

**Edmonston, Colin J. and Sheehan, Mary C. (2001) Safe school travel is no accident! Applying the Haddon Matrix to school transport safety. In Proceedings 2001 Road Safety Research, Education and Policing Conference 2, pages pp. 110-117, Melbourne, Victoria.**

**Copyright 2001 Colin J. Edmonston and Mary C. Sheehan**

**Accessed from <http://eprints.qut.edu.au>**

# ***'Safe school travel is no accident!' - Applying the Haddon Matrix to school transport safety***

***Colin J. Edmonston  
Professor Mary C. Sheehan***

Centre for Accident Research and Road Safety – Queensland  
Queensland University of Technology

## **ABSTRACT**

Given the high value placed on a child's life, safe school travel remains a priority issue for the Australian public and Government. **Research objectives.** This paper specifically documents the six-month work plan and multifaceted inquiry process adopted by the *School Transport Safety Task Force* in an attempt to review and provide recommendations to improve school transport safety in Queensland. **Methods and data sources.** Based on a review of current policy, practice and research in relation to school transport safety (*stage 1*) and extensive consultation with community groups (*stage 2*) and road safety professionals (*stage 3*), the Task Force acknowledged the need to confront risk-management and examine school transport safety in a systematic fashion. **Results and discussion.** In response, a research tool conceptualising the diverse range of school transport safety issues and strategies in an expanded Haddon Matrix framework was developed. The systematic structure of the '*School Transport Safety Matrix*', in particular the '*socioeconomic environment*' component, ensures the problem is examined in context and that feasibility and logistical concerns expressed by professionals in the field (eg. QT and QPS policy and legislative limitations, organisational culture of the bus industry, resource allocation decision-making processes, other facilitators and barriers to change) are given due consideration when prioritising recommendations.

**KEYWORDS:** *Haddon Matrix; school transport safety; community consultation; risk-management*

## **INTRODUCTION**

Each weekday in Queensland, more than 600,000 primary and secondary students travel to and from school using a variety of modes of transport. So, given the high value placed on the life of a child or young adult, school transport safety remains a major concern and priority issue for all levels of Government and the broader community (1).

The management of school transport safety has typically followed an "*issue-attention cycle*" (2) with the primary focus being the highly emotive issue of '*seatbelts on school buses*'. Driven by the media, the Australian public has voiced great dissatisfaction with an apparent lack of reform justified by the comparatively low crash-risk associated with school bus travel (3). In response, the Australian Road Research Board (ARRB) was commissioned by Austroads to: (i) review current practice and research in relation to school bus safety; and (ii) identify new or proven measures that may be used as part of a national approach to school bus safety (4). This review subsequently guided the development of a *National School Bus Safety Action Plan* specifying both short- and long-term recommendations designed to reduce crash-risk and/or severity. 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*" (p.1).

### **Formation of a School Transport Safety Task Force**

In March 2001, the Queensland Government established an independent *School Transport Safety Task Force* with four specific terms of reference approved by Cabinet. Faced with the challenge of reviewing and providing recommendations to improve school transport safety in Queensland, the intersectoral<sup>1</sup> Task Force developed a six-month work plan that harnessed:

*current research, policy and practice in school transport safety;*

*advice from experts with specialist knowledge in core areas of school transport and bus safety; and*

*contributions from interested members of the community [via public submissions and consultation].*

---

<sup>1</sup> The representative Task Force comprises membership from Queensland University of Technology (QUT), Queensland Transport (QT), Queensland Bus Industry Council, Education Queensland, Catholic Education Commission, Brisbane Transport, Queensland Council of Parents and Citizens Association (QCPCA), the Centre for Accident Research and Road Safety – Queensland (CARRS-Q) and the Royal Australasian College of Surgeons.

