



Fatal Level Crossing Collision – Virginia, SA

16 November 2007

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Figure 1: Moloney Road, looking north-west. View of van (foreground) and train 6117



Abstract

At approximately 0935¹ on 16 November 2007 a small passenger van drove into the path of a Patrick Portlink freight train (6117) at the Moloney Road passive level crossing (Figure 1) near Virginia in SA. As a result of the collision, the two occupants in the van were fatally injured. The locomotive crew were shaken but not hurt. The train sustained minor damage but the van was destroyed.

Location

The collision occurred on the Defined Interstate Rail Network (DIRN) at the Moloney Road level crossing located 33.7 km north of Adelaide and 1 km south-east of Virginia in South Australia. The DIRN at this location is managed by the Australian Rail Track Corporation (ARTC). The road and associated approach warning signs

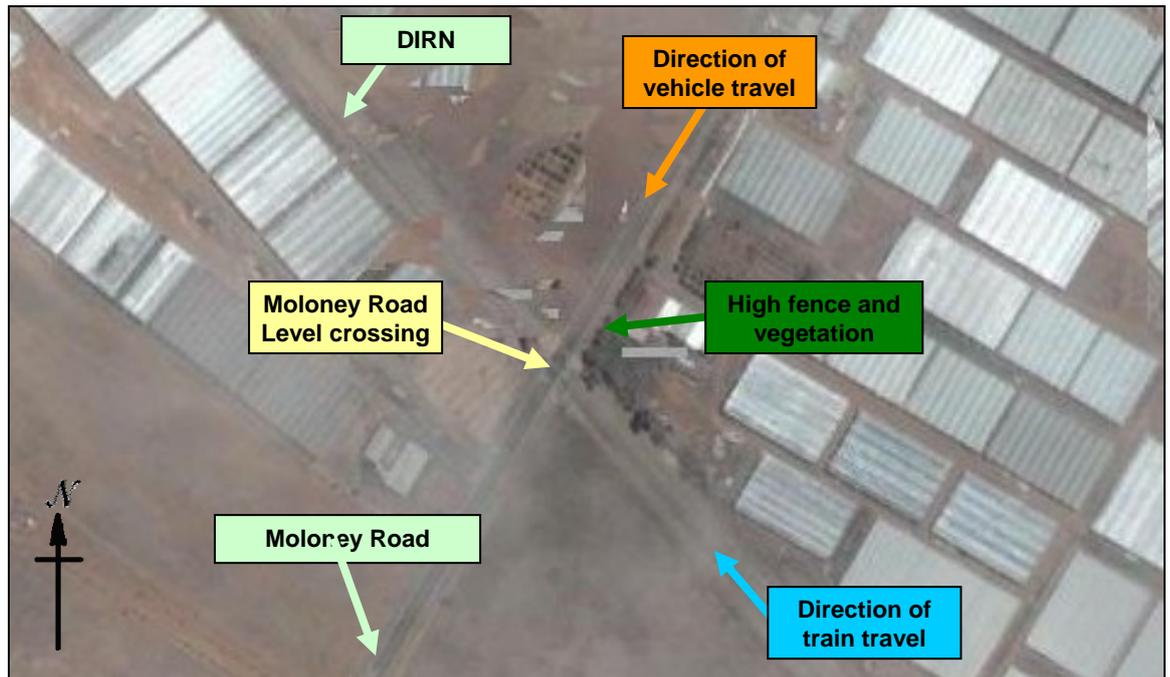
for the level crossing are managed by the City of Playford Council (CPC). Moloney Road can be accessed from Penfield Road 360 m to the north-east of the crossing, or the Old Port Wakefield Road, 760 m to the south-west. Moloney Road is a fully sealed local road with minimal grade difference between the road and the rail lines at the level crossing. The level crossing is passively² controlled by signs that require the road users to stop at the 'Stop' sign and give way to trains on or approaching the level crossing. The road crosses the rail line at an angle close to 70 degrees.

