

Bus Safety Investigation

Report No 2009/15

Collision

School Bus with Truck

Nullawarre

18 November 2009



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The Chief Investigator

The Chief Investigator, Transport and Marine Safety Investigations is a statutory position established on 1 August 2006 under Part V of the *Transport Act 1983*.

The objective of the position is to improve public transport and marine safety by independently investigating public transport and marine safety matters.

The primary focus of an investigation is to determine what factors caused the incident, rather than apportion blame for the incident, and to identify issues that may require review, monitoring or further consideration. In conducting investigations, the Chief Investigator will apply the principles of ‘just culture’ and use a methodology based on systemic investigation models.

The Chief Investigator is required to report the results of investigations to the Minister for Public Transport and/or the Minister for Roads and Ports. However, before submitting the results of an investigation to the Minister, the Chief Investigator must consult in accordance with section 85A of the *Transport Act 1983*.

The Chief Investigator is not subject to the direction or control of the Minister(s) in performing or exercising his or her functions or powers, but the Minister may direct the Chief Investigator to investigate a public transport safety matter or a marine safety matter.

Executive Summary

A school bus was conducting the scheduled after-school service from Nullawarre and District Primary School when it was struck by a truck and trailer combination. At the time, the bus was turning right onto Moreys Road from a private road.

The bus was carrying 11 primary school children. Three children and the bus driver were seriously injured in the incident. The other children and the truck driver sustained minor injuries. Both the bus and the truck were extensively damaged in the collision.

The investigation determined that, prior to entering Moreys Road from the private road, the bus did not stop but continued directly into the path of the westbound truck.

The investigation found that there was no requirement for this school bus to meet the Australian Design Rules standard for occupant protection in omnibuses.

The investigation recommends that the Moyne Shire Council and VicRoads conduct an assessment of the 100 km/h speed zones on school bus routes to ensure that the speed limit is appropriate and that the Department of Transport reviews the requirement for minimum safety construction and equipment standards for school buses.

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# Circumstances

## Background

Warrnambool Bus & Motor Company is contracted by the Department of Transport (DOT) to provide a school bus service for the Nullawarre and District Primary School. The bus company had scheduled bus 3941 to conduct a before-school and after-school service.

## Incident

On 18 November 2009, after picking up the children from the school, bus 3941 proceeded on its normal route via Henry Sawmill Road and Timboon-Nullawarre Road before turning left onto Baileys Road. It then continued on Rowans Road, Ayresford Road, Moreys Road, Renyards Road back onto Rowans Road and then Baileys Road. The bus then turned left onto Moreys Road and travelled about 450 metres before turning left into a private road leading to a dairy.

At about 1600, the bus dropped off three children at the dairy then returned along the private road to Moreys Road. The bus was turning right (east) onto Moreys Road when it was struck about midway along its right side by a westbound truck and trailer combination.

## Bus route



Figure 1 – School Bus Route

## Consequences

A seven year old male and the bus driver were ejected from the bus on impact. A 10 year old female and the seven year old male were seriously injured in the incident and flown by air ambulance to the Royal Childrens Hospital in Melbourne. Another 10 year old female was initially taken to the Warrnambool and District Base Hospital, but later airlifted to Royal Childrens Hospital.

The 64 year old bus driver sustained serious injuries and was flown to Royal Melbourne Hospital. The other children and the truck driver sustained minor injuries and were taken to the Warrnambool and District Base Hospital.

Both the school bus and the truck were extensively damaged in the collision.

# Factual Information

## Bus 3941

School bus 3941 had a 12.2 metre Hino RK 176 chassis and a body constructed by Custom Coaches, Adelaide, South Australia. Warrnambool Bus & Motor Company took delivery of the vehicle in 1994. The bus was powered by a six cylinder Diesel engine with a manual floor-shift transmission. It provides seating for 45 passengers on 20 two-passenger bench seats and a five-passenger bench seat at the rear. The bus was not fitted with seat belts.

### Damage

The main impact was to the right (driver) side of the bus. The impact distorted the bodywork and chassis rails by approximately 1130 millimetres inwards and the lower paneling was detached. The interior mid-section and floor were severely distorted and the seats in the vicinity were dislodged. The windscreen and the right forward four windows were shattered.

