Submission

No 25

INQUIRY INTO SCHOOL ZONE SAFETY

Organisation: Department of Premier and Cabinet

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Premier & Cabinet

Mr Greg Aplin MP
Chair
Staysafe (Joint Standing Committee on Road Safety)
Parliament House
Macquarie Street
SYDNEY NSW 2000

Dear Mr Aplin

I refer to the NSW Parliamentary Joint Standing Committee on Road Safety (Staysafe) Inquiry into School Zone Safety.

Please find attached a NSW Government submission.

Should you require further information, please contact Mr Ian Hunter, Acting Executive Director, Infrastructure, Environment and Economic Development Policy, Department of Premier and Cabinet on 9228 5493.

Yours sincerely

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NSW GOVERNMENT SUBMISSION

ON

SCHOOL ZONE SAFETY

October 2011

Inquiry School Zone Safety

NSW Government submission

Overview

The objective evidence documented in this submission shows that the introduction of school zones in NSW has significantly reduced pedestrian casualties, particularly children and young people.

The evidence also suggests that other road safety initiatives, ranging from physical barriers to community and school education campaigns, are complementary to school zones and contribute significantly to improved safety outcomes for school students.

The Government recognizes that there are costs as well as benefits from the operation of school zones. These include requiring motorists to reduce their speed, which can be particularly inconvenient in those cases where school zones operate on main roads. School zones can also lead to localised road congestion which, again, is likely to be most keenly felt on arterial roads.

The evidence available is that school zones are the best roads safety option around schools in most cases, but it is also noted that the same evidence also points to the value of physical barriers, bridges and other road safety measures.

However, each school environment should be considered individually, and where it is feasible and cost-effective, physical barriers and other complementary road safety mechanisms should be employed. Assessment of individual sites and options should include consideration of the impacts on motorists' safety and convenience and on traffic flow.

The Government recognises that the safety of our children and young people is the first and most important consideration. However, the objective of protecting school students' safety should be achieved in a manner that recognises the potential for adverse impacts on motorists and traffic flow, and limits these impacts where possible.

1 Introduction

1.1 On 5 September 2011 the Parliamentary Joint Standing Committee on Road Safety (Staysafe) issued its terms of reference in relation to school zone safety.

The Committee will inquire into NSW school zones to determine whether current measures are effective and/or what else can be done to optimise safety for students and simplify school zones for motorists, with particular reference to:

a) The effectiveness of school zones in reducing pedestrian casualties during school zone times;

b) The major contributing factors to pedestrian casualties in school zones;

c) Age as a factor in pedestrian crash risk and the major contributing factors for casualties by age cohort around school zones;

d) The deployment of alternative facilities to reduce reliance on school zones, such as grade separation, traffic lights and fencing;

e) The appropriateness of a single approach school zone regime as opposed to modifying zones based on existing infrastructure and other current safety measures employed around schools;

f) The availability and effectiveness of current road safety education programs in NSW schools; and

g) Any other related matters.

1.2 Background information

More than one million school students are enrolled in NSW primary and secondary schools, and each day they travel to school by different transport modes.

Children and teenagers are considered particularly vulnerable road users due to their physical, cognitive and social development and measures are required to ensure their safety in the road environment, particularly around schools.

Primary school-aged children are particularly vulnerable in the road environment because of their level of physical, cognitive and mental development. However, the risk is reduced with adult supervision.

Secondary school students are vulnerable because of their ongoing brain development, risk-taking behaviour, and inexperience in handling the road and traffic environment independently without the supervision of parents.

The NSW Government has adopted a Safe Systems approach to ensuring the safety of children around school access points.

The Safe Systems approach accepts that people using the road network will make mistakes and therefore the whole system needs to be more forgiving of those errors. This means focussing on safer speeds, safer roads, safer vehicles and safer road user behaviour.

At the centre of the Safe Systems approach for the safety of children around schools is the application of 40km/h speed limited school zones at all school access points across NSW. This is designed to protect child pedestrians by slowing down motorists and reducing both the risk of a crash and its severity, should one occur.

A small reduction in speed significantly reduces the risk of a pedestrian being killed. Research has shown that lower speeds significantly reduce the chance of a pedestrian fatality in a crash.

In addition, road treatments and pedestrian works are employed to further improve safety as well as pedestrian amenity. These include pedestrian bridges, refuge islands and traffic control devices such as traffic lights.

School zones were introduced in NSW in July 1992 and initially installed generally at the request of the school or school community. School zone speed limits were as follows:

- 60 km/h school zone – within 80, 90 and 100 km/h speed zones.
- 40km/h school zone – within 50, 60 and 70 km/h speed zones.

The initiative was expanded, with a school zone with a 40 km/h speed limit applied at every school in NSW by the commencement the 2003 school year.

Most school zones across the State operate from 8:00 am to 9.30 am and 2.30 pm to 4:00 pm on school days. School zones are identified with signage that has been prescribed by the Australian Road Rules. These signs are complemented with large yellow painted 40 km/h road patches in both directions of a school zone, to alert motorists to the presence of a school zone.

There are currently about 3,154 schools in NSW supported by more than 10,000 school zones, including 26 school zones with non-standard operating times.

On 27 July 2011, following the release of the NSW Auditor-General's Performance Audit – Improving Road Safety: Speed Cameras, cameras in six school zones were deactivated. There are now fixed speed cameras issuing infringements in 36 school zones, with cameras issuing warning letters in a further two school zones.

2 The effectiveness of school zones in reducing pedestrian casualties during school zone times

2.1 In 2001, the NSW Government announced that it would implement a 40 km/h speed limit operating on all roads with direct school/educational facility access. By 2003, the policy development had been completed and 40 km/h posted speed limits were implemented at more than 3,000 schools and educational facilities.

Since the introduction of school zones across the State, fatalities and injuries involving school age pedestrians have significantly decreased. This is shown in the Auditor General's Performance Report *Improving Road Safety: School Zones* dated February 2010 and the RTA analysis undertaken for this submission.

The 2010 Performance Audit Report found that fatalities and injuries involving school-aged pedestrians had decreased significantly between 1998 and 2008, in line with the introduction of a range of measures targeting safety around schools. The report stated that:

- RTA figures showed pedestrian casualties, particularly 5 to 16 year olds, have decreased in school zones at a far greater rate than at other locations;
- The RTA has introduced a range of further measures to improve school zone effectiveness; and
- Reducing speed limits in school zones is a trade-off between the safety of vulnerable school children and the convenience of drivers, but the evidence suggests that while children benefit significantly, the inconvenience to motorists is marginal.

A key recommendation by the Auditor-General was that the RTA should retain existing school zone facilities.

The Auditor-General also recommended a number of improvements including:

- signage (including variable message signs) to advise about school zone times;
- pedestrian facilities such as crossing points and overhead structures;
- adjusted traffic signal phasing to allow a longer "walk" time for students;
- pedestrian refuges and fencing to control pedestrian flow and to separate children and traffic;
- additional crossing supervisor locations;
- flashing lights at identified 40km/h school zone locations;
- speed cameras;
- increased penalties for driving and parking offences in school zones; and
- public education for students, parents and the general motoring public.

