

## **School Bus Safety in Australia**

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### **Abstract**

In 1999 ARRB Transport Research was commissioned by Austroads to undertake a review current practice and research in relation to school bus safety, and to identify new or proven safety measures that may be used as part of a National approach to school bus safety. The research was split into a number of components, with the key objective of developing a set of school bus safety recommendations that may be incorporated into a National School Bus Strategy.

In November 1999 the progress and findings of two research components of the project were presented at the *Road Safety Research, Policing and Education Conference* in Canberra. This presentation reported on the examination of the national crash data involving school buses to determine the magnitude and characteristics of the problem; and on the review of relevant literature to determine current knowledge related to school bus safety, injury risks and effective countermeasures.

The three remaining tasks have now been completed. These included:

- Reviewing current accident data collection practices and procedures in Australia.
- Reviewing current school bus safety programs and countermeasures implemented across jurisdictions.
- Consulting with community interest groups and key stakeholders to obtain community views on school bus safety.

The current paper aims to provide a summary of findings of these three remaining components and provide some guidance as to the intended application of these findings.

### **Body of Paper**

#### **Introduction**

Following considerable community concern over school bus incidents resulting in the death of or serious injury to school children, the Australian Transport Council (ATC) requested Austroads to review current practice and research in relation to school bus safety, and to identify new or proven safety measures that may be used as part of a National approach to school bus safety.

Consequently, ARRB Transport Research was commissioned by Austroads undertake this research, with the key objective of developing a set of school bus safety recommendations that may be incorporated into a National School Bus Strategy. It is envisaged that the strategy will underpin the development of countermeasures in each jurisdiction to maximise the safe travel of children in and around school buses.

This project comprised of the following five major tasks:

1. An examination of the national crash data involving school buses to determine the magnitude and characteristics of the problem.
2. A review of relevant literature to determine current knowledge related to school bus safety, injury risks and effective countermeasures.
3. A review of current accident data collection practices and procedures in Australia to determine difficulties associated with data collection and coding that effect the ability to identify accidents as directly related to school buses.
4. The identification of school bus safety programs implemented in Australia and overseas jurisdictions to combat school bus related accidents to obtain a detailed picture of the policies, regulations and education programs currently operating in Australia..
5. Consultation with community interest groups to obtain community views on school bus safety, to increase community ownership of the problem and to assist in the development appropriate countermeasures.

In November 1999 the progress and findings of the first two components were presented at the *Road Safety Research, Policing and Education Conference* in Canberra (see *School Bus Safety in Australia: Progress Report* (1)). Since then the remaining tasks three tasks have now been completed. The current paper aims to reflect briefly on the first two components, before providing a summary of findings of these latter three components.

Detailed findings of all components of the project can be found in *School Bus Safety in Australia: Final Report* (2).

## Research Components

### 1. Magnitude of the Problem

To determine the size and nature of the school bus related crashes, a detailed investigation of the national crash database was undertaken.

Overall, this analysis found that the number of children killed while crossing the road to board or after alighting from a bus on their way to or from school was less than 10 in each of the three years for which detailed data were available (ie. 1992, 1994 and 1996)<sup>i</sup>. This makes up approximately half of the child pedestrians killed during school commuting times in these years 53% (20/38).

Although crossing the road before or after school bus travel is clearly the major area of risk, there is also risk associated with bus travel itself. The estimation of this part of the problem is much harder due to the much smaller numbers involved. Four such fatalities were identified in the three years for which detailed data were available – two of these were cases in which the child was caught in the bus doors and the other two occurred when the bus was involved in a collision with another vehicle<sup>ii</sup>.

The small number of cases on which these fatality estimates are based precludes separate estimation within jurisdictions and anything more than a broad assessment of numerical trends over time. When the detailed data for 1992, 1994 and 1996 was supplemented by fatality and injury estimates for 1990 and 1998, the analysis revealed that the number of child pedestrians killed and hospitalised, as a result of crashes occurring during school commuting times has decreased consistently and substantially since 1990 (ie. from an estimated 14 fatalities and 190 hospitalisations in 1990, to an estimated 4 fatalities and 100 hospitalisations in 1998 - a reduction in serious injury of about 50%). However, the extent to which this is due to new school bus safety measures compared with general improvements to road safety is not clear.