The right side corner of the engine bay was distorted but otherwise relatively intact.



Figure 2 – Damage to school bus

The brake system master cylinder mounting frame was distorted and the air lines to the rear cylinder and air reservoir were also damaged. The front suspension I-beam and frame were severely distorted. No damage was sustained by the rear suspension of the vehicle.

### Maintenance and testing

Company coaches are maintained by company-employed mechanics in Portland and Warrnambool in accordance with the bus industry standard maintenance regime ‘Quality Assured Maintenance System’ (QAMS). The system requires a daily inspection of buses by the driver and a signature on the bus maintenance sheet to signify that the check was conducted. Any defects found during operations are recorded on a maintenance sheet that is given to a mechanic at the end of each driver’s shift.

Each coach is also subjected to 10,000 kilometres or a 3-month inspection, whichever comes first, and to an annual independent inspection by a VicRoads-approved inspector. At the time of the incident the vehicle had completed 399,330 kilometres. The last annual inspection conducted on the incident coach was carried out on 12 May 2009, when the vehicle had completed 386,833 kilometres. A defect notice was issued, which required the company to ‘rectify operation of turn indicators’ and ‘clean and check all suspension spring shackle bushes to manufacturer’s specifications’. During this inspection the front and rear brakes were tested and no defects were noted. The bus company advised the investigation that a notice of completion/rectification of defects was provided to VicRoads within 14 days of the inspection. The QAMS, 10,000 kilometres inspection was carried out on 22 September 2009 when the vehicle had completed 396,003 kilometres and no defects were noted.

The company management advised that, prior to the incident, they were not aware of any maintenance issues with the bus and that none of their staff had indicated there were any defects with the bus.

Post incident inspection of the vehicle by the Major Collisions Investigations Unit of Victoria Police (MCIU) did not reveal any defects that may have contributed to the incident. The brake linings and the tyre tread depths were within the tolerance limits and the tyres were satisfactorily inflated. The brake system was tested and found to operate satisfactorily. The steering system was tested lock to lock and no abnormalities were noted. Both front shock absorbers were leaking fluid and the MCIU opined that the leaks probably existed prior to the collision.

## Bus driver

The driver of the bus was a 64 year old male, holding a valid and current Victorian heavy vehicle driving licence. The driver also held a ‘driver accreditation certificate’ issued by the Director of Public Transport. His driver licence was valid until 18 August 2015 and his driver accreditation certificate was valid until 17 February 2012.

### Interview

The driver advised that he had been first employed by Warrnambool Bus & Motor Company from 1980 to 1982. He said that he had various other jobs not related to bus driving until 1992. He stated that he had done a significant amount of driving while being employed to clean telephone booths in the Timboon region, prior to being re-employed by Warrnambool Bus & Motor Company in 2005 and has been driving school buses since then.

The driver said that the bus was generally parked at his furniture showroom and that he commenced the service from there. He stated that he did two trips each school day; a morning trip to the school and an afternoon trip from the school.

He stated that he was very conscious of the schedule of the bus as children were timetabled to be at designated locations at specified times. He said that if he was ahead of schedule he would slow down and if he was running late he would speed up in order to be within 10 seconds of the specified time.

The driver stated that about 50 per cent of the roads that he drove on were single lane dirt roads. He said that in general the traffic volumes were very low but when a vehicle approached in the opposite direction he would generally pull over and stop and allow the other vehicle to proceed.

He said that on the day of the collision he had completed the morning school run without incident. He stated that on the previous day he had retired for the night at about 2200 and was well rested when he commenced his morning run. He said that did some work in his ‘studio’ for the rest of the morning and commenced his afternoon trip at about 1520 before picking up the children at about 1530 from the school.

The driver stated that he could not recall when or where the accident occurred. He stated that he has fleeting recollections of lying on the road with the paramedics attending to him and also being put on the plane to be taken to the hospital in Melbourne. He could not recall if he was wearing his seat belt prior to the incident.

### Driving record

No driving offences have been recorded against the driver in the last 10 years.

