



Office of Transport Safety Investigations

TECHNICAL INSPECTION FINDINGS

LEG INJURIES ON ARTICULATED BUSES

NOWRA COACHES

20 AUGUST & 26 NOVEMBER 2013



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THE OFFICE OF TRANSPORT SAFETY INVESTIGATIONS

The Office of Transport Safety Investigations (OTSI) is an independent NSW agency whose purpose is to improve transport safety through the investigation of accidents and incidents in the rail, bus and ferry industries. OTSI investigations are independent of regulatory, operator or other external entities.

Established on 1 January 2004 by the Transport Administration Act 1988, and confirmed by amending legislation as an independent statutory office on 1 July 2005, OTSI is responsible for determining the causes and contributing factors of accidents and to make recommendations for the implementation of remedial safety action to prevent recurrence. Importantly, however, OTSI does not confine itself to the consideration of just those matters that caused or contributed to a particular accident; it also seeks to identify any transport safety matters which, if left unaddressed, might contribute to other accidents.

This OTSI investigation was conducted under powers conferred the Passenger Transport Act 1990. OTSI investigators normally seek to obtain information cooperatively when conducting an accident investigation. However, where it is necessary to do so, OTSI investigators may exercise statutory powers to interview persons, enter premises and examine and retain physical and documentary evidence.

It is not within OTSI's jurisdiction, nor an object of its investigations, to apportion blame or determine liability. At all times, OTSI's investigation reports strive to reflect a "Just Culture" approach to the investigative process by balancing the presentation of potentially judgemental material in a manner that properly explains what happened, and why, in a fair and unbiased manner.

LEG INJURIES ON ARTICULATED BUSES

Introduction

Two school children were injured in separate incidents while travelling home from school in buses operated by Nowra Coaches in Nowra. The children, a girl aged 5 years and a boy aged 7 years, each had their leg caught in the turntable area of an articulated (bendy) bus. An examination of the incidents found that the middle area of these buses had the potential to entrap persons when the bus was turning and the flexible wall junction with the floor was an area where a person's leg could fall through. A number of remedial actions have been taken by the operator, including: discouraging passengers from travelling on the turntable area of the bus, removing any seating positioned on the turntable, and reversing any seating facing the turntable in the area around the turntable itself.

The Incidents

Incident 1. At approximately 1525 on 20 August 2013, a seven-year old schoolboy was travelling on a Nowra Coaches bus when his leg fell into a gap between the flexible screening and the metal turntable section in the middle of the bus (see *Photograph 1*). He was standing on the turntable section at the time of the incident.



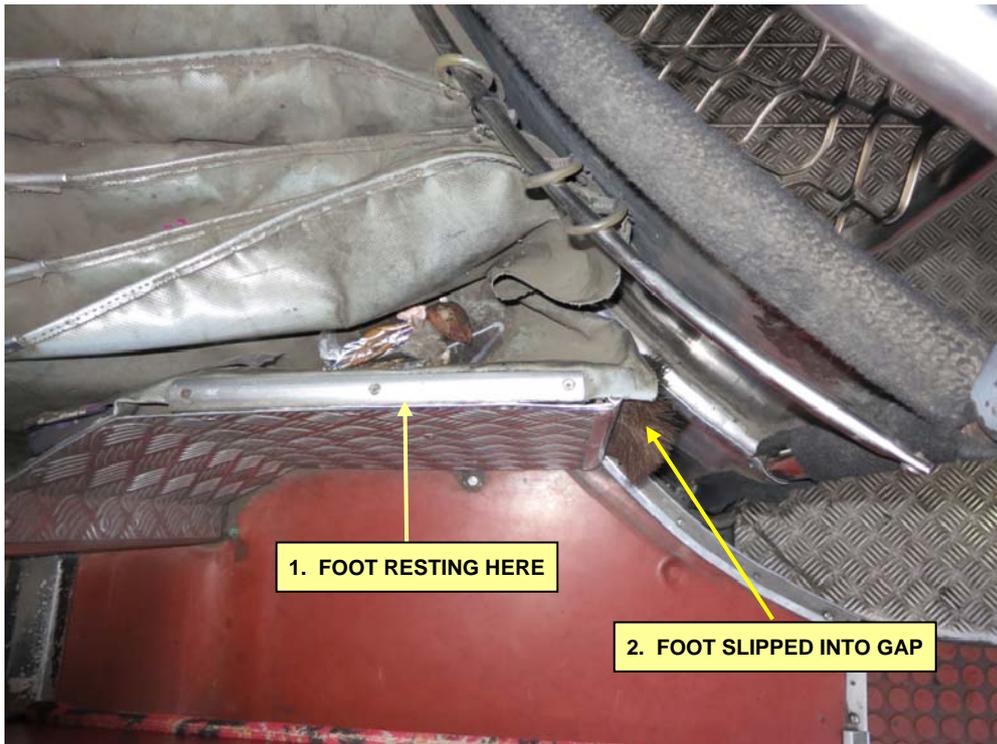
Photograph 1: Turntable area where schoolboy's leg was caught