Travelling along Moloney Road in a south-westerly direction (the direction that the van

1 The 24-hour clock is used in this report to describe the local time of day, Central Daylight-saving Time (CDT).

2 Passive Control - Control of the movement of vehicular or pedestrian traffic across a railway crossing by signs and devices, none of which are activated during the approach or passage of a train, and which relies on the road user including pedestrians detecting the approach or presence of a train by direct observation. (Source: AS1742.7-2007)

Figure 2: Aerial view of Moloney Road level crossing, Virginia SA



was travelling before the collision) the sighting of the rail line to the south-east (the direction from which the train was approaching the crossing) was obstructed by a high galvanised iron fence and vegetation. The sighting along the rail line remained obstructed for a road vehicle approaching the crossing from this direction until it was about 12.6 m from the crossing and adjacent to the 'railway crossing width marker assembly' (RX-9), see Figure 3. Visibility then improved to be in excess of 1000 m at the stop line at the crossing.

The speed limit for road traffic along Moloney Road was 100 km/h³ at the time of the collision. The speed limit for trains approaching Moloney Road was 110 km/h reducing to 100 km/h close to the Moloney Road level crossing.

Train and crew information

Train 6117 consisted of two locomotives (1873 leading and 103 trailing) hauling 27 wagons with a total train length of 721 m and gross weight of 1155 tonnes. There were no 'Dangerous Goods' on the train at the time of the accident.

The train crew comprised two drivers. Both had extensive experience and had regularly worked the corridor where the collision occurred.

Vehicle and driver information

The vehicle involved in the collision was a Toyota Hiace van. Following the accident it was inspected by SA Police and assessed to have been in good condition at the time of the collision.

The motorist was a 74 year old male from the western suburbs of Adelaide. Based on the available information, he had no known medical condition that would have precluded him from driving a motor vehicle and was appropriately licensed to drive the class of vehicle involved in the collision. He had no known history of convictions or traffic offences that would indicate an increased risk for this type of accident.

The driver was accompanied by a female passenger, his wife.

Occurrence

On 16 November 2007 the two train drivers involved in the collision joined train 6117 at Pelican Point. They completed prescribed engine, brake and safety checks before departing from Pelican Point (Outer Harbor) at 0840 for Bowmans.

3 Following the collision the speed limit along Moloney Road was reduced to 80 km/h.

The passage of the train through the Adelaide metropolitan area was fairly uneventful. At about 0928 the ARTC train controller contacted the train driver to advise him that the train would cross with a road-rail vehicle⁴ at Bolivar. At about 0934 the train passed through the Bolivar loop, crossing the road-rail vehicle as it continued on towards Bowmans. At this time the train was approximately 1.2 km from the Moloney Road level crossing, travelling at a speed of 98 km/h.

The temperature was about 32 degrees Celsius, the wind was blowing from the north-east at an estimated speed of 26 km/h.

At a distance of about 500 m from the level crossing the train driver said he sounded the horn, he looked to the west and could see no approaching road traffic. His vision to the north-east, the direction of the approaching passenger van, was obscured by the high galvanised iron fence and vegetation.

The train continued towards the crossing maintaining a speed of about 98 km/h. Neither the train driver nor the co-driver observed any vehicles to be slowly approaching or stationary at the 'Stop' sign/line in the moments before the train traversed the Moloney Road level crossing.

Shortly after the train entered the crossing, the locomotive driver and co-driver heard a loud crash, the locomotive lifted and shuddered violently, and dust and debris was seen flying near the front right-hand corner of the lead locomotive. The train driver immediately made an emergency brake application. However, it was only when the co-driver checked the rear vision mirror and he saw the crumpled wreckage of a motor vehicle, about 45 m from the northern side of the crossing, that he and the driver realised that the train had been involved in a collision.

The driver immediately contacted the ARTC train controller and requested the attendance of the emergency services. The front of the train

came to a stop approximately 840 m from the Moloney Road level crossing.

Post occurrence

The response by emergency services included police being in attendance within minutes of the collision. However, the impact had totally destroyed the motor vehicle and both occupants were fatally injured. There was only minor damage to the lead locomotive (1873) comprising damage to the drag box and air hoses.