With respect to his daily interactions with the student passengers, the driver had made several complaints to the school and the bus company regarding the behaviour of the students on the bus. From about February 2008 he submitted multiple written complaints regarding issues such as standing up, moving about the bus, and physical interactions between students while the bus was in motion. He also made several complaints to the bus company and the school with respect to parents not being at the bus stop at the designated time to drop off and pick up children and children being on the ‘wrong side’ of the road when being picked up. On several occasions he was required to escort children to their homes as the parents were not at the designated bus stop.

The driver also made several complaints to the bus company regarding vehicles being parked on private driveways blocking the bus’s entry and exit, and in particular the private road that he was on just prior to the collision.

Several parents also had verbal altercations with the bus driver on multiple occasions and several complaints were made to the school regarding the bus driver. The complaints ranged from the bus driver not picking up their children, to the driver stepping off the bus to escort children to their homes.

During a period that the incident bus driver was on leave, a company supervisor was assigned to drive the school bus route. A report from the supervisor stated that he observed the students moving around the bus, throwing items and indulging in generally loud and noisy behaviour. The report noted that when the students were ‘addressed’ they responded in a ‘positive way’.

The supervisor further commented that some parents did not drop off or pick up children at the designated stops and were not at the stops at the designated times, which delayed the bus. The supervisor also claimed that children crossed the road in an unsafe manner, contrary to the advice in the ‘Bus Safety Pamphlets’. He stated that when he addressed some of these issues with some parents, they “behaved in a very aggressive manner towards him”.

As a result of complaints, the bus company formally addressed the issues with the incident bus driver in a letter written to him in August 2009. The company wrote that “the continuous complaints are a concern, because they show that your (the driver’s) attention is not focussed primarily on the safe operation of the bus service”. The letter issued instructions on adhering to the service timetable, remaining in the bus at all times to supervise the children, submitting student behavioural reports and parental complaints to the company management, and avoiding altercations with parents.

### Medical record

The driver suffered from hypertension that was being treated with medication. A medical certificate completed by a registered medical practitioner in February 2006, declared that the driver of the coach met the relevant medical criteria for an unconditional licence and met the minimum acceptable vision acuity standards.

## Truck and trailer

The truck was a tri-axle Trident model manufactured by Mack Trucks and was 8.8 metres in length. The trailer was manufactured by Hamelex-White and was 5.3 metres in length. The truck and trailer were attached by a double ball race turntable. The total length of the rig was 17.0 metres.



Figure 3 – Truck damage

After the collision the truck came to rest against the paddock fence on the north side of Moreys Road. The truck sustained severe frontal impact damage. The radiator of the prime mover was forced into the engine block and the windscreen had come apart from its frame. The steering column had snapped from the secondary shaft connected to the bevel box.

Post-incident inspection of the vehicle by the MCIU did not reveal any defects that may have contributed to the incident. The brake linings and the tyre tread depths were within the acceptance limits and the tyres were satisfactorily inflated. The braking system was inspected and found to operate satisfactorily.

## Truck driver

The driver of the truck was a 61 year old male, holding a valid and current Victorian heavy vehicle driving licence. The driver advised that he had about 40 years experience driving trucks and had been working for his present employer, driving a ‘truck and tipper’ for about five years. He said that the majority of his current work consisted of transporting gravel for the Moyne Shire Council.

He stated that on the day of the incident he started work at about 0700 and was collecting gravel from a quarry near Cudgee and transporting it to a work site on the east end of Moreys Road. He said that he finished his work for the day after completing about six trips, collecting and delivering gravel, and was heading back to Port Fairy when the incident occurred. He had travelled about three kilometres west along Moreys Road, when he saw a bus come out “from behind the trees”. He said that he was travelling at about 80-85 km/h and was about 50-60 metres from the bus, when the bus turned right into the road. He said that he “braked hard” and “tried to turn away to the right to avoid the impact” but the bus kept coming and he was unable to avoid the collision.

He recalled that it was a warm overcast day and at the time of the collision the visibility was fine on this section of “perfectly straight road of about eight kilometres”.

He said that after the collision he used the UHF radio in the truck to call a driver who was following him in a Moyne Shire Council truck and told him that he had an accident and asked him to call an ambulance. He then called his company foreman and informed him of the incident.

He said that he was resting against the truck when he observed a 10 or 11 year old girl run past him towards the back of the truck. When he walked around to the back of the truck and saw the bus driver lying on the ground. He also said that he observed a young boy lying on the ground between the truck and the bus.