### *Characteristics of Fatalities Associated with School Bus Travel*

Leaving aside two children killed as a result of collisions between a bus and a secondary vehicle, detailed investigation of the other 22 child fatalities associated with school buses was conducted. This was completed using the fatality files of the Australian Transport Safety Bureau (previously the Federal Office of Road Safety) for 1992, 1994 and 1996. The following crash characteristics were identified:

- 19 fatalities occurred as the child alighted from the bus and then was struck when attempting to cross the road. In only 1 case was the child killed while attempting to cross the road to board the bus;
- 2 fatalities occurred when the child had attempted to alight from the bus and their leg became stuck in the door of the bus without this being seen by the driver (in both cases the child was of primary school age).
- 17 fatalities involved primary school aged children;
- 18 fatalities occurred at the end of the school day;
- 13 fatalities occurred on roads speed zoned greater than 60 km/h;
- 19 fatalities occurred within a mid-block location, away from an intersection;
- half of the fatalities occurred on roads in urban areas, with the remaining half on roads in rural areas; and
- except for one case, the child crossing the road was unaccompanied.

Despite the small number of fatal crashes identified as being related to school bus travel, certain features were more common than others. The typical crash scenario involved a child on his or her way home from school in the afternoon. Although it is difficult to determine the timing of the sequence of events from the crash records, in most cases the incident occurred immediately after the child had alighted the bus and, in all cases, was hit by another vehicle while attempting to cross the road - presumably while the bus was still in the vicinity. In most cases an adult did not accompany the child. The majority of incidents occurred on two-way undivided roads, at mid-block locations, in both urban and rural areas and, more often, on roads with speed limits of 60 km/h or more. While actual vehicle speed was not provided, based on detailed fatality crash information available, neither excessive speed nor alcohol consumption were associated with the fatal crashes identified in this investigation.

## **2. Current Knowledge and Practices related to School Bus Safety**

A literature review and Internet search were conducted to identify:

- The outcomes of findings of recent research associated with school bus safety.
- Proven safety measures that may be applied to school bus safety.
- Current best practice safety operations.

The key findings from the review of current knowledge and practice have been summarised below.

### ***Occupants in transit***

In terms of protecting occupants whilst on-board buses, research in the U.S. indicated that “compartmentalisation” - a passive design protection approach entailing high back seats, increased seat padding and restraining barriers in front seats - appears to offer the most cost-effective protection for frontal collisions.

The research examined revealed conflicting views regarding the effectiveness and cost of fitting lap-belts on school buses. This was true for both overseas research and Australian studies. Some research suggested that seatbelts, used in the absence of additional vehicle countermeasures (such as high-back seats, inappropriate seat padding and floor anchoring), can lead to increased belt-induced injuries, injuries more severe than those which may occur in the absence of these devices.

Conflicting views were also noted in respect to the merits of abolishing standees on school buses. Very few evaluations have been carried out which compare the relative safety of seated travel on a bus versus standing passengers. Similarly, there appears to be a lack of evidence indicating that the “three for two” seating policy, applied in many Australian jurisdictions, substantially compromises passenger safety. A number of studies reviewed as part of this component indicated that the abolishing standees and removal of the “three for two” seating rule would lead to significant capacity and cost impacts.

Overall, the research indicated that initiatives aimed at increasing driver and pedestrian behaviour, improved vehicle maintenance and roadside environments may be more cost effective and offer greater potential for reducing the risks of travel in school buses, than could be achieved through the mandation of seatbelts, the abolishment of standees and the removal of the “three for two” seating rule.

### ***Boarding and Alighting Issues***

The statistics presented in this paper indicate that a significantly higher proportion of school bus-related deaths occur during the period when the bus is stopped and children are moving, as pedestrians, to board or alight the vehicle, with a greater number of incidents occurring in the afternoon. In line with this finding, the literature reviewed indicated a predominance of crashes occurring in the afternoon period. The literature also highlighted differences in the travel behaviour of children journeying on and around school buses in urban areas, compared to those travelling in rural environments. These behavioural differences are attributed to variations in traffic speed, traffic volumes and the location of bus stops. The research concludes that children need to obtain a range of skills to accommodate to these different traffic environments.

A range of initiatives are currently implemented in Australia and in overseas jurisdictions to maximise the safety of children while boarding and alighting a school bus. These initiatives include a number of education programs targeting children’s traffic behaviour, in terms of their road skills and their general behaviour whilst travelling on or around buses. Initiatives that focus on influencing parents, schools, teachers and bus operators are also widely used. In addition to these behavioural initiatives, many other initiatives focus on improving the road environment and the safety of the vehicle itself. These initiatives include, though are not limited to, the application of local speed restrictions and bus route/bus stop audits, and the use of bus mounted flashing lights, swing-out stopping arms and cross-view mirrors and.

### ***Overseas Practices***

America, unlike Australia, operates a dedicated school bus fleet, whereby vehicles are used exclusively as school buses and not for the transportation of a general passengers. Consequently, many more vehicle-based safety features can be applied to maximise the safety of school children. For example, the installation of seatbelts and high-backed seats, improved roll-over protection, the use of crossing arms and swing out ‘stop’ signs and retro-reflective vehicle markings. Similarly, Canada apply many of these safety techniques, noting that crossing arms are now complemented by customary flashing red lights and traffic regulations calling for other vehicles to stop when a school bus is loading or setting down passengers.

Like Australia, New Zealand does not have a dedicated school bus fleet. The accident data indicates that school bus-related crashes are not a significant problem in this jurisdiction. Despite this, there are a number of regulations in place for ensuring safe travel in and around school buses. These include the use of 'school bus' warning signs and speed limits of 20km/h for motor vehicles approaching a parked bus at the side of the road.

### **3. Current Crash Data Collection Practices**

A review of current crash data collection practices and procedures in Australia was undertaken to determine difficulties associated with data collection and coding that effect the ability to identify incidents as directly related to school buses.

This component involved contacting each of Australia's jurisdictions and documenting existing crash data collection procedures involving school buses. The investigation also sought to identify crash data sources additional to those held by jurisdictions. It was anticipated that additional sources might document near miss or potential crash information, in addition to collecting data on casualty and property damage crashes involving buses carrying school children.

The documentation on existing crash data collection procedures involving school buses revealed significant difficulties in identifying road crashes that relate directly to school buses. Many jurisdictions indicated that they cannot currently identify incidents specifically involving school buses within their current database. In most jurisdictions, data is recorded for all buses and all bus stops; therefore, it is difficult to distinguish incidents involving dedicated school buses from general service/route buses. Some jurisdictions also noted difficulties in identifying whether a given incident involved a school child or a general bus passenger. Representatives from Tasmania believe that these problems have been alleviated to a great extent since the introduction of a regulation in January 1998 that requires separate vehicle codes for school buses and general passenger buses.

Reference was also made to ambiguities related to the definition of a 'bus incident' and the extent to which the bus was involved in the incident. If a pedestrian is killed or injured around or near a bus stop the incident is often classified as a 'bus incident', though it may be pedestrian in nature. The bus itself may not have been involved in a physical sense, yet it is still classified as involved in bus related.

Overall, the national crash databases do not contain sufficiently detailed information to allow a comprehensive evaluation of school bus safety to be undertaken. Information is required to identify school children that are injured, in addition to those killed, while using buses to commute to and from school. In particular, this study has highlighted the need for fatal and hospitalisation crash databases to contain information regarding:

- Intention of pedestrian movements (eg. the pedestrian was crossing the road to board a bus when the crash occurred).
- Origin and destination of trip for pedestrians.
- Data on secondary vehicles not directly involved in the pedestrian impacts (eg. presence of a bus, parked vehicles obstructing visibility, other traffic, etc.).
- Information such as the presence of flashing lights, signs or school bus markings, and the proximity of the bus stops and pedestrian crossings to the crash scene.

### **4. Concerns of Community and Key Stakeholder Groups**

Consultation with community interest groups, road authorities and other key stakeholders in each jurisdiction was undertaken to obtain community views on school bus safety, to increase community ownership of the problem and to assist in the development appropriate countermeasures. This consultation process took the form of small workshops, the aim of which was to prompt group discussion on community issues and concerns relating to school bus safety.

This consultation revealed that, in general, the perception of injury risk while travelling on and around school buses is great, despite statistical evidence reflecting a very low incidence of bus related crashes. The most common concerns related to issues confronting children when getting on and off the bus, with agreement that risks to children alighting from a school bus in the afternoon are of greatest concern. The concern is that after alighting, many children attempt to cross the road from either the front or rear of the bus, prior to the bus' departure, risking collision with a secondary vehicle.

There was some variation across states in respect to the age group believed to be most affected by school bus related safety issues. The majority noted that primary school students were at greater risk, perhaps as a result of their visual and perceptual skills being less well developed at this age. Some suggested that primary school children were more at risk in urban areas, while in rural areas various issues affected both primary and secondary students.

Most jurisdictions acknowledged that differences exist between safety issues in urban and rural environments, commenting that resources need to be flexible and need to have the capacity to deal with the problems in both areas. It was suggested that rural safety issues are associated with the speed of traffic, the road infrastructure, the location and visibility of bus stops and the varied pedestrian and road use behaviour. In rural areas the traffic is generally faster, therefore children have less time to cross the road. In comparison, in urban areas safety issues are related to the volume of traffic, the number of bus stops with short driving intervals, the number of students boarding and alighting and the suggestion that urban drivers are confronted by a greater number of stimuli than rural drivers.

Some jurisdictions argued that there is a perception of greater crash risk in rural areas. This may be related to the fact that children residing in rural areas need to learn to cope with both rural and urban traffic environments. They may not always make successful transitions between one environment to the next, resulting in inappropriate or unsafe behaviour, thereby increasing their risk of injury.