2.2 Crash data analysis - Trends for School-aged Pedestrian Casualties in School Zones

In March 2009, in preparation for the audit of school zones, the RTA undertook an intensive project to spatially identify school zones using available databases and site visits. Information about crashes at a sample of school zones was made available as part of this project and was used in the analysis below.

The sample consisted of 820 school zones (around one quarter of NSW schools), identified in the Sydney and South West RTA regions and involved crashes occurring at these sites between 1998 and 2008.

The RTA is currently developing the spatial crash analysis across all 10,000 school zones. This work is a resource intensive and complex task which should be available later in 2011.

a) On school days during school zone times

The data analysis found that there have been significant reductions in pedestrian casualties, including pedestrians aged 5 to 16 years, since the implementation of school zones.

During the 11 year study period (1998 – 2008), there was a total of 171 child pedestrian casualties (aged 5 to 16) including one fatality in school zones during school zone times. There was a downward trend in the number of casualties per year, particularly since 2003, as illustrated below. It is important to also note that the overall road toll for NSW also decreased during this time.

Figure 1

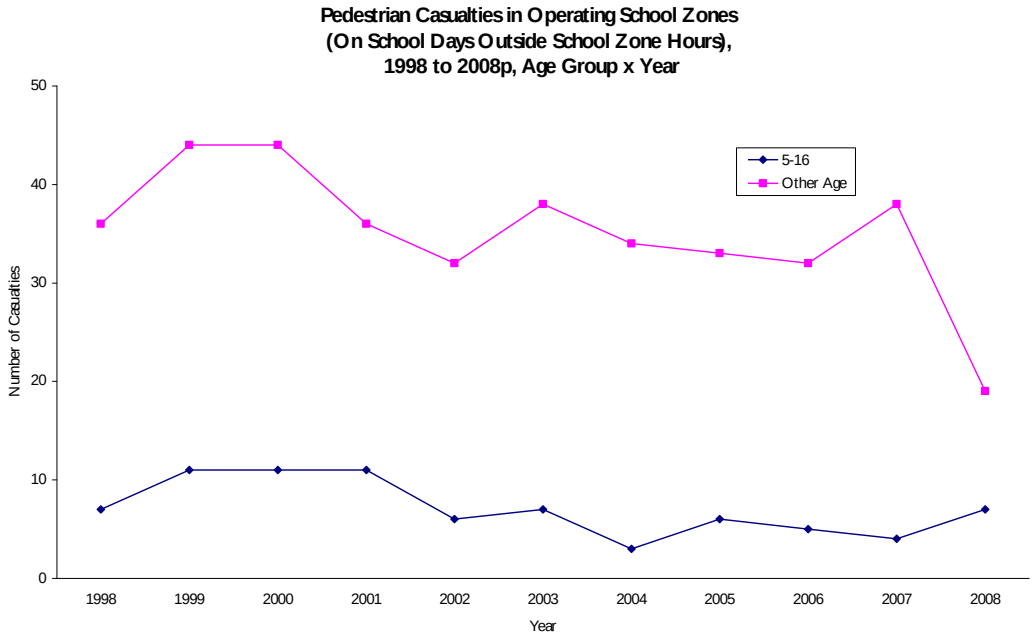
Compared with the period prior to the state-wide rollout of school zones (1998 to 2003), the average annual number of casualties of pedestrians of all ages in the selected school zones decreased by 45% during the post school zone period (2004 to 2008). For pedestrians aged 5 to 16 years there was a 46% decrease over the same period. This result suggests that the benefits of school zones (and the lowering of speeds) applied to all pedestrians and not just school-aged children.

b) On school days outside school zone times

As a contrast to the above, data were analysed for pedestrian casualties in the selected zones on school days outside school zone times.

Up to 2007, there was a decreasing trend for pedestrian casualties aged 5 to 16 years, whilst pedestrian casualties in other age groups were relatively flat. However, in 2008 pedestrian casualties in the other age group decreased by half (from 38 to 19) whilst pedestrian casualties in the 5 to 16 year age group increased (from 4 to 7). Caution must be exercised with interpreting this result because the single year pedestrian casualty figures are small and subject to large variability.

Figure 2



Comparing average annual pedestrian casualty figures for the pre and post school zone periods provides a more robust analysis. All pedestrian casualties in the selected school zones outside school zone times decreased by 30% in the post, compared to the pre period – similar to underlying levels of decrease in all pedestrian casualties in all locations at all times (29%). However, the average annual number of pedestrian casualties aged 5 to 16 years in the selected school zones outside school zone times decreased by 48% - slightly above the decrease in pedestrian casualties aged 5 to 16 years in all locations at all times (41%).

c) Discussion

Compared with other age groups, school-aged children have seen the greatest reduction in pedestrian casualties across the State and in the Sydney and South West RTA regions.

The improvements have been even more pronounced in school zones, both during and outside school zone hours. Interestingly, other age groups have also improved by the same magnitude in school zones during school zone times.

3 The major contributing factors to pedestrian casualties in school zones

3.1 Trends for Crashes by Selected Factor

Like casualties, analysis of the crash data showed that recorded crashes in school zones during school zone times decreased by 35%, from the pre period to the post period. Of particular interest were the trends for speed-related crashes and "congestion/sudden slowing down" type crashes associated with the 40 km/h school zones.

a) Speed-related Crashes

During the study period (1998 to 2008) speed was involved in around 17% of all crashes in NSW, and around 12% in the combined Sydney and South West RTA Regions. In school zones during school zone times speed-related crashes are quite rare, involved in around 5% of all crashes, and only 1% of crashes involving a 5 to 16 year old pedestrian (only 2 out of 166 crashes). The number of speed-related crashes in school zones during school zone times decreased by 20% between the pre and post periods.

b) Congestion / sudden slowing down crashes

Total crashes decreased by 35% between the pre and post period, with pedestrian (-45%) and vehicle opposing (-47%) crashes improving by the largest degree. Congestion type crashes would cover crashes involving parking or manoeuvre road user movement codes, whilst "sudden slowing down" crashes would be covered by rear end road user movement codes. The analysis of the crash data showed that these types of crashes did not increase as may have been expected, but rather they improved at about the average rate – parking (-37%), rear end (-35%) and manoeuvring (-15%) crashes.

c) Breakdown of crash types

Table 1: Road User Movement (RUM) describing the first impact that occurred in the crash

Movement in crash (RUM)	*Number of crashes*
Pedestrian nearside	74
Pedestrian far side	50
Pedestrian emerging from behind parked or stationary vehicle	22
Pedestrian on footpath	7
Pedestrian playing, working, standing, lying on carriageway	6
Pedestrian other	2
Pedestrian walking with traffic	1
Pedestrian hit by vehicle entering or leaving driveway	1
Vehicle turning right	1
Vehicles lane sideswipe	1
Vehicles at cross intersection	1

As shown in the above table, the first impact in the majority of crashes was vehicle – pedestrian. Most of these crashes involved a pedestrian emerging from the kerb to the left of a vehicle (nearside). Other numerous first impact types involved the pedestrian being hit when emerging from the right of the vehicle and emerging from behind a parked or stationary vehicle.