He recalled the arrival of the police, paramedics and the state emergency services, being attended to by the paramedics and then being taken by ambulance to the Warrnambool Hospital.

## Witnesses

A student who had been dropped off the bus just prior to the collision stated that he was walking towards his house when he heard a “screech” and turned to look in the direction of the bus. He said that the bus did not stop until it was hit by the truck. He said that he observed the truck attempt to “miss the bus” but it was travelling too fast to do so.

Another witness said that he was on his motorcycle, herding cattle, in the paddock adjacent to the service road to the dairy when he observed the truck travelling west on Moreys Road. He stated that he saw the bus travelling on the service road and moving onto Moreys Road and “knew that he wasn’t going to stop”. He switched off the ignition of his motorcycle and then heard the “smash”. He said that he ran towards the site and assisted the injured students until the arrival of the paramedics.

## Road infrastructure

The unsealed private road from the dairy terminates at a T-intersection at Moreys Road, which is a sealed road with a designated speed limit of 100 km/h. There was no *stop sign*, *stop line* or *give way sign* at the top of the private road and there is no requirement to have such signage for private roads.



Figure 4 – View along the private road from the dairy to Moreys Rd

The school bus was required to travel north on the private road from the dairy and turn right (east) into Moreys Road. Observing from the private road, the sighting of vehicles travelling on Moreys Road is partially obscured due to foliage and trees bordering Moreys Road (Figure 4). However, once at the top of the private road (prior to entering Moreys Road) there is good visibility of vehicles travelling on Moreys Road, both in the easterly and westerly directions (Figure 5).



Figure 5 – Sighting from private road to Moreys Road

## Environment

Warrnambool Airport is the most representative Bureau of Meteorology (BOM) observation point for Nullawarre and observations on 18 November at 1600 indicate clear weather and unrestricted visibility in the area at the time. The sun was at an azimuth[[1]](#footnote-1) of 2860 and at an altitude[[2]](#footnote-2) of 490. The temperature was 250 Celsius and wind speed was approximately 10 knots from the South.

## Collision mechanism

Figure 6 details the final path of the school bus and truck prior to the collision and positions the vehicles came to rest after the collision. The skid marks on the road indicate heavy braking by the truck prior to the collision. The skid marks are considered to have come from the locking of the truck and trailer wheels. The marks commenced approximately 63 metres prior to the point of collision. The truck came to rest on the grass and gravel shoulder to the right of Moreys Road and the trailer straddled the main road at an angle.

Due to the unavailability of recorded data from the truck, it is not possible to know with certainty at which point braking was initiated. For the purposes of estimating the potential truck speed at impact, the investigation assumed that braking became effective 10 metres prior to the commencement of the start of the skid marks. Using the minimum average deceleration rate of 3.78 m/sec2 as specified for trucks in the Australian Design Rules (ADR 35) and an estimated initial truck speed of 80 km/h and 85 km/h the investigation calculated a speed at impact of 27 km/h and 40 km/h respectively. At an estimated speed of 75 km/h or less, based on the above theoretical speed calculation, the truck should have been able to stop prior to impact.

After the impact the school bus rolled approximately 48 metres from the point of impact and came to a rest against the wire fence of the paddock.



Figure 6 – Sketch of incident site

## Legislation, rules and guidelines

### Road safety rules

*Road Safety Road Rules 2009* are made under section 95D of the *Road Safety Act 1986*. The objectives of these Rules are to provide road rules in Victoria that are consistent with road rules elsewhere in Australia and to establish rules to be observed by road users in Victoria in matters not otherwise dealt with in the Australian Road Rules.

Rule 74 of the *Road Safety Road Rules 2009* states that “a driver entering a road from a road related area, or adjacent land, without traffic lights or a *stop sign, stop line, give way sign* or *give way line* must give way to any vehicle travelling on the road or turning into the road. With respect to the above rule *give way* means that the driver must slow down and, if necessary, stop to avoid a collision. Further, the rule notes that “adjacent land or a road related area can include a driveway.

### Public Transport Safety Victoria

Under the *Public Transport Competition Act 1995,* operators of scheduled (route) bus services are required to be accredited by the Safety Director. Warrnambool Bus & Motor Company Pty Ltd was appropriately accredited and certified by PTSV (Public Transport Safety Victoria).