The brief of the Queensland Task Force extended beyond the national focus (4) on two distinct counts. Firstly, the Queensland inquiry was markedly more inclusive and designed to identify priorities for ensuring the safety of all children travelling to and from school (5), rather than just bus passengers and pedestrians. Secondly, the Task Force adopted a highly consultative methodology to ensure that the issues related to school transport safety were fully explored and understood. The Task Force acknowledged that school transport safety relies on a complex network of relationships between people, vehicles and infrastructure that extends throughout the community. Hence, it actively engaged community interest groups, road safety experts and professionals, and key stakeholders from throughout Queensland and across Australia in all aspects of the inquiry. By involving all areas of the community in the identification of school transport-related problems and solutions, the Task Force ensured that its final recommendations addressed the concerns and needs of students, parents and carers, educators, drivers, media and health professionals, transport planners, police, and bus operators and designers (5). “Ultimately, improving school transport safety will involve the commitment and action of all these community members” (p.1).

The importance of maximising public involvement and ownership of transport decisions is well documented. VicRoads (6) contend that community consultation not only adds value, but is an integral part of the process of identifying “better solutions to the problems to be solved in developing the transport system” (p.3). This paper provides a detailed account of the multifaceted methodology adopted by the *School Transport Safety Task Force* and the ongoing processes to utilise community input and expert advice (see **METHODS AND DATA SOURCES**). Based on the review of current research, policy and practice (*stage 1*), and extensive consultation with community groups (*stage 2*) and key stakeholders and road safety experts (*stage 3*), a sound model that conceptualises school transport safety issues and countermeasures in an expanded Haddon Matrix framework (7,8) was developed. The systematic structure of the ‘*School Transport Safety Matrix*’ ensures that safety issues and decisions are examined in context, thus enabling feasible solutions for “high-risk” problems and road users in metropolitan, rural and remote areas to be identified (see **RESULTS AND DISCUSSION**).

## **METHODS AND DATA SOURCES**

This paper does not explicitly cite research findings or recommendations borne out of Task Force deliberations. It is intended to describe the innovative research methods (*process*) employed by the Task Force and the subsequent development of a conceptual framework for examining school transport safety issues and countermeasures (*outcome*).

### **Stage 1 – Preliminary research: Review of current policy and practice in school transport safety**

The first three months of the inquiry were predominantly research oriented. Firstly, national (4) and Queensland data (5) were examined to determine the magnitude and characteristics of school transport-related crashes. This analysis enabled the Task Force to compare interstate school transport crash trends for the period 1991 to 2000 and pinpoint “high-risk” students, modes of transport, times of day and regions. Secondly, a comprehensive literature review and internet search was undertaken to identify: (i) current knowledge and research pertaining to school bus and transport safety; and (ii) related policies, programs and strategies that have been implemented in Australia or overseas.

In conjunction with the inaugural ‘*Red Sneaker Week*’ in Brisbane (July 23-27), the Task Force launched an ‘*Overview of Research and Practice*’ (5) that documents the results of the review of research, policy and practice in school transport safety throughout Australia and internationally. This report also provided a complete description of *Australian Design Rules* (ADRs) and standards for school buses and pertinent evaluations of school transport safety programs and countermeasures.

### **Stage 2 – Community input: Public submissions and consultation**

#### **The submission process**

In accordance with its terms of reference, the Task Force formally invited 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 within the past 12 months to provide a submission [5]. The Task Force also invited submissions from key school transport safety stakeholders, including all Queensland schools, transport planners and policy-makers, and school bus operators and designers. A public call for submissions was advertised in major Queensland newspapers, *Education Views* and the QCPCA newsletter and broadcast on regional radio during April. Prior to submissions closing, print and broadcast media provided a forum for discussion and debate

on core school transport safety issues, including seatbelts on school buses, which ensured the Task Force's role was widely publicised. The Task Force also set up a dedicated web page on the CARRS-Q website, which provides information about the Task Force and houses the 'Overview of Research and Practice' and other facts about school transport safety in Queensland. The website also enabled lodgement of e-mail submissions. The official closing date for public submissions was 31 May 2001.

#### Development of a submission database

A record of the 185 submissions received was incorporated into a database maintained by the Task Force and reflects the variety of stakeholders committed to the cause of school transport safety (see Table 1).

