety practitioners to assist them to understand the issues associated with rural schools. |
| Section 6 | **Treatments/toolbox** | Describes key treatment philosophies, a hierarchy of measures, combing treatments, the list of countermeasures to use, network planning, responsibility for implementation and communication and consultation. |
| Section 7 | **Programme implementation, monitoring and evaluation** | Describes the processes involved with prioritising and programming works identified as part of the methodology. Provides advice on how best to monitor and evaluate completed countermeasures at high-risk sites and routes. |
| Section 8 | **Other information sources** | Provides a list of documents and websites containing information that may be useful for practitioners and/or school communities. |

## 1.7 Summary of the process

The contents of this guide as shown in the structure in section 1.6 show that the process involves a set of steps for a school, community or RCA to determine their issues and risk and develop appropriate treatments for their schools. A summary of this process is shown in figure 2-1 with appropriate references to more detailed information.

**Figure 2-1: Process chart**

| | |
|---|---|
| **Identify/understand the issues**  | There are several ways in which we can identify and understand the issues including:<br>• determining key issues and concerns - complete travel plan questionnaire – refer to companion guide appendix<br>• undertake a crash analysis - section 4<br>• whether it has been identified by the Transport Agency[4] as a school where there is a greater risk than others - section 5<br>• referencing the school companion guide. |
| **Engage road safety partners**  | Once the key issues have been determined then discussion may be needed with all or some of the following to agree the problems and the benefits of addressing them:<br>• school community – information/discussion evenings<br>• RCA – road network, land use, LTCCP<br>• road safety coordinators<br>• police – community education officers, enforcement<br>• MoE – future school development/Improvements<br>• road safety partners – Automobile Association, Road Transport Forum, New Zealand Bus and Coach Association, Cycle Advocates Network. |
| **Determine treatment**  | • Consider the options:<br>> Relate key crash types with treatments - section 6.1.4.<br>> Relate key issues with treatments - section 6.1.5.<br>> Determine appropriate treatments - section 6.<br>• Determine whether any other analysis ,may need to be undertaken, ie collection of operating speed data. |
| **Action** | • Develop feasibility reports for physical works, with cost analysis and implementation, monitoring and evaluation plan.<br>• Develop appropriate procedures and plans. |

[4] Note that the first step in the prioritisation process is undertaken at a national level to ensure consistency in selection. RCAs can then determine further identification of concerns and issues at a local level to further identify areas to address and prioritise

| | |
|---|---|
| | • Programme for prioritisation. |
| | • Implement measures. |
| | • Enforce measures – police, school, community, RCA. |
| | • Monitor and evaluate measures. |

# 2 Strategic context

## 2.1 Safer Journeys: Road Safety Strategy 2020

The New Zealand Government released the *Safer Journeys: Road Safety Strategy* (the strategy)in March 2010. Safer Journeys is a national strategy to guide improvements in road safety over the period 2010 to 2020. The strategy sets out a long-term vision for New Zealand of **'a safe road system increasingly free of death and serious injury'.**

To support the vision, Safer Journeys introduces for the first time in New Zealand a Safe System approach to road safety (section 2.2.1).

Safer Journeys also lists a number of key initiatives that have been identified as having the greatest impact on road trauma. These initiatives will be implemented through a series of action plans relating to the four key components of a safe system – safe roads and roadsides, safe speeds, safe road use and safe vehicles.

## 2.2 Safe System

### 2.2.1 Safe System principles

The safe system approach to road safety represents a fundamental shift in the way people think about road safety. It works on the principle that it is not acceptable for a road user to be killed or seriously injured if they are involved in a crash. The Safe System approach also acknowledges that road users are fallible and will continue to make mistakes.

Scandinavian research (OECD, 2008) indicates that, even if all road users complied with all road rules, fatalities would only fall by around 50% and serious crashes by 30%. Putting this in a New Zealand context, if everybody obeyed all the road rules, there would still be around 200 road deaths each year (based on current fatalities).

The traditional 3 Es approach to road safety – engineering, education and enforcement – has helped achieve current good levels of road safety. These elements remain important, but the traditional approach tended to blame and to try to correct the road user rather than addressing the whole of the system. Continuing with the historical approach will not achieve the desired gains in road safety in New Zealand.

A Safe System approach recognises the need for system designers and road users to share responsibility, with the ultimate aim of protecting road users from death and serious injury.

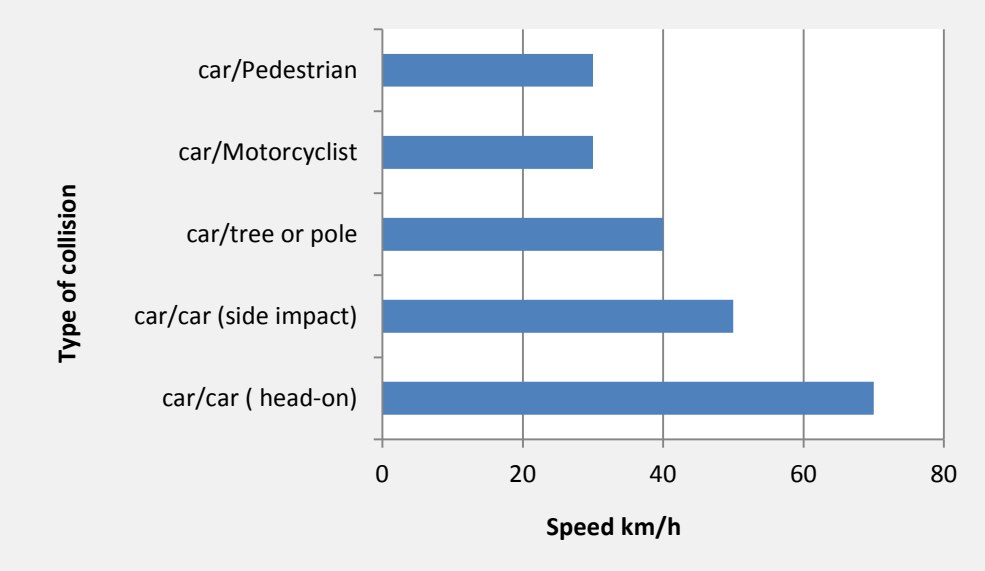
The principles in a rural school context are:

Human tolerance to physical force: The fundamental principle of a safe system is the relationship between road users, vehicles, speeds and road infrastructure, and how much force the human body can withstand when each of these four elements interacts in the event of a crash. The OECD (2008) report states that 'the human body's tolerance to physical force is at the centre of the Safe System approach'. Young people can be

impulsive and do not always behave in a rational way like adults do. School travel must be designed with the capabilities of young people in mind.

The Australian Transport Council (ATC, 2011) road safety strategy states that 'the chances of surviving a crash decrease rapidly above certain impact speeds, depending on the nature of the collision'. This is illustrated in figure 2.1, which shows the threshold speeds above which the risk of death or serious disabling injury climbs rapidly for five key crash types. Pedestrians and cyclists (especially young ones) are much more likely to be killed or seriously injured when crash forces exceed approximately 30 km/h impact speed.

**Figure 2-1: Survivable impact speeds for different scenarios (ATC, 2011 – Figure 7)**




The range of impact speeds for each crash type is considered to be survivable in most cases (ATC, 2011). A cyclist will have the same survivable impact speed as a pedestrian.

Note that there is certain rationale behind the rural school variable speed limit trials. Speed reflects the risk present. When there is pedestrian risk, a 40 km/h is a safer speed, when side impacts are the main risk then a 60 km/h speed limit is a safer speed as shown in Figure 2-1. Further information is can be found within the variable speed limit trials information at www.nzta.govt.nz/resources/rural-school-speed-management-trial/docs/rural-school-speed-management-trial.pdf.

Further information on achieving a safe system through speed, while achieving both efficiency and safety, is outlined in the Transport Agency's *High-risk rural roads guide*.

Human fallibility – People make mistakes. Young people can be impulsive and do not always behave in a rational way like adults do. School travel must be design with the capabilities of young people in mind.

Shared responsibility - System designers and system users must all share responsibility for managing crash forces to a level that does not result in death or serious injury. School road safety is *everyone's* responsibility, including road controlling authorities, school communities, the police, children and their parents.

All of system approach - It will take a whole-of-system approach to implement the safe system in New Zealand and we need to strengthen all elements of the system. For schools, there are a number of areas that can be addressed. Road signs are only part of the solution.

When considering applying a Safe System approach for the journeys to, from, and at rural schools we should consider specific measures that will lead to the reduction of fatal or serious injuries. These measures are provided in section 6.

### 2.2.2 Safe System components

Under a Safe System, designers create and operate a transport system where road users are protected from death and serious injury. The four key components of a safe system are illustrated in figure 2-2 and include:

- **safe roads and roadsides** that are predictable and forgiving of mistakes – their design should encourage appropriate road user behaviour and speeds
- **safe speeds** that suit the function and level of safety of the road – road users understand and comply with speed limits and drive to the conditions
- **safe vehicles** that help prevent crashes and protect road users from crash forces that cause death and serious injury
- **safe road use** that ensures road users are skilled, competent, alert and unimpaired; people comply with road rules, choose safer vehicles, take steps to improve safety and demand safety improvements.


**Figure 2-2: Safe System components**

Responsibility for a safe network for our children around rural schools needs to be shared by system designers and road users including school communities, parents/caregivers and children. Within that there are additional shared responsibilities for children making safer journeys as shown in figure 2-3.

**Figure 2-3: Share responsibilities for children making safer journeys (Transport Agency education portal, 2009-2012)**

In relation to figure 2-3 the following applies:

School curriculum: As a result of learning using primary and secondary road safety resources children will be knowledgeable and confident about all forms of transportation. They will be actively involved in making journeys around their community safer.

School ethos: Students' learning about and for a safe road/rail system is influenced by a positive road safety ethos and organisation in their school. The ethos and organisation for road safety is obvious when road safety is 'what we do around here'. Road safety in a school's ethos and organisation is demonstrated by:

- a 'living' school road safety education policy/procedure maintained through consultation
- enthusiasm for road patrol duty
- professional development opportunities for teachers
- road safety curriculum materials and resources being used within day-to-day learning
- parents and caregivers giving consideration to safe school travel
- planning for education outside of the classroom (EOTC) activities minimising risks around roads and rail
- road safety messages, preferably student-developed, in school newsletters
- school community members willingly report instances of dangerous or potentially dangerous road use.

School partnerships: Students' learning about and for a safe road/rail system is influenced by consistent messages and practices by all members of the school community. This membership includes parents/caregivers, students, whānau, school staff, police, and territorial authorities. School community partnerships may be evident by:

- contribution of school community members in maintaining a road safety education policy
- enthusiasm from parents and families for road patrol duty
- road safety units that include home school partnerships
- parents and caregivers adhering to guidelines/rules designed to improve safety (e.g. minimising school gate congestion, vehicle and driver requirements for EOTC activities)
- road safety messages (preferably student developed) are included in school newsletters
- police officers, road safety coordinators, and school travel planners regularly visiting the school
- the school community responding positively to reported instances of dangerous or potential dangerous road use
- student learning in road safety units is incorporated into policies/procedures/guidelines developed by the school and local territorial authorities which affect driver, pedestrian, cyclist and passenger behaviour in the local school community
- students' learning directly influencing their transport and play environment (e.g. considerate road sharing, safer crossing points, appropriate road calming for rural areas and safer vehicle speeds, alternative cycle and pedestrian routes away from roads, changes to the school's road safety education policy).

## 2.3 Key Safer Journeys principles in a rural school context

### 2.3.1 Introduction

The *Safer Journeys* strategy states that 'New Zealand has one of the highest child road fatality rates in the OECD' and, as stated by a Ministry of Social Development report (2010), for the years 2005 to 2008 'New Zealand (with Greece and Poland) had the highest death rate for children under 15 years. At 2.6 deaths per 100,000, it was double the OECD median of 1.3. New Zealand also had the highest rate for 15 to 17 year olds, with 15.0 deaths per 100,000, more than double the OECD median of 7.3'. A number of system factors are likely to contribute to this and there are only a few crashes outside of rural schools. However, at the heart of the issue is a need to better understand what is needed to keep children safe, while promoting other important outcomes such as physical activity and health. Further information on key issues, concerns and crash analysis for rural schools is provided in section 3.

Because there are many different modes by which children travel to school, whether by private vehicle, bus, walking or cycling, there are several different actions contained within the strategy that relate to improving the safety of the journey to school. Sections 2.3.2 to 2.3.5 cover the four safe system elements.

### 2.3.2 Safe roads and roadsides

We know a lot about how to make our roads safer. Engineering solutions such as median and side barriers, skid-resistant surfaces, forgiving roadsides, and intersection improvements have a proven track record in reducing the number and severity of crashes occurring on the journey to, from and at schools. [5] Some of the roads and roadside actions that will assist to improve safety for rural schools are:

- targeting high-risk rural routes and high-risk intersections within the travelled network of a rural school
- progressing safe system demonstration projects.

Significant safety gains on the journey to and from, and at rural schools are expected to be achieved by focusing on reducing crash frequency, reducing all injury outcomes, protecting active road users, and providing safer intersections and more forgiving roadsides. This approach is also consistent with the *Safer Journeys* long-term vision of: **A safe road system increasingly free of death and serious injury.**

In rural areas the main high severity crash types and movements at and on the journey to schools are those that involve crashes at intersections or accesses (eg driveways).

The Transport Agency and RCAs need to ensure that road safety efforts are primarily focused on the high severity movement types to obtain the greatest benefit from producing safe roads and roadsides. There are both reactive (crash data analysis) and predictive assessments (KiwiRAP Road Assessment Tool (KAT), Road Safety Infrastructure Assessment (RISA)), which can be used on roads to identify the key issues.

Understanding which movement types result in the most crashes helps to determine the most effective interventions for roads and roadsides.

### 2.3.3 Safe speeds

Road users need to understand how their decisions about travel speeds affect them and others (MoT, 2010). Increasingly speed limits will be intuitive and reflect the use and function of roads, reinforcing a consistent and self-explaining look and feel for users across the network.

The following initiatives could help to reduce the number and severity of crashes for those taking the journey to and from rural schools:

[5] Safer Journeys: New Zealand's Road Safety Strategy 2010–2020. Ministry of Transport, 2010, page 14.

- people will increasingly understand what travelling at a safe speed means
- speed limits will better reflect the use, function and safety of the network
- travel speeds will support both safety and economic productivity.

Safe speeds are closely linked to safe roads and roadsides – especially for rural road networks. The guide describes how safe speeds can be achieved to complement safe roads and roadsides (e.g. implementing safety treatments on high risk routes where there is a rural school) to improve safety for all road users. In addition, appropriate speed management related countermeasures are proposed that relate to the other aspects of the safe system, i.e. safe road use such as travelling at safe speeds and safe vehicles.

The association between driving/riding speed and the risk of being involved in a crash, and being injured in a crash should one occur, is well-established within the traffic safety literature (Monash, 2009). Nilsson's 'Power Model'[6] (is described in more detail within the *High-risk rural roads guide)*. In summary it shows that:

- a 5% increase in average speed leads to approximately a 10% increase in all injury crashes and a 20% increase in fatal crashes, and
- a 5% decrease in average speed leads to approximately a 10% decrease in injury crashes and a 20% decrease in fatal crashes.

As the model indicates, reducing speed by a few kilometres per hour can greatly reduce the risk of crashes as well as mitigating the consequences of a crash.

The default speed limit on New Zealand open and rural roads is 100 km/h and it is generally applied to all rural roads with only limited exceptions at present. A more suitable speed limit for many of these roads, for all users, would more closely match the use and function of roads and their present safety features. The Transport Agency is encouraging the implementation of demonstration safer speed areas for roads on which the default speed limit is inappropriate. [7]

Further investigation and trials have been undertaken on providing variable speed limits around rural schools during at-risk times. Further information on these trials can be found at: www.nzta.govt.nz/resources/rural-school-speed-management-trial/docs/rural-school-speed-management-trial.pdf.

It must be emphasised that safe speed does not necessarily mean travelling at the posted speed limit. The safe travel speed is determined by the road user based on their competency, the road and weather conditions and the standard of vehicle being driven or ridden.

Several types of speeds limits can be applied to reduce high severity crashes for a safe system, including harm minimisation and harm reduction speeds. These are further described within the *High-risk rural roads guide*.

### 2.3.4 Safe vehicles

The direction for safe vehicles includes a plan to increase public awareness of and demand for safer light vehicles, and promotion of advanced safety features such as collision avoidance technology and considering regulatory interventions and education to improve restraint use. While some of these features are not

[6] Any model is a simplified representation of reality. The Nilsson model of the relationship between vehicle speed and fatalities and injuries, while founded on a sound scientific base, cannot take into account all the characteristics of the road environment. The actual effects depend on the exact road traffic and characteristics. For example, the effect is considerably larger on urban roads as compared to motorways. (OECD Speed Management report).

[7] Under the *Safer Journeys Action Plan 2011-2012*, the Transport Agency and local government are responsible for delivering the following action: 'Ensure the uptake of effective safe speed limits in high-risk rural areas, including implementation of infrastructure to enable safe high travel speeds.'

specifically provided for increasing safety for active road users attending rural schools, these safety features would assist in reducing the overall incidence and severity of crashes for those travelling to and from school.

Parents and caregivers of school children who drive should be providing guidance and supervised practice of their driving skills and ensure the vehicle they drive is safe. As stated on the Transport Agency's younger driver's webpage, 'All young drivers in the first few years of their driving careers are at risk because of their age and inexperience. Their risk of crashing has little to do with how well they can handle the car; it's more to do with developing the experience and the decision-making skill to recognise the risky situations and make safe choices. This is not just about what they do in the car – it's also about making sure they're fit to drive before they even get into it.' For more information see www.nzta.govt.nz/traffic/ways/car/driving-safely/younger-drivers.html .

### 2.3.5 Safe road use

For rural schools the safe road use pillar of the safe system is very important. In keeping with the principle that road safety is everyone's responsibility, schools, parents, children and many others have a role in keeping children safe on their way to and from school. Good role-modelling from parents and teachers as well as effective and well-practiced school policies (including travel plans – toolbox measures SC3 - Appendix A) and procedures are both very important safe system components for rural schools. School principals, boards of trustees, parents, and teachers all have important leadership and role-modelling parts to play, as do children themselves.

Responsible road use is a key component of the Safe System. This document provides guidance for and an overview of the safe road use plan with a particular focus on walking and cycling. This is through:

- focus on education and training to increase motorist awareness of pedestrians and cyclists
- support central, regional and non-governmental initiatives.

However, safe road use for those who travel to and from rural schools requires action to be taken by other road users whose road use can adversely affect the safety of school children. Other key action areas within the Safer Journeys action plans (2011/2012 and 2013/2015) that would contribute to the safety of all school road users are:

- reducing vehicle speeds on roads identified as high-frequency use by pedestrian and cyclists
- providing safe and convenient routes and accesses
- integrating land use and transport planning in safe and efficient ways
- redirecting heavy vehicles and fleets of vehicles away from certain routes or modifying the hours they are on those rural school routes to reduce risk to school children at peak times.

**Rural school case study**

A combination of issues associated with each of the Safe System elements contributed to this fatal crash. The example also demonstrates the interaction between the safe system elements and the potential for the severity of the crash to be reduced when the safe system elements are operating properly.

At 3.30pm on a Friday afternoon in overcast and wet road conditions, a 10-year-old child who was travelling home from school on the bus was hit and critically injured by a vehicle travelling at 100km/h after walking in front of the stationary school bus.

The minor rural road had a 100km/h posted speed limit, with two lanes and minimal shoulder width. There was a school bus bay located on the one side of the road.

The crash involved issues with each of the Safe System elements as described below:

**Safe roads and roadsides**

- There was limited shoulder width with which the bus could pull completely off the road.

**Safe speeds**

- The impact speed was not survivable, so the driver's speed of travel was not safe.
- If the bus was stationary the driver should have slowed to 20km/h as required by law.

**Safe vehicles**

- It is not known whether the bus had school signs and supplementary flashing lights located on the vehicle to inform drivers that it was transporting and dropping off school children.
- Given it was overcast conditions, it is unclear if the bus or vehicle had its lights on to make it more visible to other road users.

**Safe road use**

- The child stepped out in front of the bus and should have waited until the bus had driven off to give better visibility of any approaching traffic.
- The child was possibly distracted by the family members waiting to pick him up.
- The family member could have avoided the situation where the child had to cross a busy road by himself.

Using a safe system approach to prevent such a severe crash from happening again, there would be an acknowledgement that children are impulsive and it is unrealistic to expect their safety to be assured through their compliant behaviour alone. The road and speed environment should reflect children's capabilities by providing an inherently safe system that accounts for possibility of a child impulsively stepping out from in front of a bus with little time for passing motorists to react.

## 2.4 Investment framework

The Transport Agency develops and follows an investment and revenue strategy (IRS) that sets out its investment direction and principles for revenue management. The IRS is aligned with the Government Policy Statement on Land Transport Funding (GPS). It is important to note that while central government has a vital leadership role for prioritising, assisting in and developing solutions, and providing some investment, this must be targeted to risk.

For rural schools, this means understanding the road safety risks associated with a school and matching a programme of intervention to the magnitude of risk and prioritising against other risks within the network. For further information on programme development and prioritising works refer to section 7.2.

## 2.5 Vision for child safety

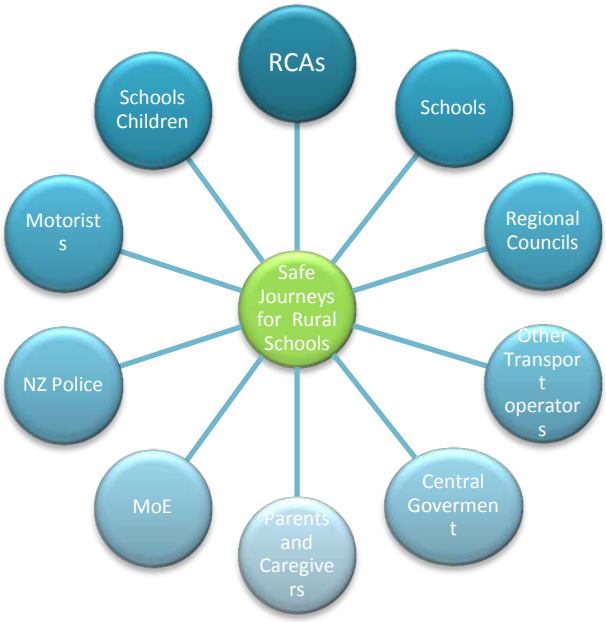
This vision for child safety reflects the current Safer Journeys Strategy, and that the journey to and from school is one element of the transport system and it should be a provided within a *'safe road system increasing free of death and serious injury.'*

As system designers we have an obligation to take children's needs and abilities into consideration when developing treatments for a site, route or network for rural schools.

## 2.6 Responsibility

Under a safe system we all have a responsibility, both the designers and road users. It is essential in developing plans and making recommendations that a thorough assessment has been completed which incorporates the various elements that make up the journey to school and at the school facilities. The number of agencies, schools and individuals responsible for ensuring school safety are shown in figure 2-4 and described in the following sections.

**Figure 2-4: Responsibility for Safer Journeys to rural schools**




### 2.6.1 Road controlling authorities (RCAs)

The RCA responsibility lies with:

- maintaining the road environment, including the corridor where school children travel and the intersections they use to access their school
- developing suitable treatments
- providing assistance and advice to the school, the Police, Ministry of Education and other key stakeholders
- understanding school and community concerns
- planning:
    - > to ensure the school environment is safe by minimising trips children need to make across strategic roads

- to minimise conflict between vehicles and children travelling on foot or bike, especially at the bottom gate to assist in creating an environment around schools that promotes driver awareness of the school

- parking enforcement
- ensure the school and school surround meets guidelines CPTED (Crime Prevention Through Environmental Design)
- ensure school bus routes and stops are safe, convenient and accessible.

## 2.6.2 Schools

The school's responsibilities are to:

- provide an environment where school children feel safe and protected
- develop policies including a travel plan to provide a safe environment
- work with key stakeholders to develop policies and ensure that all elements of the journey to and from school have been identified
- develop a code of conduct to establish school bus safety policies and procedures for students and caregivers to follow that ensure the safety of bus passengers, pedestrians and other vehicles, with the Involvement of students, parents, teachers and bus operators
- school to enforce policies and procedures by monitoring behaviour of students and take necessary action to maintain compliance
- educate and inform parents, caregivers and students of their responsibilities to wear appropriate restraints in vehicles and to ensure all other occupants are properly restrained
- provide information on the school website including what is required by law
- invite the local Police or a car restraint expert to educate parents, caregivers and students on using car restraints, which could include information on car seats and restraints for children under 5
- encourage slower speeds when passing the school and entering/exiting the car park, investigating installing speed humps in the school car park if speed is a concern
- encourage the school community to drive respectfully when dropping off or picking up children because the behaviour or actions of a driver may be the cause of concern rather than speed (unsafe u-turns, double parking)
- ensure that infrastructure to allow safe active road user and vehicle access to and from and movements within the property school has been considered and provided where possible
- ensure the school and school surrounds meets guidelines CPTED (Crime Prevention Through Environmental Design).

## 2.6.3 Central government

### 2.6.3.1 Ministry of Education

The Ministry of Education has a responsibility to:

- educate children and the community by supporting, funding, resourcing and collaborating road safety learning within the curriculum

- contribute to ensuring that Safe System principles are fully understood so they can be applied by children and the community to achieve road safety outcomes
- ensure school bus routes and stops are safe, convenient and accessible.

#### 2.6.3.2 NZ Transport Agency

The Transport Agency has a responsibility to develop policies that identify and make recommendations for the journey to, from and at school. This includes advice on high risk school environments, road asset management and development, funding criteria, restraint use, and vehicle standards.

#### 2.6.3.3 Ministry of Transport

It is the role of the Ministry of Transport to provide policy advice that enables a safe transport system, increasingly free of death and serious injury.

#### 2.6.3.4 Ministry of Health

It is the role of the Ministry of Health to enable positive health outcomes for children and the community. The Ministry can share responsibility through its considerable knowledge, skills, expertise, funding and resources. Investment in improving road safety for children today, particularly when coupled with encouraging more active transport, will enable healthier communities in the future with subsequent savings in health costs.

#### 2.6.3.5 ACC

It is ACC's role to take responsibility for child injury prevention using any mode of transport. ACC can help communities by providing support, funding, engaging experts and specialist, providing crash research, collaborating on injury prevention initiatives, supporting RCAs and aligning with the safe system approach.

#### 2.6.3.6 Ministry of Justice

It is the role of the Ministry of Justice in this case to take responsibility for fair application of road and traffic laws.

## 2.6.4 Motorists

### Restraints

- Drivers and passengers in a vehicle are required by law to use car seat belts/restraints provided or appropriate child restraint suitable for age and size of the child.
- It is a driver's responsibility to ensure that every child in their vehicle is fitted with a suitable child restraint.

### Travelling at safe speeds

- Travel at safe speeds.
- The legal speed limit for passing a school bus while it has stopped to let school children on or off is 20km/h in both directions. Research has shown that a large proportion of drivers are not aware of this road rule or they choose not to comply with it. Educate and inform parents and caregivers by carrying out an awareness campaign through school newsletters and social media.

### General road safety and courtesy

- A new Safe System approach has been launched to change the way people think about road safety. 'Drive Social' aims to encourage better driving behaviour and change the way drivers currently think about the road. 'If we stopped thinking car and started thinking people, would it change the way we drive?'
- Drive to the conditions.
- Respect other roads users and look out for active road users.

## 2.6.5 Parents and caregivers

Parent and caregivers as the primary carers for school aged children need to ensure that they are provided the best possible protection.

### When driving:

- Correct restraints must be worn:
  - > Under New Zealand law all children under seven years of age must use an approved child restraint appropriate for their age and size. Children aged seven must be secured in a restraint if one is available in the vehicle.
  - > From their 7th until their 8th birthday correctly secure your child in an approved child restraint if one is available in the vehicle (and if not, in any child restraint or safety belt that is available).
  - > Children aged between eight and 14 must use safety belts/restraints if available. If not available, they must travel in the back seat.
  - > People aged over 14 must wear safety belts/restraints where they are available.
  - > International best practice recommends the use of an appropriate child restraint (or booster seat) until your child reaches 148 centimetres tall or is 11 years old.
- When passing a bus that has stopped to load or unload children – travel no faster than 20km/h.
- Eliminate the need for students to cross the road, or get out of the car and walk with children to the school gate.
- Prevent children from running heedlessly across the road.
- Minimise the consequences by slowing down the traffic when children are crossing.

- Ensure safe and appropriate speeds on the journey.
- Adhere to the road rules and make good decisions at school access and intersections.
- Give teenagers who drive appropriate vehicle types and ensure they have enough training and experience.

Taking the bus:

- Ensure children feel safe getting on and off the bus. Ensure that what facilities there are take into account if they have to walk or cross the road after they get off of the bus and how safe the location of the bus stop is.
- Communicate to children that they are required to wait, or remain seated until the bus has completely stopped to get on or off the bus.
- Remind them that after they have got off the bus they need to wait well back from the road until the bus has moved away, and then only cross if the road is clear of traffic.
- Ensure that as much as possible, parents park on the same side of the road as the bus, removing the need to cross the road.

Walking and cycling:

- Ensure they have the appropriate safety gear (eg helmet, high visibility gear).
- There are places for them to be able to ride or walk safely.
- They are old enough to be able to travel independently to school and if so have the correct messages about safe travel been given to them.

