



Australian Government

Australian Transport Safety Bureau



ATSB TRANSPORT SAFETY INVESTIGATION REPORT  
Rail Occurrence Investigation No. 2006/004  
Final

Collision between  
**Rigid Tipper Truck/Quad Axle Trailer  
and Freight Train 4AM3**

Lismore, Victoria

25 May 2006



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### Abstract

At about 0714 on 25 May 2006, a Kenworth rigid tipper truck and its quad axle tipper, loaded with 30 tonnes of citrus pulp, collided with the second locomotive of a freight train at the Lismore Skipton Road level crossing, Lismore, Victoria. As a consequence of the collision the second and third locomotives and 41 of the train's 64 wagons were derailed. The driver of the truck was fatally injured.

The investigation found that the truck was not being driven in accordance with the conditions of reduced visibility that existed at the time and that the level crossing approach signage and sighting distances were not in accordance with the relevant standards. The investigation also found that the truck driver may have been experiencing a degree of fatigue that could have affected his driving performance.



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# THE AUSTRALIAN TRANSPORT SAFETY BUREAU

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The Australian Transport Safety Bureau (ATSB) is an operationally independent multi-modal Bureau within the Australian Government Department of Transport and Regional Services. ATSB investigations are independent of regulatory, operator or other external bodies.

The ATSB is responsible for investigating accidents and other transport safety matters involving civil aviation, marine and rail operations in Australia that fall within Commonwealth jurisdiction, as well as participating in overseas investigations involving Australian registered aircraft and ships. A primary concern is the safety of commercial transport, with particular regard to fare-paying passenger operations.

The ATSB performs its functions in accordance with the provisions of the Transport Safety Investigation Act 2003 and Regulations and, where applicable, relevant international agreements.

## **Purpose of safety investigations**

The object of a safety investigation is to enhance safety. To reduce safety-related risk, ATSB investigations determine and communicate the safety factors related to the transport safety matter being investigated.

It is not the object of an investigation to determine blame or liability. However, an investigation report must include factual material of sufficient weight to support the analysis and findings. At all times the ATSB endeavours to balance the use of material that could imply adverse comment with the need to properly explain what happened, and why, in a fair and unbiased manner.

## **Developing safety action**

Central to the ATSB's investigation of transport safety matters is the early identification of safety issues in the transport environment. The ATSB prefers to encourage the relevant organisation(s) to proactively initiate safety action rather than release formal recommendations. However, depending on the level of risk associated with a safety issue and the extent of corrective action undertaken by the relevant organisation, a recommendation may be issued either during or at the end of an investigation.

The ATSB has decided that when safety recommendations are issued, they will focus on clearly describing the safety issue of concern, rather than providing instructions or opinions on the method of corrective action. As with equivalent overseas organisations, the ATSB has no power to implement its recommendations. It is a matter for the body to which an ATSB recommendation is directed (for example the relevant regulator in consultation with industry) to assess the costs and benefits of any particular means of addressing a safety issue.



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# TERMINOLOGY USED IN ATSB INVESTIGATION REPORTS

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**Safety factor:** an event or condition that increases safety risk. In other words, it is something that, if it occurred in the future, would increase the likelihood of an occurrence, and/or the severity of the adverse consequences associated with an occurrence. Safety factors include the occurrence events (e.g. engine failure, signal passed at danger, grounding), individual actions (e.g. errors and violations), local conditions, risk controls and organisational influences.

**Contributing safety factor:** a safety factor that, if it had not occurred or existed at the relevant time, then either: the occurrence would probably not have occurred; or the adverse consequences associated with the occurrence would probably not have occurred or have been as serious, or (c) another contributing safety factor would probably not have occurred or existed.

**Other safety factor:** a safety factor identified during an occurrence investigation which did not meet the definition of contributing safety factor but was still considered to be important to communicate in an investigation report.

Other key finding: any finding, other than that associated with safety factors, considered important to include in an investigation report. Such findings may resolve ambiguity or controversy, describe possible scenarios or safety factors when firm safety factor findings were not able to be made, or note events or conditions which 'saved the day' or played an important role in reducing the risk associated with an occurrence.

**Safety issue:** a safety factor that (a) can reasonably be regarded as having the potential to adversely affect the safety of future operations, and (b) is a characteristic of an organisation or a system, rather than a characteristic of a specific individual, or characteristic of an operational environment at a specific point in time.

Safety issues can broadly be classified in terms of their level of risk as follows:

**Critical safety issue:** associated with an intolerable level of risk.

**Significant safety issue:** associated with a risk level regarded as acceptable only if it is kept as low as reasonably practicable.

**Minor safety issue:** associated with a broadly acceptable level of risk.



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## EXECUTIVE SUMMARY

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At 0714:25<sup>1</sup> on Thursday 25 May 2006, a southbound Kenworth 1995 K100E rigid tipper truck and quad axle trailer collided with an eastbound freight train at the Lismore Skipton Road level crossing in southern Victoria. The 34 year old male driver of the truck was fatally injured in the accident. The two train crew were uninjured. The level crossing is 'passive'; protected by advance warning signs, give way signs and pavement markings only. The speed limit for road traffic over the level crossing is 100 km/h. The line speed limit for trains at the crossing is 115 km/h but the train, in this instance, was limited to 110km/h.

Train 4AM3 was being hauled by three locomotives, was 1356 m long, weighed 4382 tonnes and was travelling at 112 km/h at the time of the collision. The truck and quad axle trailer combination was loaded with citrus pulp<sup>2</sup>, was 19 m long and weighed 48 tonnes.

The truck collided with the side of the second locomotive, adjacent to the trailing bogie. The estimated speed of the truck was between 53 and 78 km/h at impact and more likely to be toward the upper end of this range. The force of the impact was sufficient to derail this locomotive and the following locomotive. Forty-one of the train's 64 wagons then derailed as a result. This portion of the train (844.8 m long) was compressed into an area 128 m long, about 45 m wide and up to 12 m high.

At the time of the accident the area surrounding the level crossing was enveloped in very heavy fog. The evidence suggests that visibility was as low as 20 m and certainly no greater than 50 m.

The locomotive headlight was illuminated and the horn was sounded twice before impact. Testing established that the headlight was as specified and aligned correctly and that the sound levels of the horn were within expected levels. Although the train was travelling at 2 km/h over its permitted speed, it was still 3 km/h under the permitted track speed.

The emergency response was both timely and adequately resourced and site management processes were appropriate. The magnitude of the recovery task was such that the track was not re-opened until 0045 on Wednesday 31 May, nearly six days after the occurrence.

Neither the deceased truck driver nor the company that he worked for had any history in terms of traffic offences or other non-compliances that would indicate an increased risk for this type of accident. Notwithstanding this, the investigation found that that the truck was not being driven in a manner consistent with the prevailing conditions of reduced visibility or at a speed that would have allowed the truck to be stopped short of any hazard on the road.

The investigation found that the Lismore Skipton Road level crossing did not comply fully with the relevant standards relating to road signage or the guidelines for sighting distances for passive level crossings controlled by give way signs. However, it is unlikely that these factors contributed to the accident.

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1 Time calculated from the data event loggers of the three locomotives.

2 Citrus pulp – The remnants of citrus fruit after processing. In general terms is the rind and skin.

At the time of the accident the processes for calculating sighting distances at passive level crossings were contained in State warrants and varied considerably across jurisdictions. The investigation noted that the Australian Standard *Manual of uniform traffic devices*, 1742(7) was under review and that the draft contained several initiatives aimed at improving warnings for motorists at active level crossings and a consolidation of sighting distance formulas for passive level crossings.

The investigation noted that in times of reduced visibility it may not be possible for a motorist to safely negotiate a passive level crossing based on sighting distances alone. This is regardless of whether give way or stop control is used.

The investigation also noted that the Lismore Skipton Road level crossing has been scheduled by the Victorian Department of Infrastructure for upgrade from passive to active protection in March 2007 and that the Australian Transport Council has recently approved a level crossing strategy aimed at modifying road user behaviour to improve railway level crossing safety.

Safety actions recommended, as a result of this investigation, relate to:

- audits aimed at ensuring compliance with the relevant level crossing signage standards and sighting guidelines across Victoria
- consideration of measures to promote the need for vehicle drivers to drive according to the environmental conditions and recognise the increased risk at passive level crossings in times of reduced visibility and,
- ensuring the risks posed by the operation of B-double/higher mass limit trucks are evaluated by both road and rail authorities.

# 1 FACTUAL INFORMATION

## 1.1 Overview

Following a collision between a loaded truck and a freight train at Lismore on Thursday 25 May 2006, the ATSB initiated an investigation under the *Transport Safety Investigation Act 2003* (TSI Act).

At 0714:25,<sup>3</sup> a loaded 1995 Kenworth K100E rigid tipper truck and Tefco quad axle trailer collided with the second locomotive of freight train 4AM3 while travelling south along the Lismore Skipton Road at Lismore, Victoria. The truck driver was fatally injured in the collision; the train crew were not injured.

### 1.1.1 Location

The standard gauge rail line between the South Australian/Victorian border and Melbourne is leased to the Australian Rail Track Corporation (ARTC)<sup>4</sup>. The Lismore Skipton Road level crossing is located on this corridor 168.182 km from a zero/reference km mark near Melbourne's Southern Cross rail terminus. The level crossing is passive<sup>5</sup> and protected by signage that directs road users to give way to trains. The Lismore Skipton Road is a Class Three two-lane two-way bituminous sealed road<sup>6</sup>.