Police took control of the accident site until evidence was gathered and the site cleared.

There were no independent witnesses who observed the collision.

Drug and alcohol testing of the train drivers was undertaken at the Lyell McEwin Hospital in the presence of the SA Police and returned zero readings.

ANALYSIS

On 16 November 2007, an investigation team from the Australian Transport Safety Bureau (ATSB) was despatched to investigate the collision.

Evidence was sourced from the train drivers, the SA Police, the Department of Transport Energy & Infrastructure, City of Playford Council, the ARTC and Patrick Portlink. Evidence included interviews, photographs, train running information, voice and data logs, engineering documentation, site surveys and other material.

The preliminary examination of the evidence established that there were no known mechanical defects or deficiencies with the train or motor vehicle which would have contributed to the accident.

The train crew were appropriately trained, qualified, certified as competent and medically fit at the time. The train driver's hours of duty for the days preceding the accident indicated that fatigue was unlikely to have been a factor in the collision. Train handling and train speed was not considered a factor in the collision.

The autopsy results for the motorist established that he was in good health and not affected by

4 A road vehicle fitted with retractable rail guidance wheels. (Source: Glossary for the National Codes of Practice and Dictionary of Railway Terminology)

alcohol or illicit drugs and at the time of the collision.

The analysis therefore focuses on the effectiveness of the level crossing traffic control system and other issues that may have influenced the actions of the driver of the van.

Sequence of events analysis

Passage of the train

At the time of the collision, train 6117 was under the direction of the ARTC train controller located in Adelaide. The train driver had the correct authority to occupy the section of track between the Bolivar crossing loop and the Two Wells crossing loop, the section of track where the collision occurred.

The data logger on locomotive 1873 captured time, speed, distance and brake data. The speed recorded by the data logger was corrected for wheel diameter to accurately calculate the train speed. An examination of data from the locomotive was used to reconstruct events leading up to the collision. Based on this information the following was concluded:

- The train was travelling at a speed of 97 km/h, 13 km/h below the maximum track speed at the time of the collision.
- Based on the statement by the train drivers, the locomotive horn was sounded shortly after passing the whistle board on the approach side to the Moloney Road level crossing.
- The collision occurred at 0935 and was at the time the train entered the Moloney Road level crossing.
- The train brakes were applied just following the collision.
- The front of the train came to a stop 840 m beyond the point of collision on the Penfield Road level crossing. Deceleration was consistent with the maximum braking effort achievable by this class of train.

An inspection of the headlight and horn of locomotive 1873 was conducted while the train was on site. This inspection established that:

- The headlights were on and in good working condition.
- The locomotive horn was in good working order.

Passage of the motor vehicle

No information was available regarding the movement of the motor vehicle for the period immediately preceding the collision.

However it was established that that:

- There was no sign of tyre skid marks on the pavement on the north-eastern approach of the crossing (the vehicle not fitted with an anti-lock braking system) indicating that the vehicle did not brake heavily.
- The train driver/co-driver indicated that at the time of the collision the locomotive was felt to lift and lurch heavily as a result of what they believed was a significant impact into the front right-hand corner of their locomotive.
- Neither the train driver nor the co-driver had seen the vehicle either slowly⁵ approaching or stopped at the level crossing 'Stop' sign/line just before they entered the crossing.

Based on the available evidence it is probable that the motorist did not come to a halt at the 'Stop' sign and collided with the train at speed.

Level crossing traffic control

The traffic controls installed at the Moloney Road level crossing are passive devices that rely on the road user stopping the vehicle at the 'Stop' sign/line and detecting the presence of a train through direct visual observation. 'Stop' signs, rather than 'give-way' signs, are necessary at this location as the sighting of a train is obscured to a motorist until approximately 12.6 m from the crossing when adjacent the 'railway crossing width marker assembly' (RX-9). At level crossings like Moloney Road that are controlled by 'Stop' signs, a motorist must come to a complete

⁵ Note: Had the van been travelling at only 20 km/h at the time of the collision, it would have been visible to the train drivers for two seconds.

standstill at the crossing in order to have the opportunity to sight an approaching train and make an informed decision as to whether it is safe to proceed over the crossing.