Around 43% of crashes involving child pedestrians were located at intersections.

According to the information in the RTA CrashLink database, 40 of the 166 crashes occurred at pedestrian crossings. Of these, 22 were recorded as having occurred at signalised pedestrian crossings. In addition, 35 crashes occurred at locations that were not recorded as pedestrian crossings, but were recorded as being signalised.

The RTA coding procedure specifies that traffic controls such as pedestrian crossings should be recorded against the crash only if they were relevant to the crash in some specific way. As such, the number of crashes recorded as having occurred at a location with some form of a traffic control was 75, which is a little under half of the crashes.

There are several different types of pedestrian crossings, including zebra crossings and pedestrian walk/don't walk signals at intersections. A crash at the latter may be recorded as having occurred at either a signalised pedestrian crossing, or simply as a signalised location.

None of the crashes in this study sample were recorded to be fatigue or alcohol related. There were however a large number of motor vehicle controllers for whom blood alcohol concentration (BAC) was not recorded (61 of 170), so it is possible that some of these crashes may have been alcohol related. There were a relatively large number (12) of motor vehicle controllers in this sample who left the scene of the crash, which contributes to the large number of unknown BACs and may possibly have been an attempt by a driver to avoid blood alcohol assessment

No u-turn crashes were recorded, nor were any vehicles recorded as performing a u-turn at the time of the crash. In fact, almost 90% of vehicles were recorded as 'proceeding in lane' at the time of first impact.

d) Discussion

In summary, speed-related crashes in school zones, particularly those involving a 5 to 16 year old pedestrian, are relatively rare compared with speed-related crashes across the State. Though relatively rare, speed-related crashes in school zones during school zone times decreased by 20% between the pre and post school zone installation periods. Furthermore, there was no evidence of traffic problems generated by the creation of school zones. In fact, rear end crashes arising from a sudden slowing of vehicles and congestion type crashes involving vehicles parking and manoeuvring in the school zones actually decreased when the school zones were in place.

4 Age as a factor in pedestrian crash risk and the major contributing factors for casualties by age cohort around school zones

4.1 Pedestrian behaviour of primary school-aged children

Primary school-aged children are particularly vulnerable in the road environment, though the risk is often mitigated with close adult supervision. The NSW Government response to pedestrian safety is informed, in part, by studies into the physical and mental development of children and young adults and how this affects their behaviour as pedestrians.

A 2008 research study from Monash University entitled 'Child Pedestrians: Factors associated with ability to cross roads safely and development of a training package' identified that research suggests that between the ages of 6 to 10 children are at highest risk of death and injury, with an estimated minimum four times the risk of collision compared to adult pedestrians.

There are a range of developmental factors that place primary school-aged children at particular risk in the traffic environment. These cognitive, gross motor and social skills develop chronologically and sequentially. Cognitively, for young children under 10 years of age the strategies, skills and understandings of road safety and traffic environment are not yet fully developed. It is between the ages of 6 and 10 years that children develop the ability to plan ahead, understand rules, consider consequence of actions, follow a logical sequence of thought, determine between right and wrong (Tyson 2002).

Crossing the road requires cognitive skills that utilise problem solving skills, to identify a safe place to cross, visual scanning skills, estimating vehicle speed and distance and predicting when the vehicle will pass by.

Children also have limited ability to judge speed, have limited peripheral vision and limited ability to locate the direction of sound. Physically, primary school-aged children are smaller in stature than adults and this limits the driver's ability to clearly see them in the complex traffic environment.

As pedestrians, young children experience difficulty:

- in the ability to select a safe gap in traffic;
- in determining a safe place to cross; and
- identifying hazards in the road environment.

A child pedestrian research study by Monash University (Congiu, Whelan, Oxley, Charlton, D'Elia and Muir 2008) identified age was a strong predictor of an incorrect crossing decision, with six year olds almost 12 times more likely than 10 year olds to make a critically incorrect decision.

Young children may also over-estimate how quickly they can cross the road. This is consistent with research that shows that children often over-estimate their abilities, and that 6-year olds who over-estimate their physical abilities are more at risk for injury (Plumert, 1995 cited in Congiu, Whelan, Oxley,

Charlton, D'Elia and Muir 2008). Children also assume that the driver can see them and will stop.

Briem and Bengtsson, 2000 (cited in Congiu, Whelan, Oxley, Charlton, D'Elia and Muir 2008) investigated how children's understanding of traffic safety influences their behaviour in traffic situations, and how their behaviour may be affected by character traits. Their findings suggested that the quality of children's safety knowledge, understanding and behaviour improves markedly with age.

The increasing use of technology such as mobile phones and other electronic devices such as personal audio and other media devices also provide other challenges for decision making for pedestrians when crossing the road. One study among 10-11 year old children found that when using a mobile phone they paid less attention to the traffic, left less safe time between their crossing and the next arriving vehicle; and waited longer before beginning to cross the street (Stavrnos et al, 2009).

The safety of child pedestrians in the traffic environment is improved when they are accompanied and actively supervised by a responsible adult. Children benefit from an adult's height, road safety experience, perceptual capabilities and decision making skills. This also is an opportunity for parents and carers to provide training in the road environment. Such an approach also addresses the needs of an individual child and the nature and complexity of the local traffic environment, and raises parental awareness of their individual child's understanding and limitations.

The RTA promotes a range of messages to children and parents to address the cognitive and behavioural limitations of children in traffic. For example: a key message for children under 8 years of age is to 'hold an adult's hand'. A child's behaviour in the road environment may be unpredictable, particularly if they are distracted by something that interests them. This key message provides parents with a strategy to minimise the risk of this situation. It also provides an opportunity for the adult to explain and model appropriate and safe pedestrian behaviour. This ongoing supervision and regular reinforcement and guidance builds the primary school child's knowledge and understandings of the correct use of pedestrian facilities, the key risks or dangers and safe practices to observe as a pedestrian in the traffic environment.

The RTA also makes available to primary schools 'Safe School Travel' and 'Bus Safety' booklets designed for parents and carers. These pocket-sized booklets outline the key safety messages for children and provide parents and carers with strategies to support safer travel. Copies are available from the RTA Customer Call Centre on 132 213. These resources are also available on the My Resources section of the RTA's website.

The NSW School Road Safety Education Program provides a range of age-appropriate road safety messages and strategies to primary school-aged children through the RTA *Move Ahead with Street Sense* resource. A range of parent notes also promote the key safety messages and strategies to be reinforced for safe travel in the road environment.

4.2 Pedestrian behaviour of secondary school-aged children

The road use behaviour of secondary school students is greatly affected by their cognitive and social development. For young people there are a range of factors that contribute to their increased risk of injury in adolescence, including their road use behaviour and the road traffic environment.

In the RTA's Submission to the 2009 Staysafe Committee Inquiry on Pedestrian Safety, Youthsafe identified the following risk factors for adolescents as:

- the still maturing adolescent brain particularly those areas responsible for identifying risks and making better judgements about how to manage risks which are not fully mature until the mid to late 20s;
- new levels of independence and responsibility;
- inexperience with new activities and with alcohol/drugs;
- the strong influence of peers;
- attitudes and behaviours established early on in a young person's life;
- a desire for experimentation and thrill seeking.;
- societal expectations of young people as risk takers;
- common beliefs in young people about their inability to control safety; and
- fatigue due to busy lifestyles which often include a combination of study, work and socialising and a potential for new media to impact on sleep obtained by young people.