The bus was operating a regular school bus service transporting approximately 100 primary and high school students home from local schools. As it was travelling along Berry Street, Nowra (see *Figure 1*), the bus turned a corner causing the student's right leg to fall up to mid-thigh into a gap between the flexible wall and the turntable. Once the driver was alerted to this he stopped the bus and attempted unsuccessfully to pull the student's leg from the gap. The driver then attempted unsuccessfully to call the depot using the onboard two-way radio as he had switched the radio to an incorrect setting. The channel settings on the two-way system are changed by pressing the volume knob in and turning. It is possible that the driver had changed the channel when attempting earlier to increase or decrease the volume.

He again went to the trapped student and requested assistance from some of the older students to support the student while he moved the bus. The driver then returned to his driving position and turned the steering wheel which opened the turntable and released the child's leg. Once the schoolboy's leg was freed the bus driver drove the bus to the student's stop where his grandfather was waiting for him. The driver completed the rest of the school run, dropping off the rest of the students, and informed the depot of the incident upon his return. The child subsequently spent 4 days in hospital and underwent surgery on his leg.

Incident 2. A second incident occurred a few months later on 26 November 2013 when, at approximately 1540, a five-year old schoolgirl temporarily caught her foot in the screen area above the turntable mechanism in the middle section of an articulated bus.

The schoolgirl, who was seated in the rear-facing seats closest to the turntable was resting her foot on the top edge of a checker-plate screen which acts as a barrier to the side of the turntable (see *Photographs 2 and 3*). As the bus turned from Clipper Road into Kameruka Crescent (see also *Figure 1*) her foot slipped off into a gap which allows for rotation of the turntable. Her right foot became trapped between the moving parts of this mechanism. When the bus completed the turn her foot was released. The bus driver was not alerted to or aware that the incident occurred. The company was notified of the incident by the girl's parent later that afternoon. She sustained bruising and swelling to her right foot and was transported to hospital by her parents for further examination.



