Abstract

At about 1535\(^1\) on Saturday 1 August 2009, the lead locomotive of Pacific National (PN) freight train 5PM5 collided with a utility motor vehicle at the Bumbunga level crossing in South Australia (SA)\(^2\).

The utility vehicle was seriously damaged\(^3\) as a result of the collision and the male driver and a female passenger were fatally injured.

The train driver was uninjured. The lead locomotive of the train incurred minor damage, mainly to the headstock/pilot at the front of locomotive. The track and level crossing infrastructure incurred moderate damage that consisted of damaged rail fasteners and gouging of the road surface at the level crossing.

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1. The 24-hour clock is used in this report to describe the local time of day, Central Standard Time (CST), as particular events occurred. Central Standard Time was Coordinated Universal Time (UTC) + 9.5 hours.

2. There is no township called Bumbunga. The level crossing is located at the site of the former Bumbunga rail crossing loop.

3. The Transport Safety Investigation Regulations 2003 define ‘serious damage’. That definition is used to also describe damage which results in the ‘destruction of the transport vehicle’.
Toxicology tests conducted on the occupants of the utility vehicle revealed high levels of the drug MDMA (commonly known as ‘Ecstasy’) and Methylamphetamine (commonly known as ‘Ice’, ‘Speed’ or ‘Meth’); both are illicit drugs in Australia. It is likely that the driver of the utility vehicle did not stop at the level crossing as the vehicle occupants failed to perceive and react to the oncoming train due to the effects of those drugs.

FACTUAL INFORMATION

Location

The collision occurred about 130 km north of Adelaide on the Adelaide to Port Augusta standard gauge rail corridor in South Australia. The rail corridor is part of the Defined Interstate Railway Network (DIRN) and is managed by the Australian Rail Track Corporation (ARTC). In this role, the ARTC is responsible for the maintenance of the rail corridor, including the primary level crossing signage, and train control functions between Adelaide and Port Augusta.

Figure 2: Locality, Bumbunga level crossing

Bumbunga level crossing

The Bumbunga level crossing is located at the 131.250 km point from Mile End, Adelaide, in the section of track between Snowtown and Nantawarra, at the site of the former Bumbunga railway station/crossing loop.

The Lochiel to Clare Road traverses this level crossing. This road is a secondary sealed dual carriageway that has a maximum speed of 100 km/h. The township of Lochiel is located on the main Adelaide to Port Augusta highway, route A1, about 6 km to the west of the Bumbunga level crossing.

The township of Clare is located about 36 km to the east of the level crossing.

Travelling east, the Lochiel to Clare Road is basically straight and slightly undulating for about 2 km before the level crossing. The gradient is slightly rising although this becomes more pronounced in the final 200 m before the level crossing is encountered. At the time of the collision, there was a rise in the road immediately before the level crossing and a corresponding short dip on the eastern side.

Figure 3: Layout of Bumbunga level crossing

This was a result of the curvature of the rail track at the level crossing and the need to maintain the associated cant of the track (the outside or western rail is higher than the inside or eastern rail). On the immediate approach to the level crossing, the width of the sealed surface was about 7 m and at the road rail interface, just over 11 m².

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4 The Bumbunga level crossing was converted from passive to active protection on 4 December 2009. This work involved extensive modification of road geometry on both sides of the level crossing. Funding was provided under the Federal Government level crossing package.
At the time of the collision, the level crossing had passive protection with ‘Stop’ signs\(^5\), associated advance warning signs and pavement markings to control road traffic using the crossing.

About 25 m on the western side of the level crossing are the Snowtown to Bumbunga and the Bumbunga to Nantawarra roads, which run parallel to the rail corridor. These roads intersect with the Lochiel to Clare Road forming a four-way intersection. Traffic crossing or joining the Lochiel to Clare Road is controlled by ‘Give Way’ signs.

An ALCAM survey\(^6\) conducted in May 2008, estimated the average volume of vehicles traversing the level crossing as 237 per day and the average speed on the approach to the advance warning signage as greater than 80 km/h. The maximum speed of trains across the Bumbunga level crossing is 110 km/h.