**Table 1: Summary of submissions by community/stakeholder group**

<b>STAKEHOLDER GROUP</b>	<b>NUMBER OF SUBMISSIONS (n = 185)</b>
<i>Students</i>	2
<b><i>Parents and Carers (General Community)</i></b>	69
<b><i>Drivers of Vehicles Carrying School Students (Bus Operators)</i></b>	20
<b><i>School Principals, Teachers and School Communities</i></b>	75
<b><i>Health Professionals</i></b>	6
<b><i>Transport Planners and Policy-Makers</i></b>	13

The database contains a structured content analysis of each submission allowing the extraction of common school transport safety concerns in the Queensland context. Issues attracting the most attention in submissions included:

- ⌘⌘ *Seatbelts on buses carrying school students (n = 127)*
- ⌘⌘ *School bus routes and car driver behaviour within school zones (n = 76)*
- ⌘⌘ *Standees, overcrowding and three-for-two seating (n = 75)*
- ⌘⌘ *Student conduct on buses (n = 22)*
- ⌘⌘ *Bus driver behaviour and management issues (n = 20)*
- ⌘⌘ *Student pedestrian and cyclist safety (n = 20)*

To provide further insight into the areas most concerned with school transport safety and urban- and rural-specific problems, the Task Force assigned each submission a *Rural and Remote Areas (RaRA) Classification* (9) based on the postcode from where the submission was lodged. Despite accounting for only 51 percent of the population, areas outside of the capital city lodged in excess of 70 percent of the submissions received. This statistic, combined with many references to rural and remote road safety problems, suggests that the issue of school transport safety is high on the agenda of non-metropolitan Queensland.

#### In-depth interviews with authors of selected submissions

Once common school bus and transport safety concerns were extracted from the database, the Task Force selected eight submissions to explore further through personal interviews. The organisations represented in this sample were varied, ranging from public and private schools to medical and legal professional bodies to a private bus company and bus action committee. In 45-minute closed session interviews, the Task Force canvassed each organisation/individual's stance on a broad spectrum of school transport safety issues. Interviewees were also given the opportunity to expand on their own submission and outline what they believed should be priorities to improve the safety of children travelling to and from school.

### **Stage 3 - Expert and stakeholder input: Evidence from road safety experts and other professionals**

Together, the review of current research, policy and practice in school transport safety (*stage 1*) and public submissions and consultation (*stage 2*) provided the Task Force with a comprehensive understanding of the issues related to school transport safety (***problem definition***). This knowledge base was subsequently complimented by extensive expert and stakeholder input. In one-hour closed session interviews, the Task Force gathered informed comment from a broad cross-section of experts and key stakeholders, including road safety consultants, educators, health and media professionals, engineers and police. The expert panel was thoroughly briefed and encouraged to pinpoint programs and strategies from other jurisdictions with the potential to improve school transport safety in Queensland (***solution and strategy identification***). In addition to commenting on the effectiveness of current school transport safety initiatives, the expert panel answered a number of technical, logistical and legislative queries borne out of *stages 1 and 2*.

Finally, the Task Force interviewed bus operators, bus designers/manufacturers and other representatives of the bus industry from both rural and urban areas to gain practical insight into: (i) the age and composition of the Queensland school bus fleet [ie. proportion of vehicles meeting roll-over strength and ADR requirements]; (ii) the financial and logistical feasibility of mandating seatbelts on school buses; (iii) student behaviour on and around buses; (iv) compliance levels with Queensland Transport's *Code of Conduct*; (v) problems associated with school bus route design; and (vi) driver behaviour in school zones and around school buses.

## **RESULTS AND DISCUSSION**

The multifaceted methodology employed in the inquiry produced a unique combination of both research-generated and practical knowledge in the area of school transport safety. Furthermore, the active involvement of both community and road safety experts and professionals alerted the Task Force to two factors that are of paramount importance when prioritising safety strategies.