Young people in this age group (12-14 years of age) are usually travelling more independently, without adult supervision to high school. High school students may also use several modes of transport, travel longer distances and travel in more complex road environments.

Research into adolescent pedestrian injury fatalities by (Elliot & Baughan, 2002; Chin et al, 2004) found that typically they were not behaving in very risky ways when the fatality occurred, however common types of behaviour involved choosing unsafe places to cross and crossing against traffic lights. Several fatalities also occurred while attempting to cross dual carriageway roads away from crossing facilities

High school students may also experience greater distractions with engagement with new friends as they travel in groups. One study into group behaviour of mid-adolescent pedestrians found that they appeared to be more at risk than older or younger children due to more 'planned' risky behaviour. Small groups of 2-4 pedestrians (a common group size when young people are walking together) seemed to be particularly vulnerable to injury incidents and looking both ways before crossing often did not occur in groups of this size (Chin et al 2004).

Research from West, Train, Junger, Pickering, Taylor and West (1998) identified that young adolescents overestimate their abilities in more challenging road environments because they are less used to these (i.e. their perception of their own competence has been shaped in less difficult conditions and therefore fails to match their actual competence in the

circumstances to which they are now routinely exposed). Additionally, parents frequently overestimate the abilities of their children as road users. They pay inadequate attention to the effectiveness of their judgements, because they simply assume (with peer support) that they are able to cope. The increased influence from the peer group and reaction against parental standards results in a growing perception that riskier behaviours are the accepted norm, and a feeling that it is childish to behave carefully. The net effect of this is less careful road-crossing behaviour and a more general espousal of risk-taking as part of self-identity.

Overseas research from Lynam and Harland, 1992; Platt, 1998 and Platt et al., 2003 found clear indications that the transition to high school results in increased demands on children's abilities. Secondary schools are generally located in busier areas and may require children to travel longer distances. In the early teenage years children may also be experiencing greater independence and less parental supervision of their travel patterns. Reflecting these findings, substantially lower injury rates have been found to occur in countries with higher levels of traffic calming, including lower urban speed limits (30km/h) and road safety systems that put greater responsibility on drivers for the safety of cyclists and pedestrians (Fedtke 2003; Christie et al 2007; Pucher and Buehler 2008 cited in Garrard, J, 2011).

An emerging road safety issue is the use of devices that cause distraction to pedestrians and drivers. The use of mobile phones and electronic devices with increasing functionality provides a further challenge for road safety. Like drivers, all pedestrians need to be vigilant and maintain full awareness of their surroundings. Personal media devices such as mobile phones and music devices can be a distraction to pedestrians, which potentially impact on their safety. Several research studies have found that using a mobile phone while crossing the road results in slower crossing, with decreased attention. This may result in dangerous behaviours such as walking out in front of oncoming traffic.

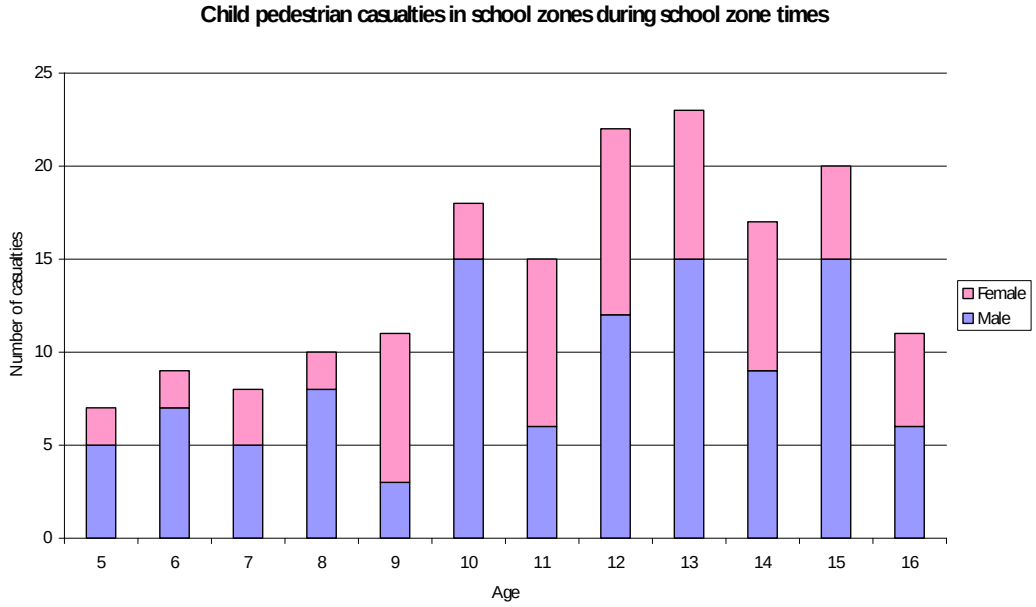
The NSW Road Safety Education Program is the key educational strategy to influence positive road use behaviour.

4.3 Child Pedestrian Casualties by Age

The majority of child pedestrian casualties in the school zone sample were male (60%), with the average age around eleven and the most frequent age, thirteen (23 of the 171 casualties were aged 13).

The graph below indicates that the majority of child pedestrian casualties are aged from 10 to 15.

Figure 3


Child pedestrian casualties in school zones during school zone times
Number of casualties
25
20
15
10
5
0
5
6
7
8
9
10
11
12
13
14
15
16
Age
Female
Male

5 The deployment of alternative facilities to reduce reliance on school zones, such as grade separation, traffic lights and fencing.

5.1 Local traffic management treatments

The fundamental premise of pedestrian safety is to minimise any conflict between pedestrians and vehicles. In terms of infrastructure, this can be achieved via regulatory devices such as pedestrian signals at traffic lights, marked pedestrian crossings (e.g. zebra crossings), children's crossings or via a range of crossing treatments such as pedestrian bridges or underpasses, kerb ramps and extensions, pedestrian refuge islands and pedestrian fencing.

The most safety-effective treatments physically separate pedestrians and vehicles. However physical separation is not always practicable. Alternative solutions include improving stopping distances by early detection of pedestrians and lower speed limits.

Improved safety from other crossing treatments may be achieved by enhancing pedestrian access and aligning crossings with pedestrian desire lines, reducing crossing distances, and improving visibility for both pedestrians and drivers. Traffic calming devices also contribute to pedestrian safety by slowing traffic and raising driver awareness of the likely presence of pedestrians.

In considering engineering treatments, it is important to assess the impact of the infrastructure at all times, such as the impact on traffic flow and not just during school zone times.

Many localised treatments are undertaken across the State every year which improve pedestrian safety. Such works include the installation of pedestrian crossings (both signalised and non-signalised), pedestrian refuge islands, kerb ramps, audio and tactile devices at signalised crossings, adjustment of signal phasings to increase the time to cross, kerb extensions, line marking, pedestrian fencing, signage, and pull-over bays. Many of these treatments may be utilised in school zones and are detailed below.