Figure 1: Location of Lismore, Victoria (Railways of Australia)



3 Calculated from the data event loggers of the three locomotives.

4 ARTC – Responsible for access to and management of the Adelaide to Melbourne rail corridor; is responsible for the maintenance of level crossings within rail property boundaries.

5 Passive – protected by sign/devices that are not activated during the approach or passage of a train.

6 Class Three – Roads in Victoria that form an avenue between important centres or between class one/class two roads or are of an arterial nature within a rural area.

Figure 2: Give way assembly and left side railway level crossing width marker assembly located on the southern approach to the level crossing (northern side destroyed)



The Lismore Skipton Road (north-south) and the Adelaide to Melbourne rail line (east-west) intersect at the level crossing at about 90 degrees. The western approach of the rail line to the Lismore Skipton Road level crossing is straight with a slight descending gradient for about 3 km.

The Lismore Skipton Road intersects the Hamilton Highway about 1800 metres to the north of the Lismore Skipton Road level crossing. Elevation at the intersection was recorded at 211 m<sup>7</sup> and at the level crossing 175 m, a difference of 36 m. Once clear of the intersection precinct, the Lismore Skipton Road straightens and, in the vicinity of the level crossing, the gradient is almost level.

The Camperdown Lismore level crossing is located about 249 m east of the Lismore Skipton Road level crossing. This crossing is 'active' and protected by signage, flashing lights and audible warning devices. The Lismore Skipton Road and the Camperdown Lismore Road merge several hundred metres south of the level crossings and continue as the Camperdown Lismore Road. The speed limit for road traffic over both level crossings is 100 km/h. The line speed limit for trains at both crossings is 115 km/h.

The township of Lismore is located about 2 km to the north of the Lismore Skipton and Camperdown Lismore level crossings and can be accessed by either road, although the Camperdown Lismore Road is a more direct route.

7 Recorded by a GPS receiver as being within nine metres accuracy.

Figure 3: Satellite/aerial view of locality



### 1.1.2 Truck and company information

The truck and trailer combination was 19 m long from 'bull-bar' to the rear of the trailer, the tare weight was 18 tonnes and it could operate to a maximum gross weight of 50 tonnes. On this occasion it was loaded with an estimated 30 tonnes of citrus pulp<sup>8</sup> (gross weight of 48 tonnes) and was travelling from Wedderburn to Camperdown.

Wheelhouse Fertiliser Pty Ltd was the owner and operator of the truck and quad axle trailer. The company is located at Bridgewater, Victoria and deals in fertiliser sales and distribution and the transportation of general commodities. The general commodities component of the business is mainly confined to intrastate work, mostly within about 300 km of Bridgewater.

The company was accredited by VicRoads<sup>9</sup> under the 'Heavy Vehicle Accreditation Scheme' in November 1998. The evidence indicates that the truck and quad axle trailer involved in the accident was maintained in accordance with this scheme. VicRoads has no record of any incidents or non-compliances relating to Wheelhouse Fertiliser.

8 Citrus pulp – The remnants of citrus fruit after processing. In general terms is the rind and skin.

9 VicRoads – The statutory government corporation that manages the Victorian arterial road network. In this role VicRoads is responsible for the maintenance of the Lismore Skipton Road and the signage (excluding RX1 and RX9, see 2.2.1) on the approach to the Lismore Skipton Road level crossing. VicRoads is also responsible for the registration of road vehicles and driver licensing in Victoria.

Figure 4: Kenworth K100E rigid tipper truck and quad axle trailer



### 1.1.3 Truck driver information

The driver of the truck and quad axle trailer was a 34 year old male from Wedderburn, Victoria. He had been employed by Wheelhouse Fertiliser for about five months as a full time permanent employee on an hourly rate of pay (in lieu of distance scales). In addition, he had been known to the proprietors of Wheelhouse Fertilisers for a long time, having lived in the area for many years.

The driver was on prescribed medication but it was of a type that would not be expected to have a detrimental effect on his driving performance. The driver was appropriately licensed and had extensive experience on various trucks on a variety of interstate and intrastate routes over about 15 years.

The truck driver had no prior convictions for traffic offences and had been fined once for a minor traffic infringement. Two demerit points were applied in this instance.

### 1.1.4 Train and crew information

Train 4AM3 consisted of three locomotives (NR 52, DL 40 and NR 33) hauling 64 wagons for a total length of 1356 m and gross weight of 4382 tonnes. The maximum allowable speed for train 4AM3 was 110 km/h. This train was crewed by a driver and an assistant.

Pacific National Pty Ltd was providing the train crew, rollingstock and locomotives of train 4AM3 on a contractual basis for Patrick Corporation Ltd. Pacific National is the largest accredited and privately owned rail operator in Australia.

The driver of train 4AM3 had driven freight and passenger trains on the Dimboola to Melbourne route for about 26 years. The second person (assistant) had about

ten months experience working on trains between Dimboola and Melbourne. Both were full time employees of Pacific National. They were appropriately qualified and medically fit in accordance with relevant standards at the time of the accident.

### **1.1.5 Environmental conditions**

The accident occurred just before sunrise in very heavy fog. Witnesses were unanimous in that the area was 'blanketed' in thick fog and visibility was reduced to between 20 and 50 m.

Bureau of Meteorology (BoM) records indicates that sunrise was at 0728, about 14 minutes after the accident. However, after sunrise the visibility did not significantly improve for several hours due to the fog. BoM records also indicate that the minimum and maximum temperatures for the day at Lismore were about 3°C and 12°C respectively.

**Figure 5: Photo taken of DL 40, just after 0900**



## **1.2 The accident**

### **1.2.1 Passage of the truck**

On Wednesday 24 May 2006 the truck driver had driven the truck and quad axle trailer from the company depot at Bridgewater to Lake Boga. At Lake Boga stone was loaded, taken to Mildura and unloaded. The truck and trailer were then re-loaded at Mildura with citrus pulp and driven to Wedderburn (about 225 km) where the driver ceased work at 1900<sup>10</sup> and rested at his residence for the evening. Wedderburn is en route to the consignment destination (a dairy) at Camperdown.

The evidence from the driver's family was that he had dinner and went to bed shortly after. It was said that he adopted a similar routine on the three previous evenings due to early starting times. He was said to be in good spirits and nothing appeared to be bothering him.

He departed his residence at about 0340 on Thursday 25 May 2006 to continue the journey to Camperdown. The exact route taken from Wedderburn to Lismore is unknown as there are several options. However, the most direct and therefore the most probable route to Lismore is about 210 km. Given the transit time of about three and a half hours and the distance travelled until the time of the accident the average speed was just over 60 km/h. However, this calculation is based on consistent running and does not take into account any stops for meals/rest that may have been taken en route.

The Tourism Victoria website contains a route planner designed, amongst other things, to give an approximate travel time between points of origin and destination in favourable conditions. The journey between Wedderburn and Lismore is calculated at about 2.75 hours. There was no specified delivery time for the consignment of citrus pulp at the dairy.

The truck driver's mobile phone records showed no incoming or outgoing calls in the period before the collision.

Figure 6: Origin and conclusion of truck journey



10 Time recorded in the National Driver Log Book.

## **1.2.2 Train crew account**

The train crew signed on at their 'home depot' of Dimboola at 0420 on Thursday 25 May after five days off duty. They were rostered to work train 4AM3 and book off in Melbourne at 1230. Following a rest in a motel, the train crew were rostered to sign on at 0920 and work train 5WP2 back to Dimboola on Friday 26 May 2006.

The crew of train 4AM3 reported that fog was encountered nearly all the way between Dimboola and the accident site, with varying degrees of visibility. Shortly after 0712 train 4AM3 entered the Tooli Block Point to Berrybank section, the section in which the Lismore Skipton Road level crossing is located. The train crew said that as they neared the Lismore Skipton Road level crossing the fog became progressively thicker until there was almost a 'curtain of fog' as the train approached the crossing. They estimated that the visibility was in the order of 20 to 30 m.

On the approach to the level crossing the driver sounded the horn twice. An initial brake application was also made to slow the train for a temporary 65 km/h speed restriction about 2.5 km away. The train crew both said they saw vehicle headlights appear out of the fog at the last moment and, a split second later, heard a loud noise that was immediately followed by a rapid, but smooth deceleration of the locomotive.

The train driver, who was sitting on the impact side of the locomotive, said that his immediate impression was that the vehicle was a truck, probably by the height and width of the headlights. To the best of his ability, given the limited information available to him, he estimated that the truck was travelling in excess of 80 km/h.

Once the train had come to a halt, the train driver called train control and, because the rest of the train could not be seen in the fog, climbed down from the locomotive and walked back to determine what had happened.

## **1.2.3 Accident sequence/aftermath**

The force of the collision was such that all wheels of the second locomotive were derailed and the citrus pulp being carried in the quad axle trailer was thrown to the opposite side of the level crossing. Part of the truck's 'bull-bar' was imbedded in the side of the second locomotive and the locomotive's number one axle was bent 1.6 mm by the collision (four times the condemning limit of 0.4 mm).