### 2.6.6 School children

School children also have responsibility for their actions and choices when they are riding bikes, walking, taking a bus and driving to school. Their responsibilities include:

- wearing their safety belts/restraints
- waiting for the road to be clear before the cross
- walking as far away from traffic as far as practicable
- keeping left as far as practicable
- using the sealed shoulder or usable berm if available
- travelling at safe speeds if driving.

### 2.6.7 Regional councils/unitary authorities

Regional Councils have a responsibility within regions for:

- public transport services
- regional land transport programmes
- road safety.

### 2.6.8 The New Zealand Police

New Zealand Police have a responsibility for:

- enforcement

- education
- road safety.

### 2.6.9 Other stakeholders

Other stakeholders include the New Zealand Bus and Coach Association, New Zealand Transport Forum, the Automobile Association and the Cycling Advocates Network who are responsible for information provision, preparation and assistance in policy development and safe road use for their members and users of their services.

## 2.7 Source material

### 2.7.1 NZ Transport Agency

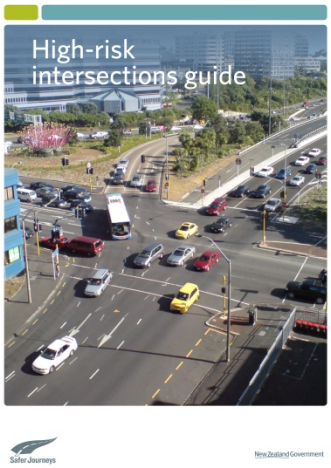
#### 2.7.1.1 Other guides

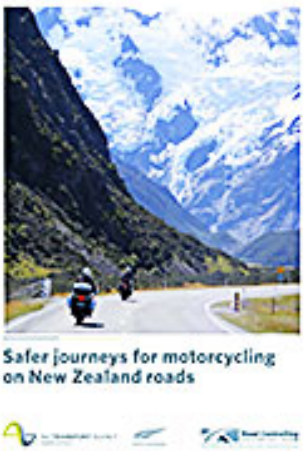
There are a number of other recently developed Transport Agency guides that focus on strategically important areas. This will consistently provide a safe system message under the Safer Journeys Strategy. These are:

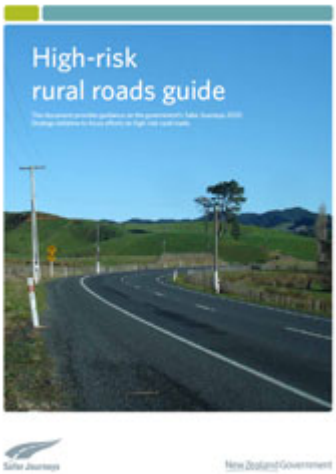
- *High-risk rural roads guide* (www.nzta.govt.nz/resources/high-risk-rural-roads-guide )
- *High-risk intersection guide* (www.nzta.govt.nz/consultation/high-risk-intersections-guide )
- *Safer Journeys for motorcycling on New Zealand's roads* (www.nzta.govt.nz/resources/safer-journeys-motorcyclists ).

Ministry of Education school bus safety materials: (www.minedu.govt.nz/NZEducation/EducationPolicies/Schools/SchoolOperations/SchoolTransport/SchoolBusSafety.aspx )

*Pedestrian planning and design guide* (www.nzta.govt.nz/resources/pedestrian-planning-guide ).



#### 2.7.1.2 School safety and information for practitioners

There are a number of resources available for use on the Transport Agency website; including but not limited to:

Schools/community:

- Transport Agency school education website – Teachers and families will find curriculum resources and guidance on road and rail safety on this website (http://education.nzta.govt.nz ).
- *Making safe choices when travelling to and from school by bus.*
- *Cyclist skills training guide.*
- *School travel plan coordinators' guide.*
- *Code of practice for school mini buses.*
- Child restraints information.
- *Starting out safely.*
- Guidance on transport options for communities with limited or no public transport.
- *How communities can get involved in the setting of speed limits.*
- *The official New Zealand road code.*
- *The official New Zealand code for cyclists.*

Road controlling authorities/consultants and contractors:

- Land transport rules and other legal requirements.
- Traffic notes and roads and traffic standards.
- Guidelines and standards for roading.
- Traffic sign specifications.
- Siting school bus stops.
- Walking and cycling documents.

### 2.7.2 Ministry of Education (MoE)

Information on the MoE website covers a number of key elements including information on existing school and new school development:

www.minedu.govt.nz/NZEducation/EducationPolicies/Schools/PropertyToolBox/StateSchools/Design/TrafficManagement.aspx.

#### 2.7.2.1 Existing schools

As part of the MoE schools development education policies, a number of ideas are given for assisting schools to manage traffic flows within and around their schools. These include information on:

- creating, implementing and monitoring travel plans
- improving traffic movement through schools
- car parks (use of old and development of new and planning for special events)
- traffic impact assessments

- traffic management checklists.

Further information can be source from the website www.minedu.govt.nz.

#### 2.7.2.2 New school development

Where any new school is developed, the Ministry of Education will work with engineers, relevant stakeholders and designers to accommodate any on-site roading and topography issue and ensure that current standards and guidelines are followed. Good land use planning is an essential starting point for road safety. Information provided for existing schools including development of travel plans and improvements to traffic flows and car-parking will provide additional information when developing any new school.

#### 2.7.2.3 School bus information

As stated on the MoE website 'School bus routes are designed by the Ministry's service agents, who are responsible for determining and delivering school transport assistance within the policy set by the Ministry'. Information is provided on:

- bus route design – for the purposes of transport entitlement zones
- bus stop placement –'The service agent consults with the school's bus controller and the bus operator to decide safe and suitable locations for bus stops. Students are expected to assemble at these stops. Anyone who has safety concerns about the location of a bus stop should contact the bus controller. The bus controller will work with the service agent and the bus operator to resolve the issue or relocate the bus stop'
- school bus safety, outlining safety actions for caregivers, schools, bus drivers, students, Ministry of Education, bus operators, and service agents – see safe behaviour on buses - www.minedu.govt.nz/NZEducation/EducationPolicies/Schools/SchoolOperations/SchoolTransport/SafeBehaviourOnBuses.aspx
- other agencies involved in school bus safety standards and providing information and resources include:
  - > the Transport Agency (www.nzta.govt.nz )
  - > the Transport Agency Vehicle Certification Unit (VCU) ( www.nzta.govt.nz )
  - > Police Youth Education Service (www.police.govt.nz/service/yes )
  - > Police Commercial Investigation Unit (www.police.govt.nz/service/road/cviu.html )
  - > Bus and Coach Association New Zealand www.busandcoach.co.nz.

### 2.7.3 Safe and Sustainable Transport Association (SASTA)

SASTA is an independent national group representing professionals working in or contracted by local government to promote national best practice in community activities that seek to improve safety and sustainability on our transport network. The group originated from the Road Safety Coordinators Association.[8]

A national companion guide to *Safer journeys for rural schools* guide has been developed concurrently with this guide to provide information to SASTA and school communities; it is intended to provide:

- support this more comprehensive and technical guide that is intended to be used by road safety professionals
- both a rural and an urban focus.

[8] http://www.sasta.org.nz/

# 3 Background and key issues

## 3.1 Crash data analysis

### 3.1.1 General

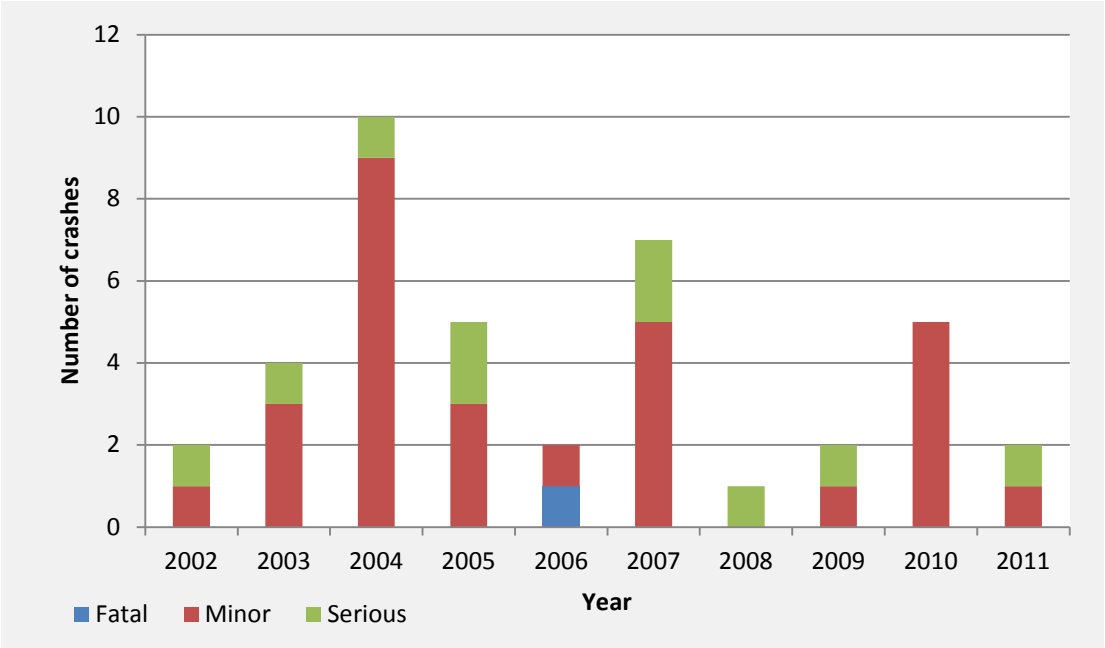
When determining the nature of the road safety problem at rural schools there were a number of different factors that had to be identified in the first instance. Although this guide focuses on the journey to, from and at high-risk schools, it is difficult to determine the routes where these journeys would occur without first consulting the school community. Therefore, the selection of data had to focus more on those crashes in the vicinity of the school. The key selection criteria are outlined in table 3-1.

**Table 3-1: Crash data selection criteria**

| Criteria | Specification |
|---|---|
| Speed limit | >= 80km/h |
| Study area | 250 radius from school |
| State highways/local roads | All roads |
| Days of the week | Monday to Friday (inclusive) |
| Months of the year | February to November (inclusive) |
| Times of day | 7.30am-9am; 3pm-4.30pm |
| Age of road user | Ages 5 to 17 years |
| Type of injury/non-injury | Injury only |
| Exclusions | Crashes on motorways |

The total number of crashes using the criteria outlined in table 3-1 is 40 crashes over 10 years, including one fatal, 10 serious and 29 minor. The majority of crashes occurred in mid-block (65%) compared to those at intersections, with the most severe crashes occurring in 100km/h mid-block sections of road. The average number of crashes per year involving school children in rural areas in New Zealand over the past 10 years is 4, with 11 (28%) of the past decade's crashes involving either a fatal or serious outcome.

**Figure 3-1: Crashes involving school children in the vicinity of rural schools in New Zealand (2002-2011)**




Source: CAS 2013; For full selection criteria refer to table 3-1.

Figure 3-2 represents school children versus the type of vehicle they were in when they were injured. The type of mode split is typical for rural areas where the car is one of the main forms of transport to and from school, and other forms of transport such as walking and cycling are less common. Note that although buses are also one of the most common forms of transport in rural areas, incidents involving these types of vehicles are not evident within the last 10 years.

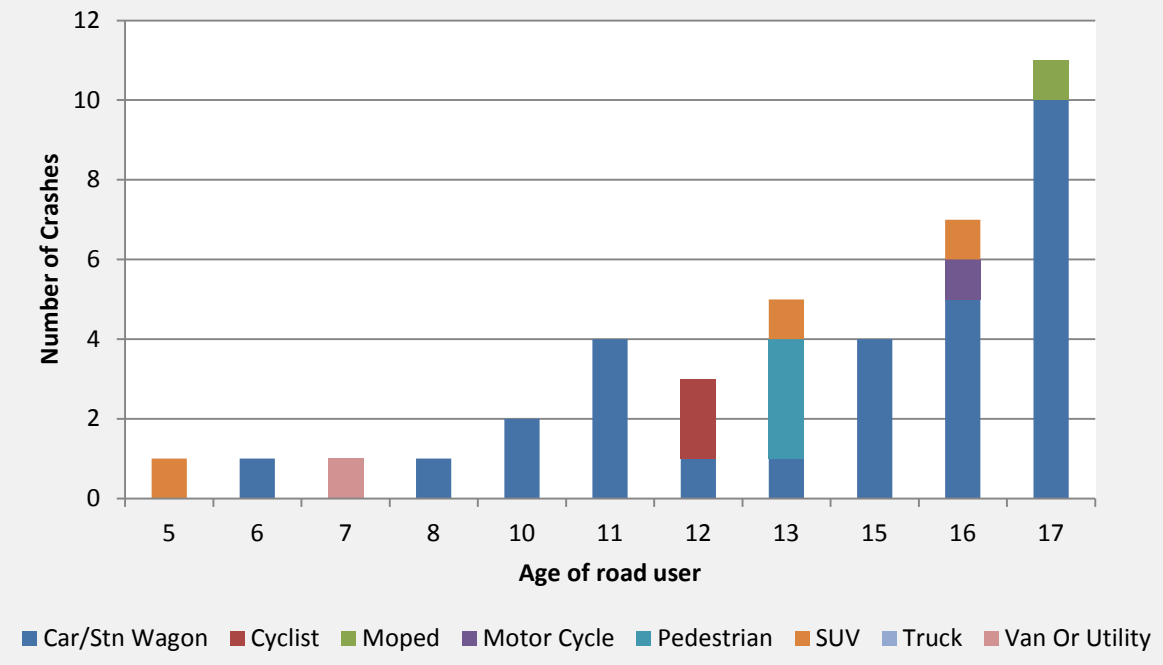
**Figure 3-1: Crashes involving school children[9] in the vicinity[10] of rural schools in New Zealand (2002-2011)**


Source: CAS 2013; For full selection criteria refer to table 3-1.

[9] 'School aged children' are those defined as being aged from 5 to 17 years inclusive

[10] Within a 250m radius of the school site boundary sourced from the Crash Analysis System (CAS)

**Figure 3-2: Age of school child[9] injured by type of vehicle (2002–2011) in the vicinity of a rural school[10]**

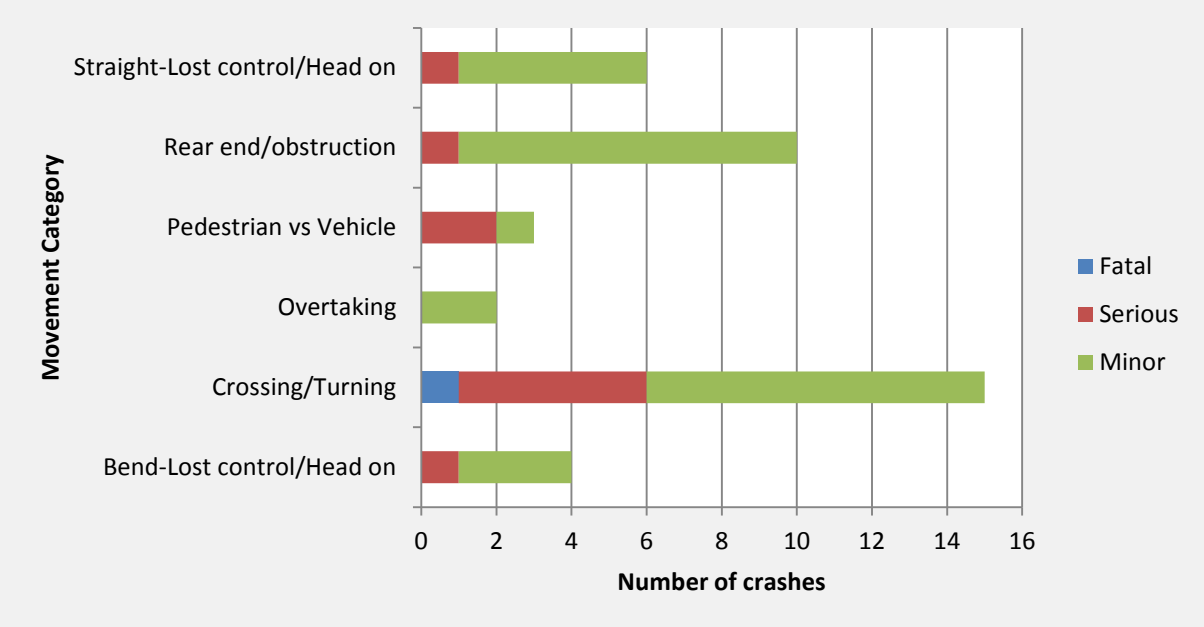



Note: For full selection criteria refer to table 3-1.

## 3.1.2 Key crash types

The key types of crashes that involve school children are shown in figure 3-3 and clearly show that children in vehicles involved (either as drivers or passengers) in crossing/turning type crashes are the most common. Approximately 35% occur at intersections compared to midblock, and of those intersection crashes, 64% are at 'T' junctions. The main causes for all these crashes are 'failed to give way' and 'did not look or see'.

**Figure 3-3: Key movement categories for school children in the vicinity of a rural school 2002–2012**



### 3.1.3 Wider context

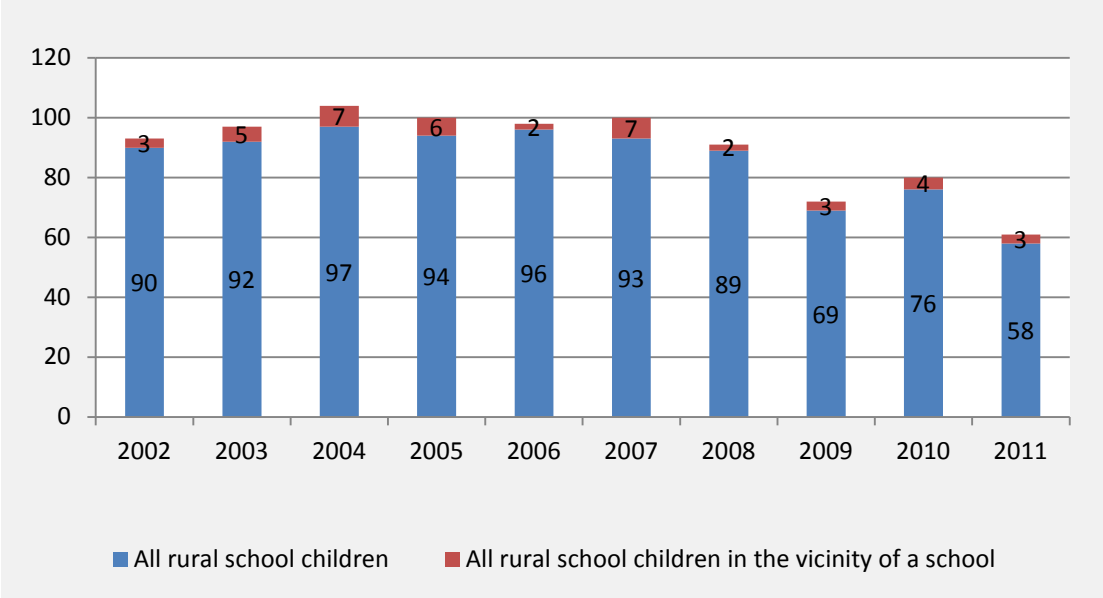
Given the limited crash information in the vicinity of schools, it is important to note the wider issues and those crashes that are not in the immediate location of the school but included school children and occur during the school peak period on other routes. In addition, it is important to recognise and analyse all crashes that occur in the vicinity of the school; while not reportedly involving school children it is conceivable that these crashes could easily have done so given the location.

#### 3.1.3.1 Crashes involving all rural school children (ie not necessarily in the vicinity of a school)

Figure 3-4 shows the proportion of crashes involving school children at school times compared with those in the vicinity of a school. This identifies that there are still issues with this age group in rural areas for the journey to and from school even if they are not near a school when they are involved in a crash. The main features with those crashes not close to the school where school children were injured are:

- 37% involved a vehicle losing control on a bend
- 78% occurred mid-block
- 39% attributed to poor observation by the driver.

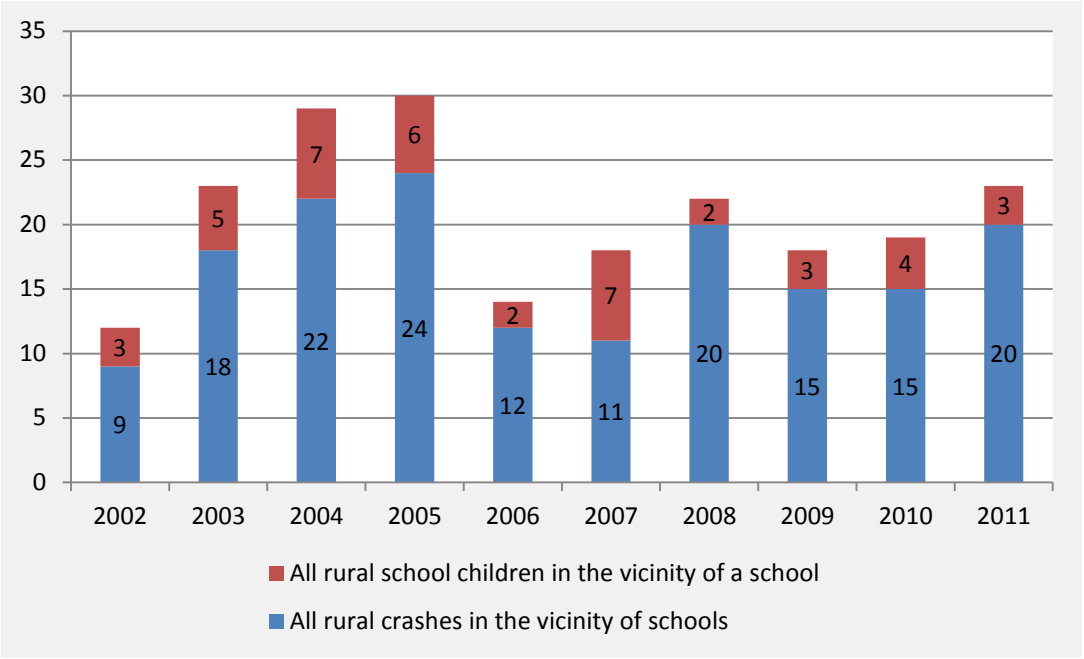
**Figure 3-4: Crashes involving all rural school children during school times**




#### 3.1.3.2 All crashes located in the vicinity of rural schools at school times

Figure 3-5 shows all the types of crashes that occur in the vicinity (ie 250m radius from school site) of schools at school times regardless of whether they involved a school child (different to that described in section 3.1.2). Analysis of all crashes in this area shows us what these types of movements are and reveals the risks to all road users. The main features of crashes are:

**Figure 3-5: Rural school crashes - all crashes and crashes involving school children**




## 3.2 Mode of travel

The decision on the mode of travel that is undertaken in rural areas is very different to urban areas. A number of issues dictate the choices of travel to rural schools:

- safety of young children walking and cycling due to a lack of facilities for these modes
- greater distances from the school to home
- availability of public transport
- reliance on private vehicles in rural communities.

A transport study recently developed by the Waikato Regional Council (2012) showed that trips for rural schools, bus use ranged from 27% to 30% and 56% to 60% for car use.

## 3.3 Perceived and actual risk

As stated in New Zealand Transport Agency: Research Report 271, (2006) 'perceived safety risks are an important factor for parents/caregivers in making the decision to allow children to journey to school unaccompanied'. They are likely to choose what they believe to be the most appropriate mode of travel, whether it is by active mode, car or bus. The most common concerns and perceived risks by parents and caregivers, community and key stakeholders are set out in section 3.4.

A 2010 research report by the Transport Agency states that 'perceived poor safety and risk aversion is something that is modifiable [and is a] significant issue that needs to be tackled at a much wider scale than within school travel initiatives alone'. Although it can be tempting to completely discount perceived issues that have very little crash data to support them, it is important to understand why parents think their children are at risk. Parents travel to and from school on a daily basis and they may see near-miss events happening frequently. It may simply be luck, an increase in the perception of risk, or a relatively low exposure that makes serious or fatal casualties at rural schools relatively rare.

Actual risk is quantitatively defined, such as the road or intersection outside the school being deemed to be high-risk based on reported crash data for all crash types and road users, as well as models developed by the Transport Agency's high-risk guides (2011 to 2012).

When determining the most appropriate solutions for the journey to and at schools, it is important to define and separate both the perceived and actual risks (refer section 4).

## 3.4 Key stakeholder/school concerns/issues

A report completed by TERNZ in September 2011 stated that 'rural school road safety is of significant concern for many communities.  A recent (Transport Agency) report on school travel systems in New Zealand (Mackie 2010) suggested that rural school safety is a specific area, among others that remains problematic. At rural schools there is a conflict between high speed through traffic and the drop off and pick up activities associated with school commuting'.

Table 3-2 summarises the key issues raised in the TERNZ report and other literature reviews. They include concerns regarding the school – access, through traffic, speed management, road designs, and bus movements.

Further information on key issues and appropriate measures can be found in sections 5 and 6.

| Table 3-2: Summary of key concerns | | | | | |
|---|---|---|---|---|---|
| **Key concerns** | | | | | |
| **School** | **Speed management** | **Road** | **Road use** | **Buses** | **Other** |
| Access, design, visibility, parking, school procedures: | High speed through traffic conflicting with turning and merging movements at the school | Design facilities, intersection, access, overtaking, hazard protection | Road user responsibility | Drop off/pick up/bus stop location/vehicle safety | Congestion and environmental concerns |
| • access design/visibility of the school – width, active users vs. vehicles, sight distance, drop off and pick up<br>• parking – outside and inside the school – facility, sight distance<br>• school procedures – travel plans, school bus procedures, safety at the school gate<br>• lack of secure cycle facilities<br>• lack of parental supervision<br>• lack of safe crossing places | • through traffic – high speed<br>• access and intersections<br>• conflict with active road users<br>• appropriate speeds around stationary buses dropping/ picking up children | • journey to school:<br>• too long to walk or cycle<br>• no facilities for pedestrians or cyclists<br>• high volumes of heavy vehicles<br>• poor intersection design in the vicinity of the school<br>• poor maintenance of roads and footpaths<br>• limited or no shoulder width<br>• narrow road width<br>• the conspicuity of the schools to other road | • lack of and appropriate restraint use<br>• travelling at safe speeds<br>• obeying the road rules<br>• young drivers. | • poor visibility for buses and other vehicles leaving the schools<br>• bus stop location outside and inside the school<br>• bus stop pick up and drop off locations along the route. | • congestion – the proportion of children driven to school by car has increased significantly over the past two decade and traffic volumes are lower during school holidays<br>• environmental Impacts – car travel and congestion to and from school. |

| | | | | | |
|---|---|---|---|---|---|
| • poor sight conditions<br>• lack of drop off and pick up zones<br>• driver behaviour | | users<br>• overtaking near schools<br>• unsealed roads. | | | |

# 4 Identifying risk at rural schools

This section explains the process for determining which schools should be prioritised for intervention and the more specific issues that should be considered in order to improve safety.

To date, some local authorities have already carried out their own analyses to determine which schools in their district are most worthy of attention and the accompanying programme of work required to make them safer. These proactive efforts need to be acknowledged, and the process described in this section should complement rather than replace these earlier efforts.

## 4.1 The rural school risk identification process

A three-stage process for identifying road safety risk priority for rural schools can be used. The stages are:

**Stage 1: Preliminary prioritisation process (section 4.2)**

This initial step gives an indication of the risk exposure of a school based on the road environment in which it is located. It takes into account:

- safe speeds (speed limit)
- safe road use (traffic volumes, number of students)
- safe roads and roadsides (crash data).

This stage provides an indication of the road safety risk profile of the environment in which the school is located. The next section outlines the process used to create the risk profile, so that readers of the guide can understand the basis from which it was created.

**Stage 2: Secondary prioritisation refinement (section 4.3)**

Focusing on the road environment, the purpose of stage 2 is to carry out a more detailed, but still desktop, evaluation of risk at each school, based on 10 questions answered using aerial photos, Google Street view, and/or local knowledge. It is envisaged that this would be carried out within a region, once its initial list of high risk school environments has been determined from Stage 1.

**Stage 3: On-site safety investigation (section 4.4)**

Stage 3 involves a more detailed assessment of specific issues, based on a visit to the school and should link to the identification of Safe System toolbox elements that can be used to address road safety at the school. Treatment options may include:

- safe road use
- safe roads and roadsides
- safe speeds
- safe vehicles

## 4.2 Stage 1: Preliminary prioritisation process - road environment risk

For rural schools, this step considers two elements of rural school road risk:

- Risk at the school gate
- Risk on the road network in the general vicinity of the school.

These can be quite different, so it is valuable to understand both separately. However, they are then combined to produce an overall school risk ranking.

This process uses nationally available data which can be readily applied to any rural school environment. The use of nationally available data means the road safety risk profile of all rural school environments in a region and district can be calculated without the need to collect any additional data. Rankings of improvement priorities nationally and within each district are best achieved with additional local knowledge, as described later in this section. Stage 1 is just the first filter for RCAs to identify and prioritise risk.

Risk at the school gate is based on:

- the traffic volume and speed on each road bordering the school
- the number of vehicle and pedestrian/cyclist movements to and from the school.

Traffic volume and vehicle and pedestrian/cyclist movements provide an indication of child exposure to risk, and traffic speed provides an indication of the likelihood and severity of a crash.

Risk on the road network near the school is estimated based on:

- the history of injury crashes, weighted by proximity to the school to reflect the reducing relevance of more distant crashes.