The RTA implements a range of measures to assist pedestrians with disabilities. For example, the installation of audio tactile push buttons at traffic signals to assist vision impaired pedestrians and tactile paving on kerb ramps.

The nature of the treatment is dependent on the best solution for the individual traffic environment and local issues. Based on literature reviews and crash data research, the RTA has formulated the following matrix, showing the relationship between various treatments and the anticipated reduction in pedestrian crashes. This tool is used to assess the effectiveness of measures to address pedestrian safety. Given the limited financial resources, it is important that priority be given to road and traffic engineering measures that offer the greatest potential for crash prevention or reduction in crash severity.

The matrix is used to model the percentage change in crash rates and to assess road safety benefits derived from different treatments. It is utilised to justify individual projects and specify the benefit of incorporating road safety treatments into a range of maintenance and upgrading works. If a cell is marked in grey, this means that the treatment cannot be applied in that speed zone.

Values for each countermeasure are listed in the table below. These values represent the percentage change (reduction or increase) associated with various treatments.

Table 2: Crash Treatment Reduction Rates Matrix

Crash Group Number:17	RUM Code groups: 00-09	Crash Description: Hit Pedestrian

Speed zone		≤ 60km/h	70km/h or 80km/h	≥ 90km/h
001	Roundabout 1-Lane	75	75	
002	Roundabout 2-Lane	75	75	
003	Install new traffic signals, filter turns allowed	5	5	
004	Install new traffic signals, no filter turns allowed	30	30	
005	Install fully control right turn with arrows	30	30	
006	Introduce right turn phase while leaving filter	5	5	
007	Upgrade signal display, mast arm/additional lanterns	10	10	
008	Install mid-block pedestrian signals on high volume roads	30	50	
009	Install mid-block pedestrian signals, pelican, on high volume roads	25		
011	Install mid-block slow point on urban road, raised threshold / horizontal deviation	30		
012	Remove sight distance restrictions at intersection	15	15	15
014	Move limit lines forward using kerb extensions on priority road	20	20	20
018	Separate through and parking lane, with painted line reinforced with kerb blisters	20		
028	Install new "Stop" signs	10	10	10
033	Install street lighting, night time crashes only	10	25	
034	Install intersection lighting, night time crashes only	20	25	30
035	Install lighting at pedestrian facilities, night time crashes only	25	30	
036	Street closure - cross intersection, targeted crashes only	30	30	30
037	Street closure - T intersection	100	100	100
038	Close intersection with median	50	40	30
040	Install a painted median greater than 1.5m wide	20	20	20
041	Install extended length of deflective median, not closing intersection	50		
042	Install extended length of mountable median, not closing intersection	50	50	
043	Install median islands with Additional Priority Signs (MIST)	25	25	25
044	Install a raised threshold at pedestrian crossing	80		
045	Install marked pedestrian crossing	5		
046	Install kerb blisters with marked pedestrian crossing	10		

Speed zone		≤ 60km/h	70km/h or 80km/h	≥ 90km/h
047	Install kerb blisters without marked pedestrian crossing	10		
048	Install pedestrian refuge with kerb blisters with marked pedestrian crossing	20		
049	Install pedestrian refuge with kerb blisters without marked pedestrian crossing	20		
050	Install pedestrian refuge without kerb blisters with marked pedestrian crossing	10		
051	Install pedestrian refuge without kerb blisters without marked pedestrian crossing	10		
052	Install pedestrian fencing on median	50		
053	Install pedestrian fencing on kerb	20		
054	Install pedestrian grade separation	80	90	90
055	Install a seagull island without acceleration lane, painted island	15	15	15
056	Install a seagull island without acceleration lane, raised island	25	25	25
057	Install a seagull island with acceleration lane, painted island	15	15	15
058	Install a seagull island with acceleration lane, raised island	25	25	25
061	Upgrade T junction from no existing treatment to channelised right turn treatment, pavement widening with a right turn lane	10	10	10
063	Upgrade T junction from BAR to CHR	10	10	10
064	Upgrade T junction from AUR to CHR	20	20	20
067	Install a 1.25 m wide painted profile (audio-tactile) centre line		10	10
085	Improve vertical alignment		20	20
086	Improve co-ordination of horizontal and vertical alignments		40	40
104	Reduce speed limit by 10 km/h	30	20	15
105	Reduce speed limit by 20 km/h	40	30	20
106	Install new seal on poor surface, wet surface crashes only	10	10	10
109	Install non-skid surface, wet surface crashes only	20	15	15

5.2 Pedestrian bridges

The RTA provides bridges over arterial roads to improve pedestrian safety and access, particularly in areas of high pedestrian concentration.

Pedestrian bridges cost approximately $3 million each. The provision of bridges at all school zones would be cost-prohibitive.

All pedestrian bridges are required to have access points to the bridge (i.e. lifts or ramps to assist disabled persons or parents with prams). This necessity may require the acquisition of additional land which substantially increases the cost of the bridge.

If the lift fails, there needs to be alternative provisions for disabled persons or parents with prams to cross the road therefore existing pedestrian facilities will remain at the site. This creates the potential for children to continue to use the at-grade crossing.

The success of a pedestrian bridge is dependent on the use of the bridge by pedestrians. While every effort is made to encourage or direct pedestrians to use a pedestrian bridge, pedestrians will often choose the quickest, not necessarily the safest route, to cross the road.

In NSW, there are currently more than 70 bridges in a school zone or in close proximity to a school zone, covering over 80 schools.

To provide some information on the usage of pedestrian overhead bridges, the RTA commissioned pedestrian counts at the following three locations in school zones with a pedestrian overhead bridge:

- Parramatta Road, Burwood (between Park Road and Broughton Street).
- Pacific Highway, Wahroonga (between Coonanbarra Road and Neringah Avenue South) (see photographs below at Figures 4 and 5).
- Princes Highway, Kogarah (between President Avenue and South Street). (see photograph below at Figure 6).

On 15 September 2011, counts were conducted on the number of pedestrians using the overhead bridge and crossing the road 50m either side of the bridge.

The results of the pedestrian counts summarised in the tables below show that a substantial proportion of students use the pedestrian overhead bridges. However, the statistics also show that a number of school children will choose to cross the road at grade rather than use the bridge, particularly where a signalised pedestrian crossing is available.

