

## **Trial of Seat Belts on School Buses in Queensland**

By Renae Butler-Moore (Queensland Transport), Philip Roper (ARRB TR), Melissa Coutts (ARRB TR), Shannon Newman (ARRB TR) & Tanya Styles (ARRB TR)

### **Abstract**

A trial of seat belts on school buses was conducted in Queensland from January to June 2003. Seat belts were fitted to 12 school buses operating on long steep and very steep routes in Queensland. A seat belt monitoring system was developed and fitted to 6 of the buses. Wearing rates and behaviours of the children travelling on the buses were examined. Results showed that wearing rates varied widely, from 14% to 89%, with an average of 45%. Encouragement to wear the belts had little effect on compliance. Teachers and parents interviewed and surveyed showed a tendency to significantly overestimate wearing rates. Students reported that the belts were uncomfortable, and this was considered to contribute to the low wearing rates.

### **Introduction**

In March 2001, the Queensland government established a School Transport Safety Task Force (STSTF) to investigate the issue of school transport safety in Queensland.

The STSTF investigated safety issues surrounding all modes of school transport, called for public submissions, and met with experts in the field of school transport safety. The final report from the STSTF was presented to government in September 2001 (1).

In their final report the STSTF determined that the use of school buses with rollover strength (standard of construction whereby a bus body will survive a rollover without collapsing) and padding, appropriate seat and seat anchorage strength and seat belts in certain situations would enhance the safety of school bus passengers. The report also called for the phase in of seat belts on school buses, beginning with buses in higher risk steep and mountainous areas. However, the STSTF also noted that there are a number of behavioural issues (such as how to encourage children to wear the belts) and operational issues (like managing the issue of standing passengers) that would need to be resolved before this could occur.

In response to this recommendation the government approved a trial of seat belts on school buses to gain an insight into how these issues could be resolved.

### **Method**

The seat belts on school buses trial commenced at the beginning of the 2003 school year and ended on 27 June 2003. Twelve school buses on designated long steep and very steep bus routes (where standees are already not permitted) were fitted with ADR68/00 seats and seat belts. All buses involved in the trial met ADR 59/00 for rollover strength. A number of the buses in the trial were new or near new vehicles introduced into the fleet through a new targeted bus funding regime (School Bus Upgrade Scheme –

SchoolBUS). Because of a series of mechanical issues one of the buses was removed from the trial after approximately 2 months, leaving eleven buses to complete the trial.

During the trial the issue of seat belt compliance was examined by looking at the effect of encouragement on seat belt wearing rates. Buses were allocated to three groups, each of which received different levels of encouragement to persuade children to wear the belts. Children travelling in buses in the low level of encouragement were exposed only to a sign in the bus telling them to wear the seat belts. Children travelling in buses the medium encouragement group received encouragement from bus operators and the school to wear the belts, as well as a sign in the bus saying that the belts must be worn. The high encouragement group received instructions from teachers and the bus driver, letters home to parents, posters around the schools, signs in the buses, and specific directions for how to use the belts in a hands-on lesson from a road safety officer.

ARRB Transport Research conducted an evaluation of the trial (2). The aim of the evaluation was to determine:

- The impact of seat belts on student behaviour
- Seat belt wearing rates during commuting and charter trips
- The level and nature of misuse of belts
- Student, driver and teacher perceptions of the acceptance of seat belts
- Whether the design of the belt impacts on student behaviour and seat belt misuse
- Whether wearing rates or seat belt misuse can be affected by signs or education campaigns.

The evaluation was conducted in three phases.

1. Phase 1 – collection of baseline data on student behaviour in the buses (November – December 2002)
2. Phase 2 – collection of information regarding student seat belt use and other aspects of behaviour, attitudes and perceptions resulting from the installation of seat belts on buses (March 2003)
3. Phase 3 – collection of information regarding any changes in seat belt use, behaviour, attitudes and perceptions (June 2003).

Tools used to determine the effect of the seat belts on the behaviour of students were:

- Interviews with bus operators at Phase 1, 2 and 3
- A log book completed by bus drivers recording issues of bad behaviour, seat belt wearing rates, and any other operational issues
- Surveys of bus drivers at Phases 1, 2, and 3
- Surveys of school communities and Phases 1 and 2, and interviews at Phase 3
- Surveys of parents in Phase 3
- Interviews with students in Phase 3
- Onboard observations of students
- Automatic monitoring of seat belt operation.

The last point refers to a new automatic monitoring system (AMS) developed by ARRB Transport Research to count the number of seat belts fastened at all times.

## Automatic Monitoring System (AMS)

The AMS was designed to allow an objective measurement of seat belt use rates. The system was fitted to five buses prior to the beginning of the trial in January 2003, with a sixth bus fitted following completion of the vehicle build in March 2003.

### AMS design and installation

Each bus involved in the AMS component of the trial was fitted with seat belts that had a switch built into each seat belt buckle to detect whether the belt was fastened. Cables were used to connect each buckle (two buckles per pair of seats) to the data logging equipment (Figure 1) at the rear of the bus. The input converter continually counted the number of seat belts that were fastened and represented the number in a form that could be recognised by the data logger. The data logger was designed to store the numbers provided by the input converter. The contents of the data logger's memory could then be downloaded to a computer for analysis.