### Director of Public Transport

Accredited coach operators are required to employ drivers who hold a valid and current Victorian heavy vehicle driving licence issued by VicRoads and a ‘driver accreditation certificate’ issued by the Director of Public Transport as required by the *Transport Act 1983.*

### Road Authority

The Moyne Shire is located in south-western Victoria, about 250 kilometres from Melbourne and has a population of approximately 16,000.

The Moyne Shire road network consists of both arterial and municipal roads as designated by the *Roads Management Act 2004*. The *Road Management Act* defines which Road Authority is responsible for the maintenance and upkeep of roads across Victoria. VicRoads is responsible for the management of arterial roads (declared roads) and the Moyne Shire Council is responsible for the management of municipal roads (unclassified roads). The bus route that this particular school bus was required to service consisted of arterial roads and municipal roads. Moyne Shire Council has a contract with Vicroads to perform road maintenance tasks on some of the arterial road network. With respect to the designation of speed limits for declared and unclassified roads, VicRoads is the responsible authority. The Shire Council may request VicRoads to reduce the speed limit for a declared or unclassified road.

## Approval process for school bus routes

Typically the process for the approval of school bus routes is for parents to complete an Application for Permission to Travel form and submit it to their school. A school in the cluster of schools in the region is nominated ‘the bus coordinating school’ which develops a school bus route and submits it to the road authority for approval. Once the approval is received an application is made to the Department of Education and Early Childhood Development (DEECD). The DEECD assesses the applications for compliance with the Student Eligibility Criteria and if the application complies, the bus route is submitted to the Public Transport Division (PTD) of the Department of Transport (DOT) for implementation.

The PTD regional officers along with the bus service provider carries out a measuring or re-measuring of the route for contractual purposes. A School Bus Service Agreement is drawn up between DOT and the school bus service provider and the service is implemented. With respect to existing services the same process is followed and the existing contract is amended. In the event that the school bus service provider or the PTD regional officers have any concerns with respect to the location of bus stops, suitability or condition of the road, the road authority is informed. The road authority then provides DOT with a costing and proposal for the improvement or alleviation of the safety issue.

The service agreement states that the vehicle provided by the operator must be in a safe operating condition at all times and that the operator must have regard to all requirements of the law imposed upon the contractor in respect of the vehicle. The service agreement does not specifically state the minimum safety standards that are required of a bus that is used for a school bus service.

The bus company advised the regional officer of PTD that they had received several complaints from the driver of the school bus regarding the parking of private vehicles in the private road to the dairy that impeded the school bus service. The regional officer advised the school to “remind the parents that the reason the bus travels to the dairy is for the benefit of the school children of the family and if the dairy loop is not kept clear for the bus, DOT would remove the bus from this section and relocate the bus stop to the corner of Baileys and Moreys Roads”. The principal of the school responded to the regional officer, stating that he was disappointed that this issue had re-surfaced as he had made significant efforts to address this issue and implemented some initiatives to resolve this issue. The regional officer advised the investigation that DOT approved school buses on private property only where there is an absolute need. The DEECD’s Procedural Guidelines for Contract School Bus Services state that the criteria for providing a service is that there must be at least five students who all live at least 2.4 kilometres from the nearest service who benefit from the provision of the extension to the service. In this instance although the property was only 500 metres from the nearest service the bus was approved to proceed through the private property as it was deemed that the safety of the children may be compromised if they were dropped off on Moreys Road.

## Accident data

An analysis of road accident data provided by the Moyne Shire Council for arterial and municipal roads from 1987 to 2006 showed that there were 1137 casualty accidents in the period which resulted in 70 fatalities, 460 serious injuries and 607 minor injuries. Of the total number of accidents, 749 were on declared roads and 388 were on unclassified roads. Fifty three of the fatalities were on declared roads while 17 fatalities were on unclassified roads. Some particular trends noted were that approximately 80 per cent of all fatalities in the Shire involved passenger type vehicles in a 100 km/h speed zone, in rural areas with fine and clear weather, on sealed roads and during daylight hours. Fifty percent of casualty accidents involved a loss of vehicle control resulting in run-off-the-road incidents. A further 35 of casualty accidents were caused by collisions with other vehicles and a total of 25 per cent of these collisions occurred at intersections. Semi-trailers, trucks and buses accounted for 10 per cent of all accidents.

An analysis of accident data by Moyne Shire Council identified that although there was an overall downward trend in the accidents from 1987 to 2006, there was a significant increase in casualty accidents on unclassified roads from 2003 to 2006. The Shire Council noted that the six fatal accidents in 2006 represented 37.5 deaths per 100,000 people, approximately five times the national road toll. It was observed that there were an increased number of accidents occurring at intersections and the council identified vegetation intrusions, and in particular signage obstruction and screening of traffic on intersecting roads as safety issues.

The majority of accidents involved light passenger vehicles with the main accident types being collisions with pedestrians, poles, animals, embankments and vehicles overturning. A significant number of the casualty accidents also involved tourists and visitors.

The Moyne Shire Council has developed a Road Safety Strategy, adopted in June 2009 that identifies the safety issues on unclassified roads and proposes key actions to address these issues.

## Occupant protection in omnibuses

Vehicle Standards 2006 (Australian Design Rules – ADR) are made under the *Motor Vehicles Standards Act 1989*. Under the ADR categorisation, bus 3941 is categorised as a “Heavy Omnibus” and given the “ME” code as its GVM[[3]](#footnote-3) is over 5 tonnes. The function of the ADR is to specify design and construction standards for vehicles operating on Australian Roads. ADR 59/00 – Omnibus Rollover strength and ADR 68/00 – Occupant Protection in Coaches are the applicable standards with respect to Omnibus superstructure strength and occupant protection.

ADR 68/00 requires that buses over 3.5 tonnes which seat more than 17 people and have seat-back heights exceeding one metre, be fitted with three-point seatbelts; provided that these buses were manufactured on or after 1 July 1995. ADR 68/00 specifies the requirements for seatbelts, the strength of seats, seat-anchorages, seatbelt anchorages and child restraint anchorages, and provisions for protecting occupants from impact with seat-backs and accessories on seats and armrests.

As the bus in this incident was built prior to 1995 it was not required to comply with ADR 68/00.

### Research on occupant protection

A study by Botto et al (1994) outlined four main injury mechanisms in severe coach crashes.

1. *Projection -*occupant interaction with other occupants and the interior of the coach.
2. *Total ejection -*the occupant being ejected or thrown out of the vehicle.
3. *Partial ejection -*part of the occupant’s body was thrown out of the compartment.
4. *Intrusion -*the occupant being injured inside the vehicle, due to structural deformation or intrusion of an object.

Intrusionis the mechanism of injury causation which ADR/59 is required to address, whereas Projection**,** TotalEjectionandPartial Ejectionare the mechanisms of injury causation which ADR 68 is expected to address.

Seat strength and padding requirements in ADR 68/00 are aimed at reducing ‘projection’, while lap-sash belts help spread the energy of the moving body in a collision over the chest, pelvis, and shoulders, while preventing total or partial ejection.

The report *Australian Bus Safety* published in Nov 2001 by the Australian Transport Safety Bureau (ATSB), states that out of the 17,840 road fatalities on Australian roads, between 1990 and 1998, coach occupant fatalities constituted a very small proportion (0.6 per cent). Statistical analysis of injury data shows a downward trend in both occupant fatalities and injuries from 1990 to 1998.

A Regulatory Impact Statement (RIS) – *ADR 59/00 Standards for Omnibus Rollover Strength*, published in 2007, by the former Department of Transport and Regional Services (DOTARS) states that “with the application of ADR 59 and ADR 66 from 1992 and ADR 68 in 1994, all ADRs have combined to reduce the trauma to occupants from bus accidents. However, the result of this combination has created the condition that makes it difficult to readily isolate the performance indicators of an isolated ADR and therefore assessing the individual success of any one ADR applicable to coaches”.