A post-accident inspection by the SA Police (SAPOL) revealed that the Ford utility appeared to be in reasonable condition with no faults that would have contributed to the accident.

### Train

Train 5PM5 was a Perth to Melbourne freight train operated by PN. It was hauled by locomotives NR77 (leading) and NR104 (trailing). The train consisted of 45 vehicles (including the locomotives) for a gross weight of 4378 t and a length of 1732 m.

The train’s cargo consisted of general goods conveyed in containers, two empty triple deck car wagons and one crew van. About three-quarters of the containers were loaded as double-stack and the crew van and the triple deck car wagons were marshalled immediately behind the locomotives. In addition, dangerous goods were located in containers that were being carried on the 20th, 26th, 32nd and 34th wagons.

Train 5PM5 was being operated in driver only mode between Port Augusta and Adelaide and, as such, the driver was the sole occupant. He had driven trains for in excess of 30 years and was last recertified on 25 October 2007. He was last medically examined on 9 September 2008 and deemed fit for duty as a locomotive driver in accordance with the National Standard for Health Assessment of Rail Safety Workers.

### Train driver’s account

The driver of train 5PM5 was based in Adelaide. On Friday 31 July 2009, he had worked a freight train from Adelaide to Port Augusta, completing his duties at 1100. He then rested in company supplied accommodation until he signed on again at Port Augusta at 1035 on Saturday 1 August 2009 to work train 5PM5 to Adelaide. He said that he felt well rested when signing on duty to work this train, having had at least 9 hours sleep during the night.

The driver boarded train 5PM5 at Spencer Junction\(^7\) and, after completing a number of pre-departure checks, departed at 1106 for Adelaide. The driver advised that he had a routine trip to Snowtown (168 km) during which he crossed four

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\(^5\) ‘Stop’ sign and ‘Stop’ sign assembly – Throughout this report ‘Stop sign’ and ‘Stop sign assembly’ refers to the ‘Railway level crossing stop assembly (RX-2)’ as defined within Australian Standard 1742.7-2007 at Clause 2.2.2 (page 12).

\(^6\) ALCAM-The Australian Level Crossing Assessment Model is a risk assessment tool which takes into account over 70 factors at each site.

\(^7\) Spencer Junction is on the outskirts of Port Augusta. The PN Drivers depot is located at Spencer Junction.
northbound trains. The train handled well and the driver detected no issues with train braking.

About 10 minutes after travelling through Snowtown, train 5PM5 was approaching the Bumbunga level crossing at an estimated 100 km/h. The driver said that he sounded the locomotive horn as he approached the level crossing. While sounding the horn, he noticed a blue utility with a white canopy about 200 m from the level crossing to his right travelling east in excess of 80 km/h. The driver continued to sound the horn but the car did not appear to slow, nor did it show any signs of attempting to brake that would be indicated by the front of the vehicle dipping.

When the utility was about 100 m from the level crossing, the train driver determined that a collision was inevitable. The car seemed to veer right when it was about 30 m from the level crossing and, at about this time, the train driver made an emergency brake application. Within moments, the collision occurred.

When the train stopped the driver made an emergency call to ARTC train control at Adelaide and informed ARTC of the situation including that he did not believe the accident was survivable. In due course he alighted from the locomotive and saw that the front pilot (cowcatcher) was bent back ‘at least 3 feet’. Sometime after the emergency services had arrived, the train driver was breath-tested by an officer of the SA Police; the result was negative. He was relieved from duty by another driver at 1710.

At the time of the collision, the train driver advised that he had the locomotive headlight on full beam and that the weather was fine and clear with no restrictions on visibility.

Witness account

A resident was outside his house, about 200 m on the south-eastern side of the level crossing, when the collision occurred.

The resident could see a car approaching the level crossing and, although it was hard to estimate the car’s speed, he thought it was travelling at about 90 km/h. He added that, in his experience, the vehicle was travelling at about the same speed as most cars he had seen approaching the level crossing. Due to sighting constraints, he then lost sight of the car, however, he could hear that it was still travelling at what seemed to be the same speed towards the level crossing. At this time, he could also hear the sound of a train approaching and a train horn sounding. Hearing that the car was not slowing, he considered that a collision seemed inevitable. In the final moments before impact, he thought he detected the car accelerating.

The sound of the collision was then heard and, as the train travelled past his property, he could see a part of the car on the front of the locomotive, including a liquid petroleum gas fuel tank.

The resident called the emergency services, then drove his vehicle along the gravel road/track that runs parallel to the western side of the rail line to where the train’s locomotive had stopped. He observed that the train driver was noticeably stressed and shaken but otherwise appeared uninjured. By the time he had returned to the level crossing, the emergency services personnel had arrived.

Post occurrence

At 1555, an ambulance from the SA Ambulance Service arrived at the accident site. This was followed at 1615 by officers from the Port Pirie SAPOL. The accident site was then controlled by the SAPOL officers.

At 2257 the site was handed over to the ARTC by SAPOL officers and train 5PM5 departed for Adelaide at 2305. A track inspection followed and the track was cleared for other train movements at 0025 on the following day, about 9 hours after the collision.

Environmental conditions

The Bureau of Meteorology (BoM) weather monitoring station at Snowtown recorded that at 1530 on Saturday 1 August 2009, the temperature was 13.7 degrees Celsius, the wind was blowing from the west-north-west at 15 to 20 km/h. No rainfall had been recorded during the previous 24-hour period. Sunset was predicted at 1737, which meant that at 1535 the sun was at an altitude of about 21 degrees. Given that the utility vehicle was travelling in an easterly direction, this would place the sun to the rear of the vehicle.
ANALYSIS

Accident investigators from the Australian Transport Safety Bureau (ATSB) arrived at the accident site at 2040 on the day of the accident. Evidence was provided to the ATSB by the ARTC, PN, SAPOL and the BoM. That evidence included locomotive data logs, train driver statements, train driver training records, train consist, train running times and weather observations.

The evidence indicated that the utility vehicle driver made no attempt to stop at the level crossing ‘Stop’ sign. Notwithstanding this, the analysis examined the data log from the locomotive in order to determine if the train driver’s account correlated with that data. In addition, the analysis included a review of the markings on the road that may indicate the trajectory of the vehicle after impact and whether the level crossing conformed with the requirements of AS 1742 Manual of uniform traffic control devices Part 7: Railway crossings.

The findings of the toxicology report of both utility vehicle occupants were also examined.

Sequence of events

Train authority and data log analysis

At the time of the collision, train 5PM5 was operating under the direction of the ARTC train controller based in Adelaide. Train 5PM5 had the necessary authority to travel the section from Snowtown to Nantawarra and hence, the Bumbunga level crossing.

The data log from NR 77 showed that the locomotive horn was sounded for a short time when train 5PM5 was about 1103 m from the Bumbunga level crossing. At this time, the speed was 95 km/h. This sounding of the horn was for the Gills Slant Road level crossing that is located 638 m north of the Bumbunga level crossing.

The speed then gradually reduced to 93 km/h and the throttle was advanced from idle to notch three (notch eight is full power) over the next 918 m. At this point, when the lead locomotive was about 185 m from the level crossing, the locomotive horn was sounded. This sounding continued for 6.5 seconds. One second after the locomotive horn ceased to sound the lead end of locomotive NR 77 impacted the utility vehicle at 90 km/h. At about this time an emergency application of the train brake was made. Train 5PM5 continued a further 1063 m under emergency braking for one minute and eight seconds before coming to a stop.

The data log also shows that the headlight was on for the entire approach to the Bumbunga level crossing and that the driver vigilance control was set to cycle ‘A’, the correct cycle for driver-only operation.

The data log confirms the train driver’s account of the actions he took to warn the approaching vehicle of the presence of his train and also shows that the train was being operated correctly in terms of speed, headlight illumination and vigilance control cycle setting.