Figure 7: Tubular bull-bar imbedded in DL 40



The impact also caused the third locomotive to derail and break away from the second locomotive resulting in a loss of brake pipe air pressure. However, momentum prevented the train from stopping before wagons collided, derailed and jack-knifed into the derailed third locomotive and each other. Ultimately, the third locomotive and 41 of the train's 64 wagons (normally a length of 844.8 m) were derailed and subsequently compressed into an area about 128 m long, 45 m wide and 12 m high. The lead and second locomotives continued ahead before coming to a stop approximately 235 m past the Lismore Skipton Road level crossing, 14.3 m from the Camperdown Lismore Road level crossing and about 68 m clear of the train wreckage.

Figures 8, 9 and 10 are aerial photographs of the wreckage. These photographs show that very little of the citrus pulp that was being carried in the truck and trailer combination remained on the northern (impact) side of the level crossing. The bulk of the citrus pulp can be seen to reach almost to the white guide posts on the southern side of the level crossing and there are scatterings at a greater distance immediately adjacent to the eastern side of the road. Dual tyre skid marks were found on the road on the northern approach to the level crossing. These skid marks were 29 m long and extended beyond the holding line and veered slightly to the right.

Figure 8: Compressed wreckage of train 4AM3



Figure 9: Aerial view looking south



Figure 10: Aerial view looking north



#### 1.2.4 Witness accounts

Two couples who lived in the vicinity gave evidence that they heard, but did not see, the accident. The first couple lived about 150 m to the north of the rail line between the two level crossings. They said the noise of the accident woke them and the household power went off momentarily. They then went to the back veranda but, due to fog and darkness, at best could only see about 50 m. They said that during the morning visibility varied as the fog drifted in and out and that it was not until several hours later that any wreckage could be seen from their house.

The second couple lived beside the Camperdown Lismore Road level crossing on the 'southern' side of the rail line, about 280 m from the Lismore Skipton Road level crossing. At the time of the accident they were in the main bedroom and the male occupant was getting dressed for the day. This bedroom is at the front of the house and faces in the general direction of the accident. The male occupant said he could clearly hear a truck accelerating from the 'top corner' towards the level crossing. He said he could hear the gear changes and thought the truck was close to, if not in, top gear as the level crossing was approached. At the same time he could hear the rumbling sound of a train approaching. Although the two sounds tended to merge as they got closer, he said he heard the train horn and then the sound of the accident. This noise continued for some seconds before all was quiet and, during this sequence, the household power went off and on about three times in quick succession. He said at the time it was still quite dark, the air was still and the visibility was less than 50 m.

## **1.3 Post accident**

### **1.3.1 Response**

#### *Emergency response*

The driver of train 4AM3 called the Adelaide train controller shortly after the locomotive came to a stop. Due to other radio communications, the train controller was unable to acknowledge the call for approximately 30 seconds, after which verbal exchanges between the driver and train controller began.

The police were notified by the ARTC train controller at about 0717 and arrived on site about 20 minutes later. The driver and assistant of train 4AM3 were breath tested by the Victoria Police at about 0740 and returned negative results<sup>11</sup>.

Additional police and personnel from the ambulance, Country Fire Authority and State Emergency Service arrived at the scene at varying intervals during the morning. Early in this sequence the police declared the site a crime scene. The emergency response during Thursday 25 May 2006 was primarily focused on locating the driver of the truck.

#### *Site control*

The site remained a declared crime scene until the body of the truck driver was found, six days after the accident. Pacific National, in consultation with the police and the ARTC, assumed the role of site controller the day following the collision. Various measures aimed at ensuring the safety of personnel working on site were adopted. These measures included attendance registers, breath testing, personal protective equipment and briefings for all who accessed the site.

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<sup>11</sup> The ARTC train controller was breath tested and returned negative results also.

### *Site recovery*

There was no fire and train 4AM3 was carrying no dangerous goods as defined by the Dangerous Goods Act 1975 (as amended). There was, however, an estimated 4200 litres of diesel fuel in the fuel tank of the third locomotive and an estimated 1100 litres of diesel fuel in the tank of the truck. The fuel in the locomotive tank was spilled due to a rupture of the tank during recovery operations; the fuel in the truck tanks was probably spilt on impact.

Figure 11: Remnants of truck



Although train 4AM3 was carrying no dangerous goods, it was nevertheless carrying considerable quantities of 'environmentally hazardous substances' such as animal carcasses, straw, blood and bone fertiliser, meat, soda ash, pasta, malt and a large amount of wine (700,000 bottles). This meant that all liquid had to be siphoned off, all soda ash/blood and bone fertiliser had to be vacuumed up and all wine bottles (declared unfit for consumption) had to be crushed on site.

Work on the restoration of the track could not be started until the bulk of the wreckage was cleared. The track was re-opened at 0045 on Wednesday 31 May 2006 with a 15 km/h speed restriction for trains. The total closure period was 137.5 hours. At 1215 on Wednesday 31 May the body of the truck driver was found by site contractors. By nightfall of 31 May, all environmentally hazardous substances and contaminated soil had been removed and the site graded.

The recovery process was aided by the lack of rain, the level site, easy road access and no waterways in the immediate vicinity. Conversely, the recovery process was hampered by the necessity to find the body of the truck driver, the unstable position

of much of the wreckage and the environmentally hazardous substances in and surrounding the wreckage. Despite these difficulties no injuries occurred at the accident site during the recovery process.

### **1.3.2 Loss and damage**

The ARTC incurred an estimated loss of \$833,687. This comprised \$600,000 in lost revenue and \$233,687 in track repairs.

Pacific National and Patrick Corporation Ltd incurred combined losses (locomotives, wagons and freight consignments) in the order of \$12 million. Locomotive NR 33, alone valued at about \$4.5 million, was written off.

Wheelhouse Company incurred material loss of the truck and quad axle trailer, estimated at about \$170,000.

**Figure 12: Locomotive NR 33, subsequently written off**





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## 2 ANALYSIS

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The accident occurred when the truck and quad axle trailer combination was driven into the side of train 4AM3. In the circumstances of the accident, the train crew were unable to take any avoiding action.

Neither the history of the truck operator, Wheelhouse Fertiliser, nor the driving record of the deceased driver gave any indication of factors likely to have contributed towards the accident.

The investigation has not been able to conclusively determine the speed of the truck or the actions of the driver before the collision although a range of impact speeds have been calculated. The presence of tyre skid marks on the immediate approach to the level crossing implies the likelihood that the truck driver had sighted the train before impact. The fact that toxicology testing could not be reliably performed on the deceased truck driver<sup>12</sup> was a limiting factor in determining his fitness for driving duties.

Factors such as the truck's in-cab engine noise, radio volume and position of side windows could not be determined because of the extent of damage. In addition, the effect that the atmospheric conditions and trees in the vicinity of rail and road had on acoustic considerations cannot be accurately quantified.

Key questions are:

- Did the train have authority to occupy the section of track and was it driven in accordance with the rules and procedures?
- Was the truck being driven in a safe manner in accordance with the reduced visibility at the time?
- Were the level crossing warning signs in accordance with the relevant standard?
- Were the level crossing sighting distances in accordance with the relevant guidelines?

The evidence was examined and analysed in order to answer these questions and identify the safety factors that are likely to have contributed to the accident.

### 2.1 Examination of evidence

#### 2.1.1 Passage of train

##### *Safeworking requirements*

The Lismore Skipton Road level crossing is located in the Tooli Block Point to Berrybank section of track. The system of safeworking is an 'in cab' electronic Section Authority Working system. Train 4AM3 had authority to occupy the section of track in accordance with the requirements of this safeworking system.

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<sup>12</sup> Due to body trauma and recovery time.

### *Data event logger examination*

An in-depth examination of the three locomotive data event loggers was conducted in order to correlate the time, speed and distance travelled of train 4AM3.

Discrete events such as the operation of the throttle, headlight, horn and vigilance acknowledgement were taken from the data event logger of lead locomotive, NR52. Key elements of this examination are:

- The time recorded by the three data event loggers was not synchronised, consequently the time recorded by NR 52 was used as the datum.
- The speed recorded by the data event loggers on NR 52 and NR 33 were corrected for wheel diameter variation and returned figures within +/- 1 km/h of each other.
- The last 'packet' of data recorded by NR 33 was at 0714:23. The most likely cause for the termination of data was a loss of power to the data event logger.
- Based on recorded data, the most likely collision time was between 0714:24 and 0714:25. 0714:25 is used as the accident time and the accuracy is within one second.
- The speed and distance recorded by the data event loggers exhibited variations in correlation after the collision, probably due to a combination of wheel-slip by NR 52 and the derailment of DL 40. Both loggers continued to record until the locomotives were stationary.

The data examination confirms that the locomotive vigilance cycle was operative and set to the correct cycle<sup>13</sup>, the headlight was illuminated, and the locomotive horn was sounded twice before impact. This corroborates the accounts given by the train crew who, in addition, advised that the headlight was on full beam and that the ditch-lights were illuminated (these parameters are not recorded). The speed of the train at impact was 112 km/h, 2 km/h over the permitted speed of the train.

Key elements recorded were:

- The horn was sounded for 2.2 seconds when the leading end of NR 52 was 340 m from the Lismore Skipton Road level crossing.
- The horn was again sounded for 2.5 seconds when the leading end of NR 52 was 117 m from the level crossing.
- A reduction in brake-pipe pressure to 482 kPa (and decreasing) was recorded and the independent (locomotive) brake was charged to 34 kPa (and decreasing), indicating a driver initiated train brake application when the leading end of NR 52 was 48 m from the level crossing.
- When the leading end of NR 52 was 14 m beyond the approach end of the level crossing (front of locomotive on the level crossing), brake-pipe pressure was 468 kPa and independent brake charged to 6 kPa.

