

**AITPM, SA Branch  
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**Seatbelts in School Buses  
Graeme Burton**

The fitting of seatbelts in school buses has been a hot topic in the public arena for some time, and the issue was brought to a head when a school bus was involved in a crash on the Eyre Peninsula in the western areas of South Australia. There had been a series of school bus crashes over recent years, and the crash at Karkoo seemed to hit the public nerve.

There was intense media interest for a prolonged period of time, and fund raising campaigns were undertaken by a number of community groups to facilitate the retro-fitting of seatbelts to existing buses.

The state government finally declared a policy of having seatbelts fitted to all new school buses, and that some of the existing bus fleet would be retro-fitted. It is understood the total cost of the retro-fit program will approach \$1 million.

While this may appear to be a relatively simple solution that would satisfy community and media concerns, the reality of the matter is that it is rather more complex from a technical point of view, with the rated operating mass of the vehicle, design of seating, design of seatbelt anchor points, and strengthening of the vehicle structure, especially under the floor, needing to be considered.

The first thing to appreciate is that over the years, the (rural) school bus fleet has changed from the old large Bedfords (and similar) to the rather more compact mid-sized buses such as the 'Coaster' made by Toyota. This has been brought about, amongst other things, by the changing conditions in the rural areas such as the reduced number of school aged children. This type of vehicle also provides greater flexibility of operation and hence is able to deliver a better service.

These newer buses have been 'designed to the limit' in accordance with the Australian Design Rules which do not require them to be fitted with seatbelts. In this sense, one could say that their design has been optimised in terms of power, weight and passenger capacity. If seatbelts were to be fitted, considerable weight would be added to the tare weight of the vehicle, due to strengthening required for the anchor points, leading to a significant under-design of the bus in terms of braking performance and the durability of critical components.

Occupant protection on buses has been traditionally provided by ensuring that each seat space forms its own 'compartment', and the focus was on ensuring that the occupant was retained in their seat, rather than being restrained to the seat, with the safety features mainly designed to accommodate frontal impacts.

There is also a community perception that lap-sash belts are superior to lap belts (although everybody happily accepts lap belts on aircraft). While lap-sash belts with emergency locking retractors are accepted as best practice for cars, they are technically difficult to fit to a bus. They require an anchor point near the shoulder of the occupant, requiring the seats to be re-designed to cater for those passengers sitting in the aisle seats. However, the loads generated on the belt during impact must then be transferred down to the floor structure, which in turn, must be strengthened.

Many second-hand buses imported from overseas must be modified to satisfy the Australian Design Rules, and up until now, this has often meant removing seatbelts because they do not meet the ADR requirements. They are generally fitted with lap belts to Japanese standards, which only require the anchor point to withstand forces of 10G rather than 20G.

In summary, the technical issues associated with the retro-fitting of seatbelts involves

- upper torso restraint must be integrated into the seats
- seatbelt anchorage loads need to be reacted into the floor structure, with each anchorage being required to withstand a force of 1.25 tonnes
- significant reinforcement of the floor structure is required
- the seatbelt structure needs to accommodate additional loads
- the seat must be re-designed, leading to additional increase in mass and internal loading

There has been some disquiet from the media at the apparently slow rate of conversion of the existing school bus fleet. However, the rate of change is limited by the production capacity of the seat manufacturers and installers, together with the ability to take the necessary buses out service for the time required to undertake the conversion.

From the discussion that followed Graeme's presentation, it was clear that a better understanding had been gained of the technical issues that lay behind the political decision.



Presenter Graeme Burton (Left) and SA Branch President Jeremy Woolley



Graeme presenting.