Table 3: Pedestrian count – Parramatta Road, Burwood, 15 September 2011				
Parramatta Rd, Burwood Between Park Rd and Broughton St	**AM (8-9am)**		**PM (3-4pm)**	
Pedestrian type	**Overhead Bridge**	**50m either side**	**Overhead Bridge**	**50m either side**
School children – accompanied	18	0	30	0
School students – unaccompanied	8	0	7	0
Disabled or impaired	0	0	0	0
Other	33	0	14	1
TOTAL	**59**	**0**	**51**	**1**

Table 4: Pedestrian count – Pacific Highway, Wahroonga, 15 September 2011				
Pacific Hwy, Wahroonga Between Coonanbarra Rd and Neringah Ave Sth	**AM (8-9am)**		**PM (3-4pm)**	
Pedestrian type	**Overhead Bridge**	**50m either side**	**Overhead Bridge**	**50m either side**
School children – accompanied	5	6	5	0
School students – unaccompanied	63	22	240	8
Disabled or impaired	2	1	4	0
Other	9	5	7	0
TOTAL	**79**	**34**	**256**	**8**

Figure 4

Photograph of the school zone on the Pacific Highway Wahroonga - 21 September 2011 morning

Figure 5

Photograph of the school zone on the Pacific Highway Wahroonga - 21 September 2011 morning

Table 5: Pedestrian count – Princes Highway, Kogarah, 15 September 2011 - Morning				
Princes Hwy, Kogarah Between President Ave and South St	**AM (8-9am)**			
Pedestrian type	**Overhead Bridge**	**50m either side** (pedestrian median fence along this length)	**Traffic signals - Princes Hwy (cnr South St)** (in school zone)	**Traffic signals – South St (cnr Princes Hwy)** (in school zone)
School children – accompanied	0	0	0	1
School students – unaccompanied	129	0	220	8
Disabled or impaired	0	0	0	0
Other	73	0	25	7
TOTAL	**202**	**0**	**245**	**16**

Table 6: Pedestrian count – Princes Highway, Kogarah, 15 September 2011 - Afternoon				
	PM (3-4pm)			
Pedestrian type	**Overhead Bridge**	**50m either side**	**Traffic signals - Princes Hwy (cnr South St)** (in school zone)	**Traffic signals – South St (cnr Princes Hwy)** (in school zone)
School children – accompanied	2	0	1	1
School students – unaccompanied	135	0	58	14
Disabled or impaired	0	0	0	0
Other	50	0	15	8
TOTAL	**187**	**0**	**74**	**23**

It should also be noted that there is a pedestrian fence on the median along the length of Princes Highway between President Avenue and South Street in Kogarah which may account for no pedestrians crossing 50 metres either side of the overhead bridge.

Figure 6

Photograph of school zone on the Princes Highway, Kogarah - 21 September 2011 afternoon

5.3 Children's crossings

Children's crossings play a vital role in road safety for children. They are legally the most stringent marked pedestrian crossings for managing traffic and road safety in the local streets around schools.

During their operating hours, children's crossing are the strongest traffic regulation of their type because drivers must 'STOP and WAIT' until the crossing is clear of pedestrians on it, or clear of pedestrians about to enter it, before driving through the crossing.

The part-time crossing operates just before or after school hours and at other times such as school excursions and lunchtime that may be agreed by the local council.

Children's crossings operate when orange flags displaying the words 'CHILDREN CROSSING' are posted by the road in front of the crossing area.

A 'Crossing Ahead' sign is located before the children's crossing to alert drivers to be ready to stop.

5.4 Pedestrian crossings

Drivers must slow down and be prepared to stop when a pedestrian steps onto a marked foot crossing (zebra crossing). Drivers must give way to any pedestrian on a crossing.

5.5 Raised pedestrian crossings

Raised pedestrian crossings are placed at locations where there is a high level of pedestrian activity, such as schools. They are raised to increase the visibility of the crossing and pedestrians to approaching drivers. They also assist in slowing down traffic.

5.6 Pedestrian refuge islands

Pedestrian refuge islands are not pedestrian crossings. They are installed on busy or wide roads to help pedestrians to cross in two stages. Sometimes they are used with a pedestrian crossing when a staged crossing is required.

By crossing in stages the pedestrian only has to concentrate on traffic in one direction at a time. However the pedestrian needs to wait for a clear gap in the traffic.

A number of Technical Directions for traffic and transport practitioners have been issued in relation to these important pedestrian safety features. These include:

- *Technical Direction for Traffic and Transport Practitioners on Pedestrian Refuges;*
- *Technical Direction for Traffic and Transport Practitioners on Use of Traffic Calming Devices at Pedestrian Crossings; and*
- *Technical Direction for Traffic and Transport Practitioners on Kerb Ramps.*

Measures implemented also focus on increasing the visibility of pedestrians. For example, roadway lighting at key crossing points is regularly reviewed and the location of bus stops near major crossings are also monitored.

5.7 Pedestrian fencing

Pedestrian fencing is installed to stop jay walking across heavily trafficked roads by directing pedestrians to controlled crossings. However, most pedestrian fences still enable children to cross the road at-grade.

A study has shown that pedestrian fences can be effective in reducing pedestrian crashes. The study involved comparing crashes that occurred at uncontrolled and controlled sites along three sections of road: Military Road between Ben Boyd Road and Spit Road at Mosman; Princes Highway between Bestic Street and Lister Street at Rockdale; and Copeland Road at Liverpool. These sites had a substantial number of pedestrian crashes prior to fencing installation and were reviewed to analyse the effectiveness of pedestrian fencing in reducing pedestrian crashes.

Uncontrolled sites referred to sites *without* any pedestrian or traffic signal controlled crossing present and controlled sites refers to sites *with* pedestrian or traffic signal controlled crossing present.

Analysis of pedestrian crashes on Military Road showed a 75% reduction in pedestrian crashes. At uncontrolled sites in the 6 years before the fencing was installed there were 68 pedestrian crashes. These dropped to 26 in the 6 years after the fencing was installed. At the controlled sites over the same time period there were 25 pedestrian crashes which dropped to 12 when the fence was installed.

Princes Highway, Rockdale and Copeland Street, Liverpool showed similar reductions in targeted crashes.

Pedestrian fencing is only one aspect to enhance safety in schools. At James Cook Boys' Technological High School and Moorefield Girls' High School pedestrian fencing is used to channel the high school pedestrians to the signalised crossing. This is one of the safety measures used at this site.

5.8 Traffic control signals

The crash history of locations is used to prioritise the need for new traffic control signals. The RTA's Sydney Coordinated Adaptive Traffic System (SCATS) enables demand to influence the timing of traffic signals. The RTA continually reviews signal times for pedestrians based on activity monitoring and requests from Councils, schools and agencies representing the needs of pedestrians and people with disabilities. If warranted, the RTA increases the pedestrian signal phase.

All new traffic control signals are required to incorporate a pedestrian phase (except in rural areas, locations with no footpath or at locations where encouraging pedestrian crossing could compromise safety).

6 The appropriateness of a single approach school zone regime as opposed to modifying zones based on existing infrastructure and other current safety measures employed around schools

6.1 The current approach to school zones has been shown to be effective in reducing pedestrian casualty crashes and raising community awareness of the need to slow down and be alert for pedestrians near schools.

The 40km/h school speed zone provides protection for the pedestrian, with the enforced lower speed providing greater ability for a vehicle to stop, reducing the risk and severity of a crash.

The Government is persuaded by the evidence available to it that school zones are the best roads safety option around schools in most cases, but it also notes that the same evidence also points to the value of physical barriers, bridges and other road safety measures.

However, each school environment should be considered individually, and where it is feasible and cost-effective, physical barriers and other complementary road safety mechanisms should be employed. Assessment of individual sites and options should include consideration of the impacts on motorists' safety and convenience and on traffic flow.