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13 Correct cycle – Cycle 'C' is used for two person train crews in Victoria. Cycle 'B' is used for two person trains in all other states and cycle 'A' is used for single person operation.



track of train speed. Therefore, safeworking authorities and signal indications are designed to give advance notification that the section of track being traversed is clear of other rail movements.

## 2.1.2 Road aspects

### *Route experience*

The truck driver travelled from Bridgewater to the south-west of Victoria three times in the two weeks before the accident. Two of these trips were to the Camperdown/Colac area and it was thought very likely that the Lismore Skipton Road would have been the preferred route to that locality. Given that he had lived in Wedderburn and had driven trucks for in excess of 15 years, the probability is that the truck driver would have travelled this route many times.

### *Hamilton Highway Intersection*

At the Lismore Skipton Road / Hamilton Highway intersection it is necessary to slow, give way to traffic on the Hamilton Highway and then proceed through the off-set intersection towards the Lismore Skipton road level crossing. Following the accident fresh deposits of citrus pulp were found on the eastern side of the Lismore Skipton Road immediately before this intersection. Multiple dual tyre skid marks of unknown origin were also found.

Figure 14: Lismore Skipton road before off-set intersection with the Hamilton Highway and beyond to level crossing



### *Immediate approach to level crossing*

On the northern side of the Lismore Skipton Road level crossing dual tyre skid marks were found. The length of these skid marks was about 29 m and they veered slightly towards the centre of the road beyond the holding line until obscured by damage caused by the wreckage.

Given the proximity of these markings to the rail line, it is almost certain that they were made in response to a conflicting rail movement. Although it was not determined conclusively that these skid marks were those of the truck involved in the accident, the probability that another dual tyre vehicle was confronted with such a situation within a reasonable time-frame of this accident is unlikely. Neither

Pacific National nor the ARTC have any reported incidents at this level crossing on their data-bases in the weeks before the accident.

Given the length of these skid marks and visibility at the time of the accident, it is likely that the dual tyre skid marks are an indication of the truck driver's reaction to the impending collision.

Figure 15: Dual tyre skid marks on the immediate approach to level crossing



#### *Adverse weather conditions, road traffic*

There is nothing specific in the Road Rules-Victoria in relation to driving in conditions of reduced visibility. The VicRoads publication 'Driving in Victoria' is a summary of some of the road rules that motorists must know. This publication briefly deals with weather conditions such as heavy rain, frost, snow and fog. It advises that it may be necessary to slow right down or, in some cases, pull off the road and await improved conditions. The 'Victorian Bus and Truck Drivers Handbook' contains similar advice.

Driver induction training at Wheelhouse Fertiliser also deals with the Road Rules-Victoria and the need to drive according to the environmental conditions. Drivers are told that if conditions become too severe then they are to pull over to the side of the road and stop providing the road shoulder is adequate and it is safe to do so. The driver of the truck was given this induction training.

The emphasis in these publications and the training is clearly that of driving according to the conditions.

### *Previous hours of work*

The log books containing the hours of work and rest of the truck driver for the fourteen days before the accident contain no breach in terms of allowable driving hours as prescribed by the National Driving Regulations. Notwithstanding this, the driver of the truck had worked long hours in the days before the accident, often starting work early in the morning. The investigation therefore considered the possible role of fatigue in the accident sequence.

**Table 1: Hours of duty, seven days up to and including the accident**

<b>Date</b>	<b>Start</b>	<b>Finish</b>	<b>Hours</b>
19/05/2006	0230	1600	13.5
20/05/2006	0300	1600	13
21/05/2006	Off Duty	Off Duty	Nil
22/05/2005	0530	1830	13
23/05/2006	0330	2000	16.5
24/05/2006	0530	1900	13.5
25/05/2006	0340	0710	3.5

Fatigue can have a profound effect on human performance. It can reduce attention, increase reaction times and affect memory. When fatigued, it can take longer for a person to perceive and interpret information and longer for them to decide on and carry out an appropriate course of action. Fatigue also affects a person's ability to judge distance, speed and time. Often individuals will be unaware of the effects of fatigue on their performance.

Driver fatigue is a known hazard in the road transport industry. In October 2000, the House of Representatives Standing Committee on Communications, Transport and the Arts, published the report titled *Beyond the Midnight Oil: Managing Fatigue in Transport*. Describing the causes and possible consequences of driver fatigue, the report (p vii) stated:

The longer (a driver) has worked, the more they have worked at night and the less they have rested, the greater the risk of fatigue. The more fatigue, the greater the risk of an accident occurring.

The hours of duty (as opposed to the actual driving hours) of the truck driver for the seven days up to and including the time of the accident were assessed using the Fatigue Audit InterDyne (FAID) fatigue modelling program. The FAID program was developed in partnership with the Centre for Sleep Research at the University of South Australia. The algorithms within the FAID program allow for both the fatigue effect of the current shift's hours of work and the cumulative effect of the work hours over the previous seven days. The calculated fatigue score is based on the assumption that the person's time off duty includes an appropriate period of recuperative sleep. Actual hours of sleep are not included in the fatigue calculations.

The FAID program does not make allowance for individual differences in the need for sleep, nor for differences in morningness-eveningness. In addition, the program does not make allowance for the effect of environmental factors such as noise, light and vibration on fatigue. However, the program is useful as a guide and is used by sectors of the aviation, rail<sup>14</sup> and marine industry for roster compilation and fatigue management.

The calculated FAID score for the driver of the truck in the hours before the accident was generally over 100, and peaked at over 115. Research by the Centre for Sleep Research suggests that a fatigue score of 40 to 80 is moderate, 80 to 100 is high and 100 to 120 very high. It is not recommended that a person perform safety critical work in circumstances involving a fatigue score in the high or very high range.

While there is moderate evidence to suggest the possible existence of fatigue, the nature of the single-driver operation precluded the investigation from obtaining any conclusive evidence about the possible influence of fatigue on the driver's performance.

### **2.1.3 Calculated truck speed**

A portion of an electronic control module from the truck was provided to the ATSB to determine if any electronic information was stored and if it could be recovered. This module was disassembled, cleaned and examined at the ATSB laboratory in Canberra. No information was able to be recovered.

The ATSB subsequently engaged the services of a specialist to calculate the impact speed of the truck. The specialist had considerable expertise in traffic engineering, vehicle dynamics and accident investigation, including evaluation of damage profiles and time-distance-speed relationships.

The calculation of the truck speed at the point of impact primarily relies on the projection of the load of citrus pulp over the top of the third locomotive and following containers and its position on the sealed pavement on the opposite side of the level crossing.

The collision sequence is thought to have been:

- First contact occurred between the front of the truck and the trailing end of the second locomotive (DL40) while the train was travelling at 31.11 m per second.
- A rapid deceleration of forward movement of the truck with rotation in an anti-clockwise direction as it was carried east by the second (DL40) and third (NR33) locomotive.
- A projection of the load from the truck on and over NR 33 and leading containers occurred.

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<sup>14</sup> Pacific National uses the FAID program to assess the master rosters of train crew. Scores greater than 80 are not permitted without a risk analysis of the shift in question. A FAID analysis of the train crew of 4AM3 was not conducted as it was their first shift after five days off duty.

- A corresponding movement of the trailer tow bar and pivoting of the front trailer bogie axles with a deceleration and lifting of the rear of trailer from the roadway.
- A projection of the load from the trailer over the NR class locomotive and leading containers to cover the road on the opposite side and subsequent rotation of the trailer in an anti-clockwise direction.

The trailer body pivots on a turntable located between the axles on the front bogie and it would be about this point that the body of the trailer would pivot as it lifted from the ground.

**Figure 16: Representation of the trailer pivoting at the connection between the trailer body and turntable**

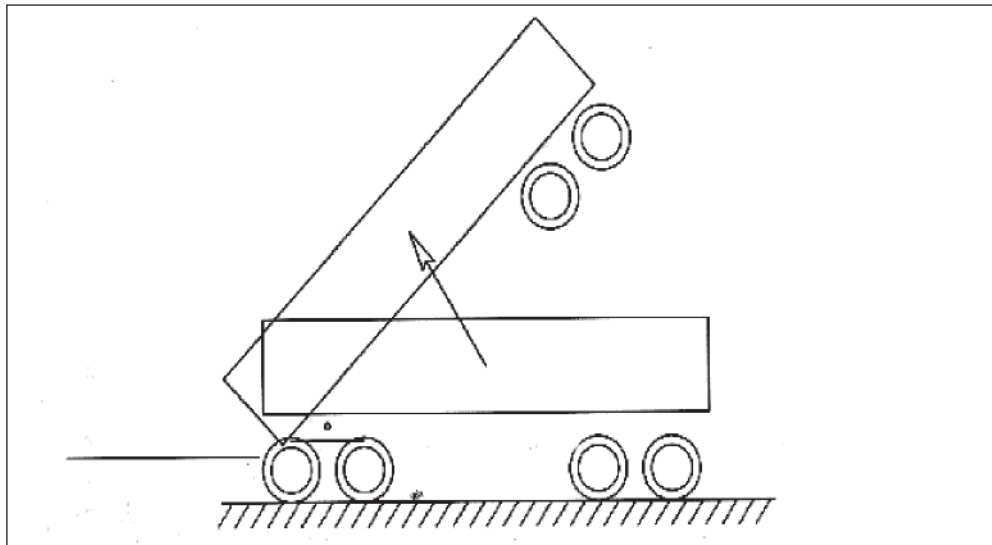


Figure 17 shows the wreckage of the trailer after the collision. The front bogie axles and wheels are those on the ground. This bogie has rotated and come to a rest 180 degrees from its original position with the result that the connections for the draw bar face towards the rear of the trailer. The body of the trailer has turned over with the underside of the trailer facing upwards. The front axle of the rear bogie has been torn from its mountings and the rear axle remains intact. The position of the trailer body and crushed side panels support the hypothesis that the trailer pivoted and then rotated in an anti-clockwise direction.