**Figure 1: Input converter (left) and data logger (right)**

The AMS was programmed to record the number of seat belts that were fastened at consecutive three-minute intervals. Drivers of each bus involved in this component were instructed to ensure that all seat belts were unfastened at the beginning of each run. This provided an opportunity for the logging system to be calibrated, as the total number of seat belts being reliably monitored by the system could be ascertained by viewing the data recorded during the first few minutes of logging each day, when there were no passengers on board.

During installation, the AMS was not linked to all seats in all six buses. On a number of occasions, the installation team confronted difficulties accessing the buckle switch cables on some bus seats. Further, where McConnell 2/3 seats (seats designed to carry 3 children seat belted with the middle child in a harness) were fitted the centre seat could not be fitted with the AMS. Some buckle switches also exhibited reliability problems during installation. As there are a number of seat belts for which the buckle status cannot be determined, it is likely that some passengers may have occupied seats where seat belts were not being monitored. For this reason, the number of seat belts shown as being fastened by the data should be taken as a minimum and considered alongside total number of seats in each bus.

Table 1 shows the number of seat belt sensors linked to the AMS and the total seating capacity for each bus involved in the sensor component, by area of operation.

**Table 1: Number of seat belts monitored and total seating capacity of each bus fitted with an AMS by area of operation**

Area of operation	Number of seat belt sensors linked to the AMS	Total seating capacity of bus
Gordonvale	49	53
Gatton	47	57
Peachester	45	54
Mt Mee	58	61
Mt Morgan	50	57
Mt Tamborine	52	61

## Results

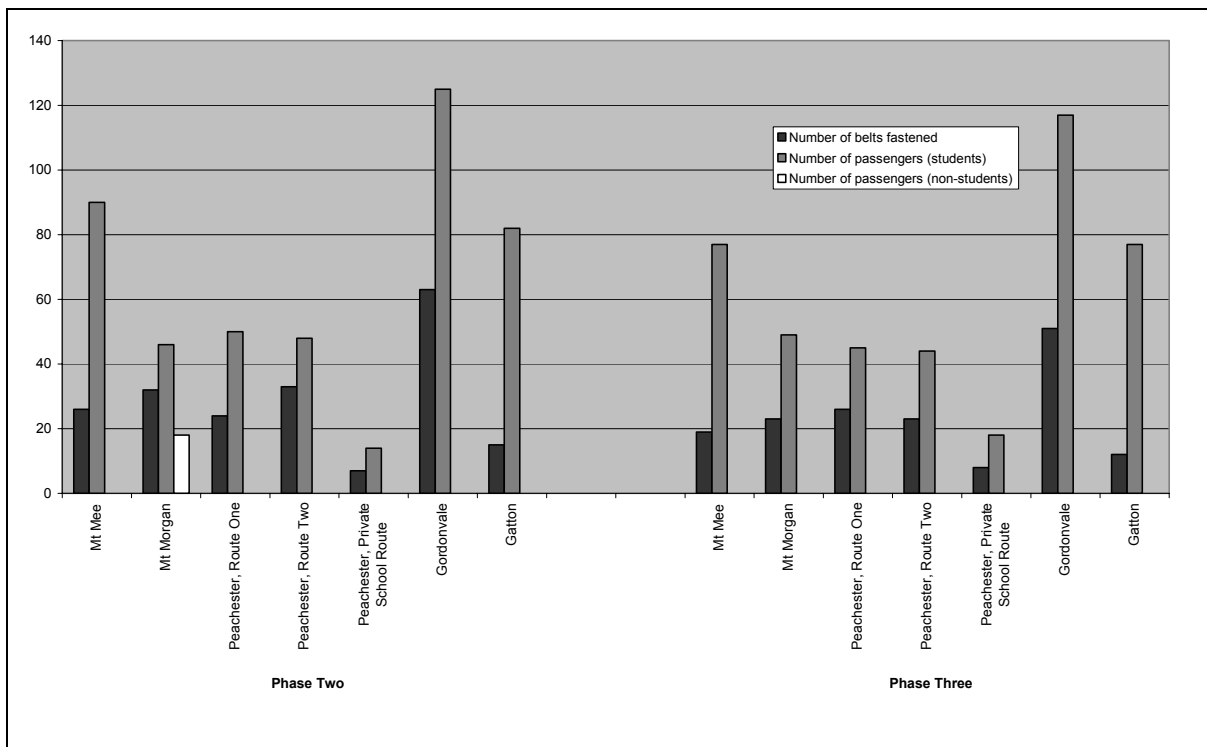
### AMS results – seat belts fastened

Data were successfully recorded and downloaded for five buses between 31 March and 11 April 2003 (*Phase Two*) and 16-26 June 2003 (*Phase Three*).

