Queensland School Transport Safety Task Force

Overview of Research and Practice

This preliminary document prepared by the Queensland School Transport Safety Task Force provides an overview of research and practice in school transport safety. It does not include recommendations.

The Task Force will present its final report with recommendations in September 2001.

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EXECUTIVE SUMMARY

The School Transport Safety Task Force was set up by the Queensland Government in March 2001 to investigate and report within six months on ways to improve school transport safety in Queensland. This preliminary *Overview of Research and Practice* identifies areas of risk in school transport in Queensland and presents the results of a review of current research, policy and practice in school transport safety throughout Australia and internationally. It does not include recommendations.

Before making recommendations, the Task Force will complete an analysis of submissions from community members and stakeholder organisations. The 185 submissions received to date cover a wide range of school transport safety issues, including concerns about bus transport and rural and remote road safety. The Task Force looks forward to interviewing a sample of respondents and to receiving further submissions in response to this overview.

The Task Force is also interviewing experts in road safety research, road engineering, education, media, policing, and health and emergency services, and stakeholders in transport planning, transport management and bus design. Community, stakeholder and expert contributions will inform the Task Force's final report and recommendations.

The safety of young Queenslanders travelling to and from school relies on a complex network of relationships that extends to almost everyone in the community, whether as students, parents and carers, educators, drivers, media and health professionals, transport planners, or bus operators and designers. Ultimately, improving school transport safety will involve the commitment and action of all these community members.

In Queensland, school transport-related student fatalities have decreased in line with national trends, from seven fatalities in 1991 to three in 2000. Numbers of injuries during the same period (113 hospitalisations in 1991, compared with 141 in 2000) have not decreased consistently with national trends. Further improvements in the safety of young Queenslanders on the way to and from school will need continued commitment and hard work.

Between 1991 and 2000, more than 90 per cent of the 1384 school transport-related fatalities and hospitalisations in Queensland occurred among students travelling in cars, on bicycles or as pedestrians. The Task Force is currently gathering information on strategies to improve the safety of students travelling by these modes.

Two thirds of the 383 school transport-related pedestrian fatalities or hospitalisations in Queensland in the past decade were younger students (under 12 years) who were much more at risk in the after-school travel period than in the before-school travel period. Younger students (especially under 10 years) can lack the perceptual skills needed to judge distance and speed of approaching vehicles. Training programs that provide models of apppropriate young pedestrian behaviour may provide more effective learning than information-only education programs.

A number of Queensland school communities are highly innovative in their strategies for getting younger students to and from school safely, including "walking buses" and "bike trains" where adults supervise children walking or cycling to school in groups. All schools participate in one or more of the programs within Queensland Transport's Safe School Travel (SafeST) Schools Package which include the Speed Awareness program, crossing supervision, and infrastructure funding to improve routes to school. The Task Force is exploring whether current programs can be improved.

Vehicle speed plays a key role in determining crash and injury severity. Most urban school zones have speed limits of 40 kilometres per hour (kph) during certain times of the day, reflecting school start and finish times. At 40kph, drivers around schools may still be driving too fast; 30kph causes fewer fatalities and may provide more leeway for young pedestrians. Scandinavian countries, which have fewer school transport-related casualties, limit speeds to 25kph around schools. The Task Force is continuing to explore this issue.

When catching buses, students were most at risk as pedestrians walking to board or after alighting a bus. New South Wales and South Australia have speed limits around stopped school buses, of 40kph and 25kph respectively.

Most of the students killed or hospitalised as a result of motorcycle or car crashes were older (13–17 years) students. The Task Force was alarmed at the number (147) of 17-year-olds killed or hospitalised in school transport-related car crashes in the past decade. The Task

Force hopes to raise community awareness of this serious casualty rate and is seeking strategies to improve the safety of older students travelling in cars and on motorcycles to and from schools.

Fewer student bus passengers were killed or hospitalised with injuries than students using other modes of transport. At the same time, many students use transport by bus, with state bus transport assistance provided to almost a fifth of Queensland's school students. Even one major bus crash could have grave consequences. Task Force members share the community desire to ensure that bus passengers are safe. For this reason, the Task Force has considered a number of issues to do with bus design and management.

Transport to and from school by bus is provided on dedicated school services (the traditional school bus) and public passenger services (like Brisbane Transport buses). More than half (57 per cent) of the 1010 bus operators involved in school transport services in Queensland are single-bus operators. More than half the buses used in school transport are more than 15 years old.

In most crashes, injuries are less severe in a bus than in other vehicles because buses are of greater mass than most of the vehicles they collide with. Severe injuries occur when a bus rolls over and passenger space is compromised. For this reason, since 1992, buses in Australia have been built to comply with an Australian Design Standard for rollover strength, which ensures passenger space is maintained if the bus rolls over. Seventy-five per cent of the 2449 buses used to transport students to and from school in Queensland were built before 1992 which means they do not necessarily meet the rollover strength standard.

Most injuries in bus crashes are minor head and facial injuries which can be caused by metal seat-backs and posts. Queensland has design standards for impact padding on and around seats which came into effect from 1997 with partial retrospectivity. At most 61 per cent of the buses used to transport students in Queensland have impact padding on seats. These buses may also have other padding.

No Australian state currently requires buses carrying school students to be fitted with seat belts. Research suggests that the risk of injury in a rollover crash in a bus that does not meet the rollover strength standard is increased for passengers in seat belts, but that the additional benefits afforded by seat belts outweigh this risk. The cost of fitting seat belts is higher in older buses. It may not be possible to fit seat belts in some older buses.

In other countries where seat belts are fitted in buses carrying students and seat belt-wearing is mandatory (some US school districts and certain seats in certain kinds of UK buses in certain conditions), bus drivers are responsible for ensuring they are worn. Under current Queensland Road Rules, bus drivers are not responsible for ensuring that passengers under 16 years wear seat belts, even if seat belts are fitted.

All bus drivers must have basic driver and customer service training under Queensland legislation. Student behaviour on buses is at times difficult to manage and can be a distraction for drivers. Queensland Transport is currently developing a training program for bus drivers, to assist with student behaviour management.

Most states of Australia allow three-for-two seating among primary school-aged students, and available research suggests three-for-two seated students are not at greater risk. All states of Australia also allow standees, passengers who stand because there are insufficient seats available. Some states put time or distance limits on standing, or speed limits on buses carrying standees. One Australian study suggests standees are as safe as seated passengers. However, the US National Highway Traffic Safety Administration recommends against standees, and some states in the US do not allow standing passengers. The Task Force is continuing to explore the risk to standees on school buses, particularly in higher speed areas. There would be economic costs associated with discontinuing three-for-two seating and standee practices.

The Task Force is working towards submission of its final report with recommendations in September 2001. As its next steps, the Task Force will:

- complete its analysis of stakeholder and community submissions and interview a sample of those who made submissions
- complete its program of interviews with experts in areas of school transport safety and bus design and management
- research strategies for improving school transport safety among high-risk groups including students who travel by car, bicycle, motorcycle or on foot

- investigate further the issues of most community concern including bus and bus route safety.

The Task Force looks forward to further contributions from the community and stakeholder organisations.

As the Task Force has systematically reviewed the literature and policies and practices around Australia, it has become increasingly aware of the multifaceted nature of school transport safety and the large number of different, even unrelated, factors which influence the safety of students as they travel to and from school. Addressing any one of these factors might have a positive effect on safety, but addressing many factors even to a limited extent could have enormous benefit. School transport involves us all. Working together, the Queensland community has the potential to change road-user behaviour and improve school transport safety. These possibilities for change will be addressed in the Report of the Task Force, due at the end of September 2001.

INTRODUCTION

Each week day in Queensland, more than 600 000 primary and secondary school students travel to and from school, using a variety of public and private transport. Everywhere there is recognition of the value placed on the life of a child or young adult. Hence, maximising safety in school transport is a major concern for the whole community, and an issue that involves most of us in the community.

Because of its importance as an issue, school transport safety has been the subject of extensive research in Australia and internationally. Governments at all levels regularly review their policies and practices in order to identify and reduce risks. Most recently, the Australian Road Research Board (ARRB) developed a set of school bus safety recommendations which were incorporated into the draft *National School Bus Safety Action Plan*. The Plan sets a national goal to reduce the total annual number of child fatalities associated with school bus travel to zero by the year 2005 (Austroads, 2001a).

Formation of a School Transport Safety Task Force

In March 2001, the Queensland Government established an independent Task Force on School Transport Safety with the following terms of reference, approved by Cabinet:

- review current research on school transport safety, including the outcomes of recent studies and the effectiveness of current school transport safety programs
- prepare an interim report analysing international, national and interstate policies and practices relating to school transport, including the use of seat belts on school buses
- consult with stakeholders and community groups and invite public submissions
- make recommendations to Government within six months on priorities for ensuring the safety of children travelling to and from school and implications for the Government and the community.

Membership of the Task Force is:

- Dr Cherrell Hirst AO MB BS, BEdSt *Qld*, DUniv *USC*, FAICD, Director, Wesley Breast Clinic and Chancellor, QUT (Chairperson)
- Mr Garry Cislowski BAppSc (Surv) *QUT*, Lic Surv, President, Queensland Council of Parents and Citizens Associations (QCPCA)
- Mr Graham Davis, Divisional Manager, Brisbane Transport
- Ms Lorraine Douglas-Smith, Executive Director, Queensland Bus Industry Council
- Mr Alan Druery BA, BEdSt, MEdAdmin, DUniv *QUT*, FQIEA, FACEA, FACE, Executive Director, Catholic Education Commission
- Mr Greg Duck, BSc, BEdSt, MEdSt, DipInfProc *Qld*, Manager (School Transport), Education Queensland
- Mr Tony Kursius BA *Qld*, MPubPol *UNE*, Executive Director (Land Transport and Safety), Queensland Transport
- Dr Cliff Pollard BD, MB BS *Qld*, FRACS, FRCS *Edin*, FACS, Queensland Trauma Committee, Royal Australasian College of Surgeons
- Professor Mary Sheehan BA (Psych) Hons, DipPsych *Syd.*, PhD *Qld*, FACRS. Director, Centre for Accident Research and Road Safety – Queensland (CARRS-Q), Head of School of Psychology and Counselling, QUT
- Ms Renae Moore BA (Psych) *Qld*, Research Officer and Secretary to the Task Force
- Mr Colin Edmonston BA (Psych) Hons *CQU*, Research Officer.

The Task Force held its first meeting on 26 March 2001 and agreed to meet fortnightly, until submission of its final report to the Queensland Government at the end of September 2001.

Purpose of this Overview

This overview discharges the Task Force's responsibility under its first and second terms of reference. The overview:

- identifies risks in the Queensland context by presenting national and Queensland road crash data for the past decade in terms of fatalities and hospitalisations among school-aged students during school travel times

- presents the results of a review of national and international research on school transport
- identifies issues for further consideration in terms of the various community members involved in school transport (students, parents and carers, educators, drivers, media and health professionals, transport planners, and bus operators and designers).

The Task Force has researched a number of safety aspects associated with school transport by bus. The Queensland Cabinet's terms of reference for the Task Force expressly mentioned the issue of seat belts in buses used for carrying students. A preliminary analysis of submissions to the Task Force indicated that transport by bus is an issue of concern in the wider community. Since the Task Force commenced its work, media coverage of school transport safety has focused almost exclusively on the issue of seat belts in buses.

The analysis of Queensland road crash data provided in this overview shows that in the 10 years from 1991, fewer students were killed or hospitalised as a result of bus crashes than as a result of crashes involving any other mode of transport. At the same time, the Task Force is aware that a major crash involving a bus could have grave consequences for families and communities.

A risk-management approach to school-transport safety would attempt to place a value on the potential *severity* of a crash in terms of social and financial cost, as well as *exposure* to danger faced by students and the *probability* or likelihood of a crash occurring. Such an approach would measure risk as the frequency of crashes multiplied by crash severity.

Risk = Crash Frequency x Severity
(Cost) (Probability x Exposure) (Crash Cost in Lives)

This relationship between probability and potential severity is a key one in devising strategies to improve school transport safety. While the Task Force intends to consider ways of improving safety in those modes of transport that have in the past resulted in fatalities and injuries, it also needs to be mindful of the potential losses which would result from a rare but grave event, such as a major bus crash. The Task Force will work to identify strategies that increase school transport safety by reducing crash frequency and/or severity (Department of Main Roads, 2001).

The Task Force recognises that school transport safety relies on a complex network of relationships between people, vehicles and infrastructure that extends throughout the community. No amount of planning and strategising from a task force or any other body will bring about the kind of change that community awareness can generate. This includes most of us—as drivers slowing down around schools, as parents and other adults modelling good pedestrian behaviour for younger students, as older students driving to school for the first time, or even as journalists with responsibility to inform the community about risks, or transport planners responding to community concerns about rural bus routes.

Ultimately, reducing the number of students killed or injured on their way to or from school may rely on every person involved in school transport. It is hoped that this overview provides insight into the areas of risk associated with school transport, as well as preliminary ideas and strategies for improved safety.

Scope of this Overview

This overview makes no recommendations. It is intended to inform and encourage further community contribution to help identify issues and possible strategies to improve school transport safety in Queensland.

The overview does not deal with the Task Force's final two terms of reference which concern consultation with stakeholders and final recommendations. The Task Force will need to consider submissions fully and undertake further community and expert consultation before preparing its final recommendations to Government.

For the purposes of this overview, the Task Force has determined that all literature reviewed should be current. In most cases, Australian literature has been limited to that published after 1988 when development began on bus-specific Australian Design Rules (ADRs). The Task Force is aware that its research task is not yet complete.

Task Force Work Plan

The ongoing processes to gather and respond to community input and expert advice are detailed below.