Figure 17: Wreck of trailer



For the purpose of the speed calculations, it was assumed that the majority of the citrus pulp on the sealed pavement was from the trailer. Although the load being carried in the truck was similarly ejected, it was thought that the citrus pulp found on and around NR 33 and adjacent wreckage and immediately to the east of the Lismore Skipton Road level crossing was more likely to have come from the truck than the trailer.

The bulk of the citrus pulp was spread about 37.5 m from the centre of the railway tracks. There was also a smaller quantity of citrus pulp about 10 m beyond this point to the east of the road.

The independent report found that the speed of the truck and trailer at the first point of contact with the train was between 53 km/h and 78 km/h with the probability being towards the upper end of that range. See Appendix 5.1 for calculations.

#### 2.1.4 Summary

Train 4AM3 was in possession of the necessary safeworking authority to occupy the Tooli Block Point to Berrybank section of track and, apart from a slight over-speed, was being operated in accordance with the relevant rules and procedures.

The train crew estimated that the truck was travelling in excess of 80 km/h. However, it is difficult to judge the speed of a vehicle that appears out of the fog at a 90 degree angle when the train itself was travelling at 112 km/h. Similarly, the evidence given by nearby residents (see 1.2.4) could be subjective in terms of distance and acoustic considerations. However, the evidence in relation to visibility and the sounding of the locomotive horn has been confirmed.

Notwithstanding these limitations, the witness evidence has to be given considerable weight. The independent expert engaged by the ATSB found that the speed of the truck at impact was between 53 km/h and 78 km/h with the likelihood being towards the upper end of this range. If braking occurred before impact then the approach speed would have been proportionally higher.

The truck driver had driven this route before. Having to slow for the off-set intersection at the Hamilton Highway, traverse the level crossing and then give way to traffic when merging with the Camperdown Lismore Road, all within about 2.2 km, requires concentration. Therefore, loss of situational awareness due either to the task being routine or reduced visibility is unlikely.

The question that then arises is was the truck being driven at a speed commensurate with the environmental conditions? That is, at a speed that would allow the truck to stop short of any hazard from the point of perception<sup>15</sup> of that hazard. To stop the truck quad axle trailer combination within 20 m would mean the speed would have to be no more than 22 km/h; to stop within 50 m would mean the speed would have to be no more than 44 km/h. See Appendix 5.2.

Given the evidence, it is apparent that even if the visibility was 50 m and the truck speed at or about the bottom of the calculated range, then the speed was not commensurate with the environmental conditions.

Given that there are no indicators of careless behaviour in the truck driver's road record or other evidence, the possibility of performance impairment due to fatigue was considered.

Despite the fact that the driver's previous hours were within the National Driving Hours Regulations, the FAID score at the time of the accident is considered to be high. Therefore, the possibility that the truck driver was experiencing a degree of performance impairment due to fatigue at the time of the accident could not be discounted.

## **2.2 Lismore Skipton Road level crossing**

### **2.2.1 Level crossing signage standards**

#### *Australian Standard 1742(7) 1993*

Railway level crossing protection in Victoria is assessed in accordance with the provisions of the *Australian Standard Manual of uniform traffic control devices (AS1742), Part 7, Railway crossings*. This Standard is one of a series of 13 prepared by the Standards Australia Committee on 'Road Signs and Traffic Signals'. The Standard specifies traffic control devices to be used to control and warn traffic at, and in advance of, railway crossings and the manner in which they are to be used. Details are also provided on the illumination, reflective qualities, installation/ location and selection of the appropriate size of the sign.

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15 Point of perception – is that place where the driver of a vehicle or pedestrian has first realised that a hazard confronts them which requires some action on their part.

Standard 1742 (7) defines a passive control level crossing as:

The control of movement of the vehicular or pedestrian traffic across a railway level crossing by signs and devices, none of which are activated during the approach or passage of a train, and which rely on the road user detecting the approach or presence of a train by direct observation.

Standard 1742 (7) defines an active control level crossing as:

The control of the movement of vehicular or pedestrian traffic across a railway level crossing by devices such as flashing light signals, gates or barriers, or a combination of these, where the device is activated prior to and during the passage of a train through the crossing.

With the exception of minimum treatments crossings (very minor roads and tracks), Standard 1742 (7) does not prescribe which type of level crossing control (passive or active) is to be used. Nor does it prescribe the level of control used, for example, whether the traffic control should be a stop or give way sign at a passive crossing or whether boom gates are to be installed at an active crossing. In regard to this determination the Standard states:

The type of control used at a railway level crossing will depend on the requirement of individual locations taking into account safety, traffic volume, geometry and other considerations.

In making this determination, sighting distances play a key role. Sighting distance warrants vary considerably from State to State. (Victorian sighting distance requirements are detailed at section 2.2.2 of this report.)

Standard 1742(7) does, however, prescribe the use of traffic controls. A passive level crossing with give way sign control is required to have the following signs and devices. They are seen in order by an approaching motorist as:

- advance warning 'symbolic train' sign code W7-7(L) on the left-hand side of the road
- 'RAIL X' pavement marking
- second or intermediate advance warning 'diagrammatic warning assembly' code RX-3-1 on the left-hand side of the road
- a holding line indicating a safe place for vehicles to stop
- railway level crossing give way assembly code RX-1

In addition, a barrier line must extend from the holding line to at least the advance warning 'symbolic train' sign code W7-7(L). (See Figure 19).

### ***Conformance with the Standard***

All of the required signs and devices were present on the northern approach to the Lismore Skipton Road level crossing (the give way assembly RX-1 was destroyed in the accident). In addition, there was also an advance warning 'symbolic train' sign on the right-hand side of the road W7-7(R) and a 'railway level crossing width marker assembly' RX-9 (left side destroyed in accident) 0.5 m in advance of the give way assembly. Standard 1742(7) stipulates additional measures such as this when added emphasis is needed or inadequacy is suspected. All remaining signs were in

reasonable condition. All road markings were in reasonable condition except for the holding line which, while complete (as a broken line) from the left side of the sealed pavement to the centre line, was in a worn condition.

The following non-conformances with Standard 1742(7) were found with the signage and devices on the northern approach to the Lismore Skipton Road level crossing.

- the distance between the advance warning ‘symbolic train’ signs W7-7 (L&R) and the diagrammatic warning assembly RX-3-1 was 21 m in excess of requirements. Conversely, the distance between the RX-3-1 warning assembly and the holding line at the level crossing was 20 m short of requirements
- the size of the left side advance warning ‘symbolic train’ sign W7-7(L) was 600 mm X 600 mm. The size of the optional right side sign W7-7(R) was 750 mm X 750 mm. The standard specifies that the smallest sign size is 600 mm X 600 mm and that it should only be used where the 85<sup>th</sup> percentile<sup>16</sup> approach speed is less than 70 km/h. Also, when one sign supplements another, the two signs should generally be the same size
- the diagrammatic warning assembly RX-3-1 was missing the supporting ‘look for trains’ sign G9-48
- the lower edge of diagrammatic warning assembly RX-3-1 was 1.44 m from the ground. The standard says that, in rural areas, the sign should not normally be less than 1.5 m above the height of the nearest edge of the ‘travelled way’. This slight non-conformance is exacerbated when it is considered that a 750 mm X 750 mm ‘look for trains’ G9-48 sign should have been mounted below the diagrammatic warning sign
- the pavement marking ‘RAIL X’ is out of sequence in that the standard says:

The marking should generally be placed 15 m beyond the initial warning sign, but nevertheless should be positioned for adequate visual impact giving at least 50 m clear viewing distance to the near edge of the marking.

Although the ‘RAIL X’ pavement marking had greater than 50 m clear viewing distance, it was beyond the diagrammatic warning assembly, which is the second advance warning sign.

Similar non-conformances in relation to sign size and ‘RAIL X’ pavement markings were also found on the southern (opposite) approach to the level crossing.