Given that not all seats were successfully monitored on all buses, the number of seat belts detected as fastened by the AMS relates to the total number of seat belts monitored on the bus, not the total number of seats on the bus. Accordingly, the number of seat belts detected as fastened should be taken as a minimum.

Six operators had an AMS installed on the bus. Five of these systems operated successfully and provided information on the frequency and number of seat belts fastened. Figure 2 shows averaged AMS data for the 6 buses where belt wearing was recorded. Overall the AMS data show that:

- At each monitored location, seat belts were being fastened. This does not guarantee that seat belts were being worn by passengers, however it provides a suitable indication.
- There were differences in seat belt fastening rates between each of the five areas of operation. These variations did not correspond with the nominated encouragement group, that is, high encouragement groups did not yield a higher number of seat belts fastened than low encouragement groups.
- In three areas of operation, on average more than 45 per cent of seat belts were fastened compared with the number of passengers travelling on the bus.
- In three areas of operation, on average fewer than 50 per cent of seat belts were fastened compared with the number of passengers travelling on the bus.
- The average number of seat belts fastened, as a proportion of the number of passengers travelling on the bus, decreased from *Phase Two* to *Phase Three* for all five operators. The AMS recorded reductions of more than 15 per cent for two operators, and less than ten per cent for four operators (Peachester is in fact two routes but run by the same operator).
- The average number of seat belts fastened compared with the number of passengers travelling on the bus increased from *Phase Two* to *Phase Three* for one operator. The AMS recorded a nine per cent increase from *Phase Two* to *Phase Three*.



**Figure 2: Average number of detected fastened belts and reported number of students for Phase Two and Three for all monitored routes**

### Comparison of AMS with reported wearing rates (where applicable)

The AMS figures relate to the number of seat belts fastened, and not to the number of passengers wearing a seat belt. Therefore, during the AMS data collection periods drivers were also asked to estimate the number of passengers they were carrying, and the number that they believed were wearing the belts. The two sets of results were then compared.

A comparison was not possible for one operator due to a problem with logging data for the trial, and for another as they did not provide any estimate of passenger seat belt wearing rates. A comparison of the AMS and driver reported wearing rates could therefore only be conducted for four operators.

Three of the four comparisons showed that drivers tended to overestimate seat belt wearing, often by a considerable margin. However, referring back to

Table 1, not all seats were monitored on each bus, and there may have been students seated in positions that were not monitored.

One operator reported similar seat belt use rates to the number of seat belts the AMS detected as fastened. This operator reported one of the lowest seat belt compliances overall.

### Reports from school communities

School representatives surveyed prior to the installation of the belts considered that behaviour would improve once the belts were fitted. However after installation seven of the eleven school communities reported that there had been no change in behaviour. It should be noted, though, that schools generally received little feedback from bus operators and therefore assumed that this reflected satisfactory student behaviour on the buses.

While only a small number of parents responded to the survey (n=62) almost half of those that did considered that behaviour had not changed since the introduction of the belts.

In terms of wearing rates, only one school community felt the students weren't wearing the belts. Others either reported that the students were wearing the belts, or that they didn't know. This result showed that schools generally overestimated seat belt compliance. This is also reflected in the results from parents, who generally believed that at least their child, or all students, were wearing the belts.

### **Reports from bus drivers**

Surveys and interviews with bus drivers prior to the installation of the belts revealed that most drivers felt students were generally well behaved, with only minor instances of bad behaviour such as children walking around the bus, being noisy or disruptive and occasionally throwing things. Few drivers or operators felt that behaviour would change after the belts were installed. After the installation of the belts drivers most operators either felt that behaviour hadn't changed, or where it improved they attributed it to inability of students to move around the bus if they were belted in, and to higher backed seats and air-conditioning making the buses more comfortable. There were only two minor instances of vandalism during the trial.

### **Reports from students**

There was little feedback from students about behaviour change since the installation of the belts, but those that did provide feedback reported that the high backed seats reduced their interaction with their peers. Students also reported that the belts were uncomfortable, particularly on the smaller children where the sash of the belt often rode high over the student's chest or neck. On-board observations of student behaviour showed that the passengers were generally well behaved.

## **Discussion**

The automatic monitoring system developed for the Queensland Seat Belts on School Buses trial provides an opportunity for objective measurement of the use of seat belts. The seat belt wearing rates recorded by this new system during the trial were generally low, even in areas of high encouragement. This indicates that some form of regulation is required to persuade students to wear the seat belts.

The low wearing rates may also be the result of the design of the seats and belts, with many students reporting that they are uncomfortable and difficult to take on and off. This is compounded by the attempts of students to move around and talk to their peers around the high backed seats.

The misconceptions in the school community about seat belt wearing rates on the buses show that parents and schools are often unaware of what occurs on the school bus. This also indicates that there is a need for these groups to be more involved in the issue of school bus safety in order to increase wearing rates.

Ultimately seat belts will not provide any safety benefit on school buses if they are not worn by the passengers. The results of this study show that the issue of seat belts on school buses is a complex one, requiring commitment from government, bus operators, schools, parents and students to achieve an effective compliance system.

## **References**

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