The safety on the nearby road network is relevant to school safety as students must use these roads to travel to and from school, whether by bus, car, motorcycle, walking or cycling. The dual approach acknowledges that risk does not exist solely at the school gate, but safety on the surrounding road network is also an important factor.

More generally, there are two ways of expressing risk:

- Personal risk, which is the average risk for each individual student, relates to the individual probability of one student at a particular school being involved in a crash.
- Collective risk, which is the total risk for all students, relates to the collective probability of a student at a particular school being involved in a crash.

The most appropriate expression of risk depends on the type of safety improvement being considered. Where safety improvement costs are proportional to the number of students targeted, as with behavioural education or signs on school buses, personal risk will show where the greatest benefit lies. Where safety improvement costs are higher and fixed, as for variable speed limit signs, collective risk will be a better measure. A balance of the two is used in the school prioritisation process.

### 4.2.1 Risk at the school gate

To calculate the risk at the school gate, each road bordering a school an exposure factor is calculated as:

$$school\ gate\ personal\ risk = \ square\ root(AADT) * \ (speed\ limit)^2$$

AADT is the average annual daily traffic volume on the road, and the speed limit is in kilometres per hour. Volume is an indicator of crash risk exposure and speed is an indicator of crash likelihood and severity. However, the relationship between crash probability and AADT is rarely linear. The use of a square root function for AADT means a doubling in AADT correlates to 41% increase in crash risk.

The second order power relationship for speed is based on Transport Research Lab crash severity work (*High-risk intersections guide* Figure 2-2) and the kinetic energy formula.

The exposure factor for the school's primary access road[11] is given higher weight than any secondary road (primary road = 70%, other road = 30%). Where there are three roads the primary road has 50% weight and other roads have 25% each. The risk is normalised by dividing by 707,107, which is the school gate personal risk of a reference high risk road environment with an AADT of 5000veh/day in a 100km/h speed limit.

The school gate collective risk multiplies the personal risk by an indicator of the number of exposures to this risk. Every student pick up/drop off vehicle movement, or student walking or cycling, is an additional exposure to the traffic on the road.

$$School\ gate\ collective\ risk = school\ gate\ personal\ risk * school\ roll$$

### 4.2.2 Risk on the road network

The risk on the road network is measured in terms of probable deaths and serious injuries accidents per kilometre of road near each school, per 5 years.

The formula is:

$$Road\ network\ risk = \frac{(deaths\ and\ serious\ injuries\ from\ 0-800m)}{length\ of\ road\ from\ 0-800m} * 60\% + \frac{(deaths\ and\ serious\ injuries\ from\ 800-1600m)}{length\ of\ road\ from\ 800-1600m} * 30\% + \frac{(deaths\ and\ serious\ injuries\ from\ 1600-3200m)}{length\ of\ road\ from\ 1600-3200m} * 10\% +$$

Where deaths and serious injuries are estimated based on recorded injury crashes in the last 5 years multiplied by the likelihood of serious or fatal injury for that crash movement, intersection type, and speed limit. [12] Non-injury crashes are excluded due to high and regionally-variable under-reporting.

The 800m, 1600m and 3200m distances from school are used for consistency with the Ministry of Education School Transport Assistance eligibility assessment (3.2km and 4.8km from school depending on age). These values reflect radial distances from the school, not road distance.

This is the public collective risk in terms of traffic volumes. If traffic flow data was available on all rural roads, the crash rate could be converted to a personal risk per vehicle by dividing by flow. Multiplying this number by the number of school road movements would give an indication of the collective risk for the school, although there is limited crash history and non-motorised trip data to clearly differentiate risks associated with car, pedestrian and cycle school travel.

At this stage, due to the lack of non-state highway rural road traffic flow data, and incompleteness of mode choice and risk data, the raw public collective risk is used for road network risk. This is normalised relative to the median road network risk from a test run of this method on a random sample of 100 rural New Zealand schools in a similar way to the normalisation of the school gate risk.

[11] The road listed as the school's street address in Ministry of Education data is considered the primary access road in the high level prioritisation process.

[12] This is based on the *High-risk intersection guide* analysis that was completed for intersections, and Abley Consulting analysis for mid-block crashes.

### 4.2.3 Total risk combination: road environment risk

The school gate collective risk number is multiplied by the road network collective risk number to give a school's road environment risk. The school road environment risk thresholds are shown in table 4-1.

**Table 4-1: School road environment risk**

| Risk rating | School road environment risk |
|---|---|
| High | >30 |
| Medium-high | 15–30 |
| Medium | 7.5–30 |
| Low-medium | 4–7.5 |
| Low | <4 |

It is useful to understand the risk category (low-medium-high) of the school gate and road network factors that make up the road environment risk. The school gate collective risk thresholds are shown in table 4-2.

**Table 4-2: School gate collective risk**

| Risk rating | School gate risk |
|---|---|
| High | >100 |
| Medium-high | 65–100 |
| Medium | 35–65 |
| Low-medium | 20–35 |
| Low | <20 |

The risk ratings above are derived from a combination of the AADT and speed characteristics of rural school frontage roads with student numbers at over 700 schools in New Zealand. The road network collective risk thresholds are shown in table 4-3.

**Table 4-3: Road network collective risk**

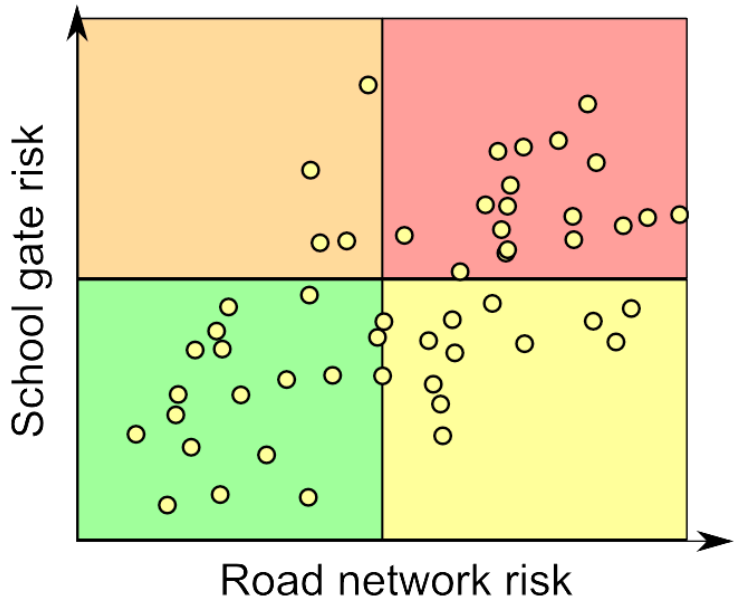
| Risk rating | Road network risk weighted DSI per km |
|---|---|
| High | >0.37 |
| Medium-high | 0.24–0.37 |
| Medium | 0.18–0.24 |
| Low-medium | 0.10–0.18 |
| Low | <0.10 |

This is based on over 700 rural schools around New Zealand, using road network, school location and crash data to give a value of expected deaths and serious injuries per km per 5 years, weighted by proximity to each school.

This would be more valuable if normalised with traffic volume data to give weighted deaths and serious injuries per km per 1000 vehicles per day. However, at the time this guide was being prepared, a nationally available set of traffic volumes on all roads in New Zealand was not widely available.

Figure 4-1 shows (with indicative data) that there is likely to generally be a correlation of both risk measures, and school environments that are high in both will have a high 'road environment risk' and be a top priority for investigation. Some school environments will be high in just one measure and will warrant a risk mitigation approach specific to that type of risk.

**Figure 4-1: School gate and road network risk matrix**




School environments in the upper left quadrant of the figure have a higher than average school gate risk and a lower than average road network risk. This suggests the type of mitigation measures likely to be most effective are those focussed on minimising risk around the school gate.

In contrast, school environments in the lower right quadrant of the figure have a higher than average road network risk and a lower than average school gate risk. This suggests the type of mitigation measures likely to be most effective are those focussed on the surrounding road network on routes that students use to travel to and from school, such as a nearby intersection with poor road safety performance.

### 4.2.4 Worked examples

- Example 1: School A

School 'A' is a rural secondary school located on a moderately busy state highway and has a role of 225 pupils. The state highway is the only access road for this school. The AADT for the state highway is 4600 vehicles per day and the speed limit is 80 km/h. Calculations of school gate, road network and overall road environment risk are set out below.

$$school\ gate\ personal\ risk = \frac{\sqrt{(AADT)} \times (speed\ limit)^2}{707107}$$

$$school\ gate\ personal\ risk\ =\ \frac{\sqrt{4600}\times(80)^2}{707107}=0.614$$

$$school\ gate\ collective\ risk\ =\ 0.614\times 225\ =\ 138.15$$

With a score over 100, this school has a high school gate collective risk rating.

Table 4.4 demonstrates how risk on the road environment has been calculated for school 'A'. The DSi values have been calculated based on the crash movement, intersection type, and speed limit for the particular crashes that occurred within the relevant distance range from the school.

**Table 4.4: Risk on the road network – school A**

| Distance from school | Injury crashes | Sum of crash DSi | Road length (km) | DSi/km | Weighting applied | Weighted DSi/km |
|---|---|---|---|---|---|---|
| 0–800m | 2 | 0.34 | 2.39 | 0.142 | 60% | 0.085 |
| 800–1600m | 3 | 0.29 | 5.21 | 0.056 | 30% | 0.017 |
| 1600–3200m | 6 | 0.84 | 25.32 | 0.033 | 10% | 0.003 |
| Risk on the road network (sum of weighted DSi per km) | | | | | | 0.105 |

The average weighted DSi per km (collective risk) value is between 0.10 and 0.18 and therefore school 'A' has a low-medium road network risk rating.

The school's road environment risk is calculated by multiplying the road network collective risk by the school gate collective risk:

$$total\ school\ road\ environment\ risk\ =\ 138.15\ \times 0.105\ =\ 14.51$$

This risk score places school 'A' in the medium risk category.

### Example 2: School B

School 'B' is a rural primary school with a role of 102 students. This school has two local access roads and therefore the risk scores will be weighted 70% for the primary road and 30% for the secondary road.

Primary road:

- AADT = 1500 vehicles
- Speed limit = 100 km/h

Secondary road:

- AADT = 2500 vehicles
- Speed limit = 100 km/h

$$school\ gate\ personal\ risk\ (primary\ road)=\ \frac{\sqrt{1500}\ \times(100)^2}{707107}\ =\ 0.548$$

$$school\ gate\ personal\ risk\ (secondary\ road)=\ \frac{\sqrt{2500}\times(100)^2}{707107}=0.707$$

$$overall\ personal\ risk = 0.548\times 70\% + 0.707\times 30\% = 0.598$$

$$school\ gate\ collective\ risk\ =\ 0.598\times 102\ =\ 61.00$$

With a score between 35 and 65, this school has a medium school gate collective risk rating.

Table 4.5 demonstrates how risk on the road environment has been calculate for school 'B'. The DSi values have been calculated based on the crash movement, intersection type, and speed limit for the particular crashes that occurred within the relevant distance range from the school.

**Table 4.5: Risk on the road network – school B**

| Distance from school | Injury crashes | Sum of crash DSi | Road length (km) | DSi/km | Weighting applied | Weighted DSi/km |
|---|---|---|---|---|---|---|
| 0–800m | 5 | 1.92 | 3.26 | 0.589 | 60% | 0.353 |
| 800–1600m | 10 | 1.42 | 7.56 | 0.188 | 30% | 0.056 |
| 1600–3200m | 38 | 8.16 | 21.3 | 0.383 | 10% | 0.038 |
| Risk on the road network (sum of weighted DSi per km) | | | | | | 0.447 |

The average weighted DSi per km value is greater than 0.37 and therefore school 'B' has a high road network risk rating.

The school's road environment risk is calculated by multiplying the road network collective risk by the school gate collective risk:

$$total\ school\ road\ environment\ risk\ =\ 61.00\ \times 0.447\ =\ 27.27$$

This risk score places school 'A' in the medium-high risk category.

## 4.3 Stage 2: Secondary prioritisation refinement

This second level prioritisation process refines the risk rating obtained in the Stage 1 using nationally available data. The risk rating is adjusted up or down based on how well the potential risk identified in the first level process is mitigated at each school.

The process involves:

a) Determining a school road environment risk score based on different characteristics of a school and its operation. Aerial photos and Google Street view should be sufficient for this process. Communication with the school or brief site visits may be necessary if this is unavailable or out of date (section 4.3.1); and then

b) Adjusting that school road environment risk score to a final rating (Table 5.14) depending on the type of risk score given to each of the 10 main components.

### 4.3.1 Calculating the school road environment risk score

The school road environment risk score can be calculated using 10 components. These 10 components are:

- Walking
- Cycling
- Buses
- Cars
- On-site movements
- Crossing road

- Primary access
- Visibility
- Conspicuity
- Speed limit

**Each component must be assessed as part of the process**. Once this assessment has been completed this will determine an overall score. This score will then need to be adjusted to a final risk rating (section 4.3.2)

The risk scores for each component are based on the characteristic and type of facility provided. Each of these 10 components, characteristics and risk scores are provided in separate tables 4-6 to 4-15.

**Table 4-6: Stage 2 component – walking**

| 1.Walking | |
|---|---|
| Do all routes where walking to school could be expected have facilities appropriate to the vehicle speed and volume? | |
| **Characteristic** | **Risk score** |
| Zero houses within walking distance | N/A |
| No footpaths; walking in traffic lane necessary | -2 Terrible |
| No footpaths; road shoulder (sealed/gravel) usable | -1 Poor |
| Footpath provided to some houses; walking on verge possible to | 0 Mediocre |
| Footpath provided to >50% of houses within walking distance | 1 Good |
| Footpath provided to >90% of houses within walking distance | 2 Excellent |

**Table 4-7: Stage 2 component – cycling**

| 2. Cycling | |
|---|---|
| Do all routes where cycling to school could be expected have facilities appropriate to the vehicle speed and volume? | |
| **Characteristic** | **Risk score** |
| Zero houses within cycling distance | N/A |
| No off road facilities; cycling in traffic lane or narrow sealed shoulder <2m necessary | -2 Terrible |
| No off road facilities; cycling on wide sealed shoulder ⩾2 | -1 Poor |
| Cycling off road facility to some houses | 0 Mediocre |
| Cycling off road facility to >50% of houses within cycling distance | 1 Good |
| Cycling off road facility to >90% of houses within cycling distance | 2 Excellent |

**Table 4-8: Stage 2 Component – Buses**

| 3. Buses | |
|---|---|
| If school buses serve the school, is a marked bus pick up and drop off area provided on the school site, separated from the road? | |
| **Characteristic** | **Risk score** |
| No school bus services | N/A |
| No designated bus parking, or on road | -2 Terrible |
| Bus parking off road but poorly separated | -1 Poor |
| Bus parking separated from road but students must cross car park or vehicle access | 0 Mediocre |
| Bus parking separated from road and pedestrian routes provided | 1 Good |
| Bus parking well off road, and students board to/from footpath well separated from vehicle movements | 2 Excellent |

**Table 4-9: Stage 2 component – cars**

| 4. Cars | |
|---|---|
| Is a marked car pick up and drop off area provided on the school site, separated from the road? | |
| **Characteristic** | **Risk score** |
| On road parking | -2 Terrible |
| Limited off road parking, and some on road parking | -1 Poor |
| Car parking off road but poorly separated from road | 0 Mediocre |
| Car parking well separated from road but poorly laid out / marked / mixed with buses and pedestrians | 1 Good |
| Car parking well off road, with separated bus and pedestrian areas | 2 Excellent |

**Table 4-10: Stage 2 component – on-site movements**

| 5. On-site movements | |
|---|---|
| Are car, bus and pedestrian/cyclist movements onto and within the school site clearly separated? (Footpaths, fences, linemarking, etc.) | |
| **Characteristic** | **Risk Score** |
| Entering, exiting, and circulating vehicle movements are mixed with pedestrian and cycle access | -2 Terrible |
| Bus passengers board to/from footpath. Entering/exiting vehicles slowed down before reaching circulation area. | 0 Mediocre |
| One way circulation, bus and car movements separated, vehicle occupants board from/to footpath, separate pedestrian/cycle | 2 Excellent |

**Table 4-11: Stage 2 component – crossing road**

| 6. Crossing road | |
|---|---|
| Is the side of the road opposite the school free of parking and other activities that are likely to lead to children crossing the road by themselves? (eg parking, shops, playground, sports fields, footpath or cycle path leading to housing areas within walking/cycling distance, etc.) | |
| **Characteristic** | **Risk score** |
| Lots of road crossing likely, and no crossing facilities | -2 Terrible |
| Some road crossing likely, and no/poor crossing facilities | -1 Poor |
| Some reason to cross road, and good crossing facilities (kerb buildouts, median refuge), OR no reason to cross road (no parking, no road to housing, no hall/fields/shops) | 0 Mediocre |
| Pedestrian bridge or underpass provided | 2 Excellent |

**Table 4-12: Stage 2 component – primary access**

| 7. Primary access | |
|---|---|
| Is primary access provided from the school onto the lowest speed or traffic volume road available? | |
| **Characteristic** | **Risk score** |
| Only one road borders school property | N/A |
| Primary access is onto highest speed or traffic volume road | -2 Terrible |
| Similar vehicle access onto both high and low speed/traffic roads | 0 Mediocre |
| Primary access is onto lowest speed or traffic volume road | 2 Excellent |

**Table 4-13: Stage 2 component – visibility**

| 8. Visibility | |
|---|---|
| Is there sufficient visibility for cars and buses leaving the school grounds in both directions for the speed environment? (60km/h: 100m, 80km/h: 160m, 100km/h 240m, 120km/h: 330m.) | |
| **Characteristic** | **Risk score** |
| <70% in either direction | -2 Terrible |
| 70-100% in both directions | -1 Poor |
| Meets requirement in one direction, >70% in other | 0 Mediocre |
| Meets requirement in both directions | 1 Good |
| >120% in both directions | 2 Excellent |

**Table 4-14: Stage 2 component – conspicuity**

| 9. Conspicuity | |
|---|---|
| Is the presence of the school clear to drivers approaching the primary access from a sufficient distance before the school? (Q8 distances for different speeds) | |
| **Characteristic** | **Risk score** |
| Difficult to identify presence of school (eg single sign on approaches but no other indication) | -2 Terrible |
| Some indication of presence of school in advance - eg one road sign, 'school' text marked on road, school name sign visible well in | -1 Poor |
| School buildings clearly visible well in advance of school, other school activity visible | 0 Mediocre |
| Large static school signs on both sides of road well in advance, or electronic sign on one side of the road | 1 Good |
| Gateway treatment with kerb buildouts and electronic signs | 2 Excellent |

**Table 4-15: Stage 2 component – speed limits**

| 10.Speed limits | |
|---|---|
| Is there a variable speed limit sign system at the school? (Check near school signs on approaches - 'SCHOOL' road marking may be visible on aerial imagery) | |
| **Characteristic** | **Risk score** |
| Unknown | N/A |
| No | -2 Terrible |
| Yes | 2 Excellent |

### 4.3.2 Final risk rating adjustment

The average risk score is derived by dividing the sum of the individual risk scores by the number of questions excluding N/A answers. Table 4-16 below shows the change to school's risk rating following the stage 2 process.

**Table 4-16: Adjustments to risk ratings**

| Risk score | Change to risk rating |
|---|---|
| < -1.20 | -2 levels |
| -1.20 - -0.50 | -1 level |
| -0.50 – 0.50 | No change |
| 0.51 – 1.20 | +1 level |
| > 1.20 | +2 levels |

Note: A school cannot move higher than the high risk level or lower than the low risk level.

## Worked examples

Example 1: school A

| School road environment component | Comment | Risk score |
|---|---|---|
| Walking | There are no footpaths provided along the state highway; however the formed road shoulder is wide enough to allow students to walk outside of the traffic lane. | -1 |
| Cycling | There are no off-road cycling facilities provided along the state highway. Cycling can take place in the formed road shoulder which is less than 2m wide. | -2 |
| Buses | Bus parking is provided away from the road in an area where vehicle pick up and drop off also occur. | 0 |
| Cars | An area away from the road is provided for vehicle pick up and drop off; however demand regularly exceeds supply resulting in some parking occurring on road. | -1 |
| On-site movements | There is a main school gate that separates walking movements from vehicular movements. Service vehicles access the site via the staff parking area. | 0 |
| Crossing road | There is no development on the other side of the state highway to require any children to cross the road. | 0 |
| Primary access | The state highway is the only access road for this school. | N/A |
| Visibility | The state highway has a straight and flat alignment that provides excellent visibility in both directions. | +2 |
| Conspicuity | The school buildings are largely hidden behind mature vegetation. The only indication of the school is an advance 'School' warning sign and the sign at the school gate. | -1 |
| Speed limit | The school does not have a variable speed limit sign. | -2 |
| **Average risk score** | | -0.56 * |

The average risk score is derived by dividing the sum of the individual risk scores by the number of questions excluding N/A answers. In this case -5 / 9 = -0.56.

The average risk score of -0.56 means an adjustment to the stage 1 risk rating by '-1 level' is justified. The school road environment score therefore changes the risk rating of school A from 'medium-high' to 'high'.

## 4.4 Stage 3: On-site safety investigation

Once a school has been identified as requiring further investigation and some degree of road safety improvements, an on-site safety investigation at a district level can be carried out to determine which treatment options are most likely to improve safety. The school road safety risk questionnaire contained in the Companion Guide includes the following topics:

- school policies
- participation in school-based road safety and active travel programmes (eg Auckland Transport's travelwise programme)
- walking and cycling, including on-site and route to school
- bus travel, including manoeuvring and pick-up/drop-off
- car travel, including parking and pick-up/drop-off
- driver behaviour
- conflict situations between road users
- vehicle safety
- school site visibility
- overall site layout and flow of vehicles and people.

Ideally, each question relating to potential safety issues could be cross-referenced to toolbox measures that are designed to improve it. More general issues (eg complex road environment) or unresolvable specific issues could link to a set of broader treatments (eg variable speed limit zone).

An automated traffic count (eg tube counter) could be deployed at this stage to determine more detailed data as needed, such as actual traffic volumes and speeds at school start and end times.

# 5 Understanding the issues

As discussed in section 4 of this guide, we have determined a series of processes for identifying the level of risk. These will use risk at the school gate and the road network to determine the highest risk environments.

These two levels of risk provide a high level analysis. It is important to provide further analysis of all data, and, therefore, a three-stage prioritisation process has been developed, which incorporates further data analysis and encourages a visit to the site to identify any specific site deficiencies likely to contribute to the safety problem (section 4). Following this the most appropriate countermeasures for the treatment strategy can be identified.

In addition to modelled outputs, the key concerns (actual and perceived risk) from the school community and key stakeholders need to be identified to ensure all elements of safety have been identified and taken into consideration.

## 5.1 Crash and data analysis

Crash analysis is the essential first step before visiting a site and eventually choosing countermeasures. Using all the crash data rather than just the high severity crashes of only those involving school children provides a larger sample size. This enables us to identify the risks and make more informed decisions on the best countermeasures for any given school and the approaching roads.

The model development (section 4) provides a high level assessment using AADT, speed limits and different length of road distances from school (800m, 1600m and 3200m) and directly around the school site, so there are likely to be different issues along the route and the access. These need to be discussed and analysed together, along with crash data and key concerns to make relevant recommendations. The approach routes may have a number of issues such as no shoulder width, which may increase loss of control crashes and the site access may be narrow, which creates congestion at peak times when children are being dropped off or picked up from school. A treatment in this case may involve widening the shoulders along the route and widening the area into the school access to provide more room.

Certain crash movement types as shown in figure 3-3 of this guide are more likely to result in fatal and serious injuries, such as crossing and turning movements and any involving active road users. These crash movement types should be given specific consideration and countermeasures identified that reduce the likelihood and/or severity of these high severity crash movement types.

In these investigations the road safety practitioner should look to understand:

- crash patterns for both fatal and serious crashes, and all crashes, as these may differ in movement categories or cause contributing factors
- in the case of pedestrian and cycle crashes, the physical location of crashes – whether they are clustered or spread out around the site – what the key issues are
- consistency of expectation and provision of intersection and roadside infrastructure in relation to road users
- specific **road user factors** to be taken into consideration including age, gender, inattention, restraint use, unsafe road use, levels of pedestrian and cycle activity
- **general factors** including crash movement types, mid-block versus intersections, direction of travel, temporal factors (day of week, time of day, month of year) and day or night
- specific **roads and roadside factors** including straights versus curves, wet or dry road conditions, objects struck, other road factors (such as surface material, sight distance, etc.), consistency and

readability of the alignment, signage and delineation, carriageway width, skid resistance, median treatments, and hazard removal, protection or mitigation

- specific **speed factors** including drivers travelling too fast for the conditions versus speeding (i.e. exceeding the posted speed limit) and time of day and traffic conditions for speed related crashes
- specific **vehicle factors** relating to school buses, (such as the route they take, the places the stop, the age, type and condition of the vehicle. Also what is the condition and safety features of the cars that children are being transported in? Are there child restraints in the vehicle? And are they being used?)
- specific **environment factors** such as wet and dark conditions. (Understanding whether these factors are issues will assist in developing appropriate countermeasures, for instance a rural school site in which the road and access are not visible in the vicinity of a school that is consistently shrouded in fog on winter mornings. Consideration could be given to providing brighter and wider road markings and additional signs, electronic signs and markings at the access of the school to increase visibility).

To help understand the safety problems, a detailed analysis of the crash data is required. Although the CAS plain English and coded reports will assist, it is strongly recommended that the original traffic crash reports are reviewed and analysed, as these provide information not available in the summary reports.

In addition to understanding the problems via crash data, it is essential to discuss the issue with the school and key stakeholders as data may be very limited at some sites. Refer to the questionnaire provided in the companion guide to determine what other factors may be relevant.

In addition to this section and the toolbox measures, it is recommended that the Transport Agency's *guide to the treatment of crash locations*, the *high risk rural roads guide* (section 2.7.1.1) and Austroads *Part 8 Treatment of Crash locations* are referenced for additional details on diagnosing and treating crash problems.

## 5.2 School, community, parents and caregivers, road users and educators

The OECD (2008) Report *Keeping children safe in traffic* states that 'road safety education and training is a lifelong learning process that neither begins nor ends in schools. All road users have a duty to keep children safe and parents have a vital role to play through teaching and example in the early years.' The report also lists key findings, including:

- road safety education in schools should use approaches based on sound educational practice with an emphasis on problem solving and practical skills training on an on-going basis
- driver training is an integral part of the safety education system because while children need to know how to behave safely on the roads, drivers need to take more care and responsibility and to recognise that children will not behave in the same way as adults.

## 5.3 Active road users

When developing solutions, both crash data and road user information is needed to understand the level of use and road issues associated with pedestrians and cyclists both along and across the road corridor to the school site.

If crash analysis or community and key stakeholder feedback has identified that a significant number of cyclists or pedestrians use this route, considering appropriate facilities for these types of road users is important when developing any treatment. In some cases specific provision for them will be warranted. The development of countermeasures for the main motor vehicle crash types will need to consider their needs. For instance, if a route has a high head-on crash rate and/or risk, one of the most appropriate solutions may be to install a central median barrier. However, installing a median barrier will require the lanes to be shifted,

and reducing the available shoulder. The presence of pedestrians and cyclists may add to the case for widening the seal to maintain a shoulder width adequate for their needs. (Refer *High-risk rural roads guide*).

### 5.3.1 Cyclists

As outlined the *High-risk rural roads guide,* there is limited data for school aged children during before and after schools times to enable further comment. However, we do know that about half of all rural fatal and serious injuries to people who were cycling result from rear end collisions or sideswipe by vehicles coming from behind the cyclist.

Given this analysis, and where there is significant cyclist activity in rural areas, the most important countermeasure is to provide sufficient space in a road shoulder of consistent width, and to ensure the road shoulder provides an appropriately clean and smooth surface for cyclists so they will use it. While full design widths are desirable, even modest shoulders are beneficial. Where cyclist volumes are considerable, greater separation of modes is desirable. Where the roadway narrows, cyclists need to move close to or into the traffic which creates a safety concern. The extent of the narrowing should be reduced or managed by measures such as active signs.

Generally in rural crashes about one third of rural fatal and serious cyclist injuries result from intersection and driveway conflicts, with the severe injuries resulting from cyclists failing to give way to faster motor vehicles. These typically happen when turning right across traffic from behind and when entering from driveways and side roads.

### 5.3.2 Pedestrians

In the last 25 years the number of school children killed as a pedestrian from a bus averages just under one a year. The majority of children killed were primary school aged and almost all deaths occurred on the open road (70km/h speed limit or higher). Since 2007, approximately 25% of school children injured in school bus incidents were pedestrians crossing the road to be picked up or after being dropped off by a school bus. The remainder were passengers.

Where pedestrians are known to cross the road in significant numbers, consideration needs to be given to whether there is:

- adequate visibility
- minimal crossing distances
- appropriate speed management
- clear delineation between the roadway and the pedestrian spaces.

For pedestrians walking along the road, having a place to walk outside the traffic lanes is important, as is street lighting for highways through small rural communities.

Further information on pedestrian facilities is contained in the Transport Agency's *Pedestrian and planning design guide*, while cyclist information can be sourced from its *Cycle network and planning design guide,* both of which are available from the Transport Agency's website (www.nzta.govt.nz). There also several Austroads guides.