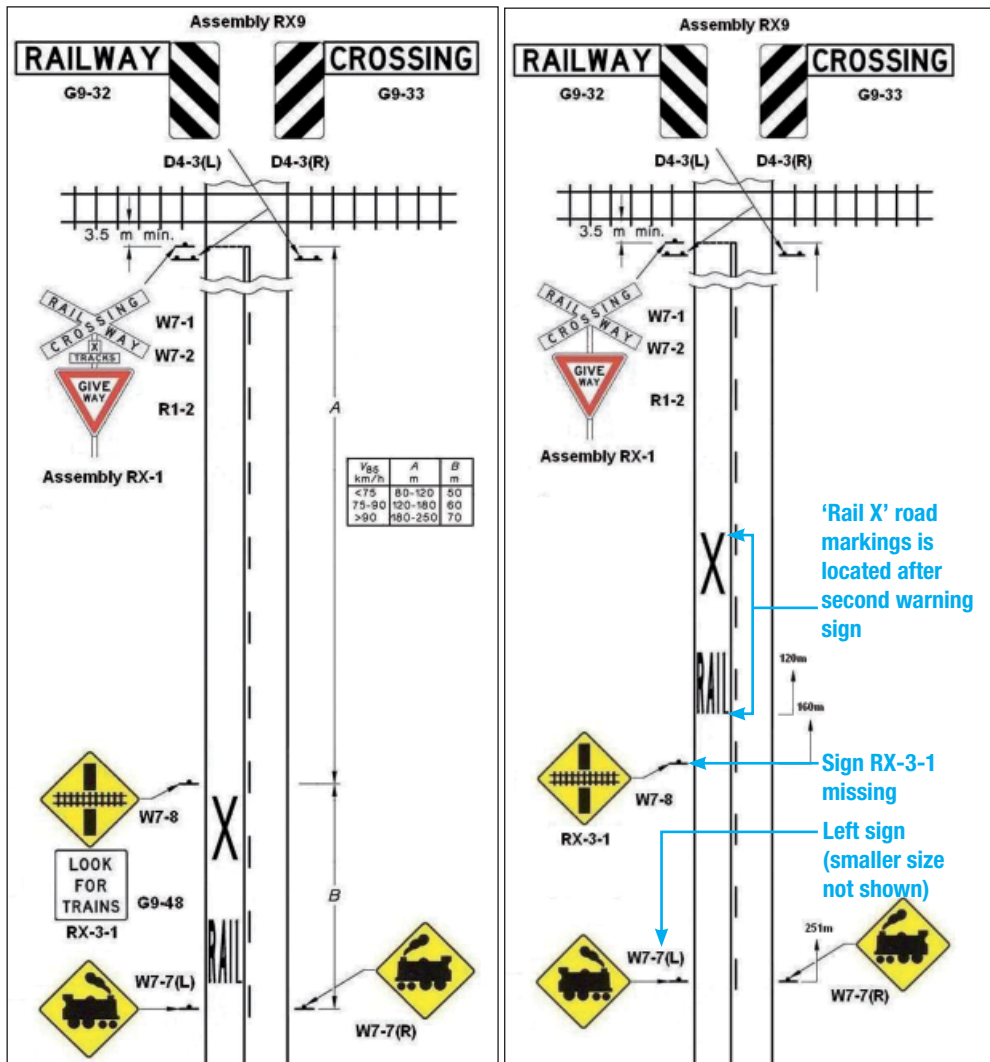
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16 85<sup>th</sup> percentile speed – the speed at or which 85 percent of vehicles are observed to travel under free-flowing conditions past a nominated point. The Austroads guide Rural Road Design, eighth edition 2003 says; “The road speed plus 10 percent is a reasonable approximation where the 85th percentile speed limit is not known”.

Figure 18: Left photograph of advance warning sign W7-7, right photograph W7-8 sign



Figure 19: AS 1742.7 – 1993. The left figure shows the standard signage and road marking layout for level crossing controlled by Give Way signs with straight approach. The right figure shows the Lismore Skipton Road level crossing as of 25 May 2006



## 2.2.2 Victorian level crossing sighting warrants

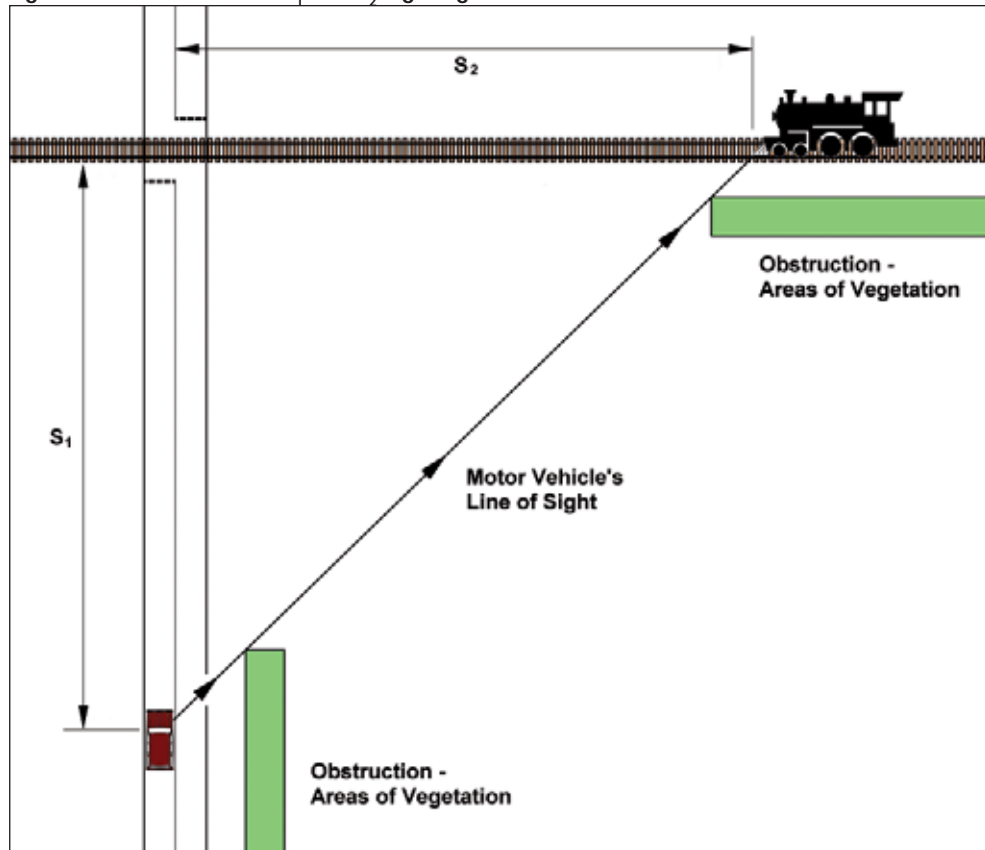
### *Warrants, passive level crossing*

Give way control of a level crossing requires the road vehicle driver to have sufficient distance from the point of perception to decide whether to decelerate and stop or continue and clear the level crossing.

VicRoads had adopted the methodology set out in the Austroads guide *Rural Road Design* (eighth edition, 2003) for the review of sighting distances at existing level crossings. These guidelines say that approach visibility is adequate when the following conditions are met:

The driver of an approaching vehicle, travelling at the 85<sup>th</sup> percentile speed can see a train travelling at maximum operating speed when the vehicle and the train are at distances  $S_1$  and  $S_2$  respectively from the crossing, such that the vehicle can either safely stop short of the crossing, or clear the crossing before the train reaches it.

Figure 20: Illustration of  $S_1$  and  $S_2$  sighting distances



In accordance with these guidelines, calculations using a road speed of 100km/h (85th percentile speed unknown), a coefficient of friction between the tyres and road of 0.26 and a train speed of 115 km/h are used. The  $S_1$  sighting distance is 230 m and the  $S_2$  sighting distance is 462 m. See Appendix C.

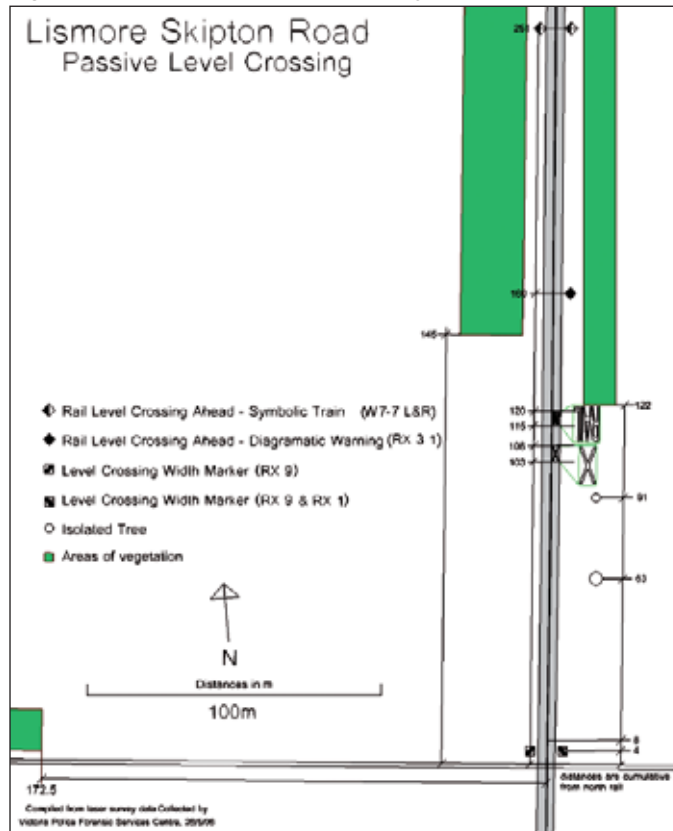
*Conformance to guidelines*

There was a line of trees on private property on the western side of the Lismore Skipton Road that ended 145 m from the nearest rail line at the level crossing. Also, there was a line of trees on the northern side of the rail line on the western approach that ended 172.5 m from the centre line of the level crossing (see figure 21). The combined effect of both stands of trees restricted the view that the driver of a southbound road vehicle had of a train approaching from the west.