Seatbelts in school buses in Australia are mandatory only in Western Australia after the Western Australian Government announced in February 2010 that all buses carrying school children were now fitted with seatbelts. In South Australia, all State Government owned and operated school buses (about 50 per cent of the school bus fleet) are fitted with seatbelts and the rest of the fleet, which are owned by private organisations, are required to fit seatbelts when the existing contracts expire and the companies re-tender for new contracts. The Queensland Government is subsidising the cost of fitting seatbelts on new buses, but there is no requirement or subsidy to retro-fit existing buses with seatbelts. There is no requirement for seatbelts in school buses in the other States and Territories.

In Australia, a number of reviews have been conducted on the use of seatbelts in school buses. A study conducted by AustRoads, *Investigation of Internal Bus Safety* *Measures,* published in 2002 found that:

* The risk of being struck by passing traffic after alighting from a bus presents a considerably greater risk to children than travelling as a bus passenger during school commuting hours.
* There is varying evidence regarding the safety effectiveness of fitting seatbelts, allowing the student to stand, allowing three for two seating or installing higher seat-backs (compartmentalisation).
* There is conflicting evidence regarding the effectiveness of fitting seatbelts. Lap-sash seatbelts may improve protection in side impact and rollover crashes, compared with compartmentalisation alone.
* There is a lack of evidence to indicate that seated travel is significantly safer than standing. The research is mixed and evidence is largely inconclusive due to the low number of crashes associated with school buses.

A National Highway Traffic Safety Administration (NHTSA) report to the United States Congress in 2002 outlines the following key findings following tests conducted using dummies and comparing various types of seatbelts and compartmentalisation.

* Compartmentalisation was effective in minimising the risk of head, chest and leg injuries but produced high neck injury measures in half of the tests.
* Two-point belts kept dummies in their seats but produced the highest neck injury measures.
* Three-point seatbelts provided the best form of occupant protection in regard to head and neck injuries, but only if worn properly. Improper wearing and any non-use produced a range of undesirable outcomes.

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# Analysis

Based on site evidence a nominal truck impact speed of 27-40 km/h has been estimated notwithstanding potential variation in the point of initial braking and actual brake performance on the day of the incident. This speed is consistent with the damage sustained by both vehicles and the distance the school bus rolled after the impact.

There is no evidence to indicate that the condition or defects in either of the vehicles contributed to the incident. Although the leaking shock absorbers of the bus may have resulted in less than optimal handling of the vehicle if they were leaking at the time, it is unlikely to have affected the handling of the vehicle on this section of road and at the low speed that the bus was travelling prior to the impact.

Although the sighting of vehicles travelling on Moreys Road is partially obscured from the private road due to foliage and trees bordering Moreys Road, once at the top of the private road road, the truck should have been clearly visible to the bus driver. The evidence indicates that the bus did not slow down or stop at the top of the service road. There was no stop or give way sign at the intersection. Relatively low traffic volumes on the roads in this area may have contributed to the driver becoming complacent and not observing the road safety rule of stopping at the intersection and giving way to through-traffic before entering Moreys Road. Signage warning drivers may heighten driver awareness leading to increased safety. However, in this instance it is doubtful if a give way or stop sign would have altered the driver’s behaviour.

## Accident data analysis

In this instance had the truck been travelling at a lower speed (less than 75 km/h), the driver may have been able to stop the truck prior to the impact. There was a significant increase in casualty accidents on unclassified roads from 2003 to 2006, and in particular there were an increased number of accidents occurring at intersections. Significantly, the fact that approximately 80 per cent of all fatalities were in the 100 km/h speed zone, in fine and clear weather, on sealed roads and during daylight hours may suggest that the designated speed limits are excessive.

## Driving conditions

There is no evidence to suggest that any environmental conditions contributed to the incident. At the time of the incident the weather was clear with unrestricted visibility in the area. The sun was to the left (west) of the driver and would not have affected him as he was heading north and turning east onto Moreys Road.

The investigation considered the evidence with respect to children behaviour and whether the driver was distracted by any activity on the bus leading to the incident. Although he had made several complaints to the bus company with regards to the misbehaviour of the children, the driver did not recall any incidents on the bus that may have diverted attention from his driving duties prior to the incident. Further, there was no evidence to suggest that the driver was affected by any previous incidents with respect to vehicles impeding his travel through the service road in the private dairy.

## Approval of school bus routes

The investigation considered the appropriateness of school buses travelling through private properties and associated driveways. DOT advised the investigation that approval for school buses to travel into private property was granted only where there is an absolute need and subject to DEECD criteria. In this instance although the property was only 500 metres from the bus service route the approval of the bus to proceed through the private property was deemed appropriate to ensure the safety of the school children.

## Occupant protection

This bus did not comply with ADR 68/00 standard nor was it required to. Seat strength, compartmentalisation and padding requirements in ADR 68/00 are there to reduce impact injuries due to ‘projection’ and lap-sash belts help spread out the energy of the moving body in a collision over the chest, pelvis, and shoulders, while preventing total or partial ejection. In this incident had the bus interior been constructed to ADR 68/00, the compartmentalisation, additional seat strength and padding may have reduced the critical injuries sustained by one child who was trapped between the seats in the bus. The child who was ejected from the bus may have avoided serious injury had he been restrained by a seat belt. Although the driver’s seat was fitted with a lap sash seat belt, the evidence indicates that the driver was not wearing it and was ejected from the bus on impact.

Seatbelts in buses will undoubtedly keep children in their seats and thereby prevent them being thrown about within the vehicle or ejected from the vehicle. Use of seatbelts in school buses may also improve student behaviour and reinforce the road safety messages. However, in many cases, standing travel in school buses is necessary due to limitations in capacity. Further, seatbelts for all passenger seats in frequently stopping school buses may not be a practical or viable option and there is a lack of evidence to indicate that seated travel is significantly safer than standing.

DOT does not specify the type of bus or the minimum safety standards required for a bus that is used for school bus services. It may be appropriate to mandate minimum safety construction and equipment standards for school buses with due respect to their operating infrastructure and environment in order to enhance the safety of children in school buses.

# Conclusions

## Findings

1. The bus driver was licensed by VicRoads and accredited by the Director of Public Transport to drive a school bus.
2. The truck driver was licensed to drive a heavy vehicle.
3. The bus operator was appropriately accredited by PTSV.
4. The bus driver was familiar with the school bus route and had been operating on this route for about three years.
5. Post-incident inspection of the bus and truck did not reveal any defects that could have contributed to the incident.
6. The school bus was not required to meet safety standard ADR 68/00 – Occupant Protection in Coaches.

## Contributing factors

The bus driver did not stop to give way to the truck prior to entering Moreys Road from the private road.

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# Safety Actions

## Safety Actions being taken

The Moyne Shire Council has developed a Road Safety Strategy that proposes key actions to address identified safety issues.

## Recommended Safety Actions

Issue 1

The designated speed limit of 100 km/h for some rural roads in the Moyne Shire may be excessive considering school bus routes in the shire.

RSA 2009015

That the Moyne Shire Council conducts, as part of their Road Safety Strategy, an assessment of the 100 km/h speed zones on unclassified roads on school bus routes to determine if the speed limit is appropriate and if necessary advise VicRoads of the assessment results.

RSA 2009016

That VicRoads conducts an assessment of the 100 km/h speed zones on school bus route roads to determine if the speed limit is appropriate.

Issue 2

The school bus was not required to meet safety standard ADR 68/00 – Occupant Protection in Coaches.

RSA 2009017

The Department of Transport reviews the minimum safety construction and equipment standards for school buses.

# References

AustRoads (2002). AP-R213. Investigation of Internal Bus Safety Measures.

Australian Transport Safety Bureau 2001, Australian Bus Safety Report, ATSB, Canberra.

Botto, P. Caillieret, M. Tarrier, C. Got, C. & Patel, A. 1994, *Evaluation of Restraint System for Coach Passengers*. Paper presented at the Fourteenth international technical conference on enhanced safety of vehicles, Munich, Germany.

Moyne Shire Road Safety Strategy 2008 – 2017.

National Highway Traffic Safety Administration 2002, School bus safety: crashworthiness research. Report to Congress.

Procedural Guidelines for Contract School Bus Services in Rural and Regional Victoria, Department of Education and Early Childhood Development, March 2009.

1. **Azimuth** is the clockwise horizontal angle from true north to the sun. [↑](#footnote-ref-1)
2. **Altitude** is the vertical angle (in degrees minutes and seconds) from an ideal horizon, to the sun. [↑](#footnote-ref-2)
3. Gross Vehicle Mass [↑](#footnote-ref-3)