Photograph 2: Top view of screen area



Photograph 3: Area where schoolgirl's foot became caught

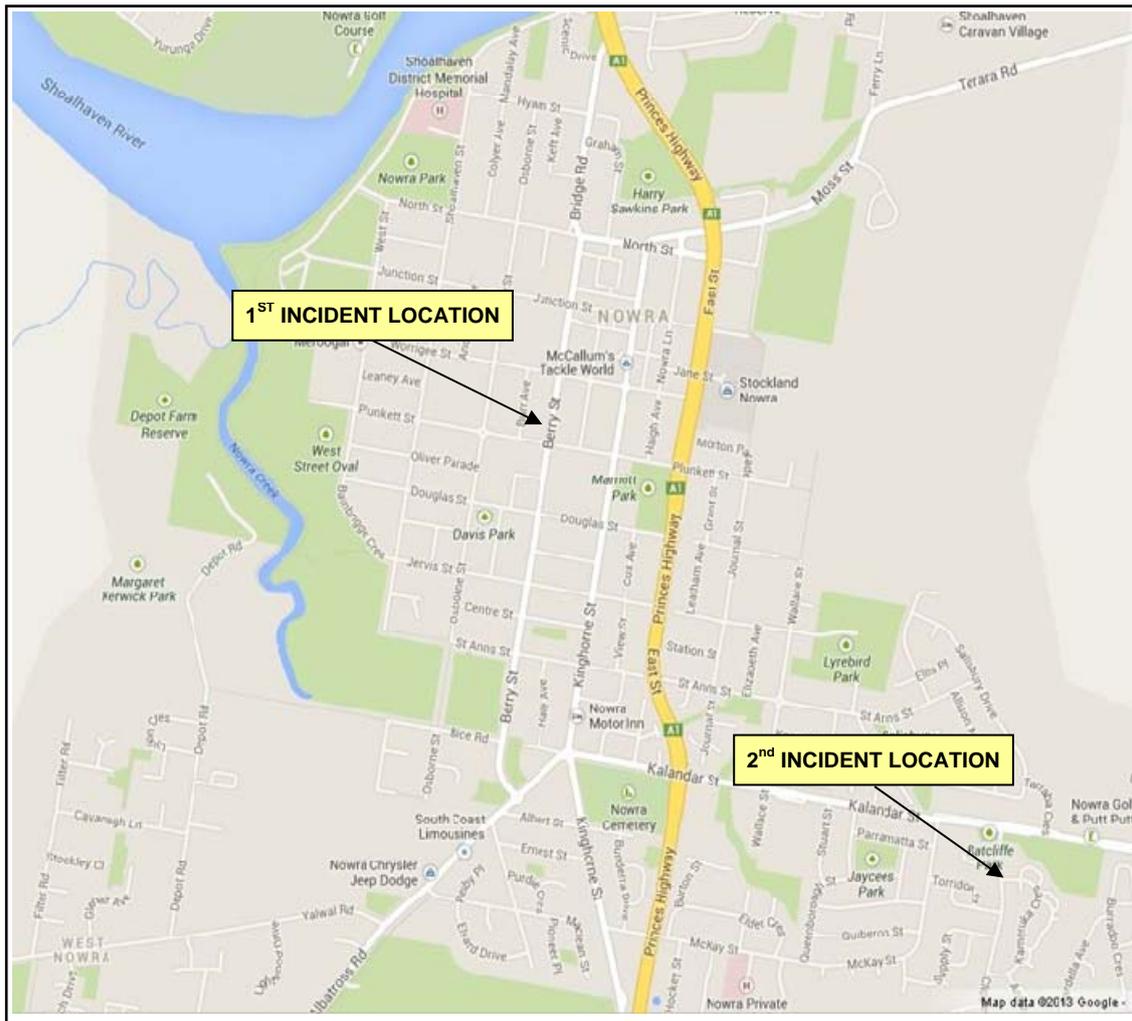


Figure 1: Nowra incident locations

Bus Information

Both articulated buses were built in the early 1980s with bodies made by the Pressed Metal Corporation (PMC). The first bus was registered as 2426 MO (see *Photograph 4*). It has a MAN SG220 model chassis and first entered service in July 1983. The second bus was registered as 5155 MO (see *Photograph 5*). It has a Mercedes Benz O350G model chassis and first entered service in March 1984. In NSW there are approximately 270 articulated buses in service. Most of these are of a more modern design with improved safety around the turntable area. However, 1980s models are still in use in regional areas and there are approximately 23 still operating in NSW.



Photograph 4: 2426 MO



Photograph 5: 5155 MO

Articulated buses, like the two involved in these incidents, are a single-deck design. There are two rigid sections with a pivoting joint between the sections (see *Photograph 6*). A flexible polymer concertina wall arrangement joins the two sections

to allow for differential wall movement on each side of the bus when cornering. The area above the joint is covered by a stainless steel checker plate. The flexible wall sits above the turntable and is prevented from being pushed outwards by a metal guide plate welded to the turntable.

At the time of the incidents there was no restriction on passengers travelling in this area of the bus.



Photograph 6: Articulation joint (floor removed)

The carrying capacity of articulated buses is greater than single deck non-articulated buses. Seating capacity for the two buses involved in the incident was 75 persons. Both buses had two sets of double doors on the kerb-side of the bus, one at the front and another towards the rear. Nowra Coaches do not use the rear doors on any of their buses.