Figure 21: Road and rail approach to the Lismore Skipton Road level crossing, note close proximity of trees



Figure 22: Reproduction of site survey



### *Conflicting road and rail movements*

A train travelling at 115 km/h will take 5.40 seconds to reach the level crossing after passing the point where the stand of trees beside the rail line ends. A road vehicle travelling at 100 km/h will take 5.23 seconds to reach the closest rail line after passing the point where the stand of trees beside the road ends. A truck of the type involved in the collision on 25 May 2006 travelling at 100 km/h has a calculated stopping distance (including reaction time of 2.5 seconds)<sup>17</sup> of 168.7 m and a corresponding time frame of 9.67 seconds. See Appendix 5.2.

These times indicate a risk of collision at the Lismore Skipton Road level crossing if road and rail traffic simultaneously reach the 'point of perception' while travelling at their respective maximum permitted speeds.

### **2.2.3 Level crossing sighting and signage**

In Victoria the road authority is responsible for all signs and pavement markings other than the RX1 and RX9 assemblies. The rail authority (in this case the ARTC) is responsible for the RX1 and RX9 assemblies.

Before the introduction of the *Road Management Act 2004*, the road authority responsible for the Lismore Skipton Road level crossing was the Shire of Corangamite. On 1 July 2004 VicRoads became the responsible road authority for this level crossing. However, the Corangamite Shire entered into a transitional arrangement with VicRoads to carry out permanent works and maintenance on the road approaches to the Lismore Skipton Road level crossing until 1 January 2005.

On 4 April 2005 a site inspection of the level crossing was conducted by VicRoads. The VicRoads officer reported that the crossing was signed to the correct standard and that all signs and line-marking were in good condition. Sighting distances on the approaches to the crossing were reported to be good. However, neither the signage nor the sighting distances complied with the relevant standards and guidelines.

#### *Previous accident, Benalla*

On 30 October 2002 a collision between a B-double truck<sup>18</sup> and a chartered steam train at Benalla resulted in three fatalities. This accident was investigated by the ATSB<sup>19</sup>. In response to this investigation VicRoads advised that:

In view of the findings and recommendations of the earlier draft ATSB report, VicRoads has initiated a review of all passive rail crossings in Victoria to ensure compliance with AS1742.7, with particular attention given to those that are on a B-double route. The review, in conjunction with local government, includes a review of the suitability for B-doubles of all passive rail crossings on B-double routes.

17 Reaction time – Research has shown that average reaction time in an unexpected situation exhibited by a person unaffected by drugs, alcohol, fatigue, illness etc usually ranges from one to 1.5 seconds. However, many drivers will take longer to react. Therefore, for design purposes such as highway design manuals and sighting distance calculations for level crossings, a figure of 2.5 seconds is typically applied to ensure that sufficient reaction time is allowed for the majority of persons.

18 B-double truck – A vehicle that is up to 25 m long and can operate at a gross mass of 65 or 68 tonnes, depending on the designation of the road/route.

19 Report number 2002/003.

Although the truck trailer combination involved in this accident was not a B-double configuration, the Lismore Skipton Road is a designated 'higher mass limit' B-double route<sup>20</sup>.

#### **2.2.4 Traffic patterns/previous incidents**

Traffic counts for the Lismore Skipton Road south of the Hamilton Highway intersection were last conducted in August 1999; the Camperdown Lismore Road in May 2001. These counts revealed that about 82 per cent of total traffic travels via the Camperdown Lismore Road.

Notwithstanding this, the evidence is that a significant number of heavy vehicles from the north and west use the Lismore Skipton Road rather than the Camperdown Lismore Road<sup>21</sup>. This is because the route is shorter and by-passes the Lismore township.

VicRoads advised that a southbound car collided with a westbound train at the Lismore Skipton Road level crossing on 20 April 2001 during the hours of darkness. Four persons were in the car at the time, two suffered serious injuries.

Neither the ARTC nor Pacific National have any reports on their databases of near misses at the Lismore Skipton Road level crossing.

#### **2.2.5 Summary**

The signage on both sides of the Lismore Skipton Road level crossing did not comply with Australian Standard 1742(7). Likewise, the guidelines set by the Victorian sighting warrants were not met by a significant margin for road traffic from the north and rail traffic from the west.

However, given the visibility and the route experience of the truck driver it is unlikely that these factors contributed to him being unaware of the proximity of the level crossing or being unable to detect the presence of a train.

Nevertheless, it is of concern that such non-conformances would be present on a road rated for B-Double/higher vehicle mass limit usage. This is particularly so given the level crossing accident at Benalla in October 2002. It appears that the assessment of the Lismore Skipton Road level crossing did not take place until April 2005 and even then, it was assessed incorrectly.

Notwithstanding the shortcomings of the Lismore Skipton Road level crossing, the necessity to have two level crossings within 249 m of each other also warrants consideration. The Lismore Skipton Road is a slightly shorter route for southbound traffic from the north or west of Lismore (and vice-versa) than the Camperdown

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20 Higher mass limit B-double route – A route where B-double trucks can operate at a gross mass weight of up to 68 tonnes.

21 The percentages of heavy (commercial) vehicles in the respective traffic counts for both roads over a seven day average is approximately double for the Lismore Skipton Road.

Lismore Road; however the traffic counts are considerably less and either route can be used.

VicRoads submitted:

VicRoads has canvassed the possibility of closing the level crossing on Lismore Skipton Road. This is not supported by the local community. Accordingly, the works to upgrade the crossing from passive to active protection will proceed as scheduled.

## **2.3 Environmental factors, passive level crossings**

### **2.3.1 Reduced visibility**

In times of reduced visibility the risk of a collision between a train and a road vehicle on passively protected level crossing increases. A passive level crossing that is controlled by give way signs relies on the road user being able to see and comprehend the signage, see or hear the train either on the crossing, or approaching it, and then decide whether to decelerate and stop, or continue and clear the level crossing. When visibility is severely restricted and a motorist is travelling at a speed slow enough to be able to react and brake to a stop when they see a train at the crossing, they may not be travelling fast enough to avoid a collision with a train which is approaching the crossing and is not visible. The risks are even greater for longer and heavier road vehicles which are slower to accelerate and decelerate and take more time to clear the crossing.

For example, in an extreme case as with the collision at the Lismore Skipton Road level crossing 25 May 2006, if visibility is reduced to 50 m, a train travelling at 115 km/h will take 1.6 seconds to travel 50 m. A 19 m long truck will need to travel the length of the truck plus about three metres (22 m) which requires an average speed on the crossing of 50 km/h. If the truck speed is less than 50 km/h it will not clear the crossing before the arrival of the train. This speed is greater than the speed which would allow the truck to be stopped if the driver sees the train on the level crossing 50 m away (44 km/h, section 2.1.4). This effectively means that it is extremely difficult for the driver to negotiate the crossing with complete safety in these conditions of visibility.

If the level crossing is protected using stop signs rather than give-way signs the risks may be even greater in conditions of poor visibility. The motorist must stop, see or hear that there is no train approaching the crossing and then move off from the stop sign/line. In these circumstances the road vehicle will be starting from standstill and thus the time taken to traverse the crossing will be greater, particularly with larger, longer vehicles. This in turn increases the risk of being hit by an approaching train.

In submission VicRoads stated:

It is noted that the train speed at impact was 112 km/h and there are no requirements for a train to slow when visibility is restricted. The report does not examine whether this is an appropriate or safe operating procedure. This is considered to be a significant omission. If trains were required to travel at lower speed when visibility is poor the safety margin for vehicles and pedestrians crossing tracks would be increased.

Given the size and weight of most trains it is not possible to accelerate or decelerate at anywhere near the rate of a road vehicle, nor is it possible to randomly accelerate or decelerate a train. Heavy freight and locomotive hauled passenger trains can take many kilometres to attain track speed or to slow from track speed. Therefore, trains are driven several kilometres ‘in advance’. It is for this reason that safeworking authorities and signal indications are designed to give advance notification that the section of track being traversed is clear of other rail movements.

To slow a train in conditions of reduced visibility would require a ‘blanket’ speed restriction for an entire corridor of track. In addition, the speed restriction would need to be low enough to take account of the lowest visibility despite the fact that the visibility restrictions may be intermittent, as is very often the case when patches of heavy rain, fog, smoke etc are encountered.

A train travelling at a speed low enough to take account of the lowest visibility constraints will occupy a level crossing for considerably longer periods. This increases the risk of a motorist running into the side of it, a risk which is heightened as visibility becomes poorer. While the consequences of a collision may be reduced as a result of slowing trains, (and an impact with a train travelling even relatively slowly may still have very severe consequences), this must be balanced with the increased risks associated with trains occupying level crossings for longer periods in poor visibility.

In examining research priorities for passive railroad-highway grade crossings<sup>22</sup>, Wigglesworth (2001) posed the question “Can the train stop (or slow)?

The answer is no. Application of this idea would require a 4000 tonne train to give way to a two tonne road vehicle. This would have a disastrous effect on operating schedules and is also technically impractical...it is presumably for this reason that that motor vehicles are required to give way to trains in Australia and in almost every overseas jurisdiction.