### **Adopting a risk-management approach to school transport safety**

Public submissions and extensive community consultation highlighted the need to move beyond traditional countermeasure development guided by crash trends and cost rationalisation and urged the Task Force to adopt a risk-management approach to school transport safety. 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 the 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 (10).

$$\text{Risk} = \text{Crash Frequency} \times \text{Severity}$$

(Probability x Exposure)      (Crash Cost in Lives)

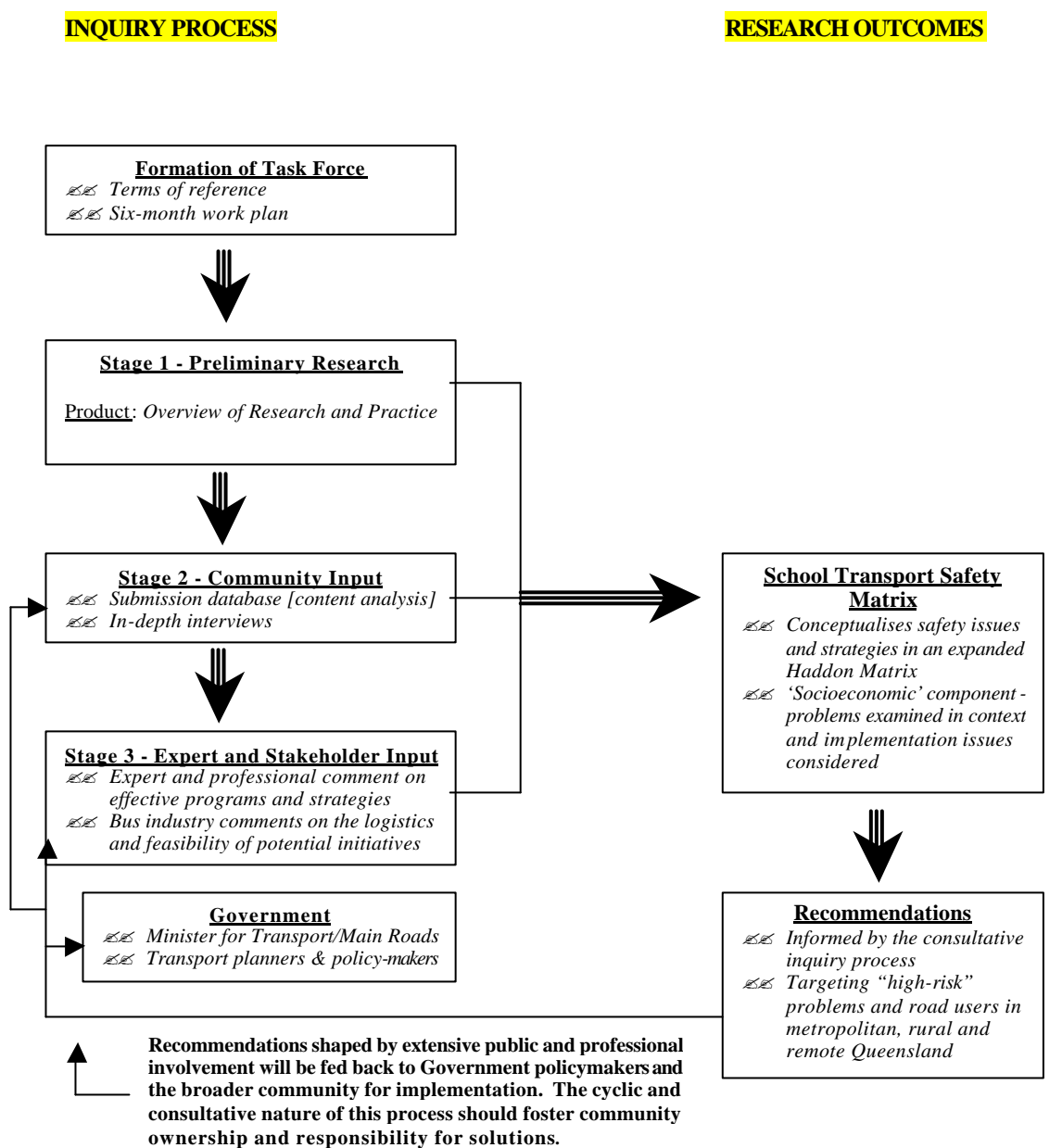
The relationship between probability and potential severity is central when devising strategies to improve school transport safety. In its deliberations, the Task Force is examining ways to improve safety in those modes that have in the past resulted in more fatalities and injuries [ie. pedestrians and cyclists], but it is also mindful of the potential losses that would result from a rare but grave event, such as a major bus crash. Consequently, the Task Force will work to identify a broad suite of strategies that increase school transport safety by reducing crash frequency and/or severity (5).

### **The 'School Transport Safety Matrix': Examining school transport safety systematically and in context**

The expert panel and representatives of the bus industry stressed the need to examine school transport safety issues and strategies systematically and in context. This process apportions some level of responsibility to key stakeholders and participants in school transport safety and ultimately maximises the potential for recommendations to be implemented. In response, the Task Force conceptualised the diverse range of school transport safety issues and strategies in an expanded Haddon Matrix framework (7,8) by: (i) their position in the "*injury control sequence*" - pre-event [*prevention*], event [*severity reduction*] and post-event [*consequence reduction*]; and (ii) the primary contributing factor - *human, vehicle, physical environment and socioeconomic environment*. Although the model is primarily descriptive (*see Table 2*), it provides a sound methodology to review school transport safety and, once again, highlights the dexterity of the Haddon Matrix as a research tool. Most importantly, the systematic structure of the '*School Transport Safety Matrix*' is conducive to identifying appropriate solutions for "high-risk" problems and road users in metropolitan, rural and remote areas of

Queensland. Furthermore, the use of the expanded Haddon Matrix incorporating 'socioeconomic environment' ensures the problem is examined in context and that the feasibility and logistical concerns expressed by professionals in the field (eg. QT and QPS policy and legislative limitations, organisational culture of the bus industry, resource allocation decision-making processes, other facilitators and barriers to change) are given due consideration when prioritising recommendations.

The Task Force is due to hand down its recommendations to improve school transport safety in Queensland to the Minister for Transport and Minister for Main Roads in late September. It is hoped that the highly consultative inquiry process and innovative research tools outlined in this paper (*see Figure 1*) will ultimately result in recommendations that address the concerns of the public and key stakeholders, thus increasing community responsibility for the implementation of solutions.