Community Input

In accordance with its terms of reference, the Task Force wrote to all individuals and

organisations who had expressed concern to the Premier or the Minister for Transport and Minister for Main Roads regarding school transport safety over the previous 12 months to invite them to make a submission. The Task Force also invited submissions from major school transport safety stakeholders, including Queensland schools and school bus operators. A public call for submissions was made through advertisements in all Queensland major daily newspapers on Saturday 31 March and Wednesday 4 April 2001. The call for submissions was also broadcast on regional radio, and advertised in *Education Views* and the Queensland Council of Parents and Citizens Association (QCPCA) newsletter in April. Before submissions closed, print and broadcast media provided a forum for discussion and debate on a number of key issues which helped to ensure that the Task Force's role was widely publicised.

The Task Force set up a dedicated Web page on the Centre for Accident Research and Road Safety-Queensland (CARRS-Q) Website, providing information about the Task Force and facts about school transport safety in Queensland. The Website has enabled lodgement of email submissions.

The official closing date for the first round of public submissions was 31 May 2001. A record of all submissions received has been incorporated into a database maintained by the Task Force that identifies, for each submission:

- the name of the concerned party or community group
- the nature of the issue(s) (eg seatbelts on school buses, standing passengers, safe routes to schools)
- the locality of the problem(s) (ie rural, urban, and remote).

A thorough analysis of submissions will be completed to pinpoint major issues in the Queensland context. Once common concerns have been extracted from the database, a number of submissions will be explored further through personal interviews.

Expert and Stakeholder Input

The Task Force is meeting with a number of experts including researchers in various aspects of road safety, educators, emergency services professionals, media professionals, engineers and police, to discuss school transport safety and strategies for improvement.

The Task Force is also meeting with bus operators, bus designers/manufacturers and other representatives of the bus industry to ensure a comprehensive coverage of relevant issues.

Further Information

Further information about the Task Force and related issues will be posted on the CARRS-Q Website:

www.hlth.qut.edu.au/psyc/carrs/schooltransportsafety/index.asp

SCHOOL TRANSPORT SAFETY: RECENT DATA

In order to identify the magnitude and characteristics of school transport-related crashes[1], the Task Force analysed national data from the recent Austroads (2001b) study of school transport by bus[2], and Queensland data provided by Queensland Transport on school transport by bicycle, bus, car, motorcycle, or on foot.

Scope of Data

This analysis looks at total fatalities and hospitalisations resulting from crashes involving various modes of school transport in Australia and in Queensland. The Task Force has no information about the total number of students using particular modes of transport other than buses. This makes conclusions about the relative safety of various modes of transport difficult.

Available data show that transport to and from school by bus resulted in fewer fatalities and hospitalisations than travelling in a car, cycling or walking to or from school. However, school transport by bus includes travel outside the morning and afternoon commuting times examined here (excursions, camps etc). Data on school transport by bus other than in commuting times were unavailable for analysis. A report of major bus crashes involving school students, including those occurring outside school commuting hours, is included as Appendix 1.

It should also be noted that school transport by bus includes school services, which are solely for student transport to and from school, and public passenger services which include a mix of school students and other passengers. The data here include both kinds of services. See later for details of **Bus Operators** and **Bus Designers and Policy-Makers.**

Differences between state and national data sets include differences in years of data collection, hours defining school travel times[3] and categories of school traveller. This means that only broad comparisons are possible between national and state data.

National Data

National trends are derived from the recent Austroads (2001b) study on school transport by bus which extracted data from three national road crash databases collated by the Australian Transport Safety Bureau (ATSB). Definitions of these databases are included in Appendix 2.

The Austroads research is limited to pedestrian and bus transport to and from school. National data on fatalities and injuries incurred in other modes of school transport (ie car, bicycle, motorcycle) were unavailable for analysis.

Table 1 shows fatalities and hospitalisations resulting from school transport-related crashes in Australia 1990 to 1997.

Table 1: Number of 5–17-year-old pedestrians and bus passengers killed or hospitalised in road crashes during school travel times in Australia 1990–1997

Mode of transport	Fatalities	Hospitalisations
Pedestrian/bus pedestrian	113	2151
Bus passenger	6	78

Source: Monthly Fatality Database and Serious Injury Database 1990–1997

In the eight-year period 1990–1997, a total of 113 fatalities and 2151 hospitalisations resulted from students[5] being struck by a vehicle during school travel times. During the same period, six student bus passengers were killed and 78 were hospitalised as a result of crashes.

Figure 1 (page 8) shows that the number of student pedestrians killed or injured in school travel across Australia decreased from 27 fatalities and 360 hospitalisations in 1990 to four fatalities and 213 hospitalisations in 1997. A further breakdown of the data used to complete Figure 1 is included in Appendix 2.

[1] For the purpose of this analysis, road crashes were deemed to be school transport-related if the following conditions were met:
- a school-aged student (5–17 years) was killed or hospitalised; and
- the school-aged student (5–17 years) appeared to be going to or coming from school (travelling during school commuting times on week days within school terms).

[2] School transport by bus includes school services and public passenger services.

[3] School commuting times are defined in national data as travel between 8am–10am and 3pm–5pm and in the Queensland road crash database as travel between 7am–9am and 2pm–4pm.

[4] National data count bus pedestrians, who are walking to board or after alighting from a bus, as pedestrians, whereas Queensland data draw a distinction between bus and other pedestrians.

[5] Student means 5–17-year-old in text references.

Figure 1: Number of 5–17-year-old pedestrians killed or hospitalised in road crashes during school travel times in Australia 1990–1997

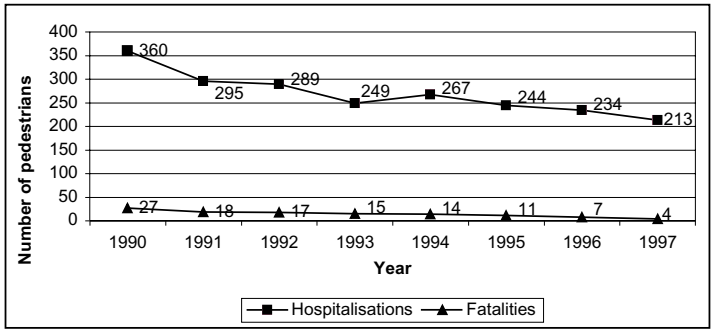


Table 2 presents school transport-related fatalities and injuries among pedestrians and bus passengers during morning and afternoon travel periods in Australia from 1990 to 1997.

More than three quarters of the pedestrian fatalities and hospitalisations occurred during the afternoon (3pm to 5pm) rather than the morning (8am to 10am) travel period. Bus passenger fatalities and hospitalisations show a similar trend.

The Austroads (2001b) study of bus crashes also drew on more detailed analyses of fatalities in 1992, 1994, 1996 and 1997 in school transport-related bus crashes. Key findings of these analyses are included under relevant headings of the **Queensland Data** section.

Queensland Data

This analysis provides an overview of fatalities and hospitalisations resulting from school transport-related crashes in Queensland for the period 1991 to 2000, by mode of transport, age and gender of students killed or hospitalised, time of day and region. The data were derived from the Queensland Police Service Traffic Incident Reporting System (TIRS) and are contained in the Queensland Road Crash Database maintained by Queensland Transport's Land Transport and Safety Division.

The Task Force acknowledges that the analysis presented here precedes a crash at Gracemere (near Rockhampton) on 7 March 2001 in which a bus on a public passenger service was hit from behind by a truck. In total, six passengers were hospitalised, of whom four were school-aged. There were no fatalities (see Appendix 1).

Mode of Transport

Ways of getting to and from school involve many different modes of public and private transport and reflect a complex network of relationships between people, vehicles and infrastructure. To make recommendations for improvements in school transport safety, the Task Force would ideally like to distinguish the degree of risk associated with different modes of transport. As indicated earlier, available data do not show the number of students using a particular mode of transport, except in the case of transport by bus. In other modes of transport, the only data available are the total number of fatalities and hospitalisations resulting from crashes. This makes comparisons difficult.

Table 3 (page 9) presents student fatalities and hospitalisations by mode of transport. The data show that 71 per cent of students killed during school travel times between 1991 and 2000 in Queensland were killed either in car crashes (45 per cent) or as pedestrians (26 per cent). Cyclists accounted for a further 14 per cent of fatalities.

Table 2: Number of 5–17-year-old pedestrians killed or hospitalised in road crashes morning or afternoon in Australia 1990–1997[6]

Mode of transport	Morning (8am-10am)		Afternoon (3pm-5pm)	
	Fatalities	Hospitalisations	Fatalities	Hospitalisations
Pedestrian/bus pedestrian	24	506	89	1645
Bus passenger	1	21	5	57
Total	**25**	**527**	**94**	**1702**

Source: Monthly Fatality Database and Serious Injury Database 1990–1997

[6] Because hospitalisation data are unavailable for 1998–2000, data on fatalities 1998–2000 were not included in Table 2. During 1998–2000, five pedestrian fatalities occurred in the morning period and 18 occurred in the afternoon period. See Appendix 2 for details.

Table 3: Number of 5–17-year-olds killed or hospitalised in road crashes during school travel times in Queensland 1991–2000

Mode of transport		Fatalities	Hospitalisations
Private car	(n=414)	29	385
Pedestrian	(n=383)	17	366
Cyclist	(n=484)	9	475
Bus pedestrian[7]	(n=72)	9	63
Bus passenger	(n=14)	1	13
Motorcyclist	(n=17)	0	17
TOTAL		**65**	**1319**

Source: Queensland Road Crash Information System 1991–2000

More than one third (36 per cent) of students hospitalised following school transport-related crashes between 1991 and 2000 were cyclists. A further 29 per cent of those hospitalised were in car crashes, and 28 per cent were struck by vehicles as pedestrians (not counting bus pedestrians).

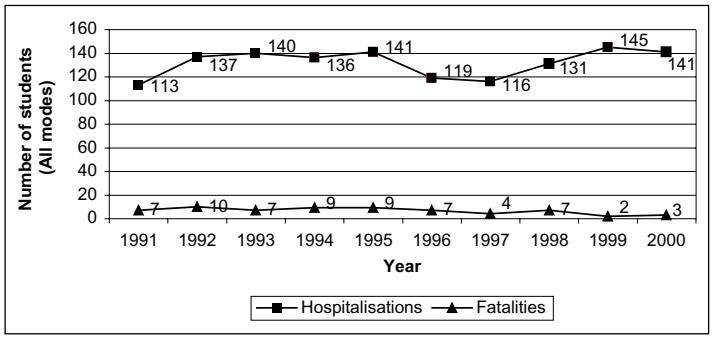
Unfortunately, the Task Force has no data on total populations using various modes of transport, except in the case of school transport by bus, where School Transport Assistance Scheme[8] (STAS) funding provides some guidance. Almost a fifth of Queensland's school-aged population (n=105 000) receive assistance for school transport by bus. It should be noted that receipt of STAS support does not accurately reflect school bus usage by Queensland students. On the one hand, a large number of students who do not meet STAS eligibility requirements pay cash fares and these are not included. On the other hand, STAS support does not necessarily guarantee that a student will take the bus to and from school every day. In 2001, STAS bus recipients make up 18 per cent of the student population in Queensland. Between 1991 and 2000, students travelling by bus accounted for only six per cent of the school transport-related fatalities and hospitalisations in Queensland.

Queensland data distinguish between bus passengers, who were on a bus when injured or killed, and bus pedestrians, who were walking to or from a bus when injured or killed. Of the 10 bus fatalities among students during school travel times in 1991–2000, nine were bus pedestrians. This is consistent with the more detailed analysis in the Austroads (2001b) study for 1992, 1994, 1996 and 1997 which found that fatalities were more likely to happen to bus pedestrians[9] than to bus passengers. (Austroads, 2001b).

Austroads (2001b) also found in the detailed analysis of 1992, 1994, 1996 and 1997 that nearly 90 per cent of school transport-related, bus-passenger and pedestrian fatalities were a result of crashes (or vehicles striking pedestrians) mid-block (away from intersections) on two-way undivided roads devoid of a pedestrian crossing.

Figure 2 shows that the number of students killed in school transport-related crashes in Queensland decreased from seven fatalities in 1991 to three fatalities in 2000. The number of students hospitalised as a result of crashes fluctuated throughout the period. Data tables are included in Appendix 3.

Figure 2: Number of students (travelling by all modes) killed or hospitalised in crashes during school travel times in Queensland 1991–2000



[7] A bus pedestrian is a pedestrian walking to board or after alighting from a bus.

[8] STAS is an eligibility-based scheme that funds student transport, mainly by bus (primary students must live > 3.2 km from the closest state primary school, and secondary students must live > 4.8 km from the closest state facility).

[9] A bus pedestrian is a pedestrian walking to board or after alighting from a bus.

Figure 3: Number of 5–17-year-old pedestrians killed or hospitalised in road crashes during school commuting times in Queensland 1991-2000

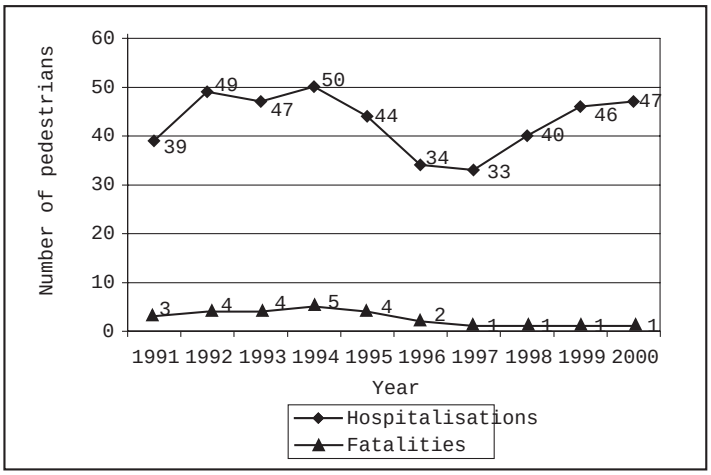


Figure 3 shows pedestrian (including bus pedestrian) and bus passenger fatalities and hospitalisations 1991–2000 in Queensland, in order to provide a point of comparison with Figure 1 national data.

While the number of fatalities has remained low, mirroring the national trend, the number of student pedestrians hospitalised after being struck while travelling to or from school in Queensland increased from 39 hospitalisations in 1991 to 47 hospitalisations in 2000. Although fluctuation in hospitalisation figures can be expected given the small numbers involved, the Queensland experience is not consistent with the decreasing national trend in student pedestrian hospitalisations during school travel (Austroads, 2001a).

There were 14 school transport-related bus pedestrian hospitalisations in Queensland in 2000, compared to six in 1999.

Age

The age range of students involved in school transport spans developmental stages of childhood and adolescence and the shift from primary to secondary education. The Task Force explored patterns that might emerge based on age of school travellers.

Table 4 provides a breakdown by age of student fatalities and hospitalisations.

Across all modes of transport, primary school students (5–12-year-olds) accounted for just over half (50.1 per cent) of fatalities and hospitalisations. However, while cyclist and bus passenger fatalities and hospitalisations are fairly evenly spread between primary and secondary (13–17-year-old) school students, two thirds of all pedestrian (including bus pedestrian) fatalities and hospitalisations were among primary school students. This is consistent with the national data (Austroads, 2001b) which showed that primary school students accounted for more than 75 per cent of school transport-related pedestrian fatalities.

More than 90 per cent of motorcycle and 60 per cent of car crash fatalities or hospitalisations were secondary school students. The number of motorcycle and car crash fatalities or hospitalisations rose sharply for 17-year-olds, presumably reflecting the age at which Queenslanders are eligible for a driver's licence. While the number of motorcycle crash fatalities or hospitalisations is much smaller than the number of car crash fatalities or hospitalisations, this is an issue of concern considering how few students would be likely to ride or be passengers on motorcycles.

Seventy per cent (147) of the 17-year-olds killed or hospitalised following road crashes were travelling in cars.

Table 4: Number and age of students killed or hospitalised due to road crashes during school travel times in Queensland 1991–2000

Mode of transport	Age												
	5 yrs	6 yrs	7 yrs	8 yrs	9 yrs	10 yrs	11 yrs	12 yrs	13 yrs	14 yrs	15 yrs	16 yrs	17 yrs
Private car (n=414)	32	14	19	14	18	25	23	21	15	16	27	43	147
Pedestrian (n=383)	30	39	29	41	37	37	22	20	42	26	24	19	17
Cyclist (n=484)	1	14	14	26	30	38	40	55	74	61	47	49	35
Bus pedestrian (n=72)	2	10	4	7	2	6	6	10	10	7	2	5	1
Bus passenger (n=14)	0	0	2	0	2	0	1	2	2	1	2	2	0
Motorcyclist (n=17)	0	0	0	0	0	0	1	0	1	0	1	3	11
TOTAL	**65**	**77**	**68**	**88**	**89**	**106**	**93**	**108**	**144**	**111**	**103**	**121**	**211**

Source: Queensland Road Crash Information System 1991–2000

Gender

Table 5 provides a breakdown by gender of student fatalities and hospitalisations.

Table 5: Number and gender of 5–17-year-olds killed or hospitalised due to road crashes during school travel times in Queensland 1991–2000

Mode of transport	Gender	
	Males	Females
Private car (n=414)	191	223
Pedestrian (n=383)	239	144
Cyclist (n=484)	365	119
Bus pedestrian (n=72)	41	31
Bus passenger (n=14)	5	9
Motorcyclist (n=17)	14	3
TOTAL	**855**	**529**

Source: Queensland Road Crash Information System 1991–2000

Overall, more male students (1.6 to 1) were killed or hospitalised as a result of road crashes in school travel times than females. There were also many more male cyclists (3.1 to 1) and more male pedestrians (1.7 to 1) killed or hospitalised. More females were killed or hospitalised as a result of car or bus crashes.

Time of Day

National data (Austroads, 2001b) suggest students are at greater risk of school transport-related crash injuries in the afternoon than in the morning travel period. Table 6 presents the Queensland data on student fatalities and hospitalisations by time of day.

Table 6: Number of 5–17-year-olds killed or hospitalised by time of day of road crashes during school travel times in Queensland 1991–2000

Mode of transport	Time of Day	
	Morning (7am–9am)	Afternoon (2pm–4pm)
Private car (n=414)	154	260
Pedestrian (n=383)	87	296
Cyclist (n=484)	153	331
Bus pedestrian (n=72)	13	59
Bus passenger (n=14)	3	11
Motorcyclist (n=17)	4	13
TOTAL	**414**	**970**

Source: Queensland Road Crash Information System 1991–2000

Table 6 shows that students are much more likely to be killed or hospitalised following crashes in the afternoon, with 70 per cent of fatalities or hospitalisations occurring in the 2pm–4pm travel period.

More than three quarters (78 per cent) of pedestrian, bus passenger and bus pedestrian fatalities and hospitalisations occurred in the afternoon travel period, which is consistent with national trends (Austroads, 2001b).

Region

The detailed analysis of 1992, 1994, 1996 and 1997 included in the Austroads (2001b) study found that fatalities resulting from school transport-related bus crashes (bus passengers in crashes and bus pedestrians struck by a vehicle) occurred slightly more frequently in rural or regional areas with speed limits of greater than 80kph. A preliminary analysis of submissions to the Task Force identified rural and remote bus transport issues as a community concern.

Queensland school transport-related crash data are not available by urban/rural area in which crashes occurred. However, using raw data from the Queensland Road Crash Database, the Task Force was able to identify school transport-related fatalities and hospitalisations by speed zone.

Table 7 (page 12) shows the number of students killed or hospitalised in school travel times in speed zones in Queensland from 1991 to 2000. Unlike the data presented in previous sections, the data presented in Table 7 are raw and contain some cases that are not school transport-related.

Total populations in areas with posted speed limits of under-80kph are likely to be higher than in the over-80kph areas. Table 7 shows that overall, 59 per cent of fatalities and 87 per cent of hospitalisations occurred in under-80kph areas. Cyclists and pedestrians accounted for 75 per cent of hospitalisations in these areas.

The higher rate of hospitalisations in areas with lower speed limits might be a result of increased exposure (ie more students and more trips) in under-80kph areas.

In contrast, fatalities and hospitalisations among bus passengers were more likely (61 per cent) to occur in areas with a posted speed limit of 80kph or above. While the overall number is small, this difference is of concern considering that population differences would suggest the balance would be the other way.

Table 7: Number of 5–17-year-olds killed or hospitalised by speed zone of crashes during school travel times in Queensland 1991–2000

Mode of transport	Speed Limit ≥ 80kph More Rural		Speed Limit < 80kph More Urban	
	Fatalities	Hosp.	Fatalities	Hosp.
Private car (n=439)	19	129	21	270
Pedestrian (n=484)	8	18	20	438
Cyclist (n=504)	3	14	5	482
Bus pedestrian	Not distinguished from pedestrians			
Bus Passenger (n=18)	1	10	0	7
Motorcyclist (n=41)	1	5	0	35
TOTAL	**32**	**176**	**46**	**1232**

Source: Queensland Road Crash Information System 1991–2000 (Raw dataset)

This is also consistent with national trends (Austroads, 2001b).

The only other primary data source available to the Task Force at the present time is crashes by Queensland Transport operational region. The South East region is primarily urban, although differences between this and other regions may not necessarily highlight issues relevant particularly to rural and remote communities.

Table 8 provides a breakdown by region of crashes during school travel times 1991–2000.

Sixty-one per cent of the students killed or injured during school travel times were involved in a crash in Queensland Transport's primarily urban South East Region which accounts for 66 per cent of the total state population in 2001. This may point to a slightly greater risk in the less population-dense regions of the state, which would be consistent with Table 7 on crashes in over-80kph zones, and national data.

Table 8: Number of 5–17-year-olds killed or hospitalised by region of road crashes during school travel times in Queensland 1991–2000

Mode of transport	Region			
	South East	Southern	Central	Northern
Private car (n=414)	232	81	48	53
Pedestrian (n=383)	290	42	18	33
Cyclist (n=484)	265	86	73	60
Bus pedestrian (n=72)	45	9	4	14
Bus passenger (n=14)	9	3	1	1
Motorcyclist (n=17)	9	2	4	2
TOTAL	**850**	**223**	**148**	**163**

Summary of Recent Data

The analysis of school transport-related crashes in Queensland between 1991 and 2000 revealed that:

- While fatalities have decreased (from seven in 1991 to three in 2000), hospitalisations have fluctuated (between 113 in 1991 and 145 in 1999). Nationally, pedestrian and bus crash fatalities and hospitalisations have both decreased.
- More than 90 per cent of the students killed or hospitalised with injuries were travelling in cars, on bicycles or as pedestrians.
- Six per cent of the students killed or hospitalised with injuries were travelling by bus.
- One per cent of the students killed or hospitalised with injuries were bus passengers (the rest were bus pedestrians, walking to or from a bus).
- Currently, 18 per cent of Queensland's school students receive bus transport assistance.
- Primary school-aged students accounted for two thirds of all pedestrian fatalities and hospitalisations.
- Secondary school-aged students accounted for more than 90 per cent of motorcycle and 60 per cent of car crash fatalities and hospitalisations.
- More male than female students were killed or injured as pedestrians, cyclists or in motorcycle crashes.
- More female than male students were killed or injured in car and bus crashes.
- School transport-related fatalities and hospitalisations were more frequent in the afternoon. This is consistent with national research.
- More pedestrians, cyclists and students in cars were killed or injured in crashes in areas with speed limits of under 80 kilometres per hour. More bus passengers were killed or injured in areas with speed limits of 80 kilometres per hour or above. This is consistent with national research which also suggests pedestrian fatalities are more likely to occur in areas devoid of pedestrian crossings.

SCHOOL TRANSPORT SAFETY: THE PEOPLE

The data analysis in the previous section shows that the number of fatalities resulting from school transport-related crashes has decreased in Queensland in the past decade, consistent with national trends. This reduction in the state's road toll reflects changes in policy and the dedicated efforts of many sectors of the community.

National trends also show a decrease in hospitalisations. This trend is less apparent in Queensland where numbers of hospitalisations have fluctuated over the 10-year period. Further improvement in school transport safety in Queensland will require the continued commitment of everyone involved in school transport.

As a result of reviewing the data and gaining an increased understanding of the issues relating to school transport safety, the Task Force is forming a view that fundamentally it is people who influence school transport safety and people who are primarily able to bring about change as they understand better the issues. The Task Force has decided therefore to present this overview in terms of the roles, responsibilities and actions of the people concerned with safety at the various places along the school transport route, including the students themselves, their parents and carers, school educators, drivers around schools, transport planners, bus designers and operators, and health and media professionals.

Students

The Queensland school transport crash data show that in school transport-related crashes over the past decade:

- most students were killed in private cars or as pedestrians
- most students hospitalised were cyclists, pedestrians or in private cars.

Further investigation of the issues associated with school transport by car, bicycle and on foot will be undertaken in the coming months, ahead of the Task Force's final report.

The Queensland crash data also show that:

- primary school-aged students accounted for two thirds of all pedestrian fatalities and hospitalisations
- secondary school-aged students accounted for more than 90 per cent of motorcycle and 60 per cent of car crash fatalities and hospitalisations.

The data show that many more school students were killed or injured in the afternoon than in the morning.

Younger Students (5–12-year-olds)

Based on national and Queensland data, the most common scenario for a pedestrian school transport-related injury or fatality is when a primary school student (more typically male) is crossing a road when travelling home from school and is hit by a passing vehicle.

Safe road-crossing decisions require accurate judgement of speed and distance. Research suggests that primary school children lack the perceptual skills needed to learn safe road user practices and act appropriately in traffic. The general consensus among researchers is that the perceptual and cognitive functioning necessary to make such decisions may exceed young children's developmental capacity (Shinar, 1978; Siegler & Richards, 1979; Vinje, 1981). Based on the results of a series of experiments that measured school-aged children's road-crossing behaviour and ability to make judgements about gaps in traffic, Connelly et al (1998, p. 450) concluded that "…pre-adolescent school-aged children, particularly those aged below 10 years, have relatively poor skills at reliably setting safe distance gap thresholds, and thus do not consistently make safe crossing decisions."

The fact that younger primary students cannot be relied upon to make safe decisions in the traffic environment has direct implications for the management of school transport and pedestrian safety.

Older Students (13–17-year-olds)

Based on the Queensland data, older students are more likely to be killed or hospitalised as a result of car and motorcycle crashes than younger students.

The Task Force was concerned by the sheer number (147) of 17-year-olds killed or hospitalised following car crashes in the period 1991–2000. Motorcycle fatalities and hospitalisations, although much smaller in number, are also of concern.

The fact that fatalities and hospitalisations rose so sharply for 17-year-olds presumably reflects the fact that 17 is the age at which

Queenslanders are eligible for a driver's licence (see later under **Drivers of Cars**). The Task Force believes that increased community awareness of this risk to young adults may help. The issue of secondary school-aged travellers in cars and on motorcycles will be investigated further in the coming months. (eg increased community awareness, driver/rider education and supervision).

Student Behaviour on Buses

The behaviour of students in buses and associated driver distraction issues have been recognised as potentially contributing to crash risk (Henderson et al, 1995). The ARRB report noted that most Australian states have introduced codes of conduct to assist in the management of student behaviour on buses (Austroads, 2001a).

The Queensland Transport *Code of Conduct for Travel on Buses*, introduced in 1998, provides a framework to assist bus operators in the management of situations where students misbehave on buses. The Code outlines the role of students, parents/carers, conveyance committees, bus operators, school principals and Queensland Transport. The Code also identifies categories of misbehaviour (Queensland Transport, 1999).

Henderson et al (1995) conducted interviews with representatives from seven bus companies and schools in New South Wales, and found that instances of disruptive behaviour were few considering the large number of students travelling on buses. At the same time, they were frequent and alarming enough to be of concern to bus operators and schools. Bus companies said that some disruptive behaviour was distracting enough to prevent bus drivers from attending fully to the driving task.

Henderson et al (1995) attributed the disruptive behaviour of students to natural childhood exuberance, compounded by crowded buses and the mix of children from different age groups and different schools.

In Australia, there has been no systematic study of seat-belt wearing in buses among students or adults. In the USA, a study of 814 school districts with seat-belted school buses in New York and New Jersey (Centre for Urban Transport Research, 1994) revealed that in more than three quarters of the districts, students used their seat belts less than ten per cent of the time. The research also suggests students misuse their seat belts.

Parents and Carers

The analysis of Queensland data on school transport fatalities and injuries for 1991 to 2000 points to the afternoon school travel period as more likely to result in fatality or injury among students, particularly among 5–12-year-old pedestrians.

As discussed earlier under **Students**, research suggests children under 10 may not have developed the skills needed to judge distance and speed of approaching vehicles. This may have implications for the degree of supervision child pedestrians need.

Road safety education programs are the most common approach to preventing child pedestrian injuries in the school environment (Malek et al, 1990; Roberts, 1994). Austroads (2001a) noted that road safety education programs in each state target the behaviour of children around buses. Similar programs in the USA, Canada and the UK aim to increase the safe road user behaviour of children. Children are told about how to cross the road safely, danger zones surrounding a bus, appropriate conduct while on the bus, and school bus evacuation and emergency procedures.

Although road safety education programs have improved knowledge as measured by verbal report and/or observed behaviour, "… very few programs have produced evidence that the training is either durable or that it has reduced child pedestrian casualty rates." (Connelly et al, 1998, p.443). In fact, there is increasing concern that such programs give parents and children a false sense of confidence in the young child pedestrian's competence and safety (Connelly et al, 1998; Shinar, 1978; Vinje, 1981). Furthermore, "… specific cognitive developmental limitations may impose constraints on what children can learn and do in traffic environments, which also increases their crash risk." (Connelly et al, 1998, p.443).

Parents and carers play a pivotal role in pedestrian behaviour among younger students. Training as opposed to information-only education (showing rather than telling) has a greater potential to positively shape child pedestrian behaviour. A child's ability to make safe road-crossing decisions can be significantly improved by parents emphasising the dangers of the road environment and modelling safe road crossing behaviour, for example, by 'commentary walking' where parents talk through or explain while modelling safe pedestrian habits (Lam, 2000; Van Schagen & Rothengatter, 1997).

Drivers of Vehicles Carrying School Students

Drivers of Cars

National and Queensland data on school transport-related crashes reveal that more students are killed in car crashes on the way to and from school than in any other mode of transport. Older students are more at risk than younger students, and females are more at risk than males.

The Task Force sees school transport by car as an area for further work. There may be few strategies specific to drivers of cars carrying students, but a first step of identifying the risk, particularly among older students, and increasing community awareness, may help.

Cyclists

Queensland road crash data reveal that more cyclists were hospitalised than students using any other mode of transport. There were more male cyclist fatalities and hospitalisations than female.

Cyclists have some characteristics in common with pedestrians in school transport, including the need for skills in judging speed and distance of oncoming vehicles. The research on development of perceptual skills in younger pedestrians (see earlier section on **Students**) is equally relevant for younger cyclists.

Cyclists also share with pedestrians the need for safe routes to school which are appropriately separated from faster vehicles. See later section on **Transport Planners**.

The Task Force noted that helmets have been mandated for cyclists since 1991 in Queensland. Since this time there has been a marked decrease in head injuries (King & Fraine, 1994). The Task Force has asked Queensland Transport to provide data on helmet-wearing rates among students and the complex problem of enforcing helmet-wearing.

The Task Force will explore factors contributing to cyclist injuries in the coming months, to identify strategies to improve their safety.

Drivers of Buses

The recent Austroads (2001b) analysis for 1992, 1994, 1996 and 1997 indicated that there were slightly more bus crash fatalities in rural or regional areas with speed limits greater than 80kph. Queensland data also point to more fatalities and hospitalisations in over-80kph areas as a result of bus crashes.

Under the *Transport Operations (Road Use Management – Vehicle Standards and Safety) Regulation 1999*, all Queensland buses with a Gross Vehicle Mass (GVM) of more than 14.5 tonnes are mechanically or electronically speed-limited to 100kph. This represents 13 per cent of the buses used in school transport (Queensland Transport, 2001).

In early 2001, Queensland Transport conducted a trial of a lowered speed limit for school buses carrying standees (passengers forced to stand because there are no seats) in the Jimboomba area (Cluff & Dwyer, 2001) in which the buses were not permitted to travel above 80kph. The distance that standees were permitted to travel was decreased from the current limit of 20 kilometres to 16 kilometres, to ensure that exposure to crash risk was not increased because of increased travel time. An evaluation of the trial indicated that reduction in speed did not negatively affect driver schedules, and the report concluded that there were no concerns with restricting the speed of buses to 80kph when carrying standees (Cluff & Dwyer, 2001).

In NSW, there is a policy of restricting the speed of school buses carrying standees to 80kph.

Bus Driver-Passenger Interaction

Henderson et al (1995) found that school bus drivers lacked knowledge and effective behaviour management strategies and techniques that would help them respond to behavioural problems among students.

In Queensland all bus drivers are required to undertake training as part of the Operator Accreditation and Driver Authorisation requirements of the *Transport Operations (Passenger Transport) Standard 2000*. This training should ensure that drivers are aware of their obligations to safely operate the bus and that they understand their customer service responsibilities and conduct themselves appropriately. Some bus operators offer specific training in communication, complaints-handling and conflict management when dealing with students.

Queensland Transport has advised the Task Force that it is in the process of developing a training package for bus drivers in the management of student behaviour on school services, to work in conjunction with the *Code of Conduct* discussed earlier under **Students**.

In the USA the National Highway Traffic Safety Administration (NHTSA) has developed a proactive training package for

school bus drivers which addresses driver attitude, student management, loading and unloading issues, and the transportation of infants and toddlers (NHTSA, 1998). The package includes techniques for reducing driver stress.

Responsibility for Passenger Seat-belt Wearing

Under Queensland's *Transport Operations (Road Use Management – Road Rules) Regulation 1999*, a passenger of any vehicle must wear a seat belt if one is provided. In cars, the driver is legally responsible for ensuring passengers under the age of 16 wear seat belts. In buses, within current legislative provisions, the driver is not legally responsible for ensuring that those under 16 wear seat belts, even if seat belts are provided.

In the USA, a University of South Florida questionnaire study of school districts with seat-belted buses in New York and New Jersey (Centre for Urban Transport Research, 1994) pointed out that in the school districts where seat-belt wearing was mandatory (49 of the 814 school districts surveyed), it was school bus drivers who were responsible for ensuring belts were worn.

In the United Kingdom, where seat belts are mandated in minibuses in certain conditions and in coaches[10], drivers of minibuses are responsible for ensuring that seat belts are worn by children, and drivers of coaches are required to ensure that children in the seats in line with or forward of the driver wear a seat belt (Department of the Environment, Transport and the Regions, 1996). In the rear seats (ie those not in line with or in front of the driver) of coaches and larger minibuses (over 2540 kg) there is no statutory requirement for children to wear seat belts or child restraints.

Drivers of Other Vehicles

Speed Around Schools

All Australian states and territories currently have mandatory school zone speed limits. In Queensland, speed limits of 40kph, 60kph, or 80kph, depending on the usual speed limit of the area, apply around schools for specified school travel time periods.

The 40kph speed limit typically adopted in school zones has been shown to be associated with shorter stopping distances and a reduced likelihood of collision (Witherby, 1996). Enforcement of 40kph speed limits is a responsibility of the Queensland Police.

In Queensland, the SafeST Package (discussed later under **Principals, Teachers and School Communities**), offered by Queensland Transport and coordinated by individual schools, includes a Speed Awareness Program in which a school community can operate radar devices with vehicle speed display boards. The Queensland Police provide assistance about where to place devices if requested. The program has the potential to raise motorist awareness and reduce vehicle speeds in school areas. There is also a need for enforcement and police activity in school zones to change driver behaviour. To date, the Task Force has been unable to access data on how often school zone speed limits are enforced.

Speed zones around schools apply on week days during school terms, with times of day varying for individual schools. Drivers need to be aware not only of the driving task and the special risks around schools but also of the time of day, day of week and week of term in order to monitor their speed.

Pedestrian safety depends on vehicle speed, and there is continuing debate as to whether 40kph is a low enough speed limit around schools. A growing body of evidence suggests speeds need to be below 30kph to avoid most serious crashes (Oei, quoted in RTA, 1989; Várhelyi, 1998). At a collision speed of 50kph, the risk of fatal injury for a pedestrian is almost eight times higher than at a speed of 30kph (Pasanen, 1992). Based on a review of UK research, Hodge (1992) concluded that about 90 per cent of pedestrians struck by vehicles travelling at 40mph (64 kph) are killed; about 45 per cent of pedestrians struck by vehicles travelling at 30mph (48kph) are killed, but less than five per cent of pedestrians struck by vehicles travelling at 20mph (32kph) are killed.

In Scandinavian countries (OECD, 1983, cited in Pitt et al, 1990; Roberts, 1994), which are characterised by lower school transport-related child fatality and injury rates, the speed limit adopted around schools is 25kph.

The Task Force is continuing to consider advice from experts on the effectiveness of various reduced speed limits around schools.

[10] In the UK, a coach is a bus that can carry >16 passengers, with a GVM over 7.5 tonnes and a maximum speed of over 60 miles per hour.

Speed Around School Buses at Bus Stops

The national (Austroads, 2001b) data suggest that students who travel by bus are more at risk as bus pedestrians (walking to or from a bus) than as bus passengers. The analysis of Queensland data also pointed to a higher risk of fatality and injury among bus pedestrians than among bus passengers.

New South Wales and South Australia currently enforce speed limits around school buses at bus stops, of 40kph and 25kph respectively.

The New South Wales provisions were introduced in 1999 as part of a range of initiatives for school bus transport safety. All school buses are fitted with a 40kph speed limit sign and flashing wig-wag lights to the rear of the bus. Motorists travelling in the same direction as a school bus must slow down to 40kph if the bus has its wig-wag lights on and is preparing to stop (Austroads, 2001a). The Roads and Traffic Authority in NSW has commissioned an initial evaluation of a range of school bus transport safety initiatives introduced in conjunction with the speed limit around stopped school buses, but results of the evaluation are not yet available.

The South Australian Government introduced its 25kph "reduced speed limit around school buses" in 1997 (Gelston, 2000). Vehicles must slow to 25kph when a child is present in the road environment near a school bus. Although the South Australian initiative has not been subjected to evaluation, preliminary reports suggest the reduced limit is being adhered to by drivers (Gelston, 2000).

In New Zealand, motorists must not exceed 20kph when passing a stopped bus that is marked with "school bus" warning signs (Austroads, 2001a).

In the USA and Canada, motorists going in either direction must respond to a series of flashing lights on a school bus and stop when the bus stops to pick up or set down children, to allow children to cross the road if necessary (Centre for Urban Transportation Research, 1996). The laws are complex, with different requirements for motorists travelling on multi-lane divided roads. A University of Florida study of motorist compliance with school bus-stopping laws revealed that approximately one third failed to stop for Florida school buses when required (Centre for Urban Transport Research, 1996). Results of focus groups with Florida motorists suggested that the high incidence of illegal passing of stopped school buses was primarily the result of low enforcement levels and a lack of motorist awareness of the stopping requirements. The majority of the passing violations occurred when vehicles were travelling in the opposite direction to the school bus. Another survey of Florida's school bus stop laws revealed confusion among motorists about responsibilities as defined in the law, and the meaning of the various signals used by school buses (Baltes, 1998).

Mix of Vehicles

The mix of vehicles in a stream of traffic may affect the school transport environment and the safety of students around school buses.

Queensland Transport's Safe School Bus Routes program (discussed later under **Transport Planners**) considers vehicle mix when making decisions about priorities for bus routes nominated for review, and in the prioritisation of works (Queensland Transport, 1998).

The Task Force noted that only five per cent of the 2000 bus routes in Queensland have been reviewed under the Safe School Bus Routes program since its inception in 1997. The Department currently reviews 15 bus routes a year. School bus routes, particularly in rural areas, were a common concern raised in submissions to the Task Force.

School Principals, Teachers and School Communities

Queensland schools play a key role in school transport safety and the Task Force has identified a number of innovative programs implemented locally to improve safety for students.

The earlier section on **Students** points out that in Queensland in the last decade, school transport-related hospitalisations were highest among cyclists, and fatalities were highest in cars. Primary school-aged students were more likely to be killed or injured as pedestrians, and secondary school-aged students were more likely to be killed in car or motorcycle crashes.

To complement reduced speed limits in the vicinity of schools, road safety authorities in Western Australia, Victoria, South Australia, New South Wales and Queensland have worked with schools to implement Safe Routes to School (SRTS) style programs (Rose, 2000), based on a concept developed in Denmark in the 1980s (Neilson, 1990). These community-

based programs, which aim to improve the safety of student transport through increased adult supervision and the identification of safe travel routes to and from school, have become a core road safety initiative both in Australia (Rose, 2000) and the United Kingdom (Clarke, 1997).

SRTS programs aim to increase the number and safety of children walking and cycling to school through four common stages listed below (Rose, 2000):

- Planning and establishing the program—schools are selected or self-select to be involved and collaborative links are established between key stakeholders (road safety and transport authorities, police, government, school management, students) and community interest groups (parents and citizens associations).
- Investigating local issues and need—determining via travel surveys, questionnaires, consultation, observation and road network audits common routes used by children to access school, travel behaviour, and any associated problems.
- Developing and implementing an action plan—identifying solutions to problems which generally include a combination of engineering, education, enforcement and encouragement approaches. In Australian programs there is a strong focus on engineering and traffic-calming measures, such as kerb extensions, pedestrian safety islands, indented bus bays and marked bus waiting areas.
- Maintaining, monitoring and evaluating the program.

Queensland's Safe Routes to School style program gathers together a suite of initiatives within the Safe School Travel (SafeST) Package, implemented in 1997. The SafeST Package encourages all sectors of the community to play a role in the development and implementation of school transport safety strategies. Individual programs are introduced at the request of schools, and involve staff, students and families from the school, and staff from Queensland Transport, the Department of Main Roads, the Queensland Police and local government. The key programs of the SafeST Package are described below:

- The Safe School Bus Routes Program identifies routes with safety concerns and provides remedial funding (see later section on **Transport Planners**).
- The Safe Walking and Pedalling (SWAP) Program provides small-scale infrastructure funding and program funding (see below the "walking bus" and "bike train", see also later section on **Transport Planners**).
- The Speed Awareness Program helps drivers and school communities check the speeds of drivers around schools (see earlier section on **Drivers Around Schools**).
- The SafeST Subsidy Scheme is for large-scale infrastructure around schools, such as pick-up and setdown areas, bus bays, or pedestrian and cycle paths. Funding is provided by the Department of Main Roads and matched by local government funding.
- The School Crossing Supervisor Scheme has been operating since 1984 and now involves more than 1700 supervisors employed by Queensland Transport to monitor 980 pedestrian and children's crossings at 625 schools each morning and afternoon. There have been no school crossing-related fatalities or injuries on a supervised crossing since the scheme was introduced.
- The SafeST Package also provides a wide variety of educational and information resources (Ram & Moore, 2000) in the form of packs, stickers, publications and Internet resources.

Due to their multifaceted nature, it is difficult to analyse the effectiveness of Safe Routes to School programs in terms of reducing injuries. However, many Australian schools have developed an intersectoral road safety committee which highlights the value placed on Safe Routes to School programs as part of a community-owned school transport safety management strategy (Rose, 2000).

A Safe Routes to School program which encourages community ownership of school transport safety can serve as a tool to identify what resources are available in a community. For example, a number of jurisdictions in Australia and overseas have successfully implemented innovative forms of school transport such as the "walking bus" and "bike train" (Caunter & Browne, 2000) in which adult volunteers (often senior citizens) walk or cycle with a group of students to and from school via a safe route determined by key stakeholders and the community, picking up and dropping off students along the way.

Carmel College and Ithaca Creek State School in Brisbane are two examples of school communities taking initiatives to improve school transport safety. At Carmel College, school management has appointed an administrative officer to work closely with bus operators in the Capalaba area to ensure that students receive the best and safest possible public transport. This partnership enables regular communication and a strategic approach to issues such as student behavioural problems and transport planning. At Ithaca Creek, a proactive Parents' and Citizens' Association is committed to implementing a number of cost-free initiatives to encourage primary school children to walk and cycle in a safe road network to and from school. Some of the programs designed to highlight the social, environmental and health benefits associated with walking and cycling include:

- Smog Busters which encourages children to cycle and walk to save the environment
- Walk on Wednesdays
- The trial of a "walking bus" to be coordinated by volunteer senior citizens
- Red Sneaker Week, during which students from primary schools in the Gap Cluster in West Brisbane (Ithaca Creek State School, the Gap State School, Bardon State School, Payne Road State School and Oakleigh State School) will be encouraged to use alternative modes of travel to and from school under strict adult supervision. Students and schools will complete activity books and receive prizes for participation.

Newmarket State School in Brisbane offers prizes to children and parents for displaying correct or exemplary behaviour on the road. This form of positive reinforcement for effective parental modelling has promising implications for improving children's road crossing decisions.

Media professionals

The media can make a positive contribution to school transport safety, through improving community awareness of risks and assisting in the promotion of strategies that will be effective in improving safety.

In 1998, Queensland's Campaign 300 involved a partnership of government and media to increase community awareness. A concerted campaign might achieve positive outcomes for school transport safety.

Health Professionals

The treatment of those unfortunate enough to be injured in a school transport-related crash involves many levels of care: appropriate first aid, followed by emergency transport services, through to definitive care and rehabilitation.

The Task Force endorses the development of optimal standards of care at all levels in the management of the injured, resulting in the best possible outcome for the patient.

The Task Force recognises the specific challenges in providing optimal care in rural and regional Queensland and notes the support within the health professions for the development of statewide trauma pathways in the Queensland Emergency Medical System (QEMS).

Transport Planners

The Task Force acknowledges that many of the roles in school transport depend on one or more of the three levels of Australian government which determine public transport, road and education policy, funding and infrastructure. This overview has not set out to determine the specific roles of governments, except as they impact on transport planning and other areas of school transport.

Transport planners include professionals and senior managers from Queensland Transport, the Department of Main Roads, local governments, Education Queensland and the Department of Public Works and Housing. Given the high incidence of car, pedestrian and cyclist injuries, these people need to be heavily involved in school transport safety policy development.

Neilson (1990) found that engineering treatments (pedestrian refuge islands, increased curb space, chicanes, speed humps) to modify vehicle-approach speeds and other driver behaviour around schools successfully reduced accident frequency by up to 85 per cent in reduced speed areas. The SafeST Package includes a subsidy scheme for large-scale infrastructure around schools, such as pick-up and setdown areas, bus bays or pedestrian and cycle paths, funded by the Department of Main Roads and matched by local government funding. In the coming months, the Task Force will explore the role of transport planners in developing safer environments around schools.

The SafeST Package also includes the Safe School Bus Routes Program discussed in the following section.

School Bus Routes and Stops

Safe School Bus Routes

All Australian states have guidelines for bus routes and stops (Austroads, 2001a).

Under the Safe School Bus Routes program implemented in 1997, Queensland Transport reviews bus routes with identified hazards, and provides infrastructure funding subsidies to road authorities (Queensland Transport, 1998). As indicated earlier in the section under **Drivers of Other Vehicles**, 15 routes are reviewed each year and only five per cent of all routes have been reviewed to date.

Queensland Transport has provided a total of $1.8 million funding for remedial works on bus routes since the Safe School Bus Routes program's introduction. Many local authorities also contribute funding to complete additional works, bringing the total value of the program to date to more than $2.5 million (Donaghey & Chisholm, 2001).

In New South Wales, the 1992 School Bus Safety Task Force report recommended an examination of bus stops and bus routes to identify and reduce the use of locations which exacerbate the problem of children being hit by cars after alighting from a school bus. As part of a range of initiatives for school bus transport safety, the New South Wales Government introduced in 1999 a school bus black spot scheme to increase the safety of school bus stops with known safety issues, by installing warning and speed restriction signs reminding drivers that they must slow to 40kph when a bus is stopped in the black spot zone. A complementary program to move bus stops off high speed roads and onto lower speed side roads, where possible, was also introduced. To date, there has been no evaluation of this program.

Rural Bus Routes

The Queensland Department of Main Roads adopted design *Guide for Rural School Bus Routes and School Bus Stops* in 2001. The *Guidelines* outline factors to be taken into account when designing bus routes and deciding on the position of bus stops in rural areas (Department Main Roads, 2001). These factors include road surface condition, traffic delay and queuing, visibility, stopping sight distances, lane widths and road shoulders.

The Task Force noted that the *Guidelines* were only adopted in 2001 and would not yet have had an impact on rural bus route safety.

Bus Stops and Road-Crossing Options

Analysis of national road crash data (Austroads, 2001b) suggested that students who travel to and from school by bus, particularly primary school-aged students, tended to be more at risk around a bus than on a bus. The analysis of Queensland data also pointed to a higher risk of fatality and injury among bus pedestrians (walking to or from a bus) than among bus passengers.

A 1996 trial in New South Wales involved an on-road observational study of students alighting from a bus fitted with crossing control arms (Paine & Adams, 1996). The arms, which extend in front of a bus, force students to walk around to cross the road. The study revealed that some students waited until the control arm was retracted and the bus was moving to cross the road, and others were distracted by the arm, paying less attention to the road-crossing task. The report concluded that the installation of crossing arms on buses operating in NSW would decrease rather than increase the safety of children (Paine & Adams, 1996).

The School Bus Safety Task Force (1992) examined 1988–1989 New South Wales crash data involving school bus pedestrians during school travel times. The Task Force noted that a bus which has travelled 70 metres could still obscure a pedestrian on the side of the road from a motorist travelling in the opposite direction.

Tracking Systems for Buses

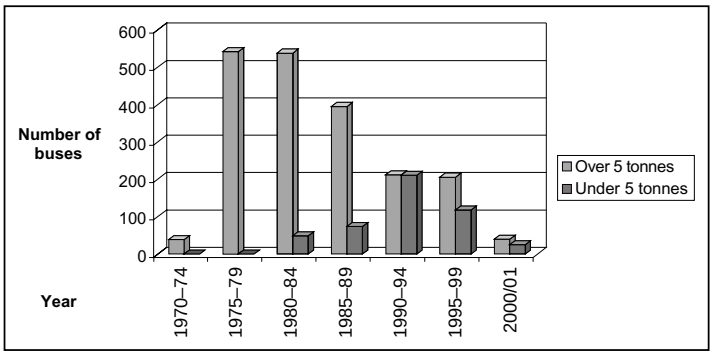
An electronic monitoring system for school buses was trialed in West Paterson, USA (Alvarado, 2000). The system included electronic ID tags, GPS and video-monitoring which tracked student pick-ups, scheduling and bus speed. Bus operators could use the system to determine if a bus had broken down or gone off route.

The Task Force found no data on vehicle tracking procedures in Australia. Vehicle tracking might have particular relevance for school buses in rural and remote areas of Queensland which are often at a distance from emergency services.

Bus Operators

Figure 4 provides a breakdown by age and size of the buses providing school transport services in Queensland.

Figure 4: Age of Queensland buses used for school transport



There are 2449 vehicles (37 per cent of all registered buses in Queensland) providing school transport services in Queensland, covering some 2000 bus routes throughout the state. Of the total, 1972 are heavy buses[11] (Queensland Transport, 2001).

The maximum age for a heavy bus in Queensland is 25 years, with provision for an extension of five years if the bus is upgraded. The maximum age for a light bus is 20 years.[12] There are stricter age limits on Open Classification for both heavy and light buses.[13]

The Task Force was concerned that more than half of all buses used for school transport in Queensland are more than 15 years old, and 30 per cent (n=609) of heavy buses are more than 20 years old. Three-quarters of the buses (n=1917) were built before 1992, which means they do not necessarily comply with the various design standards for safety, including rollover strength (Queensland Transport, 2001), discussed later under **Bus Designers and Policy-Makers**.

In Queensland, school and public passenger services are funded by a combination of cash fares from passengers and government funding which takes a number of forms:

- payment of the cost of providing bus transport to students eligible under the State Transport Assistance Scheme (STAS). This is a fee-for-service payment
- payment to operators to recompense them for government-specified concessions, eg children/pensioner discount fares
- operational funding to assist with the establishment of services that would not otherwise be viable
- assistance to purchase new and/or accessible buses for urban transport.

There are 1010 separate operators providing Government-supported school transport services in Queensland. More than half (54.7 per cent) are one-bus operators (Queensland Transport, 2001).

While not all school service operators receive government income for their services, the average government income per light bus is $35 500pa and per heavy bus is $46 500pa. In almost all cases charter income and cash fares supplement STAS income for bus operators.

Bus Designers and Policy-Makers

It is possible a disproportionate amount of attention is focused on bus design in this report—disproportionate in relation to the percentage of fatalities and hospitalisations among bus passengers relative to other modes of school transport in Queensland over the past 10 years. The Task Force has elected to provide the community with comprehensive and accurate information about bus design and its relationship to safety because of the number of submissions from community members relating to this topic and the level of attention given to it in the media.

Types of Bus Service

School students travel on three kinds of bus services:

- School services operated by contract service providers or schools themselves account for around 65 per cent (1600 buses) of the buses that carry children to and from schools in Queensland (Queensland Transport, 2001).
- Public passenger services, run by contract service providers including shire or city councils, account for the other 35 per cent (849 buses) of the buses that carry children to and from school in Queensland (Queensland Transport, 2001).
- School charter services, arranged by a school, use a provider of the school's choice (school excursions, camps).

Queensland Government funding under the School Transport Assistance Scheme (STAS) is provided for school services and for eligible students on public passenger services, with eligibility based mainly on distance from the nearest school. Some students also pay cash fares.

[11] A heavy bus has a Gross Vehicle Mass (GVM) of >5 tonnes.
[12] A light bus has a Gross Vehicle Mass (GVM) of 3.5–5 tonnes.
[13] Heavy buses can only have Open Classification (to travel unlimited distances) for 15 years; light buses for 10 years.

Types of Bus

All buses, whether they carry school students or not, are regulated by a complex framework of Commonwealth and State legislation which determines the distance and sometimes the speed a bus in a category can travel and the various design standards including safety standards that a bus in a particular category must meet.

New vehicle design and construction standards are specified under the Commonwealth *Motor Vehicle Standards Act 1989* which calls up the Australian Design Rules (ADRs) as the national standard for all road vehicles including buses. Particular standards apply to buses built with spaces for standing passengers (route service omnibuses[14]). These are the vehicles most likely to carry school students.

In Queensland, bus use is regulated according to the distance the bus is allowed to travel.

- Open Classification vehicles can travel unlimited distances.
- Regional Classification vehicles can travel in a 350km radius of first passenger pick-up.
- Local Classification vehicles can travel in a 40km radius of first passenger pick-up, or more than 40km if it is in a single or contiguous urban area.

Table 9 presents the different vehicles which might be used for school services in Queensland.

Carrying Capacity of Buses

In Australia carrying capacity of buses is weight-based and is determined at time of manufacture. Carrying capacity is limited by the lesser of:

- the Gross Vehicle Mass (GVM) of the bus
- the manufacturer's axle load limits, or
- regulatory axle load limits.

In Queensland, this is the only carrying limitation on buses, except for limits on the numbers of standees (see next section).

The Task Force understands that enforcement of vehicle loading limits is undertaken by Queensland Transport inspectors at random intervals, and in response to public complaints. The Task Force has requested data on the frequency and results of inspections of vehicles used for school and public passenger services.

Standees

All states in Australia currently permit the carriage of passengers who have to stand because all seats are taken (standees). Standees are only permitted on route service buses, which are buses specially designed with spaces for standing passengers. Route service buses are the most commonly used vehicle for public passenger and school services in Queensland. Non-route service buses, which are sometimes used on school services, are not allowed to carry standing passengers.

Operators and drivers in breach of the standee regulation are issued with a notice under Section 100 of the *Transport Operations (Public Transport) Act 1994*, and may be fined or lose Operator Accreditation and Driver Authorisation if they continue to offend.

Queensland's *Transport Operations (Public Transport) Standard 2000* prohibits buses from carrying standees on roads that have been identified as being a long, steep descent or very steep descent according to guidelines set out under the Department of Main Roads *Manual of Uniform Traffic Control Devices* (1995).

Table 9: Bus classification and type of service

Type of service	Vehicle classification				
	Queensland			Commonwealth (Australian Design Rules)	
	Open (unlimited distance)	Regional (<350km radius)	Local (<40km radius unless single/contig urban area)	Route Service (standing passengers)	Non-Route Service (no standing passengers)
School service	Unlikely	Possible	Likely	Likely	Possible
Public passenger service	Unlikely	Possible	Likely	Likely	Possible
School charter service	Possible	Possible	Possible	Possible	Possible

[14] An omnibus is a passenger vehicle having more than nine seating positions including that of the driver.

In the USA, the National Highway Traffic Safety Administration (NHTSA) Highway Safety Program *Guideline 17* specifically states that every student travelling on a school bus should be seated before the bus is in motion (NHTSA, 1991). The NHTSA view was that allowing children to travel as standees meant that they were not afforded the protection of compartmentalisation[15] in the event of a crash. Despite this advice, some states and school districts in the US have policies that allow children to stand on school buses.

Number of Standees Allowed

Standee capacity is calculated in a number of different ways across Australia. In Queensland, within the limits of a vehicle's weight-based carrying capacity, standee capacity is determined by the number of handholds on the bus (the number of standees must not exceed the number of handholds). Depending on size, a bus used for a public passenger or school service could have up to 25 handholds.

In early 2001, Queensland Transport conducted a trial on public passenger services in the Beaudesert area (Cluff & Dwyer, 2001) where buses were limited to no more than five standees per square metre of aisle. To achieve this limit, two extra vehicles were required and routes were reorganised. Standee rates were 6.9 per cent of total passengers carried during the trial. The report concluded that the trial had reduced the number of standees on the school services involved, but adoption of the standee limits for all school services would require significant extra funding (Cluff & Dwyer, 2001).

State road authorities in other jurisdictions calculate standee limits for those buses allowed to carry standees by a variety of methods including one standing passenger per row of seats, 6.2 standing passengers per square metre of aisle space, standing passengers equal to 50 per cent of adult seating capacity, or specified number limitations (eg 20 per bus in Victoria).

Time or Distance Limits on Standees

The Queensland Parliamentary Travelsafe Committee (1993) recommended that the safety of standees be managed by:

- limiting the distance standees could travel to reduce exposure to risk
- restricting the areas of the bus where standees were permitted
- limiting the speed of buses carrying standees
- identifying and banning standees from hazardous routes (Queensland Parliamentary Travelsafe Committee 1993).

In response, the Queensland Government mandated a 20 kilometres distance limitation on the carriage of standees under the *Transport Operations (Public Transport) Standard 2000*.

Other states that limit the time or distance that standees can be carried are South Australia (20 minutes), Tasmania (10 kilometres), and Victoria (10 kilometres on some buses, no limit on public passenger services).

Risk to Standees

The only Australian research on the carriage of standees was conducted by Henderson (1996b) who, based on the fact that the injury risk to bus passengers in Australia is low, determined that the additional risk of travelling as a standing passenger was small. Henderson (1996b) examined school bus crashes in NSW from 1989 to 1992 and calculated that the total cost to the community (incorporating medical costs, rehabilitation, loss of work) of injuries to student standees in New South Wales totalled between $50 000 and $60 000 per year (Henderson, 1996b). Henderson (1996b) concluded that eliminating the risk exposure of standees by banning them would cost thousands of times more than the value of the injuries saved.

Three-for-Two Seating

The carriage of three children of up to 12-years-old on a bench-style seat designed for two adults (three-for-two seating) is common to all Australian States and Territories except the Australian Capital Territory (Austroads, 2001a) where three-for-two seating is not allowed.

In reporting the outcomes of the New South Wales Bus and Coach Safety Standing Committee investigation into school bus safety, Johnson (1993) found no evidence to suggest student safety was compromised with three-for-two seating. Johnson (1993) also found that eliminating three-for-two seating would increase the cost of bus travel in New South Wales by 16 per cent.

[15] Compartmentalisation is a US-based design standard which keeps a passenger within an individual seat area and makes the area safe by use of padding.

Bus Design for Safety

Rollover Strength

Tidbury (1984) noted that bus rollover is the most serious cause of injury and fatality among bus passengers. The risk of injury to passengers in bus crashes depends on a combination of acceleration forces and intrusion into the bus interior or survival space (Irwin and Faulks, 2000).

In Australia, heavy buses built after 1 July 1992 and light buses built after 1 July 1993 are required to comply with Australian Design Rule (ADR) 59/00 for rollover strength. The only exception is ultra-low-floor buses, such as Brisbane Transport's new wheelchair-accessible buses, which are too low to the ground to be at risk of rollover.

Currently, 80 per cent of buses used in school transport in Queensland (n=1917) were built before 1992 and will not necessarily comply with the rollover strength ADR (Queensland Transport, 2001).

An international comparison of rollover strength was undertaken for the Asia Pacific Economic Corporation, which found that the only existing regulations for rollover strength are in Australia and Europe (APEC, 1997). The Australian requirements are identical to those of the European Commission.

Padding

Henderson and Paine (1994) noted that most injuries in crashes involving heavy buses were minor facial and head injuries. They recommended padding be installed on unyielding seat tops and handholds be redesigned with impact-absorbing materials.

Padding requirements for buses operating in Queensland are outlined in the information bulletin, *Safety Padding for Bus Handrails, Seats and Partitions* (Queensland Transport, 2001). All buses which entered service in Queensland on or after 1 January 1997, and Regional Class (radius of <350km) buses less than 20 years old on 1 January 1997, are required to have impact-absorbing padding on those areas of the bus likely to strike the head of a seated occupant in a frontal collision, such as handrails, tops of seats, and seat posts.

Details of how many Queensland buses meet the standard for padding specified in the information bulletin were not available. In a self disclosure survey, responding bus operators indicated that 61 per cent of buses used in school transport have padding on seats. These buses may also have other padding (on handrails etc). (Queensland Transport, 2001).

School buses in the USA and Canada are required to have high-back, closely spaced, padded seats as part of the principle of compartmentalisation (which keeps the passenger within the individual seat area in a frontal collision). In the United Kingdom, padding is required in those buses that are fitted with lap seat belts. (Department of the Environment, Transport and the Regions, 1996).

Seat Belts

Currently, seat belts are required on buses covered by Australian Design Rule (ADR) 68/00 "Occupant Protection in Buses". ADR 68/00:

- applies to heavy buses built since 1 July 1994 and light buses since 1 July 1995 designed for travel on the open road (in Queensland, these would be Open Classification buses)
- contains the requirement for seat belts, seat strength, seat anchorages, seat belt anchorages, child restraint anchorages, and impact attenuation characteristics of seat backs and arm rests
- does not apply to route services buses, or buses with fewer than 17 seats.

Most vehicles used on school and public passenger services in Queensland are route service buses which do not need to comply with ADR 68/00. Bus operators have voluntarily installed lap belts on 130 of the 2449 buses used for school services. A further 100 buses have lap-sash belts on some seats; the majority of these are light buses (Queensland Transport, 2001).

The issue of seat belts in school buses has been widely debated in the USA. Four states, New Jersey, New York State, Louisiana and Florida, now require school buses to have lap belts (National Transport Safety Bureau, 1999).

In 1998 the United Kingdom introduced a requirement for seat belts (minimum lap belts with associated padding) on coaches[16] and minibuses carrying children on organised journeys (trips to and from school, excursions) in high-speed environments (Department of the Environment, Transport and the Regions, 1996).

[16] In the UK, a coach is a bus capable of carrying more than 16 passengers, with a GVM over 7.5 tonnes and a maximum speed of more than 60mph.

Currently, no Australian state requires seat belts on school buses (Austroads, 2001a). There has been extensive research and debate on the extent to which seat belts improve safety in buses and the kinds of buses and seat belts that might lead to improved safety. The issues relating to school transport include rollover strength and seat belt safety, the problems fitting seat belts to existing buses, lap belts or lap-sash belts and safety, and injury risk reduction through seat belt use.

- **The relationship between bus rollover strength and seat belt safety**

  In Australia, seat belts may be retrofitted to existing buses under the *Guidelines for Voluntary Modification of Existing Buses and Coaches to Improve Occupant Protection* (Federal Office of Road Safety, 1995). The background paper to these *Guidelines* noted that in a rollover crash involving a pre-rollover-strength (ADR 59/00) frame, the risk of injury to the wall-side passengers from side-wall intrusion or roof collapse is increased for occupants restrained by seat belts (Federal Office of Road Safety, 1995). However, the paper also suggested that the additional benefits afforded by seat belts outweighed the risk of side-wall intrusion. For this reason, the *Guidelines* recommended that lap-sash belt-equipped seats be fitted when seats are replaced in any vehicle which can be modified to provide the appropriate mounting strength even if the vehicle does not comply with ADR 59/00.

- **Fitting seat belts to existing buses used for school transport**

  Seat and anchorage reinforcement is essential when fitting seat belts in buses. Dixon, et al, (1981) found that seat belts in buses would be rendered almost useless in the event of a crash if a seat collapsed. Ninety per cent of the buses transporting students to and from school in Queensland (n=2204) do not have provision for the installation of seat belts in the form of reinforced seats and anchorages (Queensland Transport, 2001).

  Henderson and Paine (1994) pointed out that the need to strengthen the underfloor structure when fitting seat belts means that some buses cannot practically be fitted with belts, as many underfloor areas are inaccessible because of the close proximity of the engine, fuel tank and luggage bins.

  Advice from Queensland Transport indicates that bus operators who have retrofitted seat belts to existing buses paid between $110 and $660 per seat, depending on the style of belt, and whether new seats and anchorages were required. Currently, many of the buses carrying school students are allowed to carry standing passengers, and some have three-for-two seating. There would be an additional cost associated with fitting seat belts if standees and three-for-two seating were discontinued in order to provide every student with a belted seat.

- **The use of lap belts or lap-sash belts on buses**

  Research has compared the effects of restraining children in lap and lap-sash seat belts[17].

  In the USA and Canada, school buses are required to meet standards for compartmentalisation (which keeps a passenger within the individual seat area and makes the area safer in a collision by use of padding etc). Because there is no directly comparable Australian standard for compartmentalisation, US and Canadian research does not translate exactly to the Australian context, although the results of crash tests on lap belts are relevant.

  Farr and Eng (1985) conducted crash tests using lap-belted and unbelted dummies in buses meeting compartmentalisation standards. Lap-belted dummies pivoted at the waist and struck the seat back in front of them, resulting in an increase in head accelerations. Farr and Eng (1985) determined that lap belts may increase the risk of injury to bus occupants in buses which meet compartmentalisation standards. Similar results were found by the National Highway Traffic Safety Administration (McCray, 2001), the National Transport Safety Bureau (1999), the University of Florida (Baltes, 1998), and Transport Canada (Gardner & Marie, 1999). However, the National Transport Safety Bureau (1999) recommended that occupant protection systems which provide additional protection in rollover and side impact crashes be investigated.

- **Reduced injury risk with seat belts in buses**

  When examining the effectiveness of seat belts in bus crashes, Henderson and Paine (1994) noted that the extent of reduced

[17] Lap-sash seat belts are the seat belts used in car front seats in Australia.

injury risk to passengers on route service buses fitted with seat belts was unknown, due to a lack of data on bus crashes. However, based on international crash dynamics research and seat design in Australia, Henderson and Paine (1994) indicated that the reduction in injury risk would be unlikely to exceed 20 per cent, if seat belts were worn consistently and properly, compared with a 50 per cent injury reduction achieved when seat belts were fitted and worn in cars. Henderson and Paine (1994) suggested that seat belts (and in particular, lap-sash belts) would be much more effective (up to 50 per cent) in small buses similar to passenger cars (eg people movers).

School Bus Doors and Exits

Buses built after 20 May 1992 must comply with ADR 44/02 which specifies requirements for the placement, dimension and number of emergency doors, emergency windows and escape hatches, as well as signage requirements and instructions for use. Buses built pre-1992 must comply with similar standards outlined in Section 6 of the Omnibus Licensing Evaluation. Most buses used on school services in Queensland comply with ADR 44/02 or its predecessor standard.

In response to the deaths of two children trapped in rear bus doors in 1995, the NSW Bus Safety Advisory Committee investigated bus door safety (Henderson, 1995). The Committee recommended that the NSW Motor Traffic Regulations be amended to include bus door safety systems to prevent entrapment in rear and centre doors. Recommendations included door sensors which activate the brake system and give an audiovisual alarm if an obstruction is detected, and changes to door seals and closing pressure. A subsequent report recommended these mechanisms also be introduced for front doors in buses (Henderson, 1996a). In NSW, these recommendations have been implemented under the *Motor Traffic Amendment (Bus Safety Regulation) 1997*. There is no similar requirement in Queensland, although some bus operators have chosen to introduce door safety mechanisms into their fleet.

Identifying School Buses

Warning Signs and Flashing Lights

All Australian states require buses used for school services to be fitted with warning signs and flashing lights which must be in operation whenever the bus is picking up and setting down passengers (Austroads, 2001a).

The most visible school bus warning sign identified by research (Cairney, 1992) was a fluorescent yellow sign. This has been adopted by all Australian states as part of *National Regulations – Australian Vehicle Standards Rules 1998*, and in Queensland under the *Transport Operations (Road Use Management – Vehicle Standards and Safety) Regulation 1999*.

The Western Australian School Bus Safety Committee's evaluation (School Bus Safety Committee, 1997) examined motorist behaviour around buses with and without flashing lights. Vehicle speeds reduced by up to 11kph for a stopped bus using flashing lights, which was double the reduction achieved for a stopped bus not using the flashing lights. Vehicles also altered course by braking and moving away from the bus with flashing lights and across the centre line. (School Bus Safety Committee, 1997).

Flashing lights and warning signs have been required on all Queensland buses used "exclusively for the carriage of school children" since 1979, now under the *Transport Operations (Road Use Management – Vehicle Standards and Safety) Regulation 1999*. This regulation was introduced retrospectively, so all school buses that meet the definition of being exclusively for the carriage of school children must use the flashing lights and warning signs. These account for approximately 65 per cent of all the buses that carry school students to and from school in Queensland.[18]

While the current Queensland legislation requires lights on buses "exclusively for the carriage of school children", a bus operator could avoid the installation of lights simply by carrying fare-paying adult passengers. The Task Force was provided with anecdotal evidence that this has occurred.

A survey conducted by Market and Communications Research (2001) in Queensland revealed that 70 per cent of 200 households surveyed were aware that school buses are identified by the presence of warning signs.

School Bus Colour

School buses in the USA and Canada are a uniform "school bus yellow" under standards introduced in 1978. In Australia, uniform

[18] Buses used on public passenger services that carry school students are not required to use lights and signs, as these are not school buses.

school bus colour is used in Western Australia, where contract school buses are required to be orange and green. A public opinion survey of school bus initiatives in 1999 revealed a high level of support for the colour scheme (Western Australia Department of Transport, 1999).

In Tasmania, the School Bus Safety Review Committee (1992) considered the use of a common colour for school buses. No action was taken on the issue as most buses in the Tasmanian fleet are not dedicated school buses.

Queensland Transport trialed the use of fluorescent yellow and orange high visibility strips on six school buses in urban and rural areas of Queensland, with the aim of increasing motorist awareness that the bus is carrying school children. Preliminary results of focus group sessions with school communities indicated support for the colour scheme and the use of the strips (King, 1999). However, there was little awareness of the trial and purpose of the strips.

SCHOOL TRANSPORT SAFETY: THE NEXT STEPS

Faced with the challenge of reviewing and improving school transport safety in Queensland, the Task Force has developed a six-month work plan that draws on:

- current research on school transport safety
- advice from experts with specialist knowledge in core areas of school transport and bus safety
- contributions from interested members of the community.

This preliminary *Overview of Research and Practice* identifies areas of greatest risk in school transport in Queensland and presents the results of a review of current research, policy and practice in school transport safety throughout Australia and internationally. The effectiveness of specific policies and practices will be further examined during the remainder of the review to develop recommendations that best integrate engineering, enforcement and educational approaches to improve the safety of students as they travel to and from school.

The Task Force is currently completing its analysis of the many submissions received from community members, schools and other stakeholder organisations and looks forward to interviewing some of the respondents. The Task Force is also interviewing experts and professionals in road safety research, road engineering and transport planning, education, policing, health and emergency services, transport management and bus design. Community, stakeholder and expert opinion will inform the Task Force's final report and ensure that recommendations reflect community concerns and effective responses to them.

GLOSSARY OF TERMS USED

Bus pedestrian: A person walking to board or after alighting from a bus

Compartmentalisation: A USA design standard for school buses incorporating high-backed seats and energy-absorbing padding to provide a passive restraint system for passengers. The standard aims to keep passengers within the confines of the individual seat area in the event of a frontal collision

Gross Vehicle Mass: the maximum laden mass of a bus as specified by the manufacturer

Heavy bus: a bus with a Gross Vehicle Mass (GVM) of more than 5 tonnes

Hospitalisation: admission to hospital

Light bus: a bus with a GVM of 3.5–5 tonnes

Omnibus: a passenger vehicle having more than nine seating positions including that of the driver

Rollover strength: the strength of a bus structure to withstand the forces and maintain passenger survival space in the event of a rollover crash

Route service bus/omnibus: a bus built with provision for standing passengers

Standee: a passenger who must stand because all available seats have been filled

STAS (School Transport Assistance Scheme): the Queensland distance and income eligibility based scheme that funds student transport

Three-for-two seating: the practice of carrying three primary school-aged children on a bench seat designed for two adults

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APPENDIX 1

Major Bus Crashes Involving School Students

The following list is compiled from media reports of recent bus crashes in Australia involving school students. The list cites deaths and hospitalisations from collisions and rollover crashes involving buses.

The list does not include deaths and serious injuries among student pedestrians or among students struck by other vehicles walking to board or after alighting from school buses.

Date	Location	Description of Crash	Fatalities	Hospitalisations
Feb 1987	En route from Tinaroo Dam to Cairns, Qld	The brakes on a 20-year-old chartered bus (pre-rollover-strength) with 43 school students failed on a steep descent. The bus went over a cliff edge and rolled over several times. Rust damage to the bus meant the roof peeled off.	8 (students)	23
Apr 1988	Kenwick-Madding WA	Bus rolled over	0	7 (1 adult, 6 students)
Sep 1993	Coober Pedy, SA	A chartered bus carrying 40 school students and five adults overturned on an isolated dirt road approximately 70km east of Coober Pedy. Passengers spent two hours trapped in the wreckage until the Royal Flying Doctor Service arrived.	1 (student)	12 (students)
Aug 1994	Dandaragan-West, SA	Truck attempted to overtake a bus which was indicating its intention to turn right. The bus careened down the highway, eventually crashing into the back of the truck.	0	1 (bus driver)
Nov 1994	Kalgoorlie, WA	Driver coming from opposite direction crossed over concrete road divider and crashed into front of bus	1 (car driver)	0
Jun 1996	Maitland, NSW	An afternoon school bus carrying 24 students collided with a car (driven by a learner driver) at an intersection. The bus veered into a tree in the front yard of a house.	0	1 (student)
Jul 1996	Lake King, Mt Madden, WA	Bus travelling through an intersection collided with a car.	0	1 (student)
Oct 1997	Bathurst, NSW	A bus carrying around 30 primary school students from the small community of Raglan collided with another vehicle at the intersection of the Great Western Highway at about 8.30am.	0	7 (bus driver + 6 students)
Nov 1997	Nambucca Heads, NSW	A car lost control while turning left and skidded into a school bus at 8.13am.	0	6 (students)
Nov 1998	Warrego Highway outside Toowoomba, Qld	A 28-seater bus carrying students from Oakey to special schools in Toowoomba collided with a car at around 8am.	2 (teacher + student, both in car)	0
Jun 1999	Newcastle, NSW	Two school buses, carrying 65 students from primary and secondary schools, collided at Lemon Tree Passage, just north of Newcastle at about 8.25am.	0	14 (2 bus drivers + 12 students)

Date	Location	Description of Crash	Fatalities	Hospitalisations
Dec 2000	South Gippsland, Vic	A bus carrying 57 children on school camp crashed down an embankment near Allambee at about noon.	1 (student)	6 (students)
Jan 2001	Nuriootpa (Barossa Valley), SA	A large school bus collided with a truck on a country road in the afternoon.	1 (driver)	11 (students)
Feb 2001	Wandandian/ Ulladulla, South Coast of NSW	At about 4pm, a school bus carrying 36 students from St John's High School (South Nowra) along the Princes Highway collided with a utility and crashed on to its side. A third vehicle travelling behind the bus hit the wreckage.	2 (student + driver of the utility)	21 (students)
Mar 2001	Cedar Grove, Qld	At 3.30 pm a bus carrying school students ran into the back of another bus on the Mt Lindsay Highway.	0	2 (students)
Mar 2001	Gracemere, Qld	A bus travelling from Rockhampton to Mt Morgan carrying 30 school students and 15 adults rolled over after being hit from behind by a semi-trailer at about 7.40am.	0	6 (2 adults + 4 students)

APPENDIX 2
NATIONAL ROAD CRASH DATA

Notes on Databases

1. The *Monthly Fatality Database* records the number of persons killed in crashes on Australia's roads each month and is compiled from data obtained from police reports in each State/Territory jurisdiction.
2. The *Serious Injury Database* houses information on all crashes resulting in death or hospitalisation. This database contains more detailed crash information and is compiled quarterly from police report data coded by each State/Territory jurisdiction. The *Serious Injury Database* is currently complete for the period 1990 to 1997 inclusive.
3. The *Fatality File*, compiled from coroner's reports and police reports, is a comprehensive database that contains detailed information on all aspects of each fatal crash. Prior to 1997, the *Fatality File* was only compiled every second year [ie 1988, 1990, 1992, 1994 and 1996] due to the expense and time associated with such detailed analyses. The *Fatality File* is the only database with sufficiently detailed information to identify individual crashes directly related to school transport safety. Compilations of the *Fatality File* after 1997 are incomplete.

5–17-year-olds Killed or Hospitalised: Morning and Afternoon Crashes by Years 1990–2000

Number of 5–17-year-old pedestrians killed in road crashes in the morning and afternoon on school days in Australia 1990–2000

Year	Morning (8am–10am)	Afternoon (3pm–5pm)	Total
1990	5	22	27
1991	4	14	18
1992	4	13	17
1993	4	11	15
1994	1	13	14
1995	1	10	11
1996	4	3	7
1997	1	3	4
1998	0	8	8
1999	0	6	6
2000	5	4	9
1990–2000	29	107	136

Source: Monthly Fatality Database 1990–2000

Number of 5–17-year-olds hospitalised in road crashes in the morning and afternoon on school days in Australia 1990–2000

Year	Morning (8am–10am)	Afternoon (3pm–5pm)	Total
1990	83	277	360
1991	65	230	295
1992	63	226	289
1993	57	192	249
1994	66	201	267
1995	52	192	244
1996	64	170	234
1997	56	157	213
1990–1997	506	1645	2151

Source: Serious Injury Database 1990–1997

Number of 5–17-year-old pedestrians killed in road crashes in the morning and afternoon on school days by State/Territory, Australia 1990–1998

Time of day	State/Territory								Australia
	NSW	Qld	Vic	SA	WA	Tas	NT	ACT	
Morning (8am–10am)									
1990	0	2	0	2	1	0	0	0	5
1991	0	2	0	1	1	0	0	0	4
1992	1	0	2	1	0	0	0	0	4
1993	2	0	0	1	1	0	0	0	4
1994	1	0	0	0	0	0	0	0	1
1995	0	0	1	0	0	0	0	0	1
1996	1	1	1	1	0	0	0	0	4
1997	0	0	0	0	1	0	0	0	1
1998	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0
2000	4	0	1	0	0	0	0	0	5
1990–2000 (Morning)	**9**	**5**	**5**	**6**	**4**	**0**	**0**	**0**	**29**
Afternoon (3pm–5pm)									
1990	11	5	5	0	0	1	0	0	22
1991	5	3	6	0	0	0	0	0	14
1992	5	4	3	1	0	0	0	0	13
1993	5	4	2	0	0	0	0	0	11
1994	3	4	1	2	3	0	0	0	13
1995	5	3	0	1	1	0	0	0	10
1996	3	0	0	0	0	0	0	0	3
1997	0	1	1	0	1	0	0	0	3
1998	1	1	4	1	0	0	1	0	8
1999	1	1	1	1	1	1	0	0	6
2000	0	1	1	0	1	1	0	0	4
1990–2000 (Afternoon)	**39**	**27**	**24**	**6**	**7**	**3**	**1**	**0**	**107**
Total (am + pm)									
1990	11	7	5	2	1	1	0	0	27
1991	5	5	6	1	1	0	0	0	18
1992	6	4	5	2	0	0	0	0	17
1993	7	4	2	1	1	0	0	0	15
1994	4	4	1	2	3	0	0	0	14
1995	5	3	1	1	1	0	0	0	11
1996	4	1	1	1	0	0	0	0	7
1997	0	1	1	1	2	0	0	0	4
1998	1	1	4	1	0	0	1	0	8
1999	1	1	1	1	1	1	0	0	6
2000	4	1	2	0	1	1	0	0	9
1990–2000 (am + pm)	**48**	**32**	**29**	**12**	**11**	**3**	**1**	**0**	**136**