Approach of utility vehicle

An examination of the approach to the Bumbunga level crossing on the western side revealed no evidence of vehicle braking before impact. The only tyre marks identified were beyond the level crossing as seen in Figure 4.

**Figure 4: Tyre marks beyond the level crossing**

Adjacent to the tyre mark that crosses the white stop line, were gouge marks/abrasions in the pavement surface (Figure 5) consistent with wear found on the rim of the left front wheel of the road vehicle (Figure 6). There was no such damage to the right front wheel.

The front of the vehicle separated from the rear tray and chassis at impact. It appears that the front section then rotated in an anti-clockwise direction and the rear section in a clockwise direction. The front section of the vehicle then slid across the sealed surface and rolled onto its roof at the raised verge on the southern side of the
road before coming to a rest to the south-east of the level crossing.

Figure 5: Gouge marks from left front tyre

The rear section of the vehicle was carried along on the front of the lead locomotive for about 640 m. The driver’s side window was found to be fully wound up. The investigation was unable to determine whether the passenger’s side window was wound up or lowered due to the damage incurred.

Figure 6: Abrasive wear on alloy rim

At a subsequent inspection coordinated by SAPOL officers, the setting of the air conditioner fan was found to be at 2 (of settings 1 to 4) and the temperature control was set at ‘warm’. It could not be determined whether the air conditioner or radio was on or off.

Bumbunga level crossing

Overview

The requirement for the placement of warning signs, the lay-out of road markings and the use of other devices to control road traffic at public level crossings is set out in the Australian Standard AS 1742.7-2007 Manual of Uniform Traffic Control Devices - Railway Crossings.

Road traffic across the Bumbunga level crossing was controlled by the use of ‘Stop’ signs, associated warning signs and road pavement markings.

There are two issues critical to the safe passage of a road vehicle over a level crossing that is controlled by ‘Stop’ signs. Firstly, the vehicle driver must stop at the ‘Stop’ sign or stop line and visually search the rail line in both directions and give way to any train that may be approaching. Secondly, once stationary at the ‘Stop’ sign or stop line, the motorist must have sufficient sight distance along the railway line to enable them to continue over and clear the level crossing before the arrival of a previously unseen train. If a train is seen, then the motorist must remain stationary until the train has passed.
**Signs and pavement markings**

The investigation found that the signage and road pavement markings were in good condition, in clear view of approaching road traffic and clearly indicated the presence of a passively controlled level crossing. All elements substantially met the intent of the current Australian Standard 1742.7-2007. Figure 8 is a schematic drawing of the order in which the signs and markings were encountered by a motorist travelling in the same direction as the vehicle involved in the collision (an easterly direction).

**Figure 8: Road signs, Bumbunga level crossing**

**Utility vehicle driver**

The evidence shows the level crossing was compliant with the relevant standards and that the train was being operated correctly. Available evidence established that the driver of the utility vehicle did not stop before entering the Bumbunga level crossing and did not give way to the approaching train. The following section looks at possible reasons for this.

**Visual detection**

At the time of the collision, there were no environmental issues that should have impeded the utility vehicle driver’s ability to sight the Bumbunga level crossing approach warning signs and road markings. The sun was to the rear of the utility vehicle, the weather was fine and clear and the temperature was such that heat haze would not have been present. In addition, the topography on the approach to and at the level crossing, the size of the train (made more pronounced by the double stacking of some of the containers) and the illumination of the locomotive headlight, all indicate that visual detection of the train should have been possible.

**Audible detection**

The locomotive data log recorded the train approaching the level crossing at 93 km/h (nearly 26 m per second). The horn was recorded as being activated when the lead locomotive was about 185 m from the level crossing, 7.5 seconds before impact. This sounding continued for 6.5 seconds, until the the lead locomotive was about 25 m from the level crossing, one second from impact. If the utility vehicle was travelling at 80 km/h (about 22 m per second), the horn should have been first detectable when the vehicle was about 165 m from the level crossing. Similarly, if the vehicle was travelling at 90 km/h (25 m per second), the horn should have been first detectable when about 187 m from the level crossing. Both of these distances are well within the stopping distances of the utility vehicle as calculated using the formula contained in standard 1742.7-2007. The calculated stopping distances at 90 km/h are 145.3 m and at 80 km/h, 119.2 m. Those distances include a 2.5 second reaction time but no allowance for a slightly rising grade to the level crossing. Those
calculated braking distances are therefore, somewhat conservative.