Traffic control system effectiveness

Given the size and weight of most trains it is not possible for them to brake at anywhere near the rate of a road vehicle. Heavy freight and passenger trains may take several kilometres to slow from high track speeds.

In most circumstances a train driver is unlikely to sight an approaching motor vehicle and determine its intent to stop or not, until the train is relatively close to the level crossing, by which time a collision may be imminent. In such circumstances a train driver is unable to take any effective action to avoid the collision other than sounding the locomotive horn to warn the motorist, and (if time permits) make an emergency brake application.

Consequently, it is important that road signage is effective at warning a motorist that they are approaching a level crossing and provides sufficient distance to stop safely. Similarly, it is important that from the stopped position there is sufficient sighting distance available for the motorist to decide whether it is safe to proceed across the level crossing.

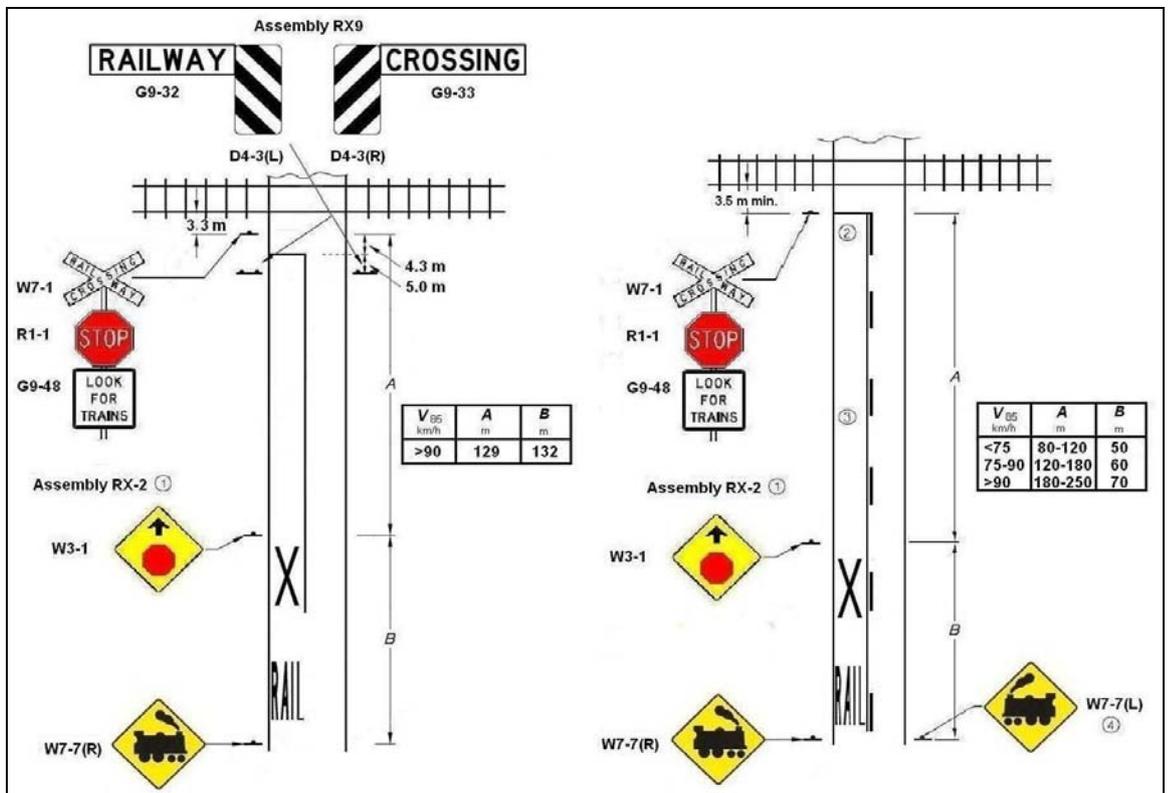
Level crossing compliance

At the time of the collision, Australian Standard AS1742.7-2007 *Manual of uniform traffic control devices Part 7: Railway crossings*, prescribed the requirements for traffic control devices used at level crossings throughout Australia.