### 5.3.3 Buses

Between 1987 and 2007, six children were killed and 35 seriously injured as passengers in school buses. Additional consultation with bus operators, the school, RCAs, the Police and other key stakeholders is necessary to determine the types of issues and concerns there may be regarding bus safety.

Detailed information on bus safety can be found at the Ministry of Education and the Transport Agency's websites. In addition a Transport Agency research report (no. 408) *School bus safety*, (2010) provides a wealth of information on the safety of children on school buses, crossing the road to or from a school bus, and provides recommendations based on the findings.

## 5.4 Other information sources

There are other information sources with which an RCA can further clarify issues and key concerns for the school. This includes using local knowledge, talking to the community and key stakeholders, the use of Safety Deficiency databases and long term strategies that relate to their networks.

# 6 Treatments/toolbox

## 6.1 Treatment philosophy

### 6.1.1 Key treatment philosophies

There are five key treatment philosophies (table 6-1) that have been developed for high-risk rural roads, the principles of which could also be applied (to a greater or lesser extent) to rural schools and routes. Further information such as application, issues, cost, crash reduction benefits, and treatment life for the majority of roads and roadside and speed management treatment types can be found within the Transport Agency's *High-risk rural roads guide.*

**Table 6-1: Summary of the key treatment philosophies**

| Treatment philosophy | Description |
|---|---|
| **Safety maintenance** | Maintaining roads to an appropriate standard in accordance with specified standard criteria. Example measures include maintaining skid resistance to current specified levels. |
| **Safety management** | Measures aimed at optimising safety levels through maintenance of the existing road network such as skid resistance. Generally, high personal risk roads with low traffic volumes will not warrant significant infrastructure investment. It will therefore be important to consider supplementing safety management on these routes with additional speed management (curve warning signs) education and enforcement measures. |
| **Safe corridors** | Infrastructure and speed management measures that improve safety, though to a lesser extent and generally at a lower cost compared to safe system transformation works. Example measures include delineation, speed activated warning signs, seal widening, and audio tactile profiled (ATP) markings. |
| **Safe System transformation works (Safe System)** | Measures that eliminate or significantly reduce the potential for fatal and serious injury crashes. These include infrastructure measures that physically separate road users and/or speed management measures that reduce impact speeds to survivable human tolerance limits. Example infrastructure measures include median barriers, roadside barriers, clear zones and roundabouts. |
| **Site-specific treatments** | These measures are used where you have crash clusters (black spots) along a route or at just one site. Depending on where the crash cluster is located, and to be consistent with other measures along the route, the types of treatments can be from a range of measures covering safe system transformation works, safer corridors, safety management and safety maintenance. |

As these are general treatment philosophies that affect all road users, further consideration needs to be given to providing appropriate treatments for specific issues and types of road users travelling to and from and accessing rural school sites. This is explained further in sections 6.1.3, 6.1.4, and 6.1.5.

In many cases, the maintenance and construction measures that will make roads and roadsides safer for those travelling to and from school and at the school gates are measures that should already be part of normal best practice and complying with contractual obligations; for example re-marking. While many existing maintenance and construction practices benefit all road users it is important for practitioners with

road maintenance and construction responsibilities to have a greater focus on, and awareness of specific interventions for rural schools which in turn can make the roads even safer for other road users as well.

### 6.1.2 Hierarchy of measures

When developing a scheme for the journey to and at schools there may be a range of countermeasures to consider, ranging from lower cost treatments, such as signs and markings, to barriers, electronic signs, intersection treatments to grade separated facilities. An example of a hierarchy of signs to use is shown in figure 6-1. It is important that the issues are discussed in depth at the start of the project and whether certain treatments may be implemented and monitored for effectiveness in the interim before larger cost measures can be considered. This is important as the larger cost measures can take a considerable amount of time to plan, design and construct. Consideration should also be given to implementing works where other works may already be programmed. For instance, intersection improvements could be completed at the same time as an area-wide treatment to save on costs.

**Figure 6-1: Example of a hierarchy of signs**


Source: Transport Agency: rural schools variable speed limit trial: 15 April 2013, 3M Traffic Safety Innovation Award.

Note: that the rural school variable speed limits trial signs are not currently available for general use in rural areas until further evaluation has been completed.

### 6.1.3 Determining treatments

When deciding what the most appropriate treatment will be for the school site and route it is important that key crash types and issues have been confirmed and that any perceived risk has been validated by data and other information.

It is also important that, once these issues are confirmed, the project manager meets with the RCA engineer (if not the project manager), the school and any other interested parties. Involve the Police if a potential measure is likely to be a speed reduction to determine a list of appropriate treatments for the site and/or route. Also note that any changes to speed limits must follow the requirements in the Land Transport Rule Setting of Speed Limits 2003 and consult with key stakeholders including the Transport Agency and the Police. Treatments can be based on key crash types (section 6.1.4) and key issues (section 6.1.5) as identified in section 4.

All detailed information on treatments and toolbox measures are provided in Appendix A.

### 6.1.4 Treatments based on key crash types

Using these key crash types described in figure 3-3 we can recommend certain treatments based on those types of movements to better reflect a safe system, to reduce high severity crashes. These are shown in table 6-2.

**Table 6-2: Key crash movement types and possible recommendations**

| Key crash type | Recommended short to medium term treatments* | Recommended longer term/larger scale treatments* |
|---|---|---|
| **Crossing and turning** | • Wider shoulders and separated turning facilities (D6, P3)<br>• Improved delineation (signs and markings) ( S1-S6, W1 –W8)<br>• Active signs (S4)<br>• Harm reduction speeds (HRRRG)<br>• Improved sight visibility (D4) | • Grade separated intersections/interchanges (HRRRG/HRIG)<br>• Roundabouts (HRRRG/HRIG)<br>• Safe System speeds on approach to the intersection/access (S1) |
| **Rear/end obstruction** | • Wider shoulders and separated turning facilities<br>• Active signs (S4)<br>• Improved delineation ( W1-W8) | • Grade separated intersections/interchanges (HRRRG/HRIG)<br>• Safe System speeds (S1) |
| **Loss of control on straight and curved roads** | • Increased skid resistance/intervention levels (HRRRG)<br>• Planting policies – planting that will reduce severity of crashes if errant vehicle runs off road (HRRRG)<br>• Hazard removal ( P2)<br>• Wider shoulders (D6)<br>• ATP markings ( W2)<br>• Improved delineation (W1-W8) | • Roadside barriers (P1)<br>• Clear zones (P2)<br>• Safe System speeds (S1)<br>• Separated off road facilities for active road users (D3, P4, P5) |
| **Overtaking** | • Marked median treatments (3)<br>• ATP markings (W2)<br>• Improved delineation (signs and markings)<br>• Active signs (S4)<br>• Harm reduction speeds (HRRRG)<br>• Increased skid resistance/intervention levels (HRRRG) | • Median barriers (solid/semi-flexible/flexible) (HRRRG)<br>• Safe System speeds (S1) |

| Key crash type | Recommended short to medium term treatments* | Recommended longer term/larger scale treatments* |
|---|---|---|
| **Pedestrian and cyclists**[13] | • Footpaths (D3, P4, P5)<br>• Walking areas (D2, P4, P5)<br>• Wider shoulders (D6)<br>• Improved delineation (W1-W8)<br>• Active signs (S4)<br>• Harm reduction speeds (HRRRG)<br>• Improved sight visibility at access/intersection and crossing points (D4)<br>• Improvements to pedestrian and cyclist visibility (ie clothing/lights - section 2.6.5) | • Separated off-road facilities (D3)<br>• Safe System speeds (S1) |

* The code provided in the bracket (eg S6) denotes the toolbox number within this guide or refers to a toolbox provided in the Transport Agency's *High-risk rural roads guide*(HRRRG) and/or the *High-risk intersection guide*(HRIG).

### 6.1.5 Treatments based on key issues

As discussed in section 3 there are many different crashes and issues associated with rural schools. These range from key concerns from the school community and stakeholders to reported crash data and modelled information. For specific countermeasures relating to key crash types on rural roads in general (e.g. head on, run off road, intersections and active road users), refer to table 6-5 in the *High-risk rural roads guide*.

A description of how some key issues could be addressed (school, speed management, road design, bus facilities and other) is shown in table 6-3 to table 6-8. Specific details on different countermeasures are provided in Appendix A. Note that this is only a snapshot of a range of issues. A thorough investigation of each site by the RCA and school community is needed to determine their actual issues. A detailed list of recommendations can then be developed by suitably qualified practitioners. Further detailed information on designing outcomes for active users, public transport, private vehicles, site selection and new schools can be found in Queensland Roads, 2011 Planning for Safe Transport Infrastructure at Schools document. (http://www.tmr.qld.gov.au/~/media/Safety/School%20road%20safety/Safe%20school%20travel%20safest/PlanningforsafetransportinfrastructureatschoolsTechnicalGuideV4a.pdf)

[13] Note that cyclist crashes do not show up in crash data but it is rightly or wrongly perceived as a higher crash risk

**Table 6-3: Summary of key issues and associated treatments – school**

| Issues | Recommended short to medium term treatments * | Recommended longer term/larger scale treatments * |
|---|---|---|
| **School - access, design, visibility, parking, school procedures** | | |
| **Access design/visibility** | • Improved sight visibility through various treatments (D4)<br>• Wider shoulders and separate turning facilities (D6, P3)<br>• Improved delineation (W1-W8)<br>• Active signs (S4)<br>• Speed management (S1-S6) | • Access rationalised with larger intersection safe system type i.e. roundabout, grade separation. (HRRRG/HRIG)<br>• Access moved to alternative location |
| **Parking – outside and inside the school** | • No stopping lines ( W6)<br>• Time restrictions (SC1,SC2)<br>• School and on-road enforcement (E1, E2) | • Separated parking facilities located inside the school (SC1,SC2) |
| **Lack of secure cycle facilities** | • Analyses need and investigate options (SC1, SC2, P5) | • Implement agreed options, such as lock up bike cages (SC3, SC5) |
| **insufficient parental supervision** | • Increase in information from the school to parents/caregivers within a communication plan (SC5) | • Memorandum of Understanding between school and parents/caregivers regarding responsibilities (SC3, SC5) |
| **School procedures** | • Develop school travel plan (SC3)<br>• Develop a communication plan for parents/caregivers/school staff SC3, SC5) | • Implement school travel and communication plan SC3, SC5) |
| **Lack of safe crossing places** | • Supervision of children crossing before and after school (SC5) | • Rationalisation of walking and cycling facilities ( P4-P6, D2, SC1,SC2,SC3,)<br>• Grade separation (D3) |

* the code provided in the bracket (e.g. S6) denotes the toolbox number within this guide or refers to a toolbox provided in the *High-risk rural roads guide* (HRRRG) and/or the *High-risk intersection guide* (HRIG)

**Table 6-4: Summary of key issues and associated treatments - speed management**

| Issue | Recommended short to medium term treatments | Recommended longer term/larger scale treatments |
|---|---|---|
| **Speed management** | | |
| **High speeds of traffic on approach to the school conflicting with turning and merging movements at the school along with active road users.** | • Variable speed zones (S3)<br>• Improved road marking to provide visual narrowing (D5)<br>• Improvements to marking and signs at access or intersection adjacent to school ( S1-S6, W1-W8, D1)<br>• Improved, larger and or active signs (S4)<br>• Harm reduction speeds (HRRRG)<br>• Increased enforcement (E1) (communication with the Police) | • Safe Systems speeds - harm minimisation speeds (S1 , HRRRG)<br>• Separated turning facilities (P3)<br>• Wider shoulders (D6)<br>• Separated and/or protected road users facilities ( P1-P6, D3)<br>• Speed cameras (E1) |

* the code provided in the bracket (eg S5) denotes the toolbox number within this guide or refers to a toolbox provided in the *High-risk rural roads guide* (HRRRG) and/or the *High-risk intersection guide* (HRIG).

**Table 6-5: Summary of key issues and associated treatments - road design**

| Issue | Recommended short to medium term treatments | Recommended longer term/larger scale treatments |
|---|---|---|
| **Road design- facilities, intersection, access, overtaking, hazard protection** | | |
| **Journey to school:** | | |
| **Distance is too long to walk or cycle** | • Promotion of alternative transport – car/bus (SC3)<br>• School – car pooling (SC3)<br>• Development of travel plans (SC3) | • Implementation and promotion of travel plan (SC3) |
| **No facilities for pedestrians or cyclists** | • Wider shoulders<br>• Walkable berms | • Provision of shared use paths<br>• Protection of shared user paths or berms |
| **Children are too young for independent transport** | • Development of school travel plan develop (SC3) | • Alternative transport arrangements |
| **High volumes of heavy vehicles** | • Wider shoulders<br>• Use of speed management measures Table 6-4 (S1-S5)<br>• liaise with commercial | • Protection of shared user paths or berms (P4)<br>• Separated/improved turning facilities into school access or |

| Issue | Recommended short to medium term treatments | Recommended longer term/larger scale treatments |
|---|---|---|
| **Road design- facilities, intersection, access, overtaking, hazard protection** | | |
| | transport operators to alter their travel times outside the peak school travel periods | at adjacent intersection (D1) |
| **High speed of vehicles** | • See speed management Table 6-4 (S1-S5)<br>• Increased enforcement (E1)<br>• Perceptual countermeasures (transverse road markings, lane narrowing effects) (S6, D5,) | • See speed management<br>• Table 6-4 (S1-S5) |
| **Limited or no shoulder width** | • Wider shoulders<br>• Use of speed management measures Table 6-4 | • Protection of shared user paths or berms (P4)<br>• Removal of roadside hazards (HRRRG) |
| **Narrow road width** | • Use of speed management measures Table 6-4 | • Road widening |
| **Poor intersection design in the vicinity of the school** | • See school access design Table 6-3<br>• See HRIG | • See school access design Table 6-3<br>• See HRIG |
| **Poor maintenance of roads and footpaths** | • Improve maintenance – sweeping, footpath, sign condition | • Continual improvements and possible increased maintenance standards |
| **The conspicuity of the schools to other road users** | • Active signs ( S4)<br>• Improved signs and delineation at access | • Lighting (HRRRG/HRIG)<br>• Access improvements (D1) |
| **Overtaking near schools** | • Install no-passing lines if warranted (W7)<br>• Increase enforcement (E1) | • Median barrier treatments (if head on risk evident) (HRRRG)<br>• Side barrier treatments (if run off road risk from overtaking - to protect active road users) (HRRRG) |
| **Unsealed roads** | • Install appropriate delineation treatments (W1)<br>• See speed management Table 6-4 (S1-S5) | • Seal road |

**Table 6-6: Summary of key issues associated with road use**

| Issue | Recommended short to medium term treatments | Recommended longer term/larger scale treatments |
|---|---|---|
| **Other** | | |
| **Lack of and appropriate restraint use** | • Provide information to school community on appropriate restraint use via school procedures and plans | • Ongoing information and enforcement of restraint use by school community and Police at the school gate |
| **Travelling at safe speeds** | • See speed management Table 6-4 (S1-S5)<br>• Increased enforcement (E1)<br>• Perceptual countermeasures (transverse road markings, lane narrowing effects) (S6, D5,)<br>• Education programmes for young drivers (DR1) | • See speed management Table 6-4 (S1-S5) |
| **Obeying the road rules** | • Provide information to school community on safe driver behaviour and references to road rules via school procedures and plans | • Ongoing information and enforcement of unsafe driving practice by school community and police at the school gate |
| **Young drivers** | • Provide information relating to young drivers to school community via school procedures and plans (DR1) | • Ongoing information and enforcement of unsafe driving practice by school community and police at the school gate |

**Table 6-7: Summary of key issues and associated treatments - bus stops/drops off and pick up**

| ISSUE | Recommended short to medium term treatments | Recommended longer term/larger scale treatments |
|---|---|---|
| **Bus stops/drops off/pick ups** | | |
| **Poor visibility for buses and other vehicles leaving the schools** | • See school access design (Table 6-3) | • See school access design (Table 6-3) |
| **Bus stop location outside and inside the school** | • Review bus stop locations on route and at school (SC4 and SC5)<br>• Provide recommendations for improvements and develop implementation and travel plan for improved siting of bus stops (SC3, SC4 and SC5) | • Implement plan |

| | | |
|---|---|---|
| **Bus stop pick up and drop off locations** | • Review bus stop pick up, drop off and on route locations and facilities (SC4 and SC5)<br>• Provide recommendations for improvements and develop implementation plan for improved locations and facilities | • Implement plan |

**Table 6-8: Key issues and associated treatment - other**

| Issue | Recommended short to medium term treatments | Recommended longer term/larger scale treatments |
|---|---|---|
| **Other** | | |
| **Congestion** | • Improved shoulder width (D5)<br>• Dedicated turning facilities (P3) | • Provision of off-road facilities (P4,P5) |
| **Environmental impacts** | • Review modal split of school to recommend more sustainable methods of travel (SC3) | • Implement a travel plan that would incorporate changes to modes and more sustainable transport (SC3) |

## 6.2 Treatments/countermeasures

A number of treatment and countermeasures have been identified in this section. In most situations it is important to consider a range of treatments. This is discussed in section 6.1.4 and section 6.1.5. Table 6-9 summarises the treatments provided in this section. A detailed description of each treatment is provided in Appendix A.

**Table 6-9: Summary of Toolbox measures**

| Issue | Toolbox category | Treatment/toolbox | Toolbox reference |
|---|---|---|---|
| **Roads** | Speed management | Safe System speeds | S1 |
| | | Lowering the posted speeds | S2 |
| | | Variable speed limit signs | S3 |
| | | Activated warning signs (vehicle and speed) | S4 |
| | | Speed limit threshold treatments | S5 |
| | | Transverse road markings on approach to intersection | S6 |
| | Warning and delineation devices | Permanent warning signs – static | W1 |
| | | Audio tactile markings | W2 |
| | | Flush medians | W3 |
| | | Line marking | W4 |

| Issue | Toolbox category | Treatment/toolbox | Toolbox reference |
|---|---|---|---|
| | | Wide centrelines | W5 |
| | | No stopping lines | W6 |
| | | No overtaking/passing lines | W7 |
| | | Road markings (text) –school | W8 |
| | Protection of road users | Roadside barriers | P1 |
| | | Clear zones | P2 |
| | | Left/right (auxiliary) turn lanes | P3 |
| | | Footpaths and shared paths | P4 |
| | | Cycle lanes/paths/facilities | P5 |
| | | Road crossing points | P6 |
| | Design of the road environment | Access – intersections and driveways | D1 |
| | | Route/corridor | D2 |
| | | Separated facilities | D3 |
| | | Sight distance – intersection and access | D4 |
| | | Lane narrowing | D5 |
| | | Wider shoulders | D6 |
| | | Coloured surface treatment | D7 |
| **Schools** | Design of facilities | Retrofit of existing schools<br>Drop-off areas | SC1 |
| | | New schools | SC2 |
| | | School travel plans | SC3 |
| | | Parking and conspicuity of school bus/vehicle at school | SC4 |
| | | Bus routes and stops | SC5 |
| | Standards and processes | Standards and processes | SC6 |
| **Enforcement** | Enforcement | Road | E1 |
| | | School facilities | E2 |
| **Vehicles** | Vehicles | School bus | V1 |
| | | Private vehicles | V2 |
| **Drivers** | Drivers | Driver Training | DR1 |

## 6.3 Network planning

It is important when developing a strategy for a school that wider network issues are considered. A systematic approach to road safety is beneficial. Some of the questions that should be raised are:

- is this school located close to another school in that they both could benefit from the recommended improvements?
- do these measures provide a network safety benefit?
- do these measures in any way incur a negative effect on other parts of the network? For instance, if banning movements at intersections or slowing speeds, this may create congestion or increase movements at other intersections, or encourage drivers onto other lower standard roads?
- are these measures consistent with others located around the network and nationally?

## 6.4 Communication and consultation

### 6.4.1 Effective engagement techniques

As stated in the *High-risk rural roads guide,* 'It is vital to engage with key stakeholders (community, affected and interested parties) when developing projects in order to create a common sense of purpose, draw on and learn from other's perspectives, make better decisions, align mutual interests, identify and mitigate risks, and find shared solutions to challenges.' In some cases it is required under law to consult with certain organisations i.e. for setting speed limits, see section 6.1.3.

Relationship building, the basis for effective engagement, takes time. Many of the hallmarks of good relationships – trust, mutual respect and understanding – are intangibles that develop and evolve over time. Early engagement provides a valuable opportunity to set a positive tone with stakeholders from the outset of a project. The absence of established relationships and communication channels can put your project at an immediate disadvantage.

Establishing and maintaining good relationships requires a long-term view. Organisations that take this approach see the value of consistently following through on their commitments to stakeholders. They take grievances seriously and deal with them in a reliable and timely manner. They continually invest in communicating about their work in a way that makes sense to their stakeholders. Effective engagement and communication will ultimately ensure the project's success.

As stated within the Austroads Research Report *Community Consultation process and methods for quantifying community expectations on the levels of service for road networks AP-R290-06* (Austroads, 2006).

An ideal consultation with road users and other stakeholders is one that:

- consists of a number of clearly defined stages, each with their own specific objectives
- includes both external stages (i.e. those that include road users and stakeholders) and internal stages (ie that include employees of the road agency only)
- is iterative in nature (ie part of an on-going and iterative cycle of learning, refinement and improvement embedded within the development process rather than an isolated event that takes place externally).

The development of levels of service and intervention criteria for maintenance and improvement activities through community consultation is complex and requires careful planning. The process consists of several iterative stages: listen, communicate, reflect and plan, implement, monitor and measure. The process alternates stages that involve the community with stages that require internal agency assessment and evaluation. Each stage is conducted in a structured manner and requires specific techniques and specialised skills.

The process begins with a two-way communication (listen and communicate) between the road agency and the community with the purpose of gaining a common understanding of community concerns, priorities, current road classification system and levels of service as well as agency  issues, priorities and budget limitations. This part of the process also helps develop a common language and identify the most effective channels to further communicate road maintenance issues. The two-way communication establishes the foundation for a transparent and strong relationship between the road agency and the community.

### 6.4.2 Working with school communities

A draft companion guide (section 1.3) has been developed that outlines the requirements and/or processes when working with school communities.

# 7 Programme implementation, monitoring and evaluation

There are currently no identified monitoring targets for rural schools in the *Safer Journeys* strategy. However, the aim of this work is to reduce:

- fatal and serious injury crashes involving those travelling to and from rural schools
- all crashes involving those travelling to and from rural schools
- the number of school age children involved in crashes.

With the development of this guide, additional monitoring targets were defined by analysis of rural school children involved in rural school crashes nationally and model development (section 4), which helped to identify high-risk environments. These targets include a reduction in all injury crashes involving school children on the journey to and from school and at the school gate in rural environments.

## 7.1 Introduction

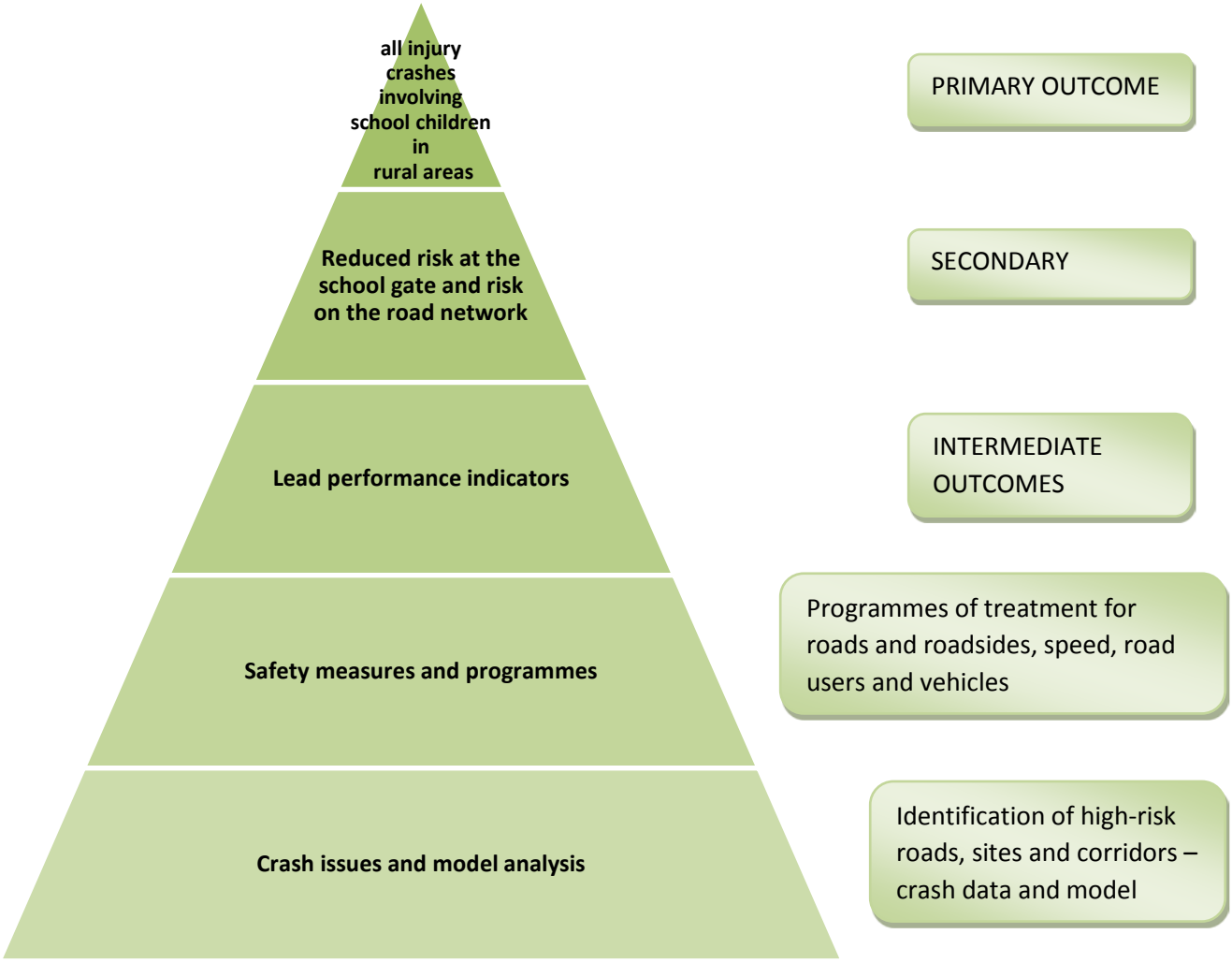
The focus of this document is to assist practitioners to identify and prioritise risk at rural school routes and sites, and develop countermeasures to reduce the risk of crashes. The toolbox measures provided will address this risk. Once countermeasures have been determined for rural schools, a suitable programme of implementation is important, along with a system to monitor the effectiveness of these countermeasures.

This section looks at issues associated with developing programmes for treating the highest priority school routes and sites and then monitoring the effectiveness of those programmes to:

- identify the benefits and the effectiveness of the various treatments
- identify the most effective packages of treatments
- assess the levels of investment that may be required to achieve various levels of crash reduction
- prove that funding has been invested wisely.

Figure 8.1 is a modified version of the safety management triangle. Working from the base up, the foundation of this triangle is the identification and analysis of crash issues, which would include the means of identifying risk at rural school routes and sites (see section 5).

**Figure 7-1: Road safety management triangle**




Additional information on primary, secondary and intermediate outcomes along with lead performance measures are provided in section 7.4.3).

Having described the method to identify sites and routes and clarify the safety concerns associated with these, this guide now discusses some possible treatments or strategies that could be used to improve the safety of rural school routes and sites.

In a lot of historic safety studies, the effectiveness of each treatment would normally be assessed by applying only one specific treatment to a range of sites and monitoring the performance of the treatment over time, before applying the next treatment. However, in New Zealand, the number of people killed or seriously injured in any one location is limited. So, because of the delays associated with the post-implementation data collection, in order to facilitate the necessary analysis, the road safety management triangle (figure 7-1) introduces the concept of intermediate and secondary outcomes.

In this section we first describe the development of a programme of treatments and how to establish the appropriate intermediate measures. We then describe monitoring the site-specific secondary and primary measures.

## 7.2 Programme development

It is important to remember that even though safe system transformation works[14] (refer also to sections 4.5.2 and 6.2.1 of the HRRRG) can produce significant safety benefits, low-cost safety management treatments are still relevant for many situations and are potentially more appropriate on rural school routes and sites.

The assessment of rural road risks in section 5 identifies the longer-term plan for a particular road or route. In some regions there will be no rural road sections that have long term larger infrastructure or corridor improvements planned, therefore, a programme of on-going safety improvements should be considered and tailored to fit the risk of the rural school and its vicinity with a desired outcome. Analysing the risk and understanding the issues are important and are discussed in more detail in sections 6 and 7.

For more information on programme prioritisation, programme implementation and challenges to implementation, refer to the HRRRG.

### 7.2.1 Focus on incremental improvements across networks

The focus for a programme of works should be on incremental improvements across networks to help achieve larger overall benefit–cost ratios.

Having identified that longer term/larger scale projects may be planned for a route to produce a safe system transformation (table 6-12 to 7-7), the end result has to some degree been confirmed. However, given the limited funding and associated priorities, together with the lead time associated with getting major infrastructure projects to construction (as a result of RoNS, safe system, high-risk rural roads and other safety projects), doing nothing until that project eventuates continues to place those children travelling to school in rural areas at risk of death or injury. Consideration can be given to other measures such as the development of a school travel plan, improvements to school processes and procedures and dissemination of information to the school community.

Responsible road safety practitioners and network managers need to consider this risk. Incremental improvements are viable if they:

- contribute to a reduction in the cost of the final project, by providing incremental benefit and costs, or
- return an economic road safety benefit over the intervening period, between now and the realistic date for delivery of the major project.

If, however, the final solution involves a completely new alignment, any proposed works will have a reduced economic life and should be analysed over the pre-implementation period.

### 7.2.2 Prioritising works for funding

#### 7.2.2.1 The Transport Agency and the National Land Transport Programme

With regards to the National Land Transport Programme (NLTP), the Transport Agency prioritises potential land transport activities to give best effect to the Government policy statement on land transport funding (GPS) (www.transport.govt.nz/ourwork/KeyStrategiesandPlans/GPSonLandTransportFunding/).

[14] Safe system transformation works are likely to be the most effective in producing a significant step change in the safety profile for a section of road. Safe system transformation works are generally the higher cost infrastructure countermeasures and are developed and implemented over a long term.

The Transport Agency uses the prioritisation process set out in their Planning & Investment Knowledge Base (http://www.nzta.govt.nz/resources/planning-and-investment-knowledge-base/, which involves assessing, prioritising and then programming activities.

While the programming process considers many factors, the key considerations are priority and a feasible start date. Activities with a high priority are programmed as soon as is feasible, depending on:

- the funding available over time
- the tasks that need to be undertaken before an activity can be implemented, eg selecting the scope of a future activity, completing detailed design, gaining resource consents, and purchasing any land
- the capacity of the construction sector and what other construction works are also underway or proposed to start
- the timing of pre-requisite projects or events, eg the planned development of a new suburb is about to reach the stage where road widening is warranted.

Usually, transport programmes include more activities than the Transport Agency can expect to implement. This ensures the Transport Agency can maintain momentum of the overall programme in the event of any individual activities experiencing unforeseen delays.

#### 7.2.2.2 Road controlling authorities

Road controlling authorities prioritise their road safety programmes for funding under the NLTP (section 7.2.2.1). A high risk rural school environment would normally be part of a number of other minor safety projects an RCA may wish to undertake. There are several factors an RCA takes into account when prioritising rural schools projects against other safety work on their network.

This could be done via consultation, local knowledge, using safety deficiency databases, using other programming and prioritising methodologies (such as the one provided for school speed zone signs). As previously discussed (section 7.2.2.1) there is also information in the Transport Agency's Planning and Investment Knowledge Base on how to prioritise works. The RCA applies for funding assistance from the Transport Agency for some project and funds others themselves. When projects do not meet NLTP funding criteria, other funding sources may need to be considered, including from the local community via fundraisers, etc.

### 7.2.3 Consistency and road classification

The road environment should provide the road user with strong indications of what to expect, how to behave and safe operating speeds. The consistency of road environment messages along the road corridor is important. These messages are delivered through the carriageway width, alignment, access management, signs and markings standards and other traffic control devices.

Service levels for travel time and safety are determined based on the roads function and use within a hierarchy, Hence, in developing road safety programmes, the road hierarchy needs to be considered and safety measures applied that are appropriate for, and consistent with, the road's function, its use, its current safety features and the traffic volumes it carries.[15]

As well as determining the appropriateness of the safety measures, the road classification is likely to influence funding priorities.

[15] The NZ Transport Agency and RCAs are currently developing a classification system for the entire roading network (i.e. State highways and local roads).

### 7.2.4 Driver awareness measures/self-explaining roads

Driver awareness measures for self-explaining roads provide clear direction and unambiguous information to all road users which drivers can use to make decisions and modify their behaviour depending on the design and function of a road and the associated risks. These measures are more likely on routes where there are higher levels of personal risk but low to medium levels of collective risk.

## 7.3 Road safety action planning

Road safety action planning is a world best-practice process for planning and implementing road safety interventions by road safety partners. Continued and enhanced road safety action planning is one of the essential platforms for delivering the Safer Journeys road safety strategy.

Effective road safety action planning requires a collaborative approach from participating partners to provide focus, commitment and urgency in order to address and mitigate road safety risks, especially in terms of the Safer Journeys high priority road safety issues (safe speeds, safe vehicles and safe road use) for the local area.

Participating partners include regional and local authorities, the Transport Agency, the Police, the Accident Compensation Corporation (ACC), school community, AA, RTF, and other road safety stakeholders according to local enthusiasm. The partners agree on regional and/or local road safety risks, identify objectives, set targets, undertake road safety actions, and monitor and review progress towards road safety targets.

This guide has a range of engineering treatments for roads and roadsides. However, given that these relate to rural schools and children, the practitioner also needs to consider a range of treatments across safe speeds, safe users and safe vehicles to address the safety issues and concerns of key stakeholders.

Road safety action planning is the primary way to coordinate a safe system approach to road safety problems at sub-regional levels and could be a key opportunity for all road safety partners to identify their rural school improvement projects. These plans can be referenced for any additional information on agreed measures at sites or routes of interest or updated as a result of safe system investigations.

## 7.4 Monitoring and evaluation

Monitoring and evaluation of safe system treatments is important in gauging the effectiveness of different treatments. This is also important when developing types of countermeasures for specific issues and implementation procedures for future programmes. Specifically:

- Monitoring involves an assessment of progress and collecting information through the course of a project. This can be before, during and after implementation to gather results for evaluation (see section 8.4.1).
- An evaluation analyses the results of monitoring and determines the results and effectiveness of the types of treatments used (see section 8.4.2).

### 7.4.1 Monitoring

Monitoring and collection of data for evaluation will help to identify if road safety has been improved. 'Systematic recording of data and analysis of trends from which the performance measures can be calculated allows the most recent values of measures and their trends to be compared with target levels.'[16] The Transport Agency's website contains quarterly outcome reports that indicate actual road safety progress

[16] Guide to road safety part 2: Road safety strategy and evaluation, Austroads, 2006, AGRS02/06, page 30.

compared with the *Safer Journeys* areas of concern. These reports provide an overall picture of road safety from a national, regional, and police district perspective.

## 7.4.2 Evaluation

The role of evaluation is to:

- ensure that recently delivered programmes are effective and enable remedial action if they are not
- build up a reliable knowledge base about the effectiveness of different interventions, which will allow more effective programmes to be developed in the future.

There are effectively two levels of monitoring and evaluation:

- strategic monitoring and then evaluating the effectiveness of the overall programme or strategy, which is made up of various projects or initiatives
- individual monitoring and evaluating of specific projects or initiatives that combined make up the overall programme or strategy.

While good monitoring and evaluation will support future road safety improvement programmes, the monitoring and evaluation effort should not consume excessive amounts of staff time or other resources that could be used to undertake more road safety initiatives. As a general observation, many people and organisations undertake little or no monitoring, while others seek to monitor an extraordinary number of items, arguing that the various measures do not take account of every minute impact.

In the following sections the monitoring and evaluation of individual initiatives or projects are described, followed by the monitoring of the overall strategy. For further information on evaluation of treatments and evaluation methods refer to the *High-risk rural roads guide*.

### 7.4.2.1 CAS monitoring, data requirements

The key to effective evaluation of specific works is to ensure the data required for evaluation of individual projects, treatments or initiatives is collected over the course of the project. Trying to collect information at the end of the project to identify when and which works have been completed can be a long process.

The best way of addressing this issue is to ensure the project monitoring established at the start of a project and, as discussed above, the entering of monitoring data forms part of the contract, in-house service agreement or task plan for the works. Monitoring is best done using the Crash Analysis System (CAS).

CAS has the ability to record three types of site:

- Sites of interest (figure 8.2) – These are simply locations that users can identify spatially and for which crash data can be recalled. Once data is recalled the user can analyse the effects of a programme of works. Recording works as sites of interest relies on recording key data about the works undertaken elsewhere, so sites of interest may be useful when monitoring areas to determine ongoing trends and whether these are related to improvement programmes or not.
- Safety improvement projects or crash reduction monitoring sites (figure 8.3 and figure 8.4) – these two types of site are essentially the same in terms of the inputs required. The first data entry screen (figure 8.3) allows the user to input site description data (the sites are spatially defined later in the process).

**Figure 7-2: CAS sites of interest**

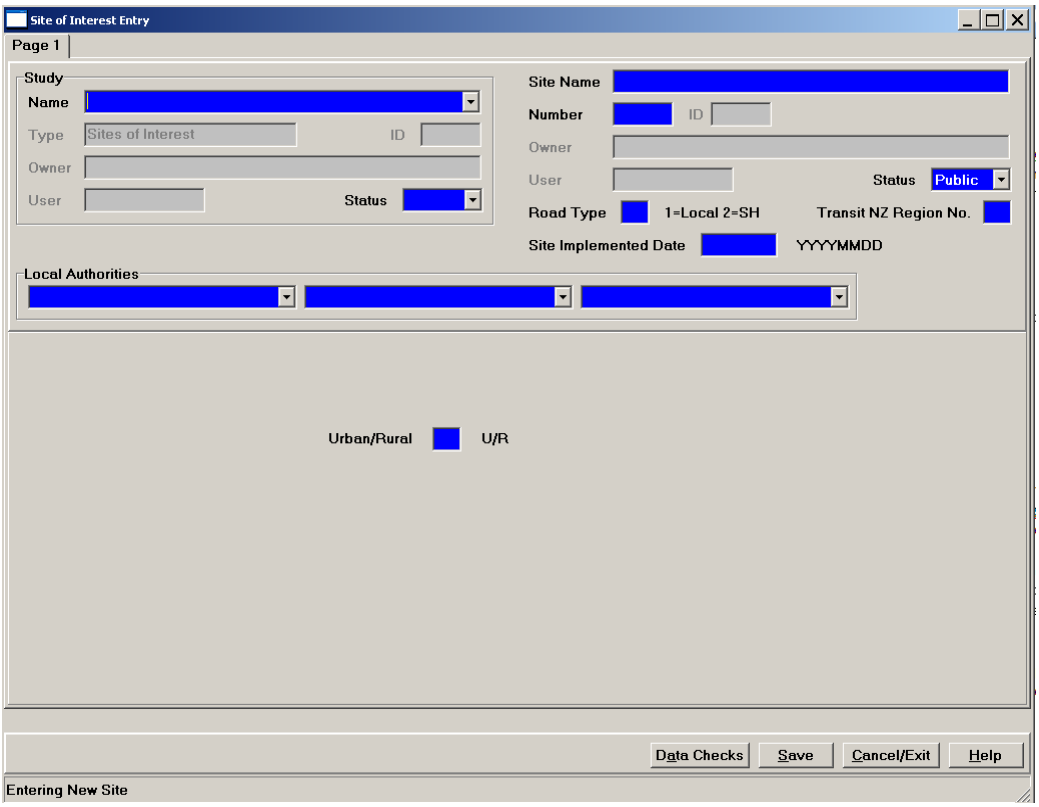


**Figure 7-3: Monitoring site data entry screen 1**

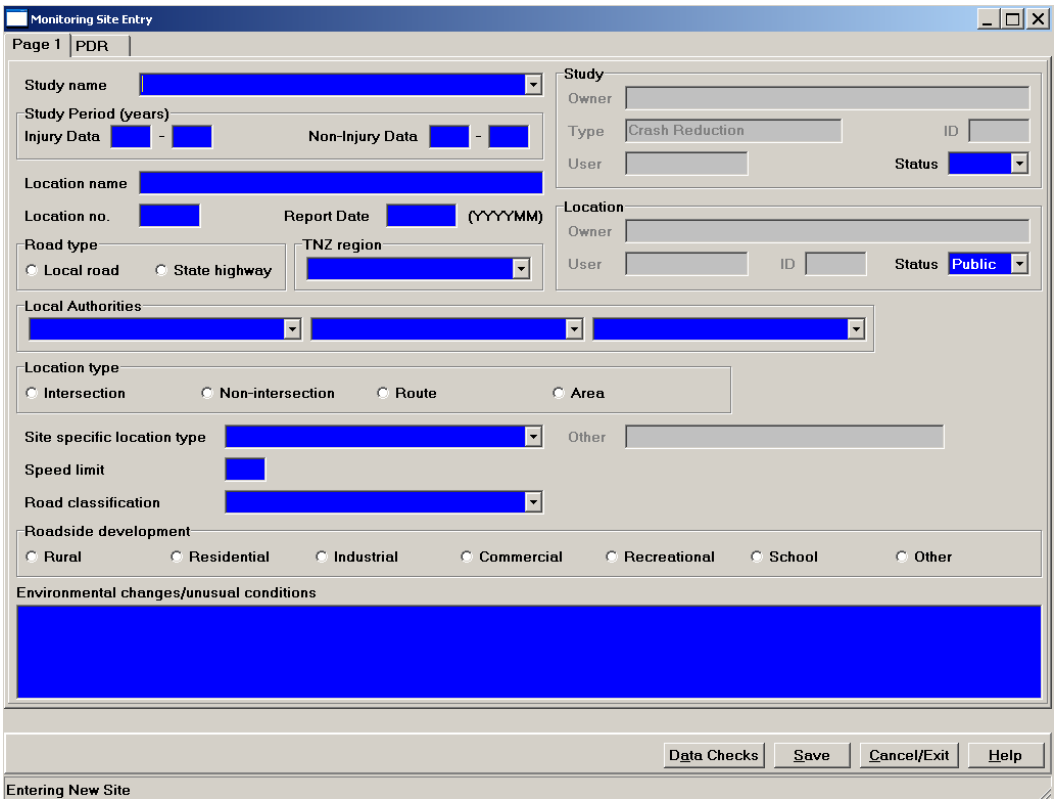
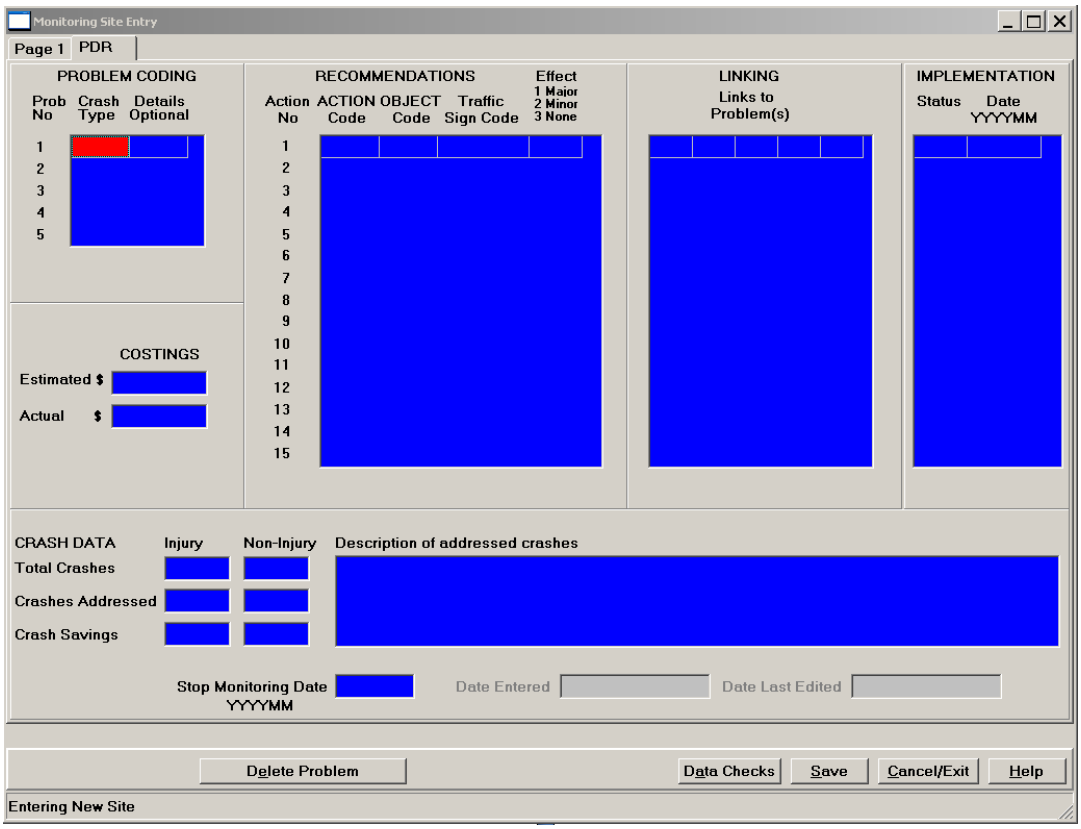



**Figure 7-4: Monitoring site data entry screen 2**



The third screen (figure 7-4) is used to identify the crash issues at the site and explicitly links the proposed solutions to the problems and the expected crash savings. While entering projects as safety improvement projects or monitoring sites involves detailed data, monitoring site performance data automatically adjusts for potential regression to the mean impacts.

It is, however, important to recognise that, under the Safe System approach, we are looking toward more proactive treatments, (rather than waiting for crash histories to develop), and implementing synergetic corridor treatments to increase consistency. It is therefore quite likely that in some situations works will be undertaken with a view to decreasing risk, rather than to treat a documented crash history.

In such situations crash performance monitoring may well be invalid because of a lack of a 'before' crash risk. In these situations we need to monitor and evaluate our programme as a whole, or develop some other key performance measures, or secondary measures and lead performance measures such as reduction in mean speeds, percentage installation of guardrail, or percentage of travel by bus etc.

## 7.4.3 Monitoring and evaluation performance measures

Referring back to figure 7-1, three types of road safety measures are available for monitoring and evaluation:

Primary outcomes – such as the reduction in the number of school aged children injured in rural areas as a result of road crash trauma.

Secondary performance measures, such as reductions in the overall collective risk for the route and site. These can be measured in terms of reported crash numbers and patterns of crash types and factors.

Lead performance indicators or intermediate measures describing the improvements to the road, road environment, speed or other features that have a known impact on road safety. These include increasing skid resistance investigatory levels to reduce loss of control crashes, providing barriers to protect active road users, and increasing percentage patronage use on buses and other alternative transport to reduce levels of personal risk. These output measures are known to directly impact safety outcomes.

The intermediate measures are particularly important as stated in the OECD, 2008 report:

Within a safe system approach there is a need to switch from injury based data (final outcomes) to performance data (intermediate outcomes). Some countries such as Sweden have already started to develop systems which give them an opportunity to address road safety problems within the road transport system without needing to wait to measure final outcomes in terms of fatalities and injuries. Focusing on this intermediate data and its measurement builds awareness that, for a safe system, 100% achievement of safety performance in various sub-target areas is required.

### 7.4.3.1 Primary outcomes

The primary outcome target is the reduction in injuries for school aged children travelling to and from school in rural areas.

### 7.4.3.2 Secondary performance measures

Secondary performance measures (Table 7-1) aim to reduce the crash risks on the network and at each high-risk rural environment. Indicators could be reductions in recorded crash types or particular subgroups.

**Table 7-1: Key secondary performance measures**

| Key secondary performance measures based on actual risk (crash data) could include a reduction in: |
|---|
| Overall  risk at the school gate and road network risk |
| Number and severity of loss of control crashes |
| Number and severity of intersection crashes |
| Injuries to school aged children |

#### 7.4.3.3 Lead performance indicators

The best and most relevant lead performance indicators will relate most directly to the change in collective crash risk that is associated with improvements in the feature being assessed. Key lead performance indicators (Table 7-2) to benefit school aged children travelling to school may include:

**Table 7-2: Key lead performance indicators**

| Key lead performance indicators |
|---|
| Proportion of road (or travel on roads) with roadside barriers or hazard reduction |
| Proportion of road (or travel on roads) with sealed shoulder widths of at least 1m |
| The length of routes subject to speed zoning below the default limit or under active speed management. |
| The change in network mean and/or 85th percentile speed (measured by the MoT) |
| Improvement to the percentage of children wearing correct restraints |
| Increased patronage of buses |
| Implementation of seatbelts/restraints in buses |
| Increased implementation of rural school travel plans |

### 7.4.4 Goals and targets

The goals for the primary outcomes for school aged children are currently being developed.

In addition to the nationally reported targets, and depending on which lead performance indicators are being used to monitor the effectiveness of the on-going programme of safety improvements, goals can be set for one or more lead indicators. However, in all cases the goals should pertain to:

- crash patterns for all crashes ( this will better highlight spatial, temporal and crash movement commonalities or factor patterns)
- the spatial location of crashes – whether they are clustered or distributed
- key risk factors such as length, proximity to road users, and severity of hazardous roadsides
- consistency of expectation and provision of road features and roadside infrastructure
- modelled outputs, including those developed from the strategic model and the site specific parameters (section 5).

### 7.4.5 Responsibilities for monitoring and evaluation

The responsibility for monitoring and evaluation at the national level lies with the National Road Safety Committee, primarily led by the Ministry of Transport and the Transport Agency, which monitors the national trends in the numbers of road users killed or seriously injured – the primary outcomes. However, the various RCAs should also be monitoring these primary outcomes for their respective networks. Where large networks, for example the state highway network or Auckland City, have been divided into sub-networks, the roading manager should also monitor the primary outcomes.

RCAs should also be monitoring the secondary outcomes related to collective and personal risk, patterns of crash types and factors, and changes in the risk profile of the routes and intersections being targeted. They should also focus on lead performance indicators as the measure of the work they are doing towards safe system goals.

# 8 Other information sources

## 8.1 New Zealand rural school safety

This research report was prepared for the Transport Agency by TERNZ in September 2011. It described the results of six workshops carried out on rural schools in New Zealand. The study highlights the key issue determined by the schools including roading issues, speeding, bus facilities and operation and the schools procedures and policies. In addition, recommendations outlined what appropriate measures could be considered when addressing these issues.

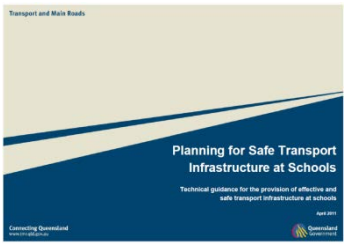
## 8.2 OECD *Keeping children safe in traffic*

The OECD's 2004 report on how to keep children safe in traffic draws on best practice and research results to show how child casualties can be reduced while at the same time encouraging children to develop into safe, active and independent road users. It focuses on the contribution education, training and publicity can make; measures related to the risks children face in the road environment; vehicle and bicycle standards; safety equipment and the importance of appropriate legislation.

One of the report's conclusions is that, currently, the best-performing countries have population-based road crash fatality rates for children that are less than half the OECD average and only a quarter of the rate in the worst-performing countries. Therefore, there is considerable potential for improving child road safety in most OECD countries. After examining the most effective strategies, based on the research undertaken, the report makes a series of policy-oriented recommendations for achieving such improvements in children's road safety.

The report also states that 'a child-centred approach to the road environment distinguished top-performing countries from those that did less well in terms of children's road safety.'

## 8.3 Queensland Government: Planning for safe transport infrastructure at schools




*Planning for safe transport infrastructure at schools,* 2011 has been developed by the Queensland Government and provides a number of treatments. It states:

- This technical guidance document has assisted in the design and provision of effective and safe transport infrastructure solutions at schools in Queensland. It provides examples of best practice and practical solutions for school transport infrastructure, such as ideal pedestrian and cycling end-of-trip facilities, set-down and pick-up layouts for public transport and private vehicles, and modal separation.
- The guide can be applied to the refurbishment and upgrading of transport assets at existing schools as well as to the provision of infrastructure at new schools. It focuses on the provision of transportation system assets at and around schools, but the design process should identify operational issues and resource demands required during the operational life of the asset.

## 8.4 Safe Kids Worldwide

This is a new venture whose main focus is to 'creating safer walking environment for children around schools'. The project 'is working with 10 schools, one in each of 10 different countries, to develop safer school zones. By doing so, they hope to create

SAFE KIDS WORLDWIDE™

evidence-based interventions to increase child pedestrian safety that could serve as models for other schools around the world.'

The project sets out four main elements that will be evaluated and modified to determine the effects on safety for school children. These are:

- physical environment
- knowledge of kids, parents and caregivers and the school community
- policy and enforcement
- behaviour.

This is in line with the three of the four elements of a safe system approach - safe roads and roadsides, safe speeds and safe road use.

## 8.5 *Guidelines for road safety around schools* (W.A. Local Government Association, 2007)

These guidelines were produced by the Western Australian Local Government Association (WALGA) for enhancing the safety of children travelling to and from, and around schools by:

- providing information on many of the major road safety issues involved
- providing information on how best to maintain or improve road safety for children travelling to and from schools, as well as advising where further assistance might be obtained
- providing answers to commonly asked questions about road safety issues around schools.

Among a number of suggestions for improving transport around schools, specific engineering suggestions are given on the issues of traffic speeds, parking, bus facilities, road crossings, applications for children's crossings, safe routes to schools, bicycle safety, and fencing and landscaping barriers.

| Title | Web reference |
|---|---|
| Auckland Transport, 2012; 60km speed zone trials | https://www.aucklandtransport.govt.nz/improving-transport/plans-proposals/Road/Documents/rural-school-speed-management-trial.pdf |
| Australian Transport Council (ATC); 2011: National Road Safety Strategy (2011-2020) | http://www.infrastructure.gov.au/roads/safety/national_road_safety_strategy/index.aspx |
| Austroads Engineering Toolkit; 'Treatment type: Profile edge lines', Austroads Road Safety Engineering Toolkit, | www.engtoolkit.com.au/default.asp?p=treatment&i=24 |
| Austroads Engineering Toolkit; 'Treatment type: Safety barriers', Austroads Road Safety Engineering Toolkit | www.engtoolkit.com.au/default.asp?p=treatment&i=30 |
| Austroads Engineering Toolkit; Treatment type: Clear zone widening, Austroads Road Safety Engineering Toolkit. | www.engtoolkit.com.au/default.asp?p=treatment&i=38 |
| Austroads Engineering Toolkit 'Treatment type: Curve warning signs', Austroads Road Safety Engineering Toolkit, | www.engtoolkit.com.au/default.asp?p=treatment&i=42 |

| Title | | Web reference |
|---|---|---|
| | Austroads Engineering Toolkit; Treatment type: Median retrofit, Austroads Road Safety Engineering Toolkit | www.engtoolkit.com.au/default.asp?p=treatment&i=45 |
| | Austroads Engineering Toolkit; 'Treatment type: Painted/flush median', Austroads Road Safety Engineering Toolkit, | www.engtoolkit.com.au/default.asp?p=treatment&i=46 |
| | Austroads Engineering Toolkit ;'Treatment type: Sight distance improvements – intersections', Austroads Road Safety Engineering Toolkit, | www.engtoolkit.com.au/default.asp?p=treatment&i=57 |
| | Austroads Engineering Toolkit ; 'Treatment type: Turn lanes', Austroads Road Safety Engineering Toolkit, | www.engtoolkit.com.au/default.asp?p=treatment&i=69 |
| | Austroads – General | www.Austroads.co.au |
| | Austroads, 2006, Community consultation process and methods for quantifying community expectations on the levels of service for road networks, AP-R290-06, page 2. | https://www.onlinepublications.austroads.com.au/items/AP-R290-06 |
| | Austroads, 2009; 'Guide to Road Design Part 4A: Unsignalised and Signalised Intersections', | www.austroads.com.au/interest_design.html |
| | AS/NZA ISO31000: 2009 Risk Management – Principles and Guidelines | http://sherq.org/31000.pdf |
| | Charlton et al, 2004; 'The Effectiveness of Delineation Treatments', Charlton/Baas/Towler, 2004 | www.nzrf.co.nz/techdocs/conferencepapers2005/papers/The%20effectiveness%20of%20delineation%20treatments.pdf |
| | 'Treatments Central Turning Lane Full Length', iRAP; International Road Assessment Programme (iRAP), the Global Transport Knowledge Partnership (gTKP) and the World Bank Global Road Safety Facility | http://toolkit.irap.org/default.asp?page=treatment&id=4 |
| | 'Treatments Pedestrian Footpaths, iRAP; International Road Assessment Programme (iRAP), the Global Transport Knowledge Partnership (gTKP) and the World Bank Global Road Safety Facility | http://toolkit.irap.org/default.asp?page=treatment&id=20) |
| | IRAP Toolbox, 'Treatments > Roadside Safety – Barriers ', International Road Assessment Programme (iRAP), the Global Transport Knowledge Partnership (gTKP) | http://toolkit.irap.org/default.asp?page=treatment&id=28 |

| Title | Web reference |
|---|---|
| and the World Bank Global Road Safety Facility | |
| IRAP Toolbox, 'Treatments > Rumble Strips', International Road Assessment Programme (iRAP), the Global Transport Knowledge Partnership (gTKP) and the World Bank Global Road Safety Facility | http://toolkit.irap.org/default.asp?page=treatment&id=30 |
| 'Treatments > Central Hatching', International Road Assessment Programme (iRAP), the Global Transport Knowledge Partnership (gTKP) and the World Bank Global Road Safety Facility | http://toolkit.irap.org/default.asp?page=treatment&id=2 |
| Kiwi Road Assessment Programme(KiwiRAP); New Zealand Joint Agency | www.kiwirap.co.nz |
| Land Transport New Zealand: Research Report 271, School Journey Safety; a comparative study of engineering devices 2006, | http://www.nzta.govt.nz/resources/research/reports/271/ |
| LTSA, 1990; 'Guidelines for the implementation of traffic control at crossroads RTS 1', Land Transport Safety Authority, 1990, | www.nzta.govt.nz/resources/road-traffic-standards/docs/rts-01.pdf |
| LTSA, 1991,'Guidelines for flush Medians RTS 4', Land Transport Authority, 1991, | www.nzta.govt.nz/resources/road-traffic-standards/docs/rts-04.pdf |
| LTSA, 1995, 'Install Flush Median', Land Transport Safety Authority, 1995, | www.nzta.govt.nz/resources/crash-reduction/docs/flush-median.pdf |
| LTSA, 2002; 'Guidelines for urban-rural speed thresholds RTS 15'Land Transport Safety Authority,2002, | www.nzta.govt.nz/resources/road-traffic-standards/docs/rts-15.pdf |
| LTSA, 2004; 'Guidelines for the Safe Siting of School bus stops' Land Transport Safety Authority,2004 | http://www.nzta.govt.nz/resources/siting-school-bus-stops/docs/siting-school-bus-stops.pdf |
| LTSA, 2006, 'Flush medians (Factsheet 52)' Land Transport Authority, Land Transport Safety Authority, 2006, | www.nzta.govt.nz/resources/factsheets/52/flush-medians.html |
| Minsitry of Education – Property Toolbox | http://www.minedu.govt.nz/NZEducation/EducationPolicies/Schools/PropertyToolBox/StateSchools/Design/TrafficManagement.aspx |
| Ministry of Transport,(MOT) 2010. *Safer Journeys 2020 Strategy.* | www.transport.govt.nz/saferjourneys/Pages/default.aspx |
| Ministry of Transport,(MOT) 2010. *Safer Journeys 2020 Strategy; Action Plan 2011/2012* | http://www.saferjourneys.govt.nz/assets/Uploads/Safer-Journeys-Action-plan-2011.pdf |
| Ministry of Transport,(MOT) 2013. *Safer Journeys 2020* | http://www.saferjourneys.govt.nz/assets/Uploads/Saf |

| Title | Web reference |
|---|---|
| *Strategy; Action Plan 2013/15* | er-Journeys-Action-plan-2013-2015.pdf |
| Monash University Assessing Community Attitudes To Speed Limits: Final Report, November 2009 | http://www.transport.tas.gov.au/__data/assets/pdf_file/0006/52998/Assessing_Community_Attitudes_to_Speed_Limits_-_National_Report.pdf |
| Road Transport Association (RTA)New Zealand | www.nzrta.co.nz/ |
| NZS 4404:2010 Land development and subdivision infrastructure | http://shop.standards.co.nz/catalog/4404%3A2010%28NZS%29/view |
| NZTA, State Highway Geometric Design Manual, NZ Transport Agency | www.nzta.govt.nz/resources/state-highway-geometric-design-manual/index.html |
| NZTA , Traffic Control Devices Manual, NZ Transport Agency, | www.nzta.govt.nz/resources/traffic-control-devices-manual/index.html |
| NZTA, Traffic Control Devices Rule and Traffic Note: NZ Transport Agency | http://www.nzta.govt.nz/resources/results.html?catid=2 |
| NZTA, 1994; 'Right turn treatment', NZ Transport Agency, 1994, | www.nzta.govt.nz/resources/right-turn-treatment/index.html |
| NZTA, 2005; Cycle Network and Route Planning design guide | http://www.nzta.govt.nz/resources/cycle-network-and-route-planning/appendix4.html |
| NZTA, December 2007; Pedestrian and Planning design guide | http://www.nzta.govt.nz/resources/pedestrian-planning-guide/ |
| NZTA, 2008; Traffic Control Devices Manual, | www.nzta.govt.nz/resources/traffic-control-devices-manual/index.html |
| NZTA 2008 (a) 'Traffic Note 57, Active warning signs (not at schools) – Guidelines', NZ Transport Agency, 2008, | www.nzta.govt.nz/resources/traffic-notes/docs/traffic-note-57.pdf |
| NZTA research report (no. 408) 'School Bus Safety', September 2010 – TERNZ, Edgar, J. | http://www.nzta.govt.nz/resources/research/reports/408/ |
| NZTA (2010); Research Report 420, Improving School Travel Systems, Mackie, H, November 2010 | http://www.nzta.govt.nz/resources/research/reports/271/ |
| NZTA October (2010); Research Report423; Effectiveness of Transversw Road markings on reducing speeds; Martindale, A; Urlich, C | http://www.nzta.govt.nz/resources/research/reports/423/docs/423.pdf |
| NZTA, November 2009; Walking School Bus coordinators guide | http://www.nzta.govt.nz/resources/walking-school-bus-coordinators-guide/ |
| NZTA, 2009; Traffic Control Devices Manual, NZ Transport Agency, - Parking | www.nzta.govt.nz/resources/traffic-control-devices-manual/index.html |
| NZTA, 2011; High-risk rural roads guide | www.nzta.govt.nz/resources/high-risk-rural-roads-guide/ |
| NZTA, 2011(a); Draft High-risk intersection guide | http://www.nzta.govt.nz/consultation/high-risk- |

| Title | Web reference |
|---|---|
| | intersections-guide/ |
| NZTA 2011 (b); NZTA Travel Plan Coordinators guide | http://www.nzta.govt.nz/resources/school-travel-plan-coordinators-guide/docs/school-travel-plan.pdf |
| NZTA, 2009-2012; education portal and resources | http://education.nzta.govt.nz/resources |
| NZTA (A); Effective Engagement Toolkit | N/A |
| OECD, 2004. *Keeping children Safe in traffic* | http://www.oecd.org/sti/transport/roadtransportresearch/keepingchildrensafeintraffic.htm |
| OECD, 2008. *International Transport Forum - Towards Zero: Ambitious Road Safety Targets and the Safe System Approach.* | http://www.internationaltransportforum.org/Pub/pdf/08TowardsZeroE.pdf |
| PIARC, 2009, Catalogue of design safety problems and potential countermeasures, PIARC, 2009 | *http://publications.piarc.org/en/search/detail.htm?publication=6047* |
| Queensland Government; 2011; *Transport and Main roads, Planning for safe transport Infrastructure at Schools* | http://www.tmr.qld.gov.au/~/media/Safety/School%20road%20safety/Safe%20school%20travel%20safest/PlanningforsafetransportinfrastructureatschoolsTechnicalGuideV4a.pdf |
| RTA, 2009, Road and Traffic Authority, New South Wales, Delineation guidelines | http://www.rta.nsw.gov.au/doingbusinesswithus/downloads/technicalmanuals/delineation_dl1.html |
| SAA/SNZ HB 436:2004 Risk Management Guidelines | http://www.standards.co.nz/news/Standards+information/Risk+management/default.htm |
| Swears, R, et al 2010; Case study referenced from paper 'Longswamp to Rangiriri Wire Rope Barrier increased crash numbers but improved road safety. Crowther, S; Swears,R; Opus International Consultants Ltd; ARRB 2010 Conference Centennial highway paper, NZTA. | www.arrb.com.au/admin/file/content13/c6/Robert_Swears.pdf |
| TERNZ, 2006; 'Speed change management for New Zealand roads' Research Report 300,SG Charlton, University of Waikato & TERNZ Ltd, 2006, | www.nzta.govt.nz/resources/research/reports/300/docs/300.pdf |
| TENZE, 2009; 'The Usability and Safety of Audio Tactile Profiled Road Markings February 2009 Research Report 365', John Edgar Consulting & TERNZ, 2009, | www.nzta.govt.nz/resources/research/reports/365/docs/365.pdf |
| TERNZ, September 2011 (a); Rural School Road Safety , Land Transport New Zealand: Research Report 271; School Journey Safety; a comparative study of engineering devices 2006 | http://www.nzta.govt.nz/resources/research/reports/420/docs/420.pdf |
| TERNZ, September 2011 (b) , Mackie, H; *Rural School Road Safety* ( prepared for Land Transport NZ) | http://www.livingstreets.org.nz/sites/livingstreets.org.nz/files/Rural%20Schools%20Report%20FINAL.pdf |
| TORBIC; 'Guidance on Design and Application of Rumble Strips', DJ Torbic, JM Hutton, CD Bokenkroger,KM Bauer, ET Donnell, C Lyon, & B | *http://trb.metapress.com/content/3vj887015hg44674/fulltext.pdf* |

| Title | Web reference |
|---|---|
| Persaud,2___, | |
| TRB, 2009, Safety Data, Analysis, and Evaluation 2009, Volume 2' research report 2103 Transport Research Board (TRB) | *www.trb.org/Main/Blurbs/162222.aspx* |
| TRB, 2010; Traffic Control Devices, Visibility, and Highway-Rail Grade Crossings 2010; Transport Research Board (TRB) research report 2149 | *www.trb.org/Main/Blurbs/Data_Systems_and_Travel_Survey_Methods_163904.aspx* |
| US DoT, 2007; ITE 'Toolbox of Countermeasures and Their Potential Effectiveness for Roadway Departure Crashes', US Department of Transportation Federal Highway Administration, 2007, | www.ite.org/safety/issuebriefs/Roadway%20Departure%20Issue%20Brief.pdf |
| Waikato Regional Council: 'Hands up' Waikato 2012, Transport Survey for primary and intermediate schools in the Waikato region. | N/A |

# APPENDIX A: Toolbox measures

## *Speed management*

Both signs and marking are part of speed management treatments. The safe system encourages speeds that reduce deaths and serious injuries. Speed limits should suit the function and level of safety of the road and road users should understand and comply with speed limits and drive to the conditions.

### S1: Safe System speeds

| | |
|---|---|
| **What it is** | Safe speeds are a component of the safe system and should suit the function and level of safety of the road. Road users understand and comply with speed limits and drive to the conditions.<br>• We need to consider several types of speed:<br>> speed limits (determined by Land Transport Rule: Setting of Speeds Limits 2003)<br>> speed zones<br>> harm minimisation speeds<br>> harm reduction speeds.<br>• These speed types are discussed in more detail in the *High-risk rural roads guide.* |
| **Application** | • Speed management (ie speed zone, harm reduction) is an option under a safe system to reduce risk to pedestrians and cyclists but the harm minimisation speed for these users is about 30km/h, which is not achievable in rural environments. Where pedestrians and cyclists are present in significant numbers, other measures to improve their safety may need to be considered.<br>• For high-risk rural environments where a significant number of pedestrians or cyclists are present, consider the following treatments:<br>> separated off-road facilities<br>> wider shoulders<br>> improved delineation/lighting<br>> active signs<br>> reduced or managed pinch points<br>> visibility especially at crossing points. |
| **Considerations/ issues** | • A lower Safe System speed limit needs to be consistent with similar environments and situations.<br>• Good key stakeholder and public consultation is required to assist in compliance. |
| **Benefits** | • A reduction in operating speed to better reflect injury tolerance levels (figure 2-1) will reduce the severity of casualties in all crash types. |
| **References and guidelines** | • Australian College of Road Safety, 2010 - Speed limits in the safe system concept.<br>• SWOV, 2008 Safe Speed Thresholds for Different Road Types.<br>• OECD, 2008, Future Safe System application – Higher Speeds Roads (>80km/h).<br>• NZTA, 2004. Land Transport Rule: Setting of Speed limits 2003. |

## S2: Lower the posted and operating speed

| | |
|---|---|
| **What it is** | • The default posted speed limit on New Zealand open/rural roads is 100km/h and is generally applied to all rural roads with only limited exceptions.<br>• A more suitable speed limit for these roads might be one that more closely matches the design speed and the present safety features, so that it reflects safe system harm minimisation speeds (sections 3.3.2 and 3.3.3).<br>• Speed limit is mandatory at all times.<br>• The aim is to slow vehicles through an environment requiring lower speeds, day and night.<br>• Permanent speed limit changes at schools are only warranted if there is a significant change in the road or surrounding environment outside school peak hours.<br>  |
| **Application** | • To lower the posted speed limit, surveys must be undertaken to first determine the current operating speed. This will provide the platform from which to make a decision. If there is already an operating speed limit that is lower than the posted speed limit, consideration could be given to implementing a speed limit that more closely aligns with a Safe System speed.<br>• Safe threshold/harm minimisation speeds are discussed in more detail within the *High-risk rural roads guide*. This type of speed limit should be carefully considered and consulted on prior to implementation as a typical rural road in New Zealand. At-grade intersections and a head-on crash risk would, in many cases, require a safer speed limit to be introduced to eliminate most deaths and serious injuries. |
| **Considerations/ issues** | • Where speed limits are introduced on routes where the operating speeds are higher than the limit, consider additional measures to achieve compliance.<br>• In most cases a posted lower speed limit where one is not warranted, or where it is not supplemented with engineering measures and enforcement, is unlikely to be complied with.<br>• A 70km/h speed limit only suitable in areas with intermediate roadside development, such as small country towns and urban fringe areas.<br>• 80km/h speed limits are suitable on rural roads where adjacent roadside activity is sufficient to warrant a reduced speed. It should be posted for a minimum of 800 metres in road length. |
| **Benefits** | • For every 10km/h reduction in operating speed, a 15–40% reduction in head-on, run-off road and intersection crashes is likely (OECD, 2008).<br>• The level of safety for active road users increases with lower speed limits.<br>• For more information on the relationship between change of mean speed and crashes refer the *High-risk rural roads guide.* |
| **References and** | • TERNZ, 2006, Speed change management for New Zealand roads. |

| | |
|---|---|
| **guidelines** | • NZTA, 2004, Land Transport Rule: Setting of Speed Limits.<br>• KiwiRAP, 2010.<br>• OECD, 2006, Speed Management Summary Document.<br>• Transport Agency February 2005, The New Zealand Speed Zoning Policy. |

## S3: Variable speed signs

| | |
|---|---|
| **What it is** | • Electronic signs that are activated for short periods of time such as before and after school.<br>• When activated, variable speed signs reduce the legal speed limit.<br>• They are installed and enforced on all approaches to the school.<br>• The speed limit lights up when turned on with alternate flashing lights (wig-wags) to capture driver's attention.<br>• The speed limit is mandatory while the sign is activated.<br>• 40km/h speed limits are for school zones are generally reserved for urban areas or where there is an identified active user risk in a rural area. The speed environment should first be reduced to 80km/h (see Traffic Note 37).<br>• Speed limits of 60km/h are being trialled for rural areas where there is a turning vehicle risk. A 60km/h speed limit is not suitable where there is already a risk to pedestrians and cyclists (refer to the Transport Agency's website).<br>  |
| **Application** | • The trials use a Safe System approach, to reduce the risk of crashes associated with turning in and out of the school, or adjacent intersections. The electronic 60km/h enforceable speed limit sign is activated during peak school traffic hours.<br>• The static 60km/h speed limit sign is enforceable at times specified on sign. |
| **Considerations/ issues** | • Vandalism.<br>• Power supply in rural areas (solar-powered devices are available).<br>• The installation and maintenance costs can be high.<br>• This requires training of school staff and licence imposes strict conditions of use.<br>• This has proven to be effective in reducing vehicle speeds outside urban schools throughout the country and is currently being trialled on roads outside selected rural schools.<br>• This should only be activated when the surrounding environment requires a lower speed (eg children present on or near the road).<br>• Children's behaviour can be influenced by the misconception that traffic will slow down. |

| | |
|---|---|
| **Benefits** | • Speed reduction without enforcement.<br>• Can collect speed data for monitoring and planning of future sites. |
| **References and guidelines** | • Transport Agency, 2011: Traffic Note 37 – 40km/h variable speed limits in school zones.<br>• Auckland Transport 2012 – 60km/h Speed Zone trials.<br>• Transport Agency, 2012 – www.nzta.govt.nz – trial of 60km/h speed limits. |

## S4: Active signs – (vehicle and speed-activated warning signs)

| | |
|---|---|
| **What it is** | • An active sign is a warning sign that has an electronic display component which becomes active when the activity or hazard described by the sign (e.g. children on the road, out of context curves, slow down, queues ahead) is likely to be occurring on or close to the road. They include:<br>• vehicle-activated signs<br>• speed-activated warning signs (SAWS)<br>  <br>• speed-activated warning signs (SAWS) are electronic signs that display a message when approached by a driver exceeding a certain speed (see S3)<br>• they are typically used to warn the motorist of an upcoming hazard, eg a school zone, bend, crossroad or worksite<br>• they can be effective where permanent static signs are often ignored or drivers fail to see them. |
| **Application** | • They should be restricted to sites where the RCA considers that none of the standard warning signs will provide adequate warning to approaching drivers. (See section 6.1.2 – hierarchy of signs)<br>• The approach speed that activates the SAWS can be set to suit the prevailing site conditions.<br>• A retro reflective or Illuminated LED warning sign with flashing lights displays when activated.<br>• They should be clearly visible to motorists.<br>• They are more effective when installed with other physical features and initiatives aimed at improving safety. |

| | |
|---|---|
| **Considerations/ issues** | • The school zone signs are owned and maintained by the RCA.<br>• Consider legal liability in event of power or equipment failure.<br>• Vandalism.<br>• Security of power supply in rural areas is needed, although solar-powered devices are available.<br>• Cost.<br>• Enforcement. |
| **Benefits** | • They improve driver awareness of a high risk site (intersection or curve close to school), which may otherwise be inconspicuous.<br>• They can encourage alternative active modes of travel to school (walking and cycling) to school.<br>• They assist in reducing vehicle speeds (without enforcement) in conjunction with other measures.<br>• SAWS can collect speed data for monitoring.<br>• 35% reduction in all crashes can be expected |
| **References and guidelines** | • Austroads Toolkit Treatment Type: Vehicle Activated Signs.<br>• Austroads Toolkit Treatment Type: Speed reducing treatments.<br>• TERNZ, 2006 - Assessment of Hazard Warning Signs used on NZ roads.<br>• Transport Agency, 2010, P32 Specification for Electronic Warning Signs of State Highways.<br>• DOT, 2002 Vehicle-Activated Signs – A large scale evaluation.<br>• RTA, 2004 Accident Reduction Guide.<br>• Transport Agency, 2010, T10:2010 Specification for State Highway Skid Resistance.<br>• Transport Agency, Resource: Traffic Note 56 – Active School Warning Signs.<br>• Transport Agency, Traffic Note 57 – Active warning signs (not at schools).<br>• Transport Agency, 2011, high-risk rural roads guides for more information. |

## S5: Speed limit thresholds

| | |
|---|---|
| **What it is** | • Threshold treatments or gateways are used to alert road users of a change in road environment.<br>• They are often used at a change in speed limit.<br>• They are often used where a speed limit sign alone is not effective in ensuring drivers comply with the speed limit on the approach to a town. |

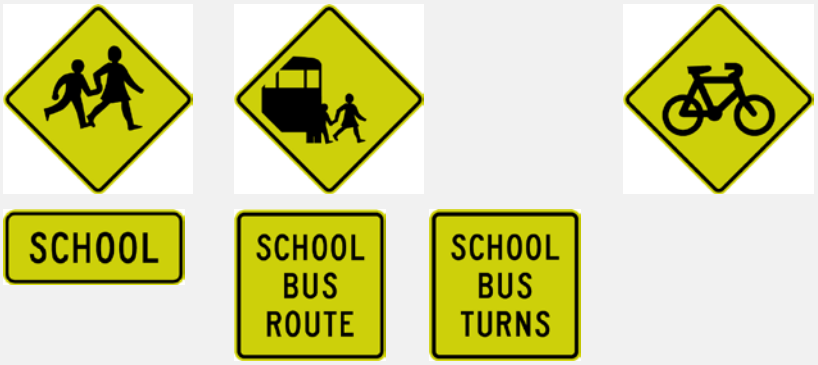
| | |
|---|---|
| |   Figure 8-1: Threshold treatment example (LTSA, RTS 15, 2002) and SH3 Hamilton |
| **Application** | • According to the guidelines for urban-rural speed thresholds (LTSA, 2002), thresholds are a potential traffic management technique when one or more of the following conditions are present:<br>> vehicle speeds on the town outskirts or through the urban areas are too high<br>> all reported injury crash rates are higher than average or need to be reduced<br>> when active mode users such as walkers and cyclists feature in the crash analysis.<br>• They should only be installed on roads that have a difference in the warranted speed limit of 20km/h or more at the rural-urban interface. |
| **Considerations/ issues** | • The speed reduction produced by a threshold may dissipate within 250m if there are no downstream changes in road conditions, such as decreases in road width or an increase in urban density. (TERNZ, 2006)<br>• A threshold should be clearly visible with adequate sight distance to be effective.<br>• Some threshold treatments provide for cyclists around the sides of the signs. However, consideration needs to be given to providing adequate space through the site and whether the sealed area will be maintained.<br>• Often they should be used in conjunction with other traffic calming measures. |
| **Benefits** | • Visually appealing entrances/gateways into smaller rural towns.<br>• A 15–27% reduction in crashes with high visibility and physical features is expected. (TERNZ, 2006)<br>• An 11% reduction in crashes with the use of dynamic or active signs. (TERNZ, 2006)<br>• An 11–20% reduction in crashes with visual narrowing treatments is expected. (TERNZ, 2006) |
| **References and guidelines** | • TERNZ, 2006 Speed change management for New Zealand roads.<br>• LTSA, 2002Guidelines for urban-rural speed thresholds, RTS 15. |

## S6: Transverse road markings

| | |
|---|---|
| **What it is** | • Transverse markings are painted lines (usually raised) across the road, predominately on the approach to intersections and curves that will create visual narrowing, and vibration noise within a car that travels over it.<br>  <br>Source Transport Agency, 2010: Research report 423 |
| **Application** | • These reduce speeds and raise awareness particularly at locations where high speeds are possible for considerable distance and featureless environments where drivers can have an adjusted perception of speed.<br>• They raise awareness of an intersection with deficiencies or crash problems where transformational works are not appropriate or possible. |
| **Considerations/ issues** | • These are not suitable near residential property due to noise.<br>• They are subject to wear, requiring regular refurbishment.<br>• These markings were installed and evaluated as part of a trial by the Transport Agency, who should be consulted on their use. |
| **Benefits** | • There are good crash reduction benefits (refer to the *High-risk intersection guide* for further information on crash reduction).<br>• These can reduce speeds of vehicles a distance away from the intersection depending on the layout. |
| **References and guidelines** | • KiwiRAP, 2010.<br>• OECD, 2008 Towards Zero: Ambitious Targets and Safe Systems Approach.<br>• OECD, 2008 Report reference to P. Wramborg, 2005.<br>• Transport Agency 2010, Research Report 423, Effectiveness of transverse Road Markings on reducing speeds.<br>• FHWA, Toolbox of Countermeasures and their potential effectiveness for Roadway Departure Crashes. |

## *Warning and delineation devices (signs and markings)*

### W1: Permanent warning signs-static

| | |
|---|---|
| **What it is** | • Diamond shaped retroreflective fluorescent yellow signs that warn drivers of certain activities on or close to the road. These can include:<br>> children warning sign with 'school' plate informing drivers they are approaching a school<br>> children alighting from a bus symbol with 'School bus route or turns' plate informing drivers of school bus activity<br>> cyclist sign.<br>  |
| **Application** | • They should be installed 100 metres in advance of the school grounds in rural areas.<br>• They can be installed on both sides of the road to increase visibility of the sign.<br>• The sign must be clearly visible for 120 metres in rural areas and 60 metres in urban areas. |
| **Considerations/ issues** | • Different sizes of sign are used depending on the operating speed of the road.<br>• The sign can either be yellow or fluorescent yellow.<br>• The signed hazard should be a regular occurrence to merit permanent warning signs. Active warning signs can be considered for less regular hazards (refer to hierarchy of signs – section 6.1.2). |
| **Benefits** | • They provide advance warning to drivers of children and activities in the area. |
| **References and guidelines** | • Austroads Engineering toolkit - Treatment Type: Curve Warning Signs.<br>• TERNZ, 2006 Assessment of Hazard Warning Signs used on New Zealand Roads.<br>• Transport Agency MOTSAM Part 1 Section 6.44. |

## W2: Audio tactile profiled (ATP) markings

| | |
|---|---|
| **What it is** | • ATP markings are lines on the road that have a raised profile and are also known as rumble strips or profiled road markings.<br>• The raised profile creates a slight vibration in vehicles as well as an audible rumbling sound.<br>• ATP markings can be provided along the edgeline and/or centreline of a roadway and can be either white or yellow (centre line only).<br>• ATP markings are used to encourage drivers to stay within their lanes and are used to reduce both loss of control (or run-off road) and head-on type crashes.<br>  <br><br>ATP edgelines and no-passing centreline |
| **Application** | • ATP edgeline and centreline markings may replace or supplement standard road markings on sections of road where:<br>> traffic volumes are high, or not high enough for central barrier treatments (refer to the Transport Agency's HRRRG)<br>> there is a significant number of run-off road (edgeline) and head-on (centreline) crashes in which fatigue or driver inattention is identified<br>> there are specific site problems such as poor visibility, frequent or heavy rain, or night-time crash history.<br>• As run-off road and head-on crashes resulting from fatigue or other factors can occur anywhere along a route, ATP edgelines and centrelines should be installed as a corridor treatment rather than be site specific. |
| **Considerations/ issues** | • They may present a hazard to cyclists and motorcyclists.<br>• They should be implemented over a continuous length rather than isolated sites.<br>• Drainage may be a problem in high rainfall areas if associated with a raised long life marking.<br>• The auditory effect is less noticeable for larger vehicles, especially trucks.<br>• They may cause noise disturbance for adjoining land users.<br>• Adequate shoulder width outside of the ATP is required to allow room for errant vehicles to recover and for cyclists.<br>• Insufficient passing opportunities can increase travel times and frustrate drivers. Consider implementing passing lanes or sign-posting upstream passing lanes |

| | |
|---|---|
| | • Different types have different effectiveness or wear off more quickly and therefore maintenance costs need to be considered. |
| **Benefits** | • Specific crash reduction benefits can be found in the *High-risk rural roads guide*.<br>• Reduced shoulder maintenance costs are expected, but there is an additional cost for rumble strip maintenance). |
| **References and guidelines** | • IRAP Toolbox - Treatments Rumble Strips (iRAP).<br>• Austroads Engineering Toolkit - Treatment type: Profile edge lines.<br>• TERNZ, 2009; The Usability and Safety of Audio Tactile Profiled Road Markings.<br>• TORBIC, Guidance on Design and Application of Rumble Strips.<br>• RTA (2010) Delineation Section 15.<br>• TRB, 2010: Traffic Control Devices, Visibility and Highway-Rail Grade Crossings.<br>• US DoT, 2007, ITE: Toolbox of countermeasures. |

## W3: Flush medians

| | |
|---|---|
| **What it is** | • A continuous series of white diagonal line, which replaces the centre line providing a central 'refuge' type area between live lanes.<br>• Suited to all types of roads.<br>• They can be used to provide protection for vehicles when turning right on into or out of a side road or access and for pedestrians to cross the road.<br>• They can help reduce traffic speeds by narrowing the road environment.<br>• Flush medians can be as wide as a car or also be narrow (ie they only provide separation between opposing traffic). Some examples of this are also included in the centreline treatment countermeasure. Care is needed with long flush medians in the rural environment as they can sometimes encourage illegal overtaking.<br>  <br>Rural flush median – State Highway 27 Raungaiti |
| **Application** | • They should be limited to 80km/h areas only.<br>• In rural areas a flush median provides separation between opposing traffic streams and a refuge for vehicles turning into and out of side roads or driveways.<br>• They are useful where a head-on crash risk is evident or predicted |

| | |
|---|---|
| | • Flush medians improve safety of vehicles by separating the traffic lanes. They can also provide a central refuge area for vehicles turning, as well as pedestrians intending to cross.<br>• They are suitable at locations where pedestrian crossing demand is not concentrated to defined locations.<br>• Where there is sufficient road width, flush medians can be retrofitted and suit all classes of road and maintain vehicular access to adjacent driveways. |
| **Considerations/ issues** | • There is potential for use of the flush median as a passing lane which may lead to rear end collisions or lane change collisions where the flush median is also used as a turning lane. Where the flush median is used as an area from which to turn, sight distance needs to be considered.<br>• Pedestrians may still feel vulnerable if required to wait for extended periods on high speed roads.<br>• They require sufficient road width while maintaining adequate room for cyclists.<br>• The cost to install is considerably less than a raised central median.<br>• The installation of raised pedestrian islands within the flush median is recommended to maintain pedestrian safety. |
| **Benefits** | • Specific crash reduction benefits can be sourced from the *High-risk rural roads guide*.<br>• Traffic flow is improved and delays reduced if the flush median is used as turning lane.<br>• Provision of painted medians may result in narrowing of wide lanes, encouraging slower speeds (IRAP).<br>• They provide a central refuge for pedestrians to cross the road.<br>• They provide a central refuge for turning vehicles.<br>• They separate traffic lanes, which can improve road safety. |
| **References and guidelines** | • US DOT, 2007, ITE Toolbox of Countermeasures and Their Potential Effectiveness for Roadway Departure Crashes.<br>• IRAP Tool Box Treatments Central Hatching.<br>• Austroads Engineering Toolkit - Treatment type : Painted/flush median.<br>• LTSA, 1995, Install Flush Median.<br>• LTSA, 1991 Guidelines for flush medians - RTS 4.<br>• LTSA, 2006, Flush medians (Factsheet 52).<br>• RTA (2010) Delineation Section 15.<br>• US Dot, ITE, 2007 ITE: Toolbox of Countermeasures.<br>• Austroads – General.<br>• Transport Agency; Traffic Note 52: School traffic safety team manual. |

## W4: Line marking

| | |
|---|---|
| **What it is** | • Line marking is 'paint' on the road.<br>  <br>• Line markings can be provided along the edgeline and/or centreline of a roadway and can be either white or yellow (no passing line only).<br>• They are used to encourage drivers to stay within their lanes and are used to reduce both loss of control (or run-off road) and head-on type crashes. |
| **Application** | • Centrelines:<br>> should be used where a road is greater than 5m wide and minimum AADT of 250 vehicles per day (vpd)<br>> may be marked on a road that is wider than 5.1m with a centreline.<br>• Edgelines:<br>> may be marked if it is desirable<br>> should be used where the seal width is greater than 7.4m or the seal width is greater than 6.6m and the AADT is greater than 750vpd<br>> should be marked where seal width is greater than 6m and AADT is greater than 250vpd.<br>• Audio tactile pavement (ATP) markings and raised reflective road markers (RRPMs) can be added to line marking. |
| **Considerations/ issues** | • Wide lines:<br>> Marking centrelines on narrow roads can increase travel speeds and decrease the level of safety. Marking edgelines only may be more beneficial on narrow roads.<br>> May present a hazard to cyclists and motorcyclists depending on the type, thickness, skid resistance, etc. |
| **Benefits** | • Edgelines can reduce shoulder damage, reducing maintenance costs.<br>• Centrelines can discourage overtaking and drifting from the lane and reduce head-on type crashes by shifting lane position.<br>• Edgelines can reduce run-off road crashes and sealed shoulder damage.<br>• Widened edgelines (200mm) in high-risk locations (such as on curves) have been |

| | |
|---|---|
| | shown to reduce crash rates.<br>• Specific crash reduction benefits can be sourced from the *High-risk rural roads guide*<br>• Centrelines can deliver:<br>> 30% reduction in all crashes (Charlton et al, 2004)<br>> 25–40% reduction in casualty crashes (Austroads).<br>• Edgelines can deliver:<br>> 30% reduction in crashes on curves and straights (TRB, 2009)<br>> 25% reduction in loss of control crashes (Charlton et al, 2004)<br>> 8–35% reduction of total accidents (PIARC, 2009). |
| **References and guidelines** | • Charlton; et al, 2004, Effectiveness of Delineation treatments.<br>• Transport Agency, Traffic Control Devices Manual.<br>• Transport Agency, Traffic Control Devices Rule and Traffic Note.<br>• PIARC, 2009 Catalogue of design safety problems and potential countermeasures. PIARC.<br>• Austroads Engineering Toolkit - Treatment type : Median Retrofit.<br>• Transport Agency, 2008(a) Traffic Note 57, Active Warning Signs (not at Schools) – Guidelines.<br>• TRB, 2009, Safety Data, Analysis and Evaluation 2009, Volume 2. |

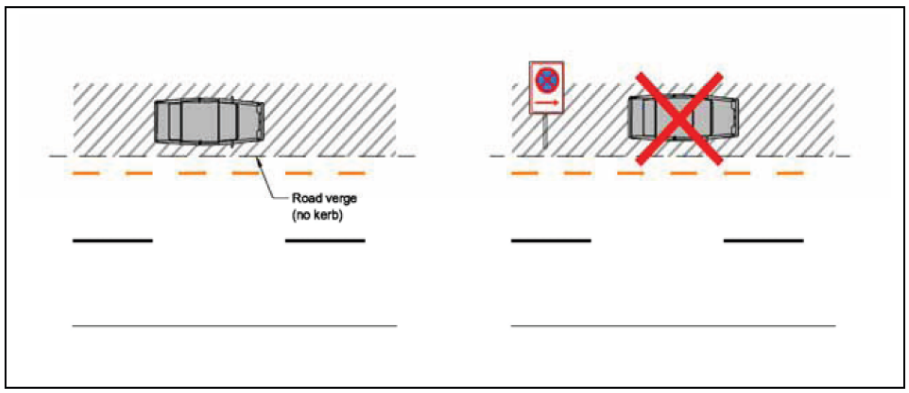
## W5: Wide centreline

| | |
|---|---|
| **What it is** | • Two lines in the centre of the road at variable widths.<br>• The lines are painted as a dashed white line on sections of the road where passing is permitted, and a solid yellow line on no passing areas.<br>• The line markings may be supplemented with rumble strips.<br>  <br>Source: Google Maps – Waikanae, State Highway 1 |
| | |

| | |
|---|---|
| **Application** | A two-year trial of wide centreline markings is underway on various sections of state highway around New Zealand. Wide centre lines are now included in the Traffic Control Devices Rule.<br>  <br>Wide centreline markings, passing allowed<br>  <br>Wide centreline marking, no passing |
| **Considerations/ issues** | • The corridor needs sufficient width.<br>• Avoid any narrowing of sealed shoulder to accommodate a wide centreline as this could adversely impact on pedestrians and cyclists. |
| **Benefits** | • This provides greater separation for opposing traffic and reduces the likelihood of cross-centreline crashes. |
| **References and guidelines** | • http://www.nzta.govt.nz/resources/wide-centreline-trial/docs/wide-centreline-trial-infosheet.pdf |

## W6: No stopping lines

| | |
|---|---|
| **What it is** | • No-stopping lines are yellow dashed lines marked on the edge of the road, either next to the kerb or the edge of a sealed road to inform drivers they must not park or stop.<br>  <br>Source: Google Maps – Entrance to Kaimai School, State Highway 29 |
| **Application** | • If marked, no-stopping restrictions must be marked by a broken yellow line, not less than 0.1m wide. The broken line must have stripes not longer than 1m and gaps not longer than 2m (as shown in figure below). The markings must be located no further than 1m away from the adjacent kerb. Where shorter lengths of no-stopping markings |

| | |
|---|---|
| | are used (i.e. less than 30m) shorter gap lengths of 1m may be used. Where longer lengths of no-stopping markings are used (i.e. greater than 30m) then the maximum of 2m gap length may be used (TCD Manual – part 13 Parking). |
| **Considerations/ Issues** | • No-stopping lines do not prevent vehicles from being parked to the left of the marking where there is no kerb (eg on a verge). However, a no-stopping sign relates to the full width of the road reserve and prohibits vehicles from being parked on a verge to the left of the roadway (see figure below).<br>  <br><br>• These can be used in rural areas where visibility of an intersection or access way needs to be maintained.<br>• They control parking behaviour outside the school access. |
| **Benefits** | • They provide additional edgeline delineation. |
| **References and guidelines** | • Transport Agency, 2009, Traffic Control Devices Manual _ Part 13.<br>• Transport Agency, Traffic Control Devices Rule. |

## W7: No passing/overtaking lines

| | |
|---|---|
| **What it is** | • A no-passing (or no-overtaking) line is a continuous yellow line which replaces the white centreline.<br>• It is used to inform drivers that they must not cross the centreline to overtake another vehicle through that section of road.<br>• It is used for a number of reasons included restricted sight visibility, on approaches to hazards.<br>• It is used if the route or site has a history of overtaking crashes (see application). |

| | |
|---|---|
| |  <br>(Source: Google Maps, - pro licence) |
| **Application** | • These should be used:<br>> on the approaches to raised traffic islands and medians that separate opposing traffic flows; (note that where tapered flush median markings are present, no-passing lines are not necessary)<br>> on the approaches to hazards or obstructions located within a carriageway and which separate opposing traffic flows;<br>> on the approaches to railway level crossings<br>> as centrelines on undivided four lane rural roads<br>> where it is considered necessary to prohibit overtaking because drivers may not be aware of visibility restrictions caused by vertical and horizontal curves.<br>• They may be used as remedial measures on lengths of roads with proven overtaking accident histories. |
| **Considerations/ issues** | • Consideration should be given to improving sight distances first, no-passing lines should only be used if acceptable sight distance and road alignment cannot be achieved.<br>• Marking no-passing line makes it illegal to cross the centreline unless turning. |
| **Benefits** | • Helps to reduce head on crashes. |
| **References and guidelines** | • Transport Agency, Traffic Control Devices Manual.<br>• Transport Agency, MOTSAM - Section 2. |

## W8: Road marking (text) - school

| | |
|---|---|
| **What it is** | • White text is marked on the road on the approach to a school or entry to a school zone.<br>• It informs drivers approaching the area of the surrounding environment and potential roadside activity.<br>  <br><br>Source: Google Maps, - pro licence |
| **Application** | • Pavement messages may be used in association with school zone signs at sites where driver awareness of the school zone may be reduced by the alignment of the road, by the volume or type of traffic, or where the school buildings are not obvious to approaching drivers.<br>• They can be used where the WU22 (PW 32) supplementary along with WU 2(PW31)) has already been installed.<br>• They must be installed with the letter marking requirements of the Land Transport Rule Traffic Control Devices Schedule 2, M8-2. |
| **Considerations/ issues** | • As these are located in the centre of a lane, consideration should be given to whether their presence may affect motorcyclists.<br>• They should not be used on curves.<br>• They should be used in conjunction with other advance warning devices, eg permanent warning and active signs.<br>• The road needs to be of sufficient width for the text to be readable (see letter height requirement within the NZTA TCD Land Transport Rule; Traffic Control Devices)<br>• They may not be suitable in situations that require a high friction surface. |
| **Benefits** | • They provide extra warning of school site to drivers. |
| **References and guidelines** | • Transport Agency, MOTSAM - Section 2.<br>• Transport Agency, TCD Manual. |

## *Protection of road users*

### P1: Barriers

| | |
|---|---|
| **What it is** | • Roadside and central safety barriers include:<br>> flexible barriers (wire rope)<br>> semi-rigid barriers (typically called guardrail)<br>> rigid barriers (concrete).<br>• Well-designed barriers reduce the severity of crashes involving vehicles that have lost control and leave the road and prevent collisions with oncoming traffic or roadside hazards such as power poles and trees.<br>• They can also provide protection for active road users walking along the edge of the road.<br>  <br>Side wire rope barrier, State Highway 1 Rangiriri |
| **Application** | • Traditionally safety barriers have been developed for speed environments in excess of 70km/h where the crash severity without a barrier outweighs the severity associated with colliding with the barrier (Austroads Engineering Toolkit). |
| **Considerations/ issues** | • Safety barriers are roadside hazards. Therefore, all other options for hazard reduction should be examined before choosing to install a barrier. Barriers are designed to reduce the severity of a collision but may also increase the collision frequency because they are closer to the roadside than the hazard being protected and often extend over a longer length than the hazard being protected.<br>• They can redirect traffic back into the live traffic lane and even into opposing traffic.<br>• The desired length must be adequately calculated and designed for.<br>• Adequate end treatments are crucial to ensure the barrier ends do not become significant hazards.<br>• Barriers can have significant maintenance costs that need to be compared with expected benefits. |
| **Benefits** | • They protect valuable or dangerous assets on the roadside.<br>• They add to the delineation of road environment, particularly on curves. |

| | |
|---|---|
| | • They protect active road users.<br>• Specific crash reduction benefits can be sourced from the *High-risk rural roads guide*. |
| **References and guidelines** | • Swears, R, et al 2010 Longswamp to Rangiriri Wire Rope Barrier.<br>• IRAP Tool Box Treatments Median Barrier.<br>• IRAP Tool Box Treatments Case Studies The Coast Road Median Barrier.<br>• Austroads engineering toolkit - Treatment Type: Safety Barriers, Austroads Road Safety Engineering Toolkit.<br>• Austroads engineering toolkit - Treatment Type: Median retrofit, Austroads Road Safety Engineering Toolkit.<br>• IRAP Toolbox Treatment Roadside Safety – Barriers. |

## P2: Clear zones

| | |
|---|---|
| **What it is** | • A clear zone is the area (with no hazards such as power poles, drains or trees) located outside of the sealed road which would allow a vehicle that has lost control to be able to recover and drive back on the road or come to a rest.<br>• A clear zone would also provide an area for walking or cycling if relatively flat.<br>  |
| **Application** | • Provision of clear zones is particularly important near intersections or bends where the complexity of the driving task and interaction with other vehicles add to the likelihood of run-off-road crashes. (Austroads Engineering Toolkit).<br>• Side slopes must not be steeper than 1:4 on embankments and 1:3 in cuttings (Transport Agency Geometric Design Manual).<br>• While full clear zone widths require in excess of 9m, the provision of 4–5m still provides significant benefits in most locations. |
| **Considerations/ issues** | • Where clear zones cannot be provided, roadside safety barriers may be considered to reduce crash severity, along with measures that reduce the risk likelihood of a vehicle running off the road.<br>• They are difficult to provide in many situations as full-width clear zones require space outside most road reservations. Some situations can be high cost. |

| | |
|---|---|
| | • Widening the look of the road environment can create increases in operating speeds.<br>• Comparative costs and benefits of roadside barriers should be considered where full clear zone width cannot be achieved.<br>• Creating shallow drainage ditches can sometimes create land or subsurface drainage issues.<br>• A percentage of vehicles will travel beyond the design clear zone.<br>• Vehicles can roll because their trajectory angles increase within the clear zone.<br>• RCAs should develop planning policies to maintain a clear zone and sight distance. Reference can also be made to using shrubs and plants to create visual vertical narrowing effects to reduce operating speeds where it would not compromise safety and sight distances.<br>• Those that are frangible, ie with a trunk that is generally less than 100mm wide; however, if possible, provision of trunks with less than 100mm would be safer and reduce severity of injury to road users. |
| **Benefits** | • Clear zones reduce the likelihood of errant vehicles striking roadside hazards by providing clear areas for vehicles to recover.<br>• Studies have indicated that, on high speed roads, a clear traversable width about 9m from the edge of the traffic lane allows about 80% of vehicles that run-off the road to regain control (RTA, NZ).<br>• Maintenance costs are reduced as roadside furniture is not hit by errant vehicles.<br>• Specific crash reduction benefits can be sourced from the *High-risk rural roads guide.* |
| **References and guidelines** | • Kiwi Road Assessment Programme(KiwiRAP); New Zealand Joint Agency.<br>• Austroads Engineering Toolkit, Treatment type: Median retrofit.<br>• Austroads Engineering Toolkit Treatment type: Clear zone widening.<br>• Transport Agency, State Highway Geometric Design Manual.<br>• Road Transport Association (RTA), New Zealand. |

## P3: Right and left turn bays (auxiliary lanes)

| | |
|---|---|
| **What it is** | Auxiliary turn lanes include right-turn lanes and left-turn lanes.<br>  <br>Right turn bay: State Highway 33 Rotorua District (source : Google Pro licence 2010)<br>• They provide a place for vehicles to wait for a suitable gap in traffic to complete their turn while not impeding through traffic.<br>• Turn lanes are installed where there is a high risk of rear-end crashes as a result of vehicle turning movements. |
| **Application** | • Auxiliary turn lanes on curves should be carefully designed with visibility to the back of the queue in mind. It should also be clear to drivers which lane is the major through lane and which is the auxiliary turn lane. Often it is beneficial to extend the auxiliary lane through the curve so that it begins on the preceding straight. This improves visibility of the auxiliary lane and reduces driver confusion.<br>• Where an intersection or access is located on a curve it may be beneficial to include an auxiliary turn lane so that queuing traffic can queue away from through traffic. This reduces the risk of rear-end collisions as a result of poor visibility.<br>• The Transport Agency's *State highway design manual* and Austroads *Guide to road design (4A)* should be referenced for relevant criteria for installation and detailed specifications. |
| **Considerations/ issues** | • Turn lanes should be designed long enough to accommodate vehicle deceleration clear of through traffic, thus reducing the potential for rear-end crashes.<br>• If a turning lane is excessively long, through drivers may enter the lane by mistake without realising it is a turning lane. Effective signing and marking at the upstream end of the turning lane may remedy such problems.<br>• Auxiliary lanes are sometimes illegally used for overtaking manoeuvres, particularly where they are located prior to a marked passing lane.<br>• At crossroads, right turn lanes widen conflict area and lead to more crossing crashes. Where there is enough side road traffic, a roundabout is a better option.<br>• Typical left turn auxiliary lanes increase right turn-out crashes as the left turner hides following traffic. However, you need to ensure that enough sight distance of left turning traffic is provided (so it doesn't obscure through traffic). This could be via a splitter island. |

| | |
|---|---|
| | • We need to be very careful we are not reducing low-severity crashes, only to replace them with high-severity types.<br>• Right turn bays at T-junctions do not suffer from any of these problems.<br>• Left turn lanes can reduce visibility for vehicles turning out of side roads.<br>• Turn lanes can result in through-traffic vehicle speeds increasing. |
| **Benefits** | • Head-on and rear-end crashes of vehicles as they wait to turn should reduce. |
| **References and guidelines** | • IRAP Toolbox Treatment  Treatments Central Turning Lane Full Length.<br>• Austroads Engineering Toolkit  Treatment type:  Turn lanes.<br>• Transport Agency, 1994 Right turn treatment.<br>• Austroads, 2009  Guide to Road Design Part 4A: Unsignalised and Signalised Intersections. |

## P4: Footpaths and shared paths

| | |
|---|---|
| **What it is** | • This is a formalised place for people to walk to and from the journey to school. In rural areas. They are more than likely to be only located on one side of the road.<br>• A footpath is a public facility built for pedestrian use, which may run alongside the road or through parks and other open spaces. Footpaths provide an alternative mode of transport from vehicles and can encourage social interaction and activities in a community.<br>• It is a direct footpath between the bus stops, car parks and school buildings in and around the school.<br>  <br>Source: www.toolkit/irap/org<br>• Shared paths are a widened, purpose-built footpath to accommodate both pedestrians and cyclists. |

**Application**

Guidance on when you would use a footpath in a rural area is provided in the following table:

| | Footpath provision | | | |
|---|---|---|---|---|
| | New roads | | Existing roads | |
| Land use | Preferred | Minimum | Preferred | Minimum |
| Three to 10 dwellings per hectare | Both sides | One side | One side | Shoulders on both sides |
| One side shoulders on both | One side | Shoulders on both sides | One side | Shoulders on both sides |

Source: Table 14.1 – Transport Agency pedestrian planning design guide

Where only the minimum provision is made, the RCA should be able to demonstrate clearly why walking is not expected in that area (although for new or improved developments, this is the developer's responsibility).

Retrofitting footpaths is more costly than providing them in the first place, so the preferred standard should be installed for any new or improved development (Transport Agency, 2007), unless:

- It is not accessible to the general public.
- The cost of suitable measures is excessive (more than 20 percent of the scheme cost).
- It can be shown to benefit very few pedestrians.
- The desirable width for footpaths is 1.8m.
- The footpath can be made out of asphalt, gravel or even a flattened down walking track to provide a facility for walking where there normally would not be one.

A shared path requires adequate links to ensure maximum use. Shared paths may be considered where the combined flow of pedestrians and cyclists is light.

**Considerations/ issues**

- There needs to be enough space to provide a footpath with sufficient width for its intended use.
- Can pedestrians be separated and protected from vehicles?
- Paths should avoid crossing entrances to car parks and areas where vehicles pick up and drop off students.
- Paths should be designed to increase the awareness and visibility of the users.
- All active transport paths within the school environment should be separated from other modes of transport, particularly near main school entrances with direct routes connecting all transport modes to the main school entrance.
- Does the path follow the desire-line where pedestrians want to walk or does it force them to take a longer route?
- Signage is proved to clearly identify pathways, school entrances/exits, school buildings and amenities.
- They should only be provided where pedestrians are likely to use them.

| | |
|---|---|
| | **Shared paths**<br>• Differing speeds between pedestrians and cyclists can lead to conflicts and pedestrians feeling vulnerable.<br>• Extreme care must be taken by all users when overtaking others due to the unpredictable nature of children.<br>• Linking a rural settlement to a school located on the outskirts can provide a valuable alternative to private vehicles transporting students direct to the school gate. |
| **Benefits** | • They provide pedestrians with a space to walk that is free of obstacles.<br>• Improvement of footpaths might lead to an increase in the numbers of those walking, therefore improvements to health and environmental benefits.<br>• Footpaths encourage walking and can reduce the risk of pedestrian-vehicle conflict.<br>• A footpath next to the road, or a wide flat road shoulder, can prevent pedestrian crashes. The safety benefits will be greatest if the footpath is separated from the road (for example, by a drain, a grass verge or a barrier). www.toolkit/irap.org<br>• A rural footpath can be made cheaply by using grader to flatten and clear one side, or preferably, both sides of the road. www.toolkit/irap.org<br>• Shared paths provide a vehicle-free facility that enable users to cycle or walk to their destination.<br>• Shared paths are generally considered safer for cyclists between junctions with roads and driveways. |
| **References and guidelines** | • Transport Agency , 2007, Pedestrian Planning and Design Guide.<br>• Queensland Government 2011 Planning for Safe Transport Infrastructure at Schools.<br>• IRAP Toolbox treatment  Pedestrian Footpaths. |

## P5: Cycle lanes/paths/facilities

| | |
|---|---|
| **What it is** | • A designated place to cycle. In New Zealand's rural areas, cyclists rarely have any alternative but to use the same road system as motorised traffic.<br>• It can be either a standalone facility, shared path (see toolbox shared path – P4) with pedestrians or as a separate lane marked on the road.<br>  <br>Source: Transport Agency cycle network and route planning guide |

| | |
|---|---|
| **Application** | • Cyclists particularly benefit from a sealed road shoulder. Separate paths have even greater safety benefits on rural roads, so their feasibility should always be considered.<br>• In areas with significant volumes of cyclists, cycle facilities can be provided to increase safety and ease of access for cyclists.<br>• Minimum width for on-road bicycle lanes is 1.2m with a desired width of 1.5m.<br>• Minimum width for a two-way off-road cycle path is 2.0m, with 2.5m desired. |
| **Considerations/ issues** | • Is the type of facility/path appropriate for the use and number of cyclists?<br>• Are there storage facilities for bicycles at the school?<br>• Bicycle parking should be located within 100m of the main school entrance.<br>• A pathway connecting the bicycle parking and the entrance and internal network could be provided.<br>• Signage should clearly identify pathways, school entrances and exits, school buildings and amenities.<br>• On-road bicycle lanes are cheaper than off-road paths if shoulder sealing is not required.<br>• Traffic calming treatments, narrow road sections such as bridges, and parked vehicles can force bicycles out into traffic, resulting in conflicts and therefore greater risks to cyclists.<br>• Surface quality must be high or it will pose a safety risk.<br>• Off-road bicycle lanes should be maintained properly to ensure that cyclists will prefer this to riding on the shoulder or in a vehicle lane of the roadway.<br>• Maintenance includes repairs to the pavement surface and vegetation clearance.<br>• Adequate sight distance must be provided around bends and at path intersections. This will also aid in improving personal security.<br>• Bicycle paths should be clear of obstructions. Where an obstruction is necessary, it should be made obvious, and lines should be used to guide bicyclists safely past. |
| **Benefits** | • They raise awareness of cyclists with other road users.<br>• They increase safety for people who cycle.<br>• They can lead to an increase in cycling and therefore provide improvements to health and the environment. |
| **References and guidelines** | • Transport Agency. Cycle network and route planning guide.<br>• Planning for Safe Transport Infrastructure at Schools – Queensland Government. www.tmr.qld.gov.au<br>• New Zealand supplement to Austroads Guide to Traffic Engineering Practice: Part 14: Bicycles. |

## P6: Road crossing points

| | |
|---|---|
| **What it is** | • A place or facility designed to assist pedestrians to cross the road safely.<br>• They can come in many types which are suitable for different road environments. |
| **Application** | • They should be positioned on pedestrian desire lines to ensure use.<br>• They should be positioned where the island won't restrict access to adjacent driveways.<br>• They require adequate road width to maintain minimum vehicle lane widths.<br>• They need to be positioned where they are clearly visible day and night (well lit) to avoid being struck by vehicles, this is even more prudent in high speed areas. |
| **Considerations/ issues** | • Can create a hazard to other road users. There is a need to balance the outcome of providing a central solid median for pedestrians who cross at only certain times of day against the high speed traffic that travels all hours of the day.<br>• Can create a pinch point increasing conflict between vehicles and cyclists.<br>• Can reduce delays to pedestrians crossing the road.<br>• Allows pedestrians to focus on crossing one direction of traffic at a time rather than two.<br>• Reduces crossing distance and risk to pedestrians when crossing.<br>• They need to be well lit and visible to both pedestrians and motorists. |
| **Benefits** | • Most beneficial on roads where traffic volumes exceed 500 vehicles per hour.<br>• Reduces potential pedestrian and vehicle conflict. |
| **References and guidelines** | • Transport Agency, Pedestrian Planning Guide 2009. |

## *Design of the road environment*

### D1: Access – intersections and driveways

| | |
|---|---|
| **What it is** | • Locating and designing intersections and driveways in such a way that they are safe, visible and easy to use.<br>  <br>Entrance to a rural School (Source: Google Maps ;Pro Licence 2013) showing marked left turn bay and no stopping/parking markings. |
| **Application** | • The location and visibility of entry and exit points to the school is very important to directing pedestrians, cyclists and vehicles to the desired location. Gates should be located so that children waiting to be collected by parents or caregivers can stay inside the school fence. |
| **Considerations/ issues** | • Are there any constraining environmental features that impact the intersection or driveway?<br>• Has best practice been followed?<br>• Is the intersection/driveway fit for purpose?<br>• Avoid school access points along arterial roads and higher level roads if practicable.<br>• Provide appropriate turning facilities where warranted.<br>• Avoid combining pedestrian and cyclists access and vehicle entrance into one driveway to reduce conflicts and achieve one-way circulation.<br>• Avoid school access points adjacent to major intersections. |
| **Benefits** | • They are safe, visible and easy to read access reduce driver confusion.<br>• They reduce traffic friction and improve flow and safety on the main road.<br>• They can potentially reduce active road user risk. |
| **References and guidelines** | • Austroads Guide to Road Design Part 4: Intersections and Crossings.<br>• IRAP> Treatments > Restrict Combine Direct Access Points.<br>• http://www.toolkit.irap.org/default.asp?page=treatment&id=26.<br>• Queensland infrastructure guide.<br>• Transport Agency State Highway Design Manual. |

## D2: Route/corridor

| | |
|---|---|
| **What it is** | • The route that school aged children or their caregivers use to transport them to and from school.<br>• The route includes the:<br>> road network on approach to the school<br>> route in the vicinity of the school gate.<br>  |
| **Application** | • Intended routes for school treatments should include the application of a variety of treatments covered within this guide and include:<br>> signs and markings<br>> protection of active road users<br>> speed management<br>> intersection design<br>> bus facilities<br>> parking facilities.<br>• It is important with any corridor treatment approach that the method of applying these treatments is consistent. |
| **Considerations/ Issues** | • What obstacles are there restricting safe travel?<br>• There is a need to prioritise and balance the treatments along the route against measures recommended directly at the school access or main intersection. |
| **Benefits** | • Overall route safety benefits with any measures implemented along the route will affect all road users. |
| **References and guidelines** | • All references provided in this guide relating to the road corridor. |

## D3: Separated facilities

| | |
|---|---|
| **What it is** | • The separation of facilities for different users so the pedestrians and cyclists do not have share vehicle space.<br>• They should be in the form of underpasses, overpasses, protected facilities (i.e. path protected by guardrail).<br>   <br>Source(Transport Agency *Cycle network planning guide*; www.csppacific.co.nz ) |
| **Application** | • Providing separate paths for each mode or installing physical barriers between different modes ie:<br>> pedestrian fencing separating footpaths from car parks<br>> separating car park from the bus stop/drop off area<br>> having at grade or grade separate cycle and walking paths.<br>• For rural areas a protective facility such as those with guardrail or fencing is more likely to be appropriate.<br>• Bicycle lanes and paths should:<br>> form a network that connects homes, schools, and other points of interest<br>> be well integrated with footpath crossings and bridges, and allow safe crossing of roads<br>> not require the bicyclist to dismount frequently. |
| **Considerations/ issues** | • Will separation prohibit normal use of the facility?<br>• They are unlikely to be used where the walking distance is more than 50 percent greater than the at-grade distance.<br>• Is there enough space on site to provide separate facilities?<br>• They are unlikely to be used if children or caregivers do not feel that they are safe.<br>• Pedestrians can feel vulnerable using underpasses due to limited natural surveillance.<br>• They are costly to construct. Approval of this level of infrastructure would require a cost benefit analysis to be undertaken.<br>• They are only effective if pedestrians perceive the route easier or faster than an at- |

| | |
|---|---|
| | grade option and may require restrictions of other options which could put pedestrians at risk.<br>• They can result in increased vehicle speeds.<br>• They may be prone to vandalism. |
| **Benefits** | • Separating different modes improves the safety for more vulnerable types of transport, such as walking and cycling.<br>• They allow pedestrians to cross a busy road or highway safely.<br>• They reduce delays for both pedestrians and vehicles.<br>• They maintain community links that may be severed by a busy highway or road. |
| **References and guidelines** | • Transport Agency, 2007; Pedestrian Planning and Design Guide.<br>• Queensland Government , 2006; Planning for Safe Transport Infrastructure at Schools. |

## D4: Sight distance – intersection and access

| | |
|---|---|
| **What it is** | • Sight distance at an intersection is needed to allow intersecting traffic to identify gaps in the through traffic stream and to allow through traffic to anticipate and accommodate traffic turning in or out of an intersection or access.<br>• Adequate site distance is a key part of the safety performance of an intersection/access. (Further analysis on safety performance will be completed as part of the high-risk intersection guide).<br>  <br>Sight distance restricted by vegetation looking from side road onto SH27 |
| **Application** | • The following low-cost solutions may be implemented to restore or improve the sight distance at intersections: (Austroads Engineering Toolkit), (LTSA, 1990).<br>• Remove/cut back the vegetation.<br>• Relocate structures that impede sight distance (signs, safety barriers).<br>• Flatten embankment or batter.<br>• Bring forward the limit line, if this can be done safely. |

| | |
|---|---|
| **Considerations/ issues** | • They can be difficult to achieve in rural areas as a low-cost measure due to nature of the road.<br>• If too much sight distance at intersections is achieved this can sometimes create 'rolling start' type movements, where drivers become complacent and make an early decision to pull out of an intersection before correctly assessing the distance of approaching traffic. |
| **Benefits** | • Improved lighting<br>> 30% reduction in casualty crashes (Austroads Engineering Toolkit)<br>> 28% reduction in total crashes (PIARC ,2009) |
| **References and guidelines** | • PIARC, 2009., Catalogue of design safety problems and potential countermeasures,<br>• Austroads Engineering Toolkit > 'Treatment type: Sight distance improvements – intersections',<br>• LTSA, 1990; 'Guidelines for the implementation of traffic control at crossroads RTS 1', |

## D5: Lane narrowing effect

| | |
|---|---|
| **What is it** | • Reducing the width of existing vehicle lanes by marking wider edgeline, striped shoulder and central flush medians can create an optical illusion to drivers, which can reduce vehicle speeds.<br>  <br>Source: Google Maps, Pro Licence- State Highway 27 |
| **Application** | • Marking either a centre line or an edge-line or both on a road can help to channelize vehicles using the road |
| **Considerations/ issues** | • What types of vehicles are using this road?<br>• Will the lane width be sufficient for them?<br>• Is the 'extra' road space gained by narrowing the lane width better utilised in a wider shoulder or as a diverged centreline? |
| | |

| | |
|---|---|
| **Benefits** | • They can have the effect of reducing vehicle speeds and therefore improve safety for all road users<br>• They can influence where vehicle position themselves on the road therefore improve safety<br>• They provide a central area if a flush median is used for cars to turn and for active road users to stand while waiting to cross the road |
| **References and guidelines** | • See all road marking treatments within this guide |

## D6: Wider shoulders

| | |
|---|---|
| **What it is** | • A sealed or unsealed shoulder provides drivers with an appropriate surface on which to regain control of an errant vehicle and for pedestrians and cyclists to use if necessary.<br>  |
| **Application** | • Historically they have aimed for consistent corridor shoulder widths.<br>• The greatest benefits for overall rural road safety may come from widening on curves. Particularly on the outside of curves.<br>• For rural schools, they offer wider shoulders within the network of roads the journey to school may take. |
| **Considerations/ issues** | • Shoulders should not be too wide (greater than about 2m) or drivers may use them as an additional lane and benefits can reduce. |
| **Benefits** | • 25% casualty reduction for widening shoulder to less than 1.2m (RTA, 2010).<br>• 35% reduction of casualty crashes for widening sealed shoulder to greater than 1.2m (RTA, 2010).<br>• They allow drivers to pull off road in emergency situations or for emergency vehicle access.<br>• Sealed shoulder can be used by cyclists and pedestrians. They reduce edge break and water ingress – and hence can lengthen the life of the pavement. |
| **References and guidelines** | • RTA ,2009;  Delineation Section 15. |

## D7: Coloured surface treatments

| | |
|---|---|
| **What it is** | • Coloured surfacing applied to a section of road to inform the driver of a change in environment or a hazard. Green is often used to mark out cycle lanes.<br>• The coloured surface can be combined with either a high skid surfacing material or normal road seal.<br>  <br>High friction surface<br>  <br>Coloured surfacing |
| **Application** | • A coloured surface is applied to areas to define or highlight the use of that space.<br>• High friction surfaces are used at sites of conflict such as intersections and accesses, or along routes to indicate specific lanes. |
| **Considerations/ issues** | • Surface can colour fade and therefore lose effectiveness.<br>• It is more expensive to maintain than standard surfacing. |
| **Benefits** | • To reduce operating speeds and raise awareness of conflict points or routes travelled.<br>• To reduce stopping distances on approaches to intersection. |
| **References and guidelines** | • Transport Agency, Cycle Network Planning Design Guide.<br>• Transport Agency, Technical Specifications. |

### *Design of facilities/access/parking and traffic movements within the site*

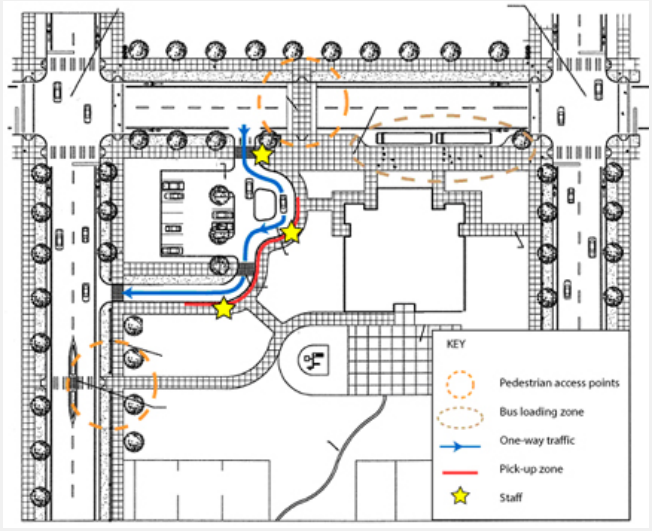
## SC1: Retrofit of existing schools

| | |
|---|---|
| **What it is** | Redesigning of existing transport infrastructure at school site to improve safety through better traffic flow and provision of facilities. |
| **Application** | Some schools have either been built with little regard for the type of access to and from the school sit and are currently not up to best practice, or were established when road safety related issues were considered a low risk (low traffic volumes etc.). A gradual increase in traffic volumes over the years may have triggered a number road safety concerns. As a result, schools now have to retrofit solutions around the existing layout to alleviate these road safety issues. |
| **Considerations/ issues** | Some of the following issues/ layout facilities need to be considered when developing a plan for the school:<br>• Drop off/pick up zones:<br>> Establishes a drop-off/pick-up zone where parking for longer than two minutes is not permitted. They inform and educate parents/caregivers of the parking restrictions. This should be followed up by monitoring and enforcement if necessary by the school. Each area with specific parking restrictions should be well marked and signed.<br>• Short-long term parking:<br>> Clearly marked parking bays will guide parents to park responsibly and safely. Angle parking is the most space efficient parking layout but requires vehicles to reverse which can create a hazard to students.<br>> Encourage parents to park a short distance away from the school and walk the remaining distance to the school gate. Discuss with your RCA about installing footpaths and crossing facilities (if applicable) to promote and encourage use.<br>> Consider creating a one-way traffic flow system for existing car parks.<br>> Consider the possibility of staggering start and finish times of each school grade to alleviate traffic congestion.<br>• Utilising available parking areas:<br>> Rural schools are often located near community halls or grounds where there may be an existing car park available for use. If usable, encourage parents or staff to use this parking space to reduce congestion immediately outside the school. These car parking spaces can reduce congestion directly outside the school but will require adequate links (accessible footpaths, lighting etc.) to encourage use.<br>• Alternative modes<br>> Encourage students and staff to cycle by providing safe access to and from the school by installing cycle lanes, footpaths or shared paths and designated access into the school grounds. Safe access to and from the school is vital to encourage alternative modes without requiring them to arrive and depart the school grounds flanked by vehicles and buses.<br>> A safe and secure area for students and staff to leave their bicycles unattended is a necessity. On-going theft of bicycles will deter those currently cycling as well as those considering cycling. |

| | |
|---|---|
| | • Reducing traffic congestion<br>> Encourage parents/caregivers to car pool with other families living nearby.<br>• Encourage students to walk, scooter or cycle to school if it is safe to do so. This could include organising a walking school bus or parents and caregivers cycling to school with their children.; however this may be difficult in rural areas<br>• Perceived safety of children walking or cycling to school is generally perceived to be low. |
| **Benefits** | • There is a reduction in traffic congestion around school.<br>• There is a reduction in the risk of pedestrian to vehicle conflict.<br>• There is a reduction in traffic volumes accessing the school daily, therefore reducing volumes on a local and regional scale. |
| **References and guidelines** | • Transport Agency, November 2009; - Walking School Bus |

## SC2: New development

| | |
|---|---|
| **What it is** | Designing transport infrastructure for new schools requires careful planning and analysis of future growth in the local area to determine future traffic volumes and potential school roll growth. |
| **Application** | • Greenfields sites allow planners and designers to design school parking facilities to accommodate expected traffic volumes that are likely to access the school daily.<br>• The need for new or upgraded car parks may be triggered by new teaching spaces for roll growth space. In the new teaching spaces budget, boards are given a site works allowance for each roll growth classroom to pay for new car parks. The council may require a traffic impact assessment be undertaken.<br>• There are no policies in place by the Ministry of Education (MoE) indicating the number of car parks required per school but RCAs may have requirements stipulated in their District Plans, which would apply to any new development at the school that requires a building consent.<br>• NZS 4404:2010 Land development and subdivision infrastructure can be used for additional information on any proposed development.<br>• Separation of transport modes will minimise the risk of conflict between all road users. This includes establishing bus parking areas separate from private vehicle parking, and creating multiple points of access for pedestrians and cyclists separate from vehicles. The figure below shows an example of an efficient traffic system layout. |

| | |
|---|---|
| |  |
| **Considerations/ issues** | • With Greenfields development, space is often limited and education facilities and classrooms are likely to take priority (physically and financially) over car parking priorities.<br>• Schools encourage the use of school bus transport and other modes (if it is safe to do so) which will place limitations on car park sizes.<br>• School roll growth can be underestimated due to a sudden surge in growth in the area (new subdivision, commercial or residential). |
| **Benefits** | • They minimise the risk of pedestrian – vehicle conflict.<br>• They encourage compliance of good road safety practices. |
| **References and guidelines** | • Ministry of Education Website – Property Toolbox/.<br>• NZS 4404:2010 Land development and subdivision infrastructure. |

## SC3: School travel plans

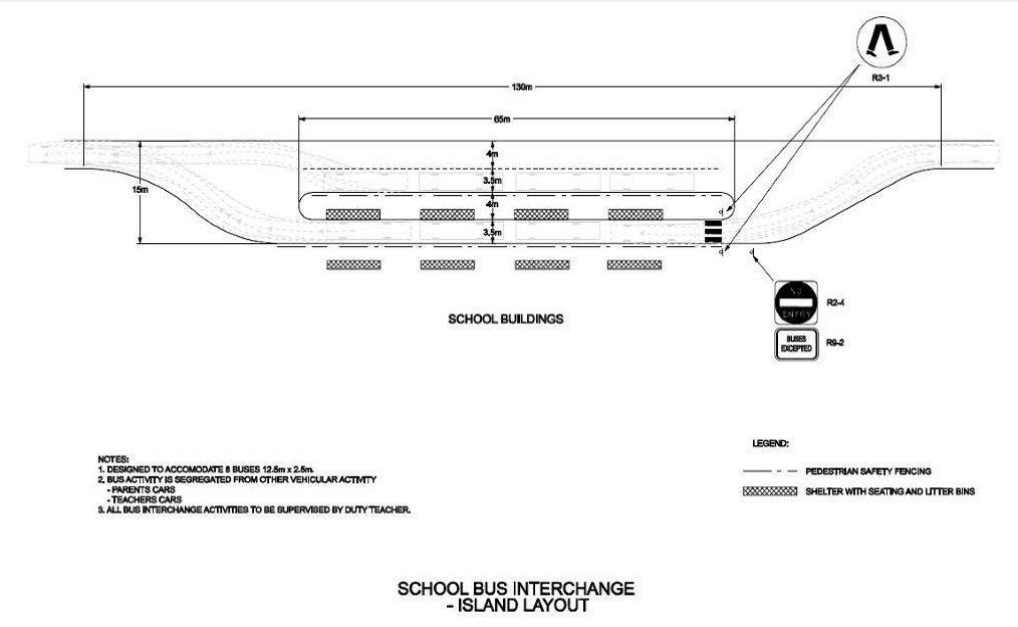
| | |
|---|---|
| **What it is** | A school travel plan (STP) is a document prepared and implemented by the entire school community. It provides an opportunity for parents/caregivers, schools and the community to work together to improve safety around their school. |
| **Application** | Establishment of a school travel plan which is prepared, adopted and implemented by the school community can often be the first step towards improving road safety around a school.<br>Travel plan process<br>Set up phase<br>• A working party is formed which should include: the school travel plan coordinator, Principal and/or teacher(s), parent representative(s), and may also include the Coordinator from the RCA, police education officers, local council roading engineers and other interested parties.<br>Data collection phase<br>• Students are surveyed to establish current travel habits and modes of transport to and from school.<br>**Action planning phase**<br>• The working party determines the aims of the school travel plan and develops an action plan and strategies to help achieve these aims. Students take part in a fun, interactive mapping exercise, which helps them to understand the aims of the school travel plan and look for ways of adopting more active modes of travel on their journey to and from school.<br>**Implementation phase**<br>• Work begins on implementing the aims of the school travel plan as identified by the working party and the action plan.<br>**Monitoring phase**<br>• On-going monitoring is carried out by the working party and the students to ensure that the aims of the school travel plan are being achieved and the action plan reviewed.<br>• Parents and caregivers are kept informed of all phases of the school travel plan through the school newsletter, noticeboard and/or website. |
| **Considerations/ issues** | • For the school travel plan to be effective in the long term, the entire school community needs to buy in to the idea and make it work. Therefore the school community including parents/caregivers, students, teachers, school staff and Board of Trustees should prepare the plan from the beginning and agree on all policies and procedures. Establishing buy-in from the outset lays the foundations for a successful travel plan.<br>• Report near misses so hazards can be identified and solutions can be found. Minimise, Isolate, or eliminate hazards.<br>• Engage with the school community to find ways to create incentives for parents/caregivers to improve road safety around the school during start and finish times. Reward good behaviour.<br>• 'Lead by example' - ensure all school staff comply with road safety rules as established |

| | |
|---|---|
| | by the school. Parents and caregivers will lose respect for school policy and procedures if they see school staff not adhering to the rules.<br>• Reward good behaviour. |
| **Benefits** | • Benefits to the school include:<br>> improved safety for students on their journey to and from school<br>> reduced traffic congestion at the school gate<br>> sets an example for being socially and environmentally responsible<br>> helps to develop relationships with the local community.<br>• Benefits to parents/caregivers include:<br>> reduced time spent in the car<br>> cost savings<br>> fitter, healthier children.<br>• Benefits to students include:<br>> improved health and fitness levels<br>> increased road and personal safety skills<br>> helps to develop confidence and independence<br>> creates a greater connection with the local community<br>> greater awareness of the environment.<br>• Benefits to the community include:<br>> reduced air pollution<br>> reduced traffic congestion around schools<br>> fewer cars on the road. |
| **References and guidelines** | • Transport Agency, Travel plan Coordinators Guide, 2011(b).<br>• Ministry of Education - Property Toolbox. |

## SC4: Parking and conspicuity of school buses/vehicles at school

| | |
|---|---|
| **What it is** | • Improving the visibility of school buses and providing safe areas and facilities for when they are loading and unloading children both at school and at bus stops along its route.<br>• Establishing a school parking layout that will allow buses to arrive and depart from the school without the risk of pedestrian to vehicle conflict.<br>• Most of the following information is summarised by the report by Peter Baas, Research report 408 for the Transport Agency. It is recommended to reference this report for further detailed information on school bus safety.<br>• See also SC5 : School Bus Routes. |
| **Application** | • The figure below shows the Island layout where buses enter at one end and exit at the other. The island layout consists of a boarding and alighting island which services two |

lanes of buses. The island is connected to the school by a pedestrian crossing. Buses operate on a first in first out basis and can accommodate up to eight vehicles. Island should ideally be 4 metres wide to accommodate passenger queues, bus shelters and guard railing but is possible for students to muster off the island and move onto when the bus is ready to depart to avoid congestion. (Baas, P; 2010)




SCHOOL BUS INTERCHANGE
- ISLAND LAYOUT

**Considerations/ issues**

- Construction of any of the school bus stop layouts will require sufficient space, which established schools may not have. Variations of the layout could be designed to create separate zones for buses and private vehicles within the proposed layout.
- Unsafe parking practices by parents and caregivers may be brought on by the lack of parking within reasonable close proximity to school. This can result in double parking, parking in bus bays or blocking access ways. Alternative parking should be made available and well communicated to parents and caregivers.
- Schools that have a car park within the school grounds could consider installing a raised controlled crossing such as a zebra crossing (within a car park) if students are required to cross vehicle lanes to exit the school or reach their transportation. A raised zebra crossing will improve visibility of pedestrians as well as act as traffic calming for vehicles.
- Bus stops/bus bay provision is designed to cater for the anticipated school student population. The following factors determine if a bus bay is required:
  - > expected final demand
  - > existing and potential cyclist and pedestrian catchment area
  - > potential students living outside the catchment area
  - > age of students
  - > bus size.
- Allocation of space for parent's vehicles and cycle storage (if applicable).
- Minimise the need to undertake higher-risk manoeuvres such as U-turns, or turns at locations with restricted vision, and on narrow roads.

| | |
|---|---|
| **Benefits** | • They reduce the risk of pedestrian-vehicle conflict.<br>• They improve road safety for all road users including school children. |
| **References and guidelines** | • Transport Agency, 2008 Research Report 408: School Bus safety.<br>• Transport Agency – Siting School Bus stops - http://www.nzta.govt.nz/resources/siting-school-bus-stops/docs/siting-school-bus-stops.pdf. |

## SC5: School bus routes and stops

| | |
|---|---|
| **What it is** | • Improving the visibility of school buses and providing safe areas and facilities for when they are loading and unloading children at bus stops along its route.<br>• A school bus stop located on or near the roadside or carriageway in a rural area.<br>• Most of the following information is summarised by the report by Peter Baas, Research report 408 for the Transport Agency and the Transport Agency's *Guidelines for the safe siting of school bus stops* It is recommended to reference these report for further detailed information on school bus safety and bus stop locations.<br>• Refer also SC4: Parking and conspicuity of school buses/vehicles at schools. |
| **Application** | • Identify safe locations to locate rural bus stops by identifying potential hazards to children and to other road users as a result of the bus stop being there. |
| **Considerations/ issues** | At bus stops on the bus route (rural)<br>• Choosing safe and convenient bus stop locations in rural areas is important. Further, there are a number of principles that can be followed to ensure child safety when getting to and from school buses.<br>• Eliminate the need for students to cross the road to reach their homes:<br>> rearrange bus routes, where possible, to allow all children to be dropped off on the same side of the road to their house or road<br>> encourage parents and caregivers to walk with their children to bus stops and be present to walk their children home when they are dropped off<br>> improve existing bus stops by providing an area for parents to park their vehicles while waiting for the bus.<br>• Prevent students from heedlessly crossing the road:<br>> if crossing the road is necessary, ensure children are supervised.<br>> educate children on road safety and crossing the road safely.<br>> encourage students to wait until the bus has pulled away before attempting to cross the road.<br>• Reduce vehicle speeds passing school buses:<br>> Carry out awareness campaigns through school newsletters & social media to remind the community of the 20km/hr speed limit required when passing a school bus that has stopped to allow students on or off the bus. |

| | |
|---|---|
| | **Rural bus stops and turning points**<br>• Bus stops should ideally be located with the following features:<br>> good visibility of oncoming traffic for drivers and children required to cross the road. See detailed visibility requirements within the Transport Agency's '*Guidelines for the safe siting of school bus stops"*<br>> adequate pull-in area (wide shoulder) for the bus to pull off the road. Where this is not possible, adequate visibility of the bus stop is essential.<br>> identify hazards getting to the school bus stop - Inadequate shoulder widths, one-way bridges etc. Minimise, isolate or eliminate hazards or consider relocating the bus stop.<br>> space for students to stand back from the road<br>> adequate space for parent/caregiver vehicles<br>protection from the elements – provision of bus shelters which also increase visibility of students.<br>**Bus stop assessments**<br>Undertake an assessment of all bus stops en route to identify any hazards that could be easily remedied. A checklist of requirements is provided within the Transport Agency's *Guidelines for the safe siting of school bus stops.* This considers the following factors when selecting a location for a bus stop:<br>• traffic volumes – specific to that location<br>• number of students using the bus stop<br>• available alternative sites<br>• requirements for appropriate warning signage if topography is constrained<br>• identify number of bus stops en route and space efficiently to minimise disruption to other road users<br>• minimise the need to undertake higher-risk manoeuvres such as U-turns, or turns at locations with restricted vision, and on narrow roads.<br>**Consultation**<br>It is important that consultation is included as part of the process in selecting a safe bus stop. Key stakeholders to consider discussing with include the school bus operator, driver of the route, local engineers, school, police and the Transport Agency. |
| **Benefits** | • Well placed bus stop areas reduce the risk of pedestrian-vehicle conflict and improve road safety for all road users including school children.<br>• Reduction in school peak traffic. |
| **References and guidelines** | • Transport Agency, 2008 Research Report 408: School Bus safety.<br>• Transport Agency – Siting School Bus stops - http://www.nzta.govt.nz/resources/siting-school-bus-stops/docs/siting-school-bus-stops.pdf. |

## SC6: School policy and procedures

Parents/caregivers, children and other members of school communities can do a great deal to keep themselves safe when travelling to and from school. Clear policies and procedures, enforcement and embedded education taking Transport Agency's 'whole of school' approach are key examples.

Establishing and practicing school road safety policy and procedures for parents/caregivers, teachers, staff and students to follow can provide clear expectations for safe behaviour. Examples include:

- rules for separating pedestrians from vehicle traffic
- clear and regularly enforced expectations about parking behaviour
- following the Transport Agency's procedures for walking school buses and kea crossings
- a policy of parents/caregivers and teachers modelling safe behaviour
- regularly checking compliance with policies and procedures and reviewing them as needed.

## *Enforcement*

### E1: Road enforcement

| | |
|---|---|
| **What it is** | • Compliance of the road rules is required by law.<br>• The police enforce the road rules, including:<br>> speeding<br>> failure to adhere to the road rules<br>> parking Illegally<br>> unsafe practices<br>> restraint use.<br>• The police also undertake road safety education through different interactions with the community. |
| **Application** | • Information on the types and application of road enforcement is generally determined by the targeted enforcement practices and general visible enforcement from the police. However it is necessary for the police to consult the school and its community along with key stakeholders and vice versa to further clarify the issues regarding the journey to and at the school gate.<br>• The police state in their road policing strategy 2011-2015 that 'they will work closely with our communities to identify local problems and hot spots with the aim of preventing known issues from escalating'. |
| **Considerations/ issues** | • Discuss concerns and issues with the police to develop an enforcement plan together.<br>• Ensure local police are made aware of any changes to speed limits outside the school to ensure better compliance from all road users.<br>• Installing no parking signs or marking dashed 'no parking' yellow lines are only likely to be effective if these no parking areas are enforced.<br>• Mark out and installing signs identifying school bus parking bays to avoid parents using the space for parking.<br>• Place school staff at key points to manage and monitor the behaviour of school traffic and students. |
| **Benefits** | • Targeted and visible enforcement has significant impacts on road user behaviour and therefore improves overall safety for the journey to and from school. |
| **References and guidelines** | • The New Zealand Police (www.police.govt.nz).<br>• Transport Agency Factsheet 07 Child Restraints (2012) http://www.nzta.govt.nz/resources/factsheets/07. |

## E2: School facilities enforcement

| | |
|---|---|
| **What it is** | • Ensuring that school facilities are used as intended and any unsafe use is monitored and reported on. |
| **Application** | • Enforce road safety by using school staff, parking wardens or police to monitor driving and parking practices.<br>• Enforcement plans can be developed as part of the school's policies and procedures to ensure the maximum compliance with parents and caregivers dropping off or picking up children from school. |
| **Considerations/ Issues** | • School staff or parents to observe and monitor the driving behaviour of other parents and caregivers. They keep a register and report any near misses or unsafe road practices. This information could be given to the RCA.<br>• Request local police attend school start/finish times on a regular basis to monitor speeds and driving behaviour of 'through' traffic.<br>• Improve conspicuity of school by installing school signs (static or variable) that are visible to motorists, cutting back vegetation to allow 'through traffic' to identify they are passing a school.<br>• Provide environment where compliance is self-mitigating rather than directed i.e. localised parking areas, traffic calming and separated roads, parking facilities and footpaths will reduce speeds and remove risk to active road users. |
| **Benefits** | • Improved compliance of the rules will improve overall safety for school children and other road users. |
| **References and guidelines** | • School Travel Plan.<br>• Any other relevant standards and process related to how things should be used.<br>• http://www.minedu.govt.nz/NZEducation/EducationPolicies/Schools/PropertyToolBox/StateSchools/Design/TrafficManagement.aspx . |

## *Vehicles*

### V1: School buses

| | |
|---|---|
| **What it is** | • Travelling to and from school by bus is considered one of the safest modes of travel compared to any other mode of travel.<br>• The current vehicle roadworthiness of the school bus can be a factor in reducing both the number and severity of injury crashes involving school children. |
| **Application** | • The Ministry of Education has information on the following for bus safety in relation to the vehicle. Compliance of the legislative requirements is undertaken by the Transport Agency and the Ministry of Education.<br>• The school bus requirements are generally covered in contracts with the bus operators. They include:<br>> the standards that buses must comply with<br>> up-to-date certificates of loading (and loading limits are not exceeded), fitness, and registration, plus road user charges paid<br>> all appropriate laws, regulations, orders and rules are complied with. Such as ensuring that the appropriate signs are present if transporting school children<br>> ensure the school bus signs are only displayed on buses when the bus has school children travelling on the bus to and from destinations. It is mandatory the 'SCHOOL' sign is removed or folded down while the bus is parked at a destination (outside the school or at an event or specific destination).<br>• The TCD rule allows a school bus operator to use any one of the following four approved signs:<br>  <br>• The 'school' sign can be modified by substituting 'school bus'. The right-hand sign is an active one and is fitted with two flashing LED lights on its top edge (the 'flashing school bus sign'). The driver activates the LED lights and they can be set to flash alternately, or concurrently. |
| **Considerations/ issues** | • Not all school buses are required to be fitted with seatbelts/restraints. Where seats are fitted with a belt/restraint the belt/restraint must be used.<br>• In 2002, Minibuses with 12 or less sets have to be fitted with seatbelts/restraints (Land Transport Rule: 32011 Seatbelts and Seatbelt anchorages, 2002).<br>• Check all relevant standards with regards to responsibility of the bus driver, operator, road users, caregivers, school, police and central government. |
| **Benefits** | • Up to date vehicle standards improve safety for all road users. |
| **References and guidelines** | • http://www.minedu.govt.nz/NZEducation/EducationPolicies/Schools/SchoolOperations/SchoolTransport/SchoolBusSafety.aspx. |

## V2: Private vehicles

| | |
|---|---|
| **What it is** | • That the vehicle is roadworthy – that is the vehicles meets current warrant of fitness standards and it is fit for purpose and the components are at a safe standard.<br>• The vehicle should include appropriate restraints for passengers. Drivers and passengers in a vehicle are required by law to use car seat belts/restraints provided or an appropriate child restraint suitable for age and size of the child. |
| **Application** | • Personal and school vehicles should have a current warrant or certificate of fitness.<br>• It is the driver's responsibility to ensure that every child in their vehicle is fitted with a suitable child restraint. |
| **Considerations/ issues** | • Crash Data shows that 0.5% of all fatal and injury crashes have vehicle factors as the main contributing factor. Of fatal and injury crashes involving light vehicles, approximately 2.5% involve a contributing vehicle defect which could have been identified by a warrant of fitness inspection ( MOT, 2013).<br>• An action in Safer Journeys is to encourage the phasing out of older less-safe vehicles from the fleet. |
| **Benefits** | • Improvements to vehicle roadworthiness will improve safety for all road users.<br>• Properly-used child restraints and safety belts/restraints reduce the risk of death in a vehicle crash by 71% and serious injury by 67% (ACC, 2010).<br>• Reduction in fatal and serious injuries as a result of children wearing no restraints or incorrect or ill fitted child restraints. |
| **References and guidelines** | • Transport Agency Factsheet 07 Child Restraints (2012) http://www.nzta.govt.nz/resources/factsheets/07<br>• To find an approved child restraint technicians who can assist in finding the correct child restrain for your child and vehicle, visit the interactive page on the Transport Agency's website www.nzta.govt.nz<br>• For additional information how to fit and correctly use a child restraint see:<br>> www.safekids.org.nz<br>> www.acc.co.nz<br>> www.plunket.org.nz<br>> www.transport.govt.nz<br>• MOT – Warrant of fitness changes keep vehicles safe with better targeted measures, 2013 |

## *Drivers*

### DR1: Driver training

| | |
|---|---|
| **What it is** | • The education of young drivers (15-24yrs) in safe driving. |
| **Application** | • What process and information is needed to assist young drivers in making informed and safe decisions while driving.<br><br>Detailed information can be found within the Safer Young Drivers: A Guide to Best Practice Education developed by the AA and the Transport Agency http://www.aa.co.nz/assets/about/events/aa-def/pdf/safer-young-drivers.pdf?m=1303802458 |
| **Considerations/ issues** | Some of the key consideration as part of the best practice guidelines are:<br>• Building on other road safety education practices<br>• Meeting the needs of individual participants<br>• Taking a participant centred approach<br>• Education the whole driver<br>• Being responsive to the needs and realities of young people<br>• Using and appropriately qualified trainer<br>• Empowering parents and supervisors<br>• Offering effective delivery methods<br>• Promoting 'eco driving' and alternative transport choices<br>• Having a focus on quality and improvement |
| **Benefits** | • Reduction in young driver crashes |
| **References and guidelines** | • http://www.aa.co.nz/assets/about/events/aa-def/pdf/safer-young-drivers.pdf?m=1303802458<br>• Transport Agency young drivers portal – www.safeteendriver.co.nz. |