7 The availability and effectiveness of current road safety education programs in NSW schools

7.1 NSW School Road Safety Education Program

The NSW School Road Safety Education Program makes available educational resources to all schools and provides professional development on road safety for all teachers throughout NSW, on an ongoing basis. The program aims to increase the delivery of quality road safety education programs within the classroom from Kindergarten to the final years of schooling. Road safety education in NSW forms part of a mandatory curriculum and this program has been developed to be age appropriate, ongoing and sequential so that all students have the opportunity to have road safety reinforced throughout their schooling years.

Road safety in NSW schools is addressed as a part of the NSW Board of Studies Personal Development, Health and Physical Education (PDHPE) syllabi and as such is mandatory in all NSW schools. Curriculum resources meeting the outcomes of the appropriate PDHPE syllabi are developed by the NSW Centre for Road Safety in conjunction with the NSW educational agencies, and are available free of charge for all teachers, students, parents and school communities throughout NSW. A copy of *The NSW road safety education program Catalogue 2011* is attached (Annexure A).

In NSW there are approximately 3,154 schools educating over one million students. To ensure students receive appropriate and timely road safety education, the NSW Centre for Road Safety funds and co-ordinates the NSW School Road Safety Education Program which is conducted in partnership with all education agencies overseeing NSW schools.

This is a highly innovative program that provides quality world's best practice curriculum-based teaching resources and professional development training for teachers to enhance their teaching of road safety in the classroom. This has been achieved after working closely with the NSW Board of Studies during curriculum design processes. No other state in Australia (and very few other countries) has been able to achieve mandatory road safety education within its school curriculum.

The Program funds road safety education consultants who provide a variety of services to all NSW schools including assistance with programming road safety education into classroom activities and with linking road safety to the curriculum. Consultants and advisers are best placed to provide teachers and schools with curriculum and policy advice and to manage the professional development processes required during the implementation of each newly-released road safety teaching resource.

The Program also funds the development of road safety education resources for use by teachers and provides these free of charge to all NSW schools.

The objectives of the School Road Safety Education Program are to:

- produce behavioural and attitudinal changes through programs and campaigns;
- act as an advocate for children and young people in road safety;

- provide appropriate resources for teachers and students; and
- promote best practice in road user behaviour.

The program is evaluated regularly and is highly regarded within school and education communities. An independent evaluation has evidenced strong road safety learning in former and present students.

The NSW Centre for Road Safety has routinely conducted independent, whole of program evaluations of the School Road Safety Education Program to assess the:

- extent to which road safety education is delivered in school programs;
- nature and level of road safety education provided by the education agencies and
- level of awareness and usage of the road safety education resources.

The most recent independent program evaluation, found that almost all NSW schools taught road safety education during the period reviewed. For primary schools 99% taught it and in secondary schools 97% taught road safety education. The teaching resources were regarded as high quality with the majority of teachers rating them as relevant, very suitable for their students and well linked to the syllabus.

Most teachers rated the professional development they attended for road safety education as very high quality. They found the sessions useful for teaching practice, informative about key facts, relevant to their needs and appropriate for their schools.

In 2009 an independent and external evaluation assessed the penetration and recognition of road safety education by former and current students (1,612) in NSW schools in both rural and metropolitan areas. All student interviews were conducted outside of the school environment to ensure that the results would be completely independent of any influence by teachers or schools.

Both current and former students demonstrated a widespread recognition of specific materials from each of the stages of road safety educational resources produced by the NSW Centre for Road Safety school education program:

- messages and themes about risks faced and how to be safer as a pedestrian, as a passenger in cars and buses, especially the use of seat belts were widely recalled;
- for young driver materials/resources, drink driving was the most acknowledged issue followed by the effects of speed and
- topics recalled as taught included drink driving, seat belts and speeding.

"An overwhelming majority of students recall material about road safety that has been covered in primary or secondary school; the key messages recalled are consistent with those highlighted in the NSW Centre for Road Safety's educational resource materials". Taverner Research 2009

Almost all of the students interviewed showed evidence of exposure to key themes of the NSW School Road Safety Education Program materials with 98% recalling road safety experiences from secondary school and 97% from primary school.

This research demonstrated that students do remember key road safety education themes and messages that were a part of their educational experiences. The majority of road safety education material was recognised through this study as having being presented by the students' classroom teachers. Their strong recall of key road safety messages was consistent with those highlighted in the educational school resources.

7.2 Pedestrian safety education for primary and high schools

One of the NSW School Road Safety Education Program's components addresses pedestrian safety in school settings.

Support resources include information or advice on pedestrian safety available free to schools and school communities. Resources are also available for parents, who play a key role in the supervision of primary school-aged children. Parents can influence the behaviour of a child pedestrian and are key role models in demonstrating safe pedestrian behaviours.

In primary school, pedestrian safety is addressed through the *Move Ahead with Street Sense* road safety education resource. The stage-appropriate, research-based main pedestrian safety messages are explored in teaching and learning experiences and in the wide variety of available resource components. Resources include teacher booklets and student videos, worksheets, full-colour photographs, story books, song and story cassettes and CDs, board games, posters and stickers developed to ensure the effective communication of each main pedestrian message to students.

The materials give parents and carers the following pedestrian safety messages aimed to ensure that young children are accompanied by an adult in the traffic environment.

Early Stage One and Stage One (ages approximately 5-7 years) pedestrian safety messages include:

- Until they are at least eight years old, children should hold an adult's hand on the footpath, in the car park and when crossing the road.

Stage Two (Years 3 and 4) pedestrian safety messages include:

- Between the ages of eight and ten, children should be closely supervised in the traffic environment and hold an adult's hand when crossing the road.

Stage Three (Years 5 and 6) pedestrian safety messages include:

- Stop! Look! Listen! Think! every time you cross the road
- Use a safe place to cross the road.

Primary schools and school communities are constantly reminded of these pedestrian safety messages and of available and new resources delivering these messages through mail outs.

Other resources available to schools, bus companies and the community include:

- Bus safety poster - Schools, bus companies and members of the public can order this poster which illustrates the RTA's main bus safety message, *Wait*

until the bus has gone, then use a safe place to cross the road. The poster is available from the RTA's school road safety education catalogue.

- Bus safety stickers - Stickers, including those with a bus safety message, are available for primary school students and can be ordered in bulk through the RTA's school road safety education catalogue. Stickers are often ordered by other groups who may be addressing road safety education, such as scouts, vacation care or before-and-after-school care.
- Bus safety activity sheets - These sheets for students in Stages 1 and 2 (Kindergarten to Year 4) include an activity for the student on one side and information and advice on bus safety for parents and carers on the reverse. Schools can order these though the RTA school road safety education catalogue.

Secondary school key pedestrian messages for Stage Four (Years 7 and 8 students) include:

- Recognise what can put you in danger when walking.
- Scan all around for people and vehicles that can put you in danger.
- Keep plenty of space between you and traffic when walking.
- Choose the safest place to walk and cross.
- Double check for traffic before stepping onto the roadway.
- Make sure other road users can see you.
- Don't assume drivers will stop for you.

Key safe behaviours to reduce pedestrian casualties are the use of pedestrian facilities such as traffic lights and marked pedestrian crossings. Where these facilities are not available, crossing in the middle of a block with clear views, and away from parked cars is the safer option.