Given that the position of the passenger’s side window and the radio settings were unknown, the likely amount of sound insertion loss\(^8\) within the utility vehicle cabin could not be determined. Therefore, it is unknown if the horn was audible to the vehicle occupants.

**Toxicology report, vehicle occupants**

Two toxicology summary reports, based on toxicology tests conducted on the two deceased occupants of the utility vehicle, were prepared by SA Department of Justice.

The reports drew attention to the fact that concentrations of drugs in post-mortem blood can be somewhat higher after death due to movement of the drug in the body post-mortem and that the results are approximations of the concentrations at the time of death rather than exact readings. However, the reports found that both occupants had very high levels of the drug MDMA (commonly known as ‘Ecstasy’) and Methylamphetamine (commonly known as ‘Ice’, ‘Speed’ or ‘Meth’) with the female passenger having the higher concentrations. MDMA and Methylamphetamine are illicit drugs in Australia.

In summary, the reports stated that the level of MDMA and Methylamphetamine found in the utility vehicle driver and passenger were sufficient to decrease performance and cause:

- a high risk of hallucinations
- inattention
- blurred vision and detachment from reality
- elevated risk taking and possible irrational manoeuvres

In addition, it was proffered that the vehicle occupants may have seen the train but did not understand that it was real.

In summary, it is likely that the driver of the utility vehicle did not stop at the level crossing as the vehicle occupants failed to perceive and react to the oncoming train due to the concentrations (and consequential effects) of MDMA and Methylamphetamine.

**FINDINGS**

**Context**

At about 1535 on Saturday 1 August 2009, two occupants of a utility motor vehicle were fatally injured when they were involved in a collision with a freight train at the Bumbunga level crossing in South Australia.

From the evidence available, the following findings are made. These findings should not be read as apportioning blame or liability to any individual.

**Contributing safety factors**

- The driver of the utility vehicle did not stop before entering the Bumbunga level crossing or give way to the approaching train.
- The driver and passenger of the utility vehicle had consumed illicit drugs and were likely to have been experiencing profound performance decreasing effects of the drugs.

**Other key findings**

- Train 5PM5 was being operated in accordance with the relevant rules and procedures. The train driver did all that he could to warn the occupants of the utility vehicle of the presence of his train.
- The Bumbunga level crossing was compliant with the requirements of Australian Standard AS 1742.7-2007 Manual of Uniform Traffic Control Devices - Railway Crossings.

**SOURCES AND SUBMISSIONS**

Information for this report was obtained from:

- Australian Rail Track Corporation
- Pacific National (Asciano)
- SA Police
- SA rail regulator
- Train driver.

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\(^8\) Insertion loss refers to the difference between the measured sound values from an exterior sound source taken outside the highway vehicle and inside the vehicle (NTSB, 1998).
References


Bureau of Meteorology - Snowtown Weather Monitoring Station 1 August 2009.

Toxicology Summary Report (vehicle occupants) 4 August 2009.

Submissions

Under Part 4, Division 2 (Investigation Reports), Section 26 of the Transport Safety Investigation Act 2003, the ATSB may provide a draft report, on a confidential basis, to any person whom the ATSB considers appropriate. Section 26 (1) (a) of the Act allows a person receiving a draft report to make submissions to the ATSB about the draft report.

A draft of this report was provided to:

- Australian Rail Track Corporation
- Pacific National (Asciano)
- ‘Next of Kin’ of the utility occupants
- SA rail regulator
- The train driver.

A Submission was received from the Australian Rail Track Corporation. That submission was reviewed and where considered appropriate, the text of the report was amended accordingly.