**Figure 1:** Methodology adopted by the Task Force and subsequent research outcomes

**Table 2: School Transport Safety Matrix**

INJURY CONTROL SEQUENCE	HUMAN/HOST (Key stakeholders)	AGENT/VEHICLE (Buses and other modes of transport)	PHYSICAL ENVIRONMENT (Primarily engineering)	SOCIOECONOMIC ENVIRONMENT
<p><b><u>PRE-CRASH</u></b></p> <p><i>Issues relating to the prevention of crashes</i></p>	<p><b><u>Bus Passenger Behaviour Issues (1)</u></b></p> <p>?? Use of seat belts by children and adults</p> <p>?? Enforcement of seat belt usage</p> <p>?? Student behaviour in and around buses</p> <p>?? Compliance with the 'Code of Conduct'</p> <p><b><u>Child Pedestrian/ Cyclist Issues</u></b></p> <p>?? Risk-taking</p> <p>?? Reduced cognitive abilities (gap selection, road sense, peripheral vision)</p> <p>?? Cyclist helmet wearing</p> <p>?? Current road safety education received</p> <p>?? Compliance with basic road rules</p> <p><b><u>Car/Bus Driver Behaviour Issues</u></b></p> <p>?? Awareness of children's cognitive deficiencies</p> <p>?? Knowledge of school transport and school zone legislation</p> <p>?? Compliance with school transport and school zone legislation</p> <p>?? Driver training needs</p> <p><b><u>Community Ownership Issues</u></b></p> <p>?? Modeling of parental behavior</p> <p>?? 'Duty of Care'</p> <p>?? Proactive programs in other jurisdictions (eg. 'Walking Bus', Bike Trains)</p>	<p><b><u>Bus Pick-Up/Set-Down Procedures</u></b></p> <p>?? Flashing lights</p> <p>?? School bus warning signs</p> <p>?? Bus colours</p> <p>?? Speed restrictions and vehicle behav. around buses</p> <p>?? Age of the bus fleet and compliance with <i>Australian Design Rules</i></p> <p><b><u>Traffic Interaction</u></b></p> <p>?? Vehicle mix (eg. heavy vehicles, tourist traffic)</p> <p>?? Speed choice/differentials</p> <p><b><u>ITS Possibilities</u></b></p> <p>?? Pedestrian detection devices</p>	<p><b><u>School Bus Operating Environment and Procedures</u></b></p> <p>?? Speed and school [40km/h] zones</p> <p>?? School bus route signage</p> <p>?? Road geometry (ie. street design/ traffic calming)</p> <p>?? Pick-up/set-down areas</p> <p>?? Speed limits around buses</p> <p>?? Speed limits for buses</p> <p>?? Appropriateness of speed limits [survivability at 40kph]</p> <p><b><u>Safe School Tavel (SafeST) Initiatives</u></b></p> <p>?? Safe School Bus Routes Program</p> <p>?? Safe Walking and Pedaling (SWAP) Program</p> <p>?? Speed Awareness Program</p> <p>?? SafeST Subsidy Scheme</p> <p>?? School Crossing Supervisor Scheme</p> <p>?? School-based road safety education [ie. RAW, Roadsafe, Kids &amp; Buses, Student Driver Education, Special Needs Road Safety Education]</p>	<p><i>Aim: Improving school transport safety by identifying "best practice" solutions for "high-risk" problems in metropolitan, rural, and remote areas.</i></p> <p><i>Determining the feasibility of potential programs and strategies for different populations and locations.</i></p> <p><b>Key considerations:</b></p> <ol style="list-style-type: none"> <li>1. Cost of initiatives;</li> <li>2. Cost-benefit analyses;</li> <li>3. Willingness to pay;</li> <li>4. Availability of infrastructure;</li> <li>5. Availability of QT, QPS and Main Roads resources;</li> <li>6. Resource allocation decision-making processes;</li> <li>7. Current QT, QPS, DMR policy avenues and limitations (eg. '3-for-2 seating legislation);</li> <li>8. Immediate or phased introduction of countermeasures;</li> <li>9. Funding to support immediate/phased implementation of countermeasures.</li> </ol> <p><b>Organisational Culture (1)</b></p> <p>?? Bus company policy and policy development</p> <p>?? Recruitment of bus drivers</p> <p>?? Training of bus drivers</p> <p>?? Monitoring of bus drivers and initiatives</p>
<p><b><u>CRASH</u></b></p> <p><i>Issues relating to minimising injury when a crash occurs</i></p>	<p><b><u>Bus Passenger Behaviour Issues (2)</u></b></p> <p>?? Use of seat belts by children and adults</p> <p>?? Enforcement of seat belt usage</p> <p>?? Student behaviour in and around buses</p>	<p><b><u>Bus Design and Use – Heavy/Light Buses</u></b></p> <p>?? Comparisons to design features and fittings of overseas [US and Canadian] buses</p>	<p><b><u>Road Environment</u></b></p> <p>?? Removal of obstructions</p> <p>?? Road geography</p> <p>?? Breakaway barriers/poles</p> <p>?? Adequate footpath</p>	<p>(As Above)</p>

<p><b><u>CRASH (ctd)</u></b></p> <p><b>Issues relating to minimising injury when a crash occurs</b></p>	<p>?? Presence of standees</p>	<p><b><u>(a) Interior</u></b></p> <p>?? Seating capacity and practices</p> <p>?? Loading regulations</p> <p>?? Loading enforcement</p> <p>?? Standee capacity</p> <p>?? Occupant protection</p> <p>?? Vehicle safety standards (padding, seat heights)</p> <p><b><u>(b) Exterior</u></b></p> <p>?? Window strength</p> <p>?? Rollover protection</p> <p>?? Door mechanisms</p> <p>?? Vehicle safety standards</p> <p><b><u>Occupant Restraints</u></b></p> <p>?? Seat belt standards and design</p> <p>?? Mounting issues (reinforcement, padding, rollover protection)</p> <p>?? Lap belts versus lap sash belts</p> <p>?? Maintenance and vandalism of seat belts</p> <p>?? Standees on buses (children and adults)</p> <p><b><u>Potential for Simulation and Crash Testing</u></b></p> <p>?? Testing of restraints with occupants of varying body sizes and masses</p> <p>?? Testing of rollover protection in conjunction with restraint and non-restraint use</p> <p>?? Testing of airbags on buses</p>		
<p><b><u>-EVENT</u></b></p> <p><b>Issues relating to reducing unnecessary consequences after a crash</b></p>	<p><b><u>Treatment Services</u></b></p> <p>?? Adequate rehabilitation/counseling services</p> <p>?? Adequate medical treatment in rural areas</p> <p>?? Knowledge of first-aid</p>	<p><b><u>Bus Design Features</u></b></p> <p>?? Availability of, and access to, emergency exits</p> <p>?? Education about emergency exits</p> <p>?? Crash consequence minimisation (eg. fireproof)</p>	<p><b><u>Crash Response Issues</u></b></p> <p>?? Access and response time for emergency services</p> <p>?? Communication systems (especially in rural areas)</p> <p>?? Current QMES trauma system</p>	<p><b><u>Organisational Culture (2)</u></b></p> <p>?? Crash investigation procedures</p> <p>?? Risk-management analyses</p> <p>?? Site-risk analyses</p> <p>?? Policy development revisited</p>



## ACKNOWLEDGMENTS

The authors would like to applaud the ongoing commitment of Task Force members to the cause of school transport safety and their active participation in all aspects of the inquiry. In particular, a sincere thanks is expressed to Ms Renae Moore (Secretary of the Task Force) for her tireless work in the research phase of the investigation. Finally, the authors would like to acknowledge the editorial and intellectual input of staff from the *Centre for Accident Research and Road Safety - Queensland (CARRS-Q)*.

## REFERENCES

1. King, M.J. (2000). Review of the Safe School Travel (SafeST) initiatives: flashing lights at school zones and high visibility bus strips. *Proceedings of the 3<sup>rd</sup> National Conference on Injury Prevention and Control*, pp.52-55, 9-12 May, Brisbane, Queensland.
2. Downs, A. (1972). Up and down with ecology – the “issue-attention” cycle. *The Public Interest*, 28, 38-50.
3. Davis, R. (1995). *Surveys into issues relating to the safety of school bus travel for school children*. Gold Coast: Attwood Marshall Lawyers.
4. Austroads. (2001). *School bus safety in Australia - Technical report (AP-R186A)*. Canberra: Austroads.
5. School Transport Safety Task Force. (2001). *Queensland School Transport Safety Task Force: Overview of research and practice*. Brisbane: Queensland University of Technology.
6. VicRoads. (1997). *Community participation: Strategies and guidelines*. Melbourne: VicRoads.
7. Haddon, W., Jr. (1972). Reducing highway losses: a logical framework for categorizing highway safety phenomena and activity. *Journal of Trauma*, 12, 193-207.
8. Williams, A.F. (2000). The Haddon matrix: its contribution to injury prevention and control. *Proceedings of the 3<sup>rd</sup> National Conference on Injury Prevention and Control*, pp.15-16, 9-12 May, Brisbane, Queensland.
9. Cowan, J. (1997). *The Queensland classification of rural, remote and metropolitan towns and postcodes*. Brisbane: University of Queensland, Graduate School of Medicine.
10. Department of Main Roads. (2001). *Guide for the road safety management of rural school bus routes and bus stops*. Brisbane: Main Roads.