Moloney Road level crossing was required to comply with this standard. An examination of the signage (Figure 3) when approaching from the north-east (direction of road vehicle travel, see Figure 5) established that it was generally in compliance with the requirements of the

Figure 3: Signage at Moloney Rd level crossing. Assembly RX-9 is optional

Figure 4: Signage prescribed in AS1742.7 with W7-7(L) being optional



By comparison, a road vehicle can stop relatively quickly. It is for this reason that, regardless of the type of crossing control, the onus to take appropriate action is very much on

standard (Figure 4). There were some minor non-conformances described hereunder, however, these were unlikely to have been factors that contributed to the collision:

- The distance of the RX-2 assembly from the closest rail was 3.3 m. The standard specifies a minimum distance of 3.5 m.
- The stop line was set back from the RX-2 assembly by 4.3 m.
- The standard specifies that the stop line and RX-2 assembly should be adjacent to one another⁶. However, the location of the stop line was unlikely to have been a factor in the collision but closing the distance between the RX-2 assembly and stop line can, under certain circumstances, improve sighting along the track.
- The distance between the 'Railway level crossing ahead' signs W7-7 (R) and the 'Stop Sign Ahead' sign W3-1 was 60 m in excess of that specified in the standard.
- The distance between the 'Stop Sign Ahead' sign W3-1 and the RX-2 assembly was 50 m closer than that specified in the standard.

Sighting distance

Based on AS1742.7-2007 a level crossing having 'Stop' sign control requires:

The sight distance shall be sufficient for the road vehicle driver stopped at the railway crossing stop line to be able to start off and clear the crossing before the arrival of a previously unseen train.

Using the formulae contained within AS1742.7-2007, a light motor vehicle stopped at the stop line on the north-east side of the Moloney Road level crossing needs about 360 m sighting to safely cross the track with a train approaching at 110 km/h. The sighting distance on the north-eastern side stop line was found to be in excess of 1000⁷, and thus well in excess of the requirements of the standard.

Australian Standard 1742.7-2007 also prescribes that the maximum viewing angle measured at the stop line when looking for an approaching train should not exceed 110 degrees when looking to the left. An assessment of the Moloney Road level crossing's geometry revealed a viewing angle of 70 degrees for a motor vehicle stopped on

⁶ This issue was reported to the City of Playford Council by ARTC on 3 June 2003 and had not been corrected.

the north-eastern side at the stop line. This is significantly better than the 110 degrees specified by the standard and indicates that the amount 'head twist' required of the driver was not excessive. At the time of day when the accident occurred, 0935, the sun's azimuth⁸ was 82 degrees at an altitude⁹ of 44 degrees. Reflection and glare was therefore unlikely to have been a factor that affected the visibility of the level crossing signs or of the approaching train.

Figure 5: Motorist's view of Moloney Road level crossing, travelling in a south-westerly direction (direction of vehicle travel)



When driving along Moloney Road in a south-westerly direction and with a train coming from the south-east, the train is completely obscured by the high galvanised iron fence and vegetation. It is therefore essential for a motorist come to a stop at the level crossing if they are to be able to adequately sight and respond to an approaching train.

Based on available evidence it is concluded that had the vehicle been brought to a standstill

⁷ Note: A loaded semi-trailer, 19 m in length, (maximum allowable for this road) having an acceleration of 0.36 m/sec requires 458 m sighting. Therefore adequate sighting distance was available for all vehicle types that were allowed to use the Moloney Road level crossing.

⁸ Azimuth is the clockwise horizontal angle (in degrees minutes and seconds) from true north to the sun/moon. (Source: Australian Government, Geoscience Australia)

⁹ Altitude is the vertical angle (in degrees minutes and seconds) from an ideal horizon, to the sun/moon. (Source: Australian Government, Geoscience Australia)

at the 'Stop' sign/line as required the driver would have been able to clearly see the train.