A separate inspection was carried out on a modern articulated bus operated by State Transit. These newer model Volvo B12BLEA articulated buses first entered service in 2005. The design of the centre area addresses the joining of the two sections in a different way that affords better protection to passengers when compared to the older 1980s articulated buses. There are minimal gaps between the bus floor and the turntable and the flexible wall extends further into the passenger area which reduces the likelihood of passengers being caught in this area. The centre of the

flexible wall is also reinforced by a metal joining piece which gives rigidity to the structure (see *Photograph 7*). There is also a solid barrier between the passenger seating and the flexible wall barrier which eliminates the risk of passengers placing legs (or other body parts) into this area (see *Photograph 8*). It was determined that the likelihood of leg injuries occurring was reduced due to an improved design of the articulated area of the modern buses.



Photograph 7: Flexible wall on Volvo B12BLEA



Photograph 8: Solid barrier on Volvo B12BLEA

Vehicle inspections

An inspection of the two buses involved in the incidents, together with six other articulated buses in the Nowra Coaches fleet, was carried out by two OTSI investigators on 28 November 2013.

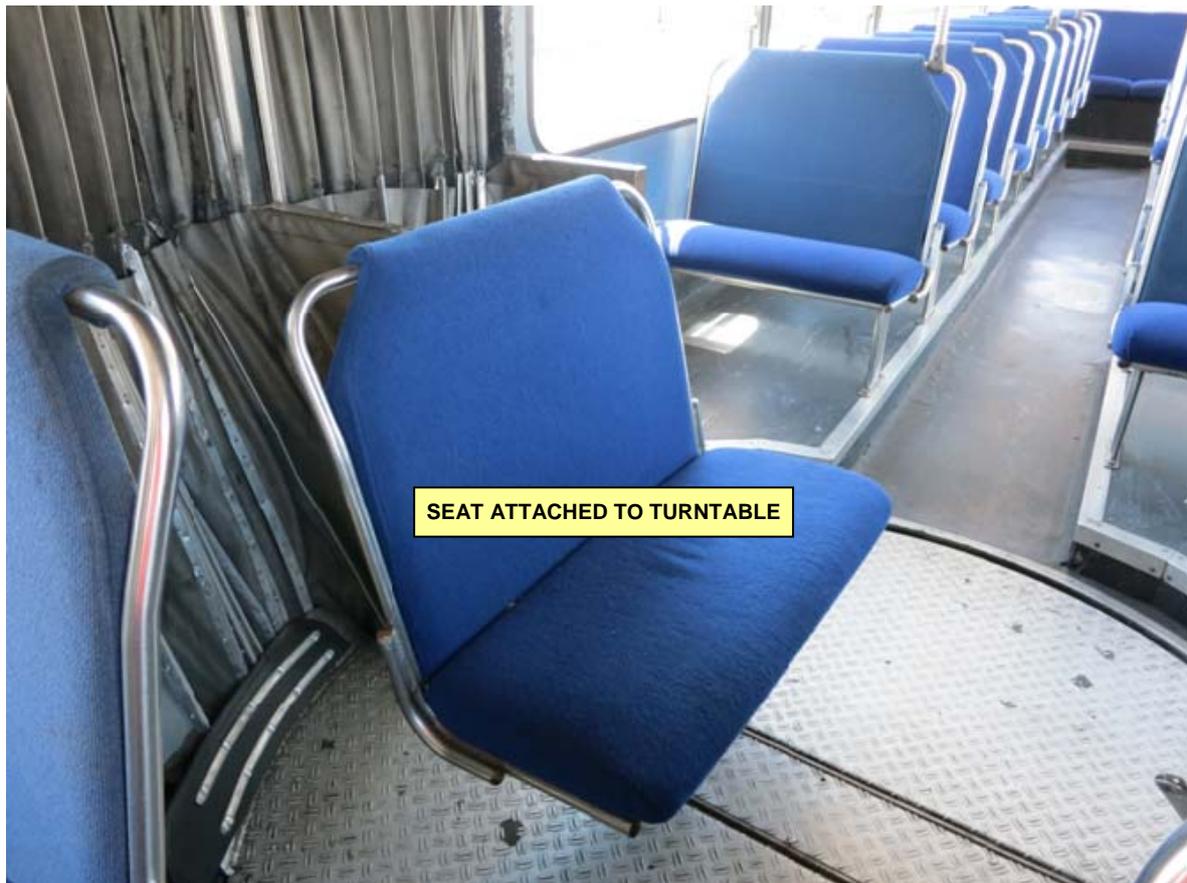
The inspection found that on 2426 MO, the bus where the schoolboy's leg fell into the well of the turntable area, the flexible wall area was damaged and missing two of the metal strips that increase the rigidity of the wall (see *Photograph 1*). There was also damage to the metal guide plate at the base of the screen; it was bent outwards which would make it easier for the screen to push over it. It could not be determined if this damage was pre-existing or the result of the incident.