### ***Speed and School Bus Safety***

Although excessive speed was not associated with the crashes presented in this investigation, the fact that a significant number of the fatalities investigated occurred on roads with speed limits of 60km/h or more indicates that speed is a major element of risk. This is supported by a strong perception within the community that the speed of traffic around buses and bus stops is of key concern for children travelling in and around school buses, particularly in rural areas.

Various approaches to reducing the speed of vehicle travel around schools, bus stops and school buses have been implemented by road and transport authorities across Australia. Most jurisdictions have introduced School Zones to reduce traffic speed around schools and school bus stops, while some have installed wig-wag lights on school buses, which flash to warn other traffic that the driver is stopping to set down or pick up children.

Some jurisdictions have extended on these initiatives by regulating the speed of motorists travelling in the same direction as a school bus. One state has introduced a speed restriction of 25 km/h when passing a school bus that is appropriately signed and has stopped on the side of the road, for the apparent purpose of allowing children to board or alight. In two other states, buses have been fitted with flashing wigwag lights to the rear of the bus, accompanied by a '40km' sign, with the surrounding text 'when lights flash' located below these lights. When these lights are activated, motorists travelling in the same direction as the bus are required, by law, to slow down to 40 km/h. While there are a range of initiatives aimed at moderating traffic speeds around school buses, within the school setting and beyond, few evaluation studies have been carried out to determine their effectiveness.

## **5. Programs implemented across Australia**

A review of current school bus safety programs and countermeasures implemented by Australian jurisdictions to combat school bus related accidents was undertaken to obtain a detailed picture of the policies, regulations and education programs currently operating in Australia. As part of the consultation phase with community groups, road authorities and key stakeholders were asked to provide information regarding current school bus safety initiatives in place, their effectiveness as means of reducing school bus related injuries and identification of where improvements could be made.

This investigation revealed that a wide range of initiatives are implemented, to varying degrees, to improve school bus safety across Australia. These initiatives include behavioural/educational type programs, environmental countermeasures and vehicle safety measures. The most common initiatives implemented across Australia include, though are not limited to, the following:

- The application of speed restrictions around school buses or in school zones (eg. 40km/h).
- Fitting school buses with flashing lights (wigwag lights) to warn that the bus is stopping to pick up and/or drop off children.
- Guidelines for the provision of rural bus stops and auditing bus routes.
- The implementation of the Safer Routes to School program, incorporating bus safety issues.

- The development of codes of conduct for the behaviour of school children and, to a lesser extent, bus operators.
- The development and release of videos for school students and parents promoting safe behaviour and techniques for increasing the safety of children travelling to school.
- The release of various pamphlets to keep parents informed of changes and emerging issues.
- Seminars and special workshops for teachers, parents and bus operators.
- Incorporation of road safety education, with components that relate specifically to school bus safety, in school curriculum.

The investigation also identified that, in general, there is a lack of formal evaluation of initiatives operating to maintain safe school bus travel. This study has indicated that as many initiatives have only been recently implemented, few formal evaluations have been carried out. It was further suggested that due to the nature and the small number of crashes involving school buses, the ability and usefulness of formal program evaluations has been questioned. Despite this, there is a general consensus that programs and treatments focused towards improving the safe travel of children around school buses are successful - provided they are accompanied by adequate publicity campaigns and appropriate levels of enforcement.

### **Conclusion**

This paper has highlighted the size and nature of the school bus safety problem in Australia and briefly compared the safety concerns faced by children journeying to and from school in Australia with children in a number of overseas jurisdictions. The difficulties associated with current crash data collection practices have been summarised and suggestions for improvements have been identified. Concerns raised by community interest groups, road authorities and other key stakeholders related to the travel of children in and around school buses have also been summarised. The key safety concerns raised through consultation with the community are consistent with the characteristics of crashes involving school buses during school travel times and with the issues faced by children in comparative countries. Finally, this paper highlighted that a wide range of initiatives are currently implemented, to varying degrees, across Australia to combat school bus related incidents.

Based on the outcomes of this study, ARRB Transport Research, in conjunction with Austroads prepared set of recommendations that may be included into a National School Bus Safety Strategy. Austroads have submitted these recommendations to Australian Transport Council for endorsement. At this stage, the outcomes of this process are unknown.

### **Acknowledgments**

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### **References**

- (1) Pinder, S.L, Tziotis, M., Stephenson, W.J., & Attewell, R. (1999). *School Bus Safety in Australia: Progress Report*. Presented at Road Safety Research, Policing and Education Conference, Canberra, November 1999.
- (2) Newman, S.L, & Tziotis, M. (2000). *School Bus Safety in Australia: Final Report*. Unpublished report provided to Austroads.

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<sup>i</sup> Changes in the coding frame and changes to the nature of the compilation process over time meant that crashes of interest could only be identified for the three most recent compilations (1992,1994 and 1996).

<sup>ii</sup> These latter 2 crashes were been included in the crash analysis presented in this investigation.