Motor vehicle driver behaviour

During discussions with the family of the couple who owned the van involved in the collision, the SA Police established that the couple regularly travelled the route over the Moloney Road level crossing when buying produce from growers in the Virginia area. This produce was then sold from their stall at the Pooraka markets on Sundays. It was established that the driver was probably in good health at the time of the collision. This was corroborated by the autopsy results. The family advised that the driver had a reasonable understanding of the English language, at least well enough to comprehend the meaning of street signage. They further indicated that he was usually a good and careful motorist.

The evidence indicates that the van was probably travelling at significant speed when the collision occurred. It is possible that the driver of the van may have only seen the train at the last moments before the collision and had insufficient time to apply the brakes. The remaining analysis will focus on the driver's behaviour and possible reasons why he did not stop before traversing the crossing.

Crossing awareness

Based on the interview with his family, it would appear that the motorist had regularly travelled Moloney Road and should have been aware of the need to stop at the crossing in order to sight a train. Importantly, the approach warning signs were in good condition and would have been clearly visible to the motorist.

It is therefore considered unlikely that the driver of the van made an error due to any lack of awareness of the presence of the crossing or a lack of knowledge regarding the need to stop to adequately sight a train.

Fatigue

Fatigue can have a profound effect on driver performance. It can reduce attention, increase reaction time and affect memory. It can also affect a person's ability to judge distance, speed and time. It is not known whether the

driver was well rested at the time of the collision so the issue of fatigue cannot be excluded.

Expectation

The evidence from the family indicated that the couple in the van had used the Moloney Road level crossing regularly usually at least once a week in visiting growers in the Virginia area to buy vegetables. It is not known how frequently they had encountered a train at the crossing, however with an average of only 15 train movements per day over the crossing it is quite likely that they did not often see a train.

Crossing familiarity combined with an expectation that a train won't be present has the potential to lull motorists into becoming complacent and develop poor looking/crossing habits¹⁰. A road user's expectation that a train is unlikely to be at a level crossing is reinforced every time they traverse a level crossing and don't encounter a train.

With a low expectation of encountering a train, a motorist may develop poor looking/crossing habits and may routinely fail to come to a stop at a crossing as required. It is possible that the van driver's familiarity with the crossing and a low expectation of encountering a train were factors that contributed to his failure to stop at the crossing. Alternatively, the motorist may simply have had a lapse of concentration and failed to stop.

FINDINGS

Context

At approximately 0935 on 16 November 2007 a small passenger van drove into the path of a Patrick Portlink freight train (6117) at the passive level crossing of Moloney Road near Virginia in SA. As a result of the collision, the two occupants in the vehicle were fatally injured.

Based on available evidence, the following findings are made with respect to the collision but should not be read as apportioning blame or

¹⁰ Caird, Creaser, Edwards, and Dewar (2002) *A human factors analysis of highway-railway grade crossing accidents in Canada*

liability to any particular individual or organisation.

Contributing safety factors

The driver of the road vehicle probably did not come to a halt at the 'Stop' sign as required and entered the level crossing while the train was approaching/on the crossing.

It is probable that the motorist's familiarity with the crossing and a low expectation of encountering a train were factors that contributed to the collision. Alternatively, the motorist may simply have had a lapse of concentration and failed to stop.

Other key findings

The restricted visibility at the Moloney Road level crossing means that it is not possible for a motorist to see a train approaching the crossing unless the vehicle is stopped at the 'Stop' sign/line and the track is visually searched.

A review of the Moloney Road level crossing geometry revealed that the available sighting distance and viewing angle on the north-eastern side of the level crossing was better than that prescribed in Australian Standard 1742.7-2007. Had the motorist come to a halt at the 'Stop' sign/line he should have been able to see the train.

There were no deficiencies that relate to the mechanical condition of the train. Train speed, locomotive braking, headlight illumination and the sounding of the horn were appropriate.

The train crew were appropriately trained, qualified and medically fit at the time of the accident.