An inspection of 5515 MO, the bus where the schoolgirl's leg was trapped, found the seating had been modified since the accident in an attempt to reduce the likelihood of a recurrence (see *Photograph 9*). The seating that was facing the turntable was reversed to face away from the turntable. OTSI determined that this measure would be effective in reducing this risk as the temptation for passengers to place their leg on the barriers is removed.



Photograph 9: Seating reversed from original position.

There was also a difference between the two buses in that the bag racks installed on 5515 MO provided a barrier to the flexible side wall. It was a different configuration on 2426 MO where these barriers were missing thus allowing direct contact with the flexible bus wall. One unusual aspect of 2426 MO was the placement of a seat on one side of the turntable (see *Photograph 10*). A positive aspect of this placement was that it blocked access to the flexible wall but it also presented a risk by allowing passengers to sit in this moving area. The seat was removed by Nowra Coaches following the inspection.



Photograph 10: Turntable seat.

Another modification on both buses was new painted signage which prohibited standing in the turntable area (see *Photograph 11*). At the time of the second incident processes were in place to discourage passengers travelling in the bendy section. Signage was also being installed progressively after the first incident as part of the risk management process undertaken by the company.

Once driving, it is difficult for bus drivers to ensure that passengers are complying with directions once they move to the rear of a bus, especially if the bus has standing passengers blocking line of sight. Although a bus driver may have difficulty in ensuring that no person was standing in these turntable areas, the clear signage is a reminder to passengers of the rule.

There was no onboard closed circuit television recording devices fitted to these buses, nor was there any requirement to do so, therefore there was no footage of the incidents.



Photograph 11: Inside of 5515 MO

Following the first incident on 20 August 2013, Roads and Maritime Services conducted an audit of the operations of Nowra Coaches. This audit was conducted on 30 and 31 October 2013 and 14 vehicles were selected to be inspected by officers of the Heavy Vehicle Inspection Scheme (HVIS) at the Nowra HVIS inspection station. Of the 14 buses inspected, 8 minor defect notices were issued. It was recorded that Nowra Coaches took appropriate action to address the deficiencies within 21 days.

A search of the records of incidents reported to the Office of Transport Safety Investigations did not reveal any other reports of incidents of this type.

Findings

Examination of the circumstances of these incidents highlighted the safety issue of older model (1980s) articulated buses presenting a serious risk of leg and foot injuries to passengers travelling in the area on and around the turntable.

Remedial Actions

Nowra Coaches has advised that the following remedial actions have been undertaken on all articulated buses in their fleet:

- Clearly visible 'CAUTION NO STANDING ON TURN TABLE' signs have been posted to discourage passengers from travelling in the turntable area.
- All seating has been removed from the turntable area.
- Seats that faced the turntable area have been reversed to face away from the turntable.

Bus companies with unmodified older model articulated buses the same or similar to those the subject of these findings would do well to consider implementing the type of remedial action undertaken by Nowra Coaches.

OTSI has concluded its examination of the circumstances of this incident and has determined that it does not require further investigation under the provisions of Section 46BA (1) of the Passenger Transport Act 1990.

A copy of these Findings has been provided to Nowra Coaches, Transport for NSW and the Roads and Maritime Services (as the NSW Bus Regulator).