Number of 5–17-year-old pedestrians hospitalised as a result of road crashes in the morning and afternoon on school days by State/Territory, Australia 1990–1997

Time of day	State/Territory								Australia
	NSW	Qld	Vic	SA	WA	Tas	NT	ACT	
Morning (8am–10am)									
1990	29	16	21	8	7	1	1	0	83
1991	21	10	21	3	6	4	0	0	65
1992	18	10	23	3	6	1	0	2	63
1993	16	8	23	4	6	0	0	0	57
1994	25	6	23	3	4	3	1	1	66
1995	11	7	21	4	5	1	1	2	52
1996	26	8	17	2	6	4	0	1	64
1997	20	7	18	2	4	1	1	3	56
1998	*Not Available*								
1999	*Not Available*								
2000	*Not Available*								
1990–2000 (Morning)	**166**	**72**	**167**	**29**	**44**	**15**	**4**	**9**	**506**
Afternoon (3pm–5pm)									
1990	103	36	76	28	23	7	2	2	277
1991	81	37	51	23	24	10	1	3	230
1992	96	40	40	13	24	10	1	2	226
1993	76	36	41	13	19	5	1	1	192
1994	73	45	48	6	21	4	2	2	201
1995	74	38	47	12	13	5	0	3	192
1996	50	28	54	14	17	3	1	3	170
1997	60	24	39	7	19	3	3	2	157
1998	*Not Available*								
1999	*Not Available*								
2000	*Not Available*								
1990–2000 (Afternoon)	**613**	**284**	**396**	**116**	**160**	**47**	**11**	**18**	**1645**
Total (am + pm)									
1990	132	52	97	36	30	8	3	2	360
1991	102	47	72	26	30	14	1	3	295
1992	114	50	63	16	30	11	1	4	289
1993	92	44	64	17	25	5	1	1	249
1994	98	51	71	9	25	7	3	3	267
1995	85	45	68	16	18	6	1	5	244
1996	76	36	71	16	23	7	1	4	234
1997	80	31	57	9	23	4	4	5	213
1998	*Not Available*								
1999	*Not Available*								
2000	*Not Available*								
1990–2000 (am + pm)	**779**	**356**	**563**	**145**	**204**	**62**	**15**	**27**	**2151**

APPENDIX 3
QUEENSLAND DATA

Year Breakdown of School Transport-Related Fatalities and Hospitalisations in Queensland 1991–2000

Year	Mode of transport													
	Private car		Pedestrian		Cyclist		Bus pedestrian		Bus passenger		Motorcyclist		All modes	
	Fat.	Hosp.	Fat.	Hosp.	Fat.	Hosp.	Fat.	Hosp.	Fat.	Hosp.	Fat.	Hosp.	Fat.	Hosp.
1991	3	24	1	36	1	47	2	3	0	3	0	0	7	113
1992	4	40	2	41	2	48	2	8	0	0	0	0	10	137
1993	3	39	3	43	0	49	1	4	0	1	0	4	7	140
1994	3	38	2	45	0	46	3	5	1	2	0	0	9	136
1995	3	41	3	38	2	54	1	6	0	1	0	1	9	141
1996	3	38	2	27	2	45	0	7	0	1	0	1	7	119
1997	3	40	1	30	0	38	0	3	0	1	0	4	4	116
1998	4	38	1	33	2	47	0	7	0	2	0	4	7	131
1999	1	47	1	40	0	49	0	6	0	1	0	2	2	145
2000	2	40	1	33	0	52	0	14	0	1	0	1	3	141
TOTAL	**29**	**385**	**17**	**366**	**9**	**475**	**9**	**63**	**1**	**13**	**0**	**17**	**65**	**1319**

Source: Queensland Road Crash Information System 1991–2000

APPENDIX 4 DESIGN STANDARDS FOR BUSES

Buses as vehicles in Queensland are regulated according to the following classifications:

- *Open Classification*—a vehicle classified for open use is permitted to operate over an unlimited distance.
- *Regional Classification*—A vehicle classified for regional use is permitted to operate within a radius of 350km from the point of the first passenger pick up.
- *Local Classification*—A vehicle classified for local use is permitted to operate within a radius of 40km from the point of the first passenger pick up or a radius exceeding 40km, providing the journey is entirely within a single or contiguous urban area.

Under the Transport Operations (Road Use Management—Road Rules) Act, a "School Bus" is a bus used exclusively for the carriage of children to and from school.

Under the Transport Operations (Passenger Transport) Act, a "School Service" is a 40-week a year services provided school days only for which the principal purpose is the transport of school children to and from school.

There are currently many Australian Design Rules (ADRs) pertaining to buses. The following table provides information on what ADRs are required for each classification (noted in italics) of bus operating in Queensland.

Under the Commonwealth Motor Vehicle Standards Act, a Route Service Omnibus or Bus is a bus specially designed with spaces for standing passengers.

There are also a number of standards that apply to school buses under Queensland regulations, such as the installation of flashing lights and warning signs on school buses used 'exclusively for the carriage of school children', safety padding for bus handrails, seats and partitions, and cosmetic standards.

Standard required	Open Classification	Regional Classification	Local Classification
School bus flashing lights and signs	For buses used exclusively for the carriage of school children *(Transport Operations (Road Use Management) Act*	For buses used exclusively for the carriage of school children *(Transport Operations (Road Use Management) Act*	For buses used exclusively for the carriage of school children *(Transport Operations (Road Use Management) Act*
Maximum Age – *Heavy bus* – *Light bus* – Forward control and off road passenger vehicle	15 years 10 years 10 years	25 years 20 years 10 years	25 years 20 years 10 years
Australian Design Rules	Applicable to non route service buses with high back seats inc. ADR 68	Applicable to non route service buses inc. ADR 68	Applicable to route service buses
Seating for buses	Forward or rearward facing coach style (high back) seats	Forward, rearward or side facing, high or low back seats	Forward, rearward or side facing seats

Australian Design Rules for buses

ADR 1/00 **Reversing Lamps** which specifies the requirements for reversing lamps to warn pedestrians and other road users that the vehicle is reversing. 1 July 1973 for light and 1 July 1975 for heavy buses.

ADR 4/03 **Seat Belts** which specifies requirements for seat belts. 1 January 1969.

ADR 5/04 **Seat Belt Anchorages** which specifies the requirement for a lap belt on the drivers seat. 1 January 1969.

ADR 6/00 **Director Indicator Lamps** which specifies the photometric requirements for turn direction indicator lamps. 1 January 1973.

ADR 7/00 **Hydraulic Indicator Lamps** which specifies the photometric for turn direction indicator lamps. 1 January 1970.

ADR 8/01 **Safety Glazing Material** which specifies the performance requirements for material used in both external and internal glazing to ensure adequate visibility, minimise obscuration if shattered and minimise the likelihood of serious injury if a person comes into contact with the broken glazing material. 1 July 1971.

ADR 12/00 **Glare Reduction in the Field of View.** The function of this ADR is to minimise the glare from certain surfaces in the field of view of the driver. 1 July 1973.

ADR 13/00 **Installation of Lighting and Light Signalling Devices.** ADR 13/00 specifies requirements for the installation of lights and light signalling devices on the vehicle to ensure appropriate operation. 1 October 1991.

ADR 14/02 **Rear Vision Mirrors** which specifies the number, position and size of rear vision mirrors to provide the driver with a clear and reasonably unobstructed view to the rear. 1 July 1992.

ADR 15/01 **Demisting of Windscreen** which specifies standards for equipment to keep the windscreen clear of mist so that the drivers forward view is not obscured. 1 January 1987 for omnibuses up to 3.5 tonnes GVM.

ADR 16/01 **Windscreen Washers and Wipers** which specifies requirements for windscreen wipers and washers to ensure reasonable visibility through the windscreen in inclement weather. 1 January 1987 for omnibuses up to 3.5 tonnes GVM.

ADR 18/02 **Instrumentation** which specifies requirements for the provision, location and accuracy of certain instrumentation including speedometers and odometers. 1 January 1973.

ADR 24/02 **Tyre and Rim Selection**. This ADR specifies requirements for tyres and rims appropriate to vehicle load capacity, rim size requirements and vehicle speed characteristics. 1 January 1987.

ADR 28/01 **External Noise of Motor Vehicles** which specifies limits for the external noise of motor vehicles in order to limit the contribution of motor traffic to community noise. 1 July 1974.

ADR 35/01 **Commercial Vehicle Brake Systems** which specifies braking performance under both normal and emergency conditions. 1 July 1975.

ADR 42/03 **General Safety Requirements**. This rule specifies design and construction requirements to ensure the safe operation of the vehicle and covers issues such as steering systems, controls for automatic transmissions, electrical wiring, electrical connectors, positioning of exhaust outlets, minimisation of internal and external protrusions to reduce the risk of injury, mudguards, ventilation and warning devices. 1 July 1992.

ADR 43/03 **Vehicle Configuration and Dimensions** which specifies the requirements for vehicle configuration and dimensions. 1 July 1991.

ADR 45/01, ADR 46/00, ADR 47/00, ADR 48/00, ADR 49/00, ADR 50/00, ADR 51/00, ADR 52/00.

These ADRs which set out the photometric requirements for lights, light signalling devices and reflectors. 1 July 1992.

ADR 44/02 **"Specific Purpose Vehicle Requirements"** contains the requirements for emergency exits for MD3, MD4 and ME vehicles (ie. buses greater than 3.5 tonnes GVM) designed for more than 16 passengers in addition to driver and crew. There is no differentiation between route service and non-route service buses. 1 July 1993.

ADR 58 **"Requirements for Omnibuses designed for Hire and Reward"**, 1 July 1988, contains a series of requirements for buses including:

- Occupant capacity—based on 65 kg per person plus 15 kg of luggage where luggage space is provided
- Aisle requirements—380 mm for route service buses and buses with less than 25 person capacity, otherwise 300 mm for buses with only seated passengers
- Access—need for a door on the left hand side and the required dimensions for steps, and opening
- Head room—clearance inside the bus, 1800 mm for a large bus with frequent stops, 1650 mm for a coach. Smaller dimensions for smaller buses.
- Drivers guard rail
- External mirror to allow driver to view any rear doors
- Hand straps/rails/grips—suitable number to be fitted
- Floors
- Emergency exits—requirements for buses not meeting ADR 44/02
- Passenger seats—size and spacing of seats. Small differences for route service buses
- Driver's seat
- Passenger stop signals
- Interior fittings / materials
- Interior lighting
- Interior luggage racks—minimum clearance for seated passengers
- Tail shaft guards
- Fuel system—general principals for location of fuel tank and fuel system
- Fire extinguisher
- Dual tyres—need for dual wheels on rear axle
- Field of view—positioning of passenger seats not to obstruct the drivers field of view

ADR 59/00 **"Omnibus Rollover Strength"** applies to all buses, including route service buses built after 1 July 1993, except low floor height buses.

ADR 61/02 **Vehicle Marking** which specifies the requirements for vehicle marking ie. the position and details of the Vehicle Identification Number, Compliance Plate and Manufacturers Plate. 1 July 1992.

ADR 65/00 **Maximum Road Speed Limiting for Heavy Goods Vehicles and Heavy Omnibuses.** This ADR sets out the requirements for devices or systems to limit the maximum road speed of a heavy goods vehicle or heavy bus to 100kph. 1 July 1991.

ADR 68/00 **"Occupant Protection in Buses"** contains the requirement for seat belts, seat strength, seat anchorages, seat belt anchorages, child restraint anchorages, and impact attenuation characteristics of seat backs and arm rests.

- ADR 68/00 is applicable for:

  Buses with a GVM over 5 tonnes built since 1 July 1994

  Buses with a GVM over 3.5 tonnes built since 1 July 1995

- ADR 68/00 does not apply to:

  Route service buses; or

  Buses with less than 17 seats including the driver and crew; or

  Buses where all passengers seats have a reference height of less than one metre.

ADR 70/00 **Exhaust Emissions for Diesel Engine Vehicles** which reduces air pollution by limiting the hydrocarbons, carbon monoxide, oxides of nitrogen and particulates emitted from diesel engined vehicles. Route service buses built after 1 July 1996 must meet this ADR. Buses built after 1988 but prior to 1 July 1996 will be required to meet ADR 30/00 which also sets limits for reducing emissions but is not as stringent as the more recent ADR 70/00.

Design standards in other countries

The USA has a dedicated school bus fleet, with a range of safety standards introduced from 1978 (Austroads, 2001; Levy, 1985). These standards include

- a uniform colour
- roll-over strength
- emergency exit requirements
- strength of body panels and joints
- window strength
- mirrors to enhance visibility of passengers outside the bus
- padding and seat height designed to keep the passenger in the seat area during a crash (known as 'compartmentalisation')
- loud speaker systems
- boom gate crossing arms to stop children walking too close to the front of the bus
- stop arms to encourage traffic to stop when children are boarding and exiting a school bus.

The installation of seat belts in school buses has been mandated in four US states.

Canada has introduced a number of standards relating to school buses, including stop arms, red flashing lights, requiring traffic to stop when the bus is loading and unloading, and a comprehensive mirror arrangement (Austroads, 2001).

Queensland School Transport Safety Task Force

Phone: 3253 4393
Fax: 3253 4388
Email: schooltransportsafety@qut.edu.au
Web: www.hlth.qut.edu.au/psyc/carrs/schooltransportsafety/index.asp