Pedestrian safety messages and information on pedestrian safety issues around schools and prior to school settings are conveyed routinely to parents, carers and the school community through the provision of free RTA publications – brochures, booklets, take home notes, and material designed for inclusion in school newsletters. These resources are provided routinely to early childhood centres and primary schools. The school road safety catalogue provides schools with ongoing access to these resources.

The recently released *Kindergarten Orientation Day* road safety resource provides information on road safety to parents at a time when their child will have a greater exposure to the traffic environment as a school student.

Parents are often unaware of the limitations and influences on young adolescents' decision-making when travelling to and from high school. Youthsafe, in partnership with the RTA, has developed a parent information fact sheet: *On the way to high school: Helping teenagers to travel safely*. The fact sheets provide parents with key road safety information and tips to discuss with their young teenager about travel to and from high school. Recent evidence suggests that realistic training in real-life settings can result in success in coping with more complex situations. The strategies promoted through this parental engagement encourage this training in daily school travel situations.

Youthsafe promotes the fact sheet to primary schools and high schools for orientation days and transition programs through:

- Mailouts each year to all NSW primary and secondary schools in Term 4 with recommendations to include fact sheet in orientation kits for students about to commence secondary school in the coming year.
- Mailout to secondary schools twice a year, of Youthsafe's resource catalogue, including information about the fact sheet and an order form.
- Intermittent inclusion of information about the fact sheet in Youthsafe Newsletter and e-bulletins to almost 1,000 contacts – primarily community based organisations and individuals working with young people and their families.
- Youthsafe presenters deliver sessions at secondary schools including students in Years 7 and 8.
- Lectures delivered annually by Youthsafe at five universities to PDHPE student teachers.
- The fact sheet is posting on Youthsafe website and may be downloaded.
- Inclusion of information about the fact sheet and ordering details in the RTA Catalogue for principals, teachers and educators in NSW early childhood, primary and secondary schools (see 2011 catalogue) – the fact sheet is available through the RTA mailing house and through Youthsafe.

Annually the RTA distributes over 10,000 copies of the fact sheet to school communities and Youthsafe distributes almost 30,000.

Youthsafe is a not-for-profit organisation funded to deliver injury prevention programs for young people and community professionals working with youth.

7.3 Bus safety education for primary and high schools

One of the riskiest times for students to be injured on our roads during school zone times is when they are getting on board or alighting from a bus.

Bus safety is a component of the *Move Ahead with Street Sense* road safety education resource delivered to each NSW primary school since 2000. The resource includes stage-appropriate bus safety teaching and learning activities.

The main message for bus safety in Stages 1, 2 and 3 (Kindergarten to Year 6) of the *Move Ahead with Street Sense* road safety education resource is: *Wait until the bus has gone, then use a safe place to cross the road.* The pedestrian phase of bus travel when students alight from the bus provides greatest risk.

There is also a road safety education program for Stage 4 (Years 7 and 8) students in NSW high schools, *Road risks, your choice* which contain a variety of teaching/learning activities highlighting key road safety messages for 12-14 year olds. Activities focus on risk behaviours, decision making and personal responsibility when using the roads.

This age group is most involved in pedestrian crashes when crossing the road and emerging from beside parked vehicles. Key safe behaviours to reduce pedestrian casualties are using pedestrian facilities such as traffic lights and crossings. Where these facilities are not available, crossing in the middle of a block and away from parked vehicles (cars, buses, trucks) is the safest option.

Specific pedestrian safety messages that are developed in this resource are:

- Recognise what can put you in danger when walking.
- Scan all around for people and vehicles that can put you in danger.
- Keep plenty of space between you and other traffic when walking.
- Choose the safest place to walk and cross.
- Stop, look, listen and really think if it is safe to cross.
- Double check for traffic before stepping onto the roadway.
- Make sure other road users can see you.
- Don’t assume drivers will stop for you.

In addition to the RTA developed school education teaching resources a *School bus safety: How parents can help* brochure for parents and carers has also been provided for schools.

The RTA is currently planning a project to refresh the safety around buses resource material.

7.4 Other key road safety messages for primary school-aged children

The RTA provides a number of resources for children about passenger safety, and safety on wheels (bicycles, skates and skateboards). The key messages include:

- Click clack front 'n' back
- Always buckle up in your seatbelt
- Get in and out of the car on the footpath side
- Always wear your helmet when you ride or skate
- Ride your bike away from the road
- Ride your bike away from busy roads.

References

Congui M, Whelan M, Oxley J, Charlton J D'elia A and Muir C, November, 2008, *Child Pedestrians: Factors Associated with Ability to Cross Roads Safely and Development of a Training Package*, Monash University Accident Research Centre, Report 283

Chin L, Elliot M, Sentinella J, Williams K, 2004, *The road safety behaviour of adolescent children in groups*, TRL Report 599

Elliot, M.A. and Baughan, C.J, 2002, *Adolescent Road User Behaviour: A Survey of 11-16 year olds*, TRL Report 561

Garrard J, *Submission to National Road Safety Strategy 2011-2020* , School of Health and Social Development, Deakin University

Kloeden CN, McLean AJ, Moore VM, Ponte G, 1997, *Travelling speed and the risk of crash involvement*', University of Adelaide Road Accident Research Unit

Lynam D and Harland D, 1992, *Child pedestrian safety in the UK*, proceeding of the VTI/FERSI Conference, Berlin

McLean AJ, Anderson RW, Farmer MJB, Lee BH, Brooks CG, 1994, *Vehicle travel speeds and the incidence of fatal pedestrian collisions* Federal Office of Road Safety, Canberra (URL: http://casr.adelaide.edu.au/pedspeed/PEDSPEED.PDF - accessed 22 September 2011)

NSW Auditor-General, 2010, *Performance Audit – Improving Road Safety: Speed Cameras*,

Meehan G, Burke J & Porritt D, 2009 *NSW School Road Safety Education Program Research* Project Reference 3260, Taverner Research

Richards DC, 2010, Relationship between speed and risk of fatal injury: pedestrians and car occupants *Road Safety Web Publication No. 16* Department for Transport, London

Rosén E and Sander U, 2009, Pedestrian fatality risk as a function of car impact speed *Accident Analysis and Prevention 41*, pp 536-542

Rosén E, Stigson H, and Sander U, 2011, Literature review of pedestrian fatality risk as a function of car impact speed *Accident Analysis and Prevention 43*, pp 25-33

Stavrnos et al, 2009, *Effect of Cell Phone Distraction on Pediatric Pedestrian Injury Risk,* Pediatrics Vol. 123

Thomson J A, Andrew Tohnie A, Foot H C, McLaren B; 1997, *Child Development and the Aims of Road Safety Education Road Safety Report,* Department of Transport, United Kingdom

Tyson P, 2002, as cited in the National Research Council (US) *The relative risk on school travel: a national perspective and guidance of local community risk assessment: Committee on School Transport Safety: Special report 269*

West R, Train H, Junger M, Pickering A, Taylor E and West A, 1998, *Childhood Accidents and their Relationship with Problem Behaviour*, Road Safety Research Report No. 7. London: DETR