The actions of the train crew were appropriate in the circumstances. There was little effective action they could have taken to prevent or minimise the impact of the collision.

Breath testing of the train driver and co-driver returned zero readings.

The driving record of the motorist involved in the collision gave no indication of factors likely to have contributed to the accident.

A post mortem examination of the motorist established that he was in good health and not

affected by alcohol and/or illicit drugs at the time of the collision.

Level crossing accident at Moloney Road - 13 December 2007

On 27 June 2008 the Australian Transport Safety Bureau released its final investigation report into another collision that occurred at the Moloney Road level crossing on 13 December 2007. (TSIR 2007/008 can be viewed at the ATSB's website www.atsb.gov.au). A summary of that accident report follows.

At approximately 1417 on 13 December 2007 a tandem tip truck loaded with a 'bobcat' excavator drove into the side of the *Indian Pacific* passenger train (4SA8) at the Moloney Road passive level crossing. The investigation concluded that the accident occurred because the driver of the truck entered the level crossing and did not come to a halt at the 'Stop' sign while a train was on the crossing. There were no injuries to passengers, the train drivers or train's hospitality staff, however, the truck driver was seriously injured.

The investigation identified a number of safety issues to be addressed which are also relevant to this accident:

During the investigation it was noted that the Moloney Road level crossing had a history of collisions and near misses. A mechanism should be considered to flag for attention, level crossings that have not been identified as posing a high risk when assessed using the ALCAM¹¹ but have a history of incidents and/or accidents

The history of accidents and incidents at this location supports a need to undertake a further review of the road/rail interface risk and determine whether opportunities are available to enhance the safety of the site.

During the investigation it was noted that the Australian Rail Track Corporation and the City of Playford Council did not have an 'Interface Agreement' covering their responsibilities with respect to the provision and maintenance of level crossing signage. Maintenance responsibilities need to be clearly defined.

These 'Safety Issues' were identified for actioning by the Department for Transport,

¹¹ Australian Level Crossing Assessment Model (ALCAM) a mathematical model used as a basis for determining level crossing risk and upgrade priority.

Energy and Infrastructure (Level Crossing Unit), the Australian Rail Track Corporation and the City of Playford Council respectively. In TSIR 2007/008 it was noted that the City of Playford Council is currently in the process of closing the section of road over the level crossing as alternative access with active control is close-by and available for public use. This action will eliminate the risk of any future collision at the Moloney Road level crossing.

The findings and recommendations are equally applicable to this investigation and as they have already been published they have not been reproduced in this report.

SUBMISSIONS

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

A draft of this report was provided to:

- 'Next of Kin' as applicable
- The Australian Rail Track Corporation
- The City of Playford Council
- The Department of Transport, Energy & Infrastructure – SA
- Patrick Portlink, including train driver and train co-driver
- SA Coroner
- SA Police

Submissions were received from:

The City of Playford Council, the Australian Rail Track Corporation and the Department for Transport Energy & Infrastructure – SA have made a number of comments and observations on the draft report issued to directly involved parties.

The submissions were reviewed and where considered appropriate, the text of the report was amended accordingly.

MEDIA RELEASE

Fatal level crossing collision at Moloney Road South Australia

The ATSB has found that a fatal collision between a Patrick Portlink freight train and a small passenger van occurred when the motorist drove into the path of the train at the Moloney Road level crossing near Virginia, SA.

The Australian Transport Safety Bureau report into the collision on 16 November 2007 concluded that the motorist's familiarity with the crossing and low expectation of encountering a train were probably factors that contributed to the collision. Alternatively, the motorist may simply have had a lapse of concentration and failed to stop. Both occupants of the van were fatally injured in the collision.

The investigation established that had the motorist come to a halt at the 'Stop' sign as required he would have been able to clearly see the train, remain at stop and then proceed safely over the crossing when the train had passed.

On 27 June 2008 the ATSB released its final investigation report into another collision at the Moloney Road level crossing which included safety actions relevant to the current investigation.

The City of Playford Council is closing the Moloney Road crossing to prevent similar accidents in the future.