### **2.3.2 Draft standard 1742(7)**

Australian Standard 1742(7), at the time of this report’s release, is in the process of being revised. The draft standard specifies the method for calculating the minimum sighting distance requirements at level crossings with passive control.

The draft standard also contains provision for active advance warning assemblies to be installed to supplement the active protection at the level crossing. These lights are designed to activate a predetermined number of seconds before the lights at the level crossing activate. The draft standard notes that:

These assemblies are particularly effective in improving safety on high speed road approaches used by heavy vehicles, such as road trains, and where the required visibility to the flashing signals at the crossing cannot be maintained by normal measures.

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22 Wigglesworth, E.C., (2001). Passive railroad-highway grade crossings: What are the research priorities? <http://www.rtsa.com.au/conferences/crossings/Papers/wig/wig.doc>.

Given the visibility constraints and the calculated speed of the truck at impact, there is a possibility that contemporary active level crossing protection measures may not have prevented this accident. An advance warning assembly as proposed in the draft standard however; may have alerted the truck driver in time to prevent the collision.

### **2.3.3 Summary**

The evidence of the train crew (see 1.2.2) is that they did not see the vehicle approaching the level crossing until the 'last second'. It is reasonable to assume the truck driver had a similar lack of visual warning of the train's approach.

It is not possible for road vehicles to give way to rail traffic based on sighting distances alone, where the visibility is less than that needed to make such a decision. A passive level crossing that is controlled by either give way or stop signs relies on the road user being able to see or hear an approaching train in sufficient time to respond appropriately. In conditions where visibility is very limited the only effective way to mitigate the risks to motorists traversing level crossings may be to provide them with advance warning that a train is approaching.

However, it is recognised that there are many thousands of passive level crossings throughout Australia where visibility constraints caused by environmental conditions could result in similar risks. It is also recognised that each 'safety dollar' needs to be spent where it can best generate the greatest safety improvement.

## **2.4 Road/Rail interface**

### **2.4.1 Level crossing assessment and education**

There are 2274 level crossings in Victoria of which 1468 are passive. An initiative of the Victorian Government, aimed at reducing the risk to road and rail users at level crossings, is the Level Crossing Upgrade Program. Under this program \$250 million has been allocated over ten years across a range of areas, including the upgrade of 90 level crossings from passive to active control and road/rail (grade) separation. The Victorian Department of Infrastructure (DOI) manages the program on behalf of the Government and VicTrack manages the implementation of the program on behalf of the Victorian DOI.

The manner in which level crossings have been selected for upgrade has varied in recent times. Historically, the order in which level crossings were selected for upgrade was based (primarily) on an assessment of a particular level crossing's accident history, the frequency of road and rail traffic and cost of upgrade. In essence, these criteria originated from when the Public Transport Corporation was responsible for the operation of the State's railways. The level crossings currently identified for upgrade in the Level Crossing Upgrade Program were assessed in this manner. The Lismore Skipton Road level crossing had been selected for upgrade from passive to active control with the tender for the work advertised in September 2005, the contract awarded in December 2005 and work scheduled for completion in March 2007.

There is now an industry transition to a comprehensive assessment model known as the Australian Level Crossing Assessment Model (ALCAM). This model is essentially a risk assessment that takes into account over 70 factors for each site. This model can generate multiple proposed mitigation measures that are then 'scored' by the ALCAM program to determine the optimum treatment for each individual level crossing. All level crossings in Victoria are currently being assessed using ALCAM for priority ranking for risk mitigation treatment. Once this task is complete, future ranking of level crossings for upgrade will be identified using this assessment model.

To manage this process, the Victorian Railway Crossing Safety Steering Committee (VRCSSC) has been established. This committee has two working groups that report to it. These groups are comprised of representatives from a range of stakeholders, including road and rail infrastructure managers, operators and local authorities. The role of the VRCSSC is to advise the Minister for Transport on issues of policy, management and standards for railway road and pedestrian level crossings in the State of Victoria. The Victorian Minister for Transport or delegate is a member of the Australian Transport Council (ATC<sup>23</sup>).

At an ATC meeting in June 2006 it was agreed to commence work on implementing a national level crossing behavioural strategy<sup>24</sup>. The behavioural strategy forms part of the ATC's National Railway Level Crossing Safety Strategy and builds on the work of the National Road Safety Strategy. The behavioural strategy will work towards the national development and delivery of programs through each jurisdiction aimed at modifying road user behaviour to improve railway level crossing safety.

#### **2.4.2 Declaration of B-double routes**

B-double routes are roads gazetted for use by B-double and higher mass limit trucks. VicRoads and (where applicable) local councils, assess the risks associated with this determination. The Lismore Skipton Road was gazetted as a B-double/higher mass limit route in 1996.

While the VRCSSC and associated working groups have representation from rail and road (including VicRoads), no evidence has been found of joint consideration between road and rail authorities of the risks associated with B double/higher mass vehicles using level crossings. Australian Standard 4292 part 6 *Railway interface with other infrastructure* requires a manager of a railway to have an interface coordination plan with the owner of any infrastructure that interfaces with the railway. There is no reciprocal requirement on the part of road managers.

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23 The ATC comprises Commonwealth, State, Territory and New Zealand Ministers responsible for transport, roads and marine and port issues. The Papua-New Guinea Minister responsible for transport matters and the Australian Local Government Association (ALGA) have formal observer status on the Council.

24 The Australasian Railway Association developed the national level crossing behavioural strategy.



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## 3 FINDINGS

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The following findings are made with respect to the collision between a rigid tipper truck/quad axle trailer and freight train 4AM3 at Lismore, Victoria on 25 May 2006. These findings identify the different factors that contributed to the accident and should not be read as apportioning blame or liability to any particular individual or organisation.

### 3.1 Contributing factors

These findings identify the various events and conditions that increased safety risk and contributed to the incident.

1. Visibility was reduced by heavy fog to between 20 and 50 m in the vicinity of the Lismore Skipton Road level crossing at the time of the accident.
2. The truck was not being driven in accordance with the conditions of reduced visibility, that is, at a speed that would allow the vehicle to stop short of any observed hazard.

### 3.2 Other safety factors

These findings identify other events and conditions that increased the safety risk.

1. In the days before the accident, the truck driver had been working long days with early starts. Analysis of his working hours indicated that he may have been experiencing a degree of fatigue that could have affected his driving performance.
2. If environmental conditions reduce visibility to less than that needed for motorists to sight and then give way to rail traffic, passively protected level crossings cannot be safely used.
3. In favourable environmental conditions, the sighting distances at the Lismore Skipton Road level crossing were such that there was a risk of collision if road traffic from the north and rail traffic from the west simultaneously reach the point of perception while travelling at the maximum permitted speeds.
4. The Lismore Skipton Road level crossing sighting distances were not in accordance with the guidelines for passive level crossings controlled by give way signs as set out in the Austroads publication *Rural Road Design, (eighth edition, 2003)*.
5. The Lismore Skipton Road level crossing approach signs and road markings were not in conformance with Australian Standard 1742, *Manual of Uniform Traffic Control Devices, part 7, Railway Crossings*.

6. In response to a fatal level crossing accident at Benalla in 2002, VicRoads undertook to review all passive level crossings in Victoria to ensure compliance with AS 1742(7), with particular attention to be given to B-double gazetted routes. In April 2005 the Lismore Skipton Road level crossing was incorrectly assessed as being in compliance with this standard. The sighting distances were reported to be good.
7. There was no evidence of road authorities liaising with rail authorities when considering gazettal of a road as a B-double/Higher Mass Limits route.
8. The Lismore Skipton Road level crossing is 249 m from the Camperdown Lismore Road level crossing and through traffic can use either route. The opportunity may exist to close the Lismore Skipton Road and re-route traffic via the Camperdown Lismore Road.

### 3.3 Other key findings

These are findings that are not defined as safety factors or may be positive events and conditions that reduced the risks associated with the incident.

1. There were no indicators in the truck driver's traffic record or employment history that indicate careless driving behaviour.
2. VicRoads records contain no record of any infringements/non compliance regarding Wheelhouse Fertiliser.
3. The Pacific National train crew were appropriately qualified and medically fit in accordance with the relevant standards.
4. Train 4AM3 was in possession of the necessary safeworking authority for the section of track being traversed.
5. The speed of train 4AM3 was 2 km/h over that permitted for the train and 3 km/h under that permitted for the track at the time of impact.
6. The driver of train 4AM3 had operated the locomotive horn twice before the Lismore Skipton Road level crossing and the headlight was illuminated.
7. At the time of the collision the train brakes had been routinely applied for a temporary speed restriction about 2.5 km past the level crossing.
8. Notification of the accident was given by the driver of train 4AM3 and the response from the ARTC train control centre was timely.
9. The response of the emergency services personnel was prompt and appropriate in terms of resources.
10. The accident site control and site recovery measures implemented were particularly good in terms of control of access, ensuring all on site personnel were 'fit for duty' and overall safety. No injuries occurred during the 6.5 day recovery process.
11. The cooperation between all parties involved in site recovery phase was well organised and executed.
12. The Lismore Skipton Road level crossing was selected for upgrade from passive to active control and work is scheduled for completion in March 2007.

As a result of its investigation, the ATSB recognises safety actions already taken and recommends further safety actions with the intention of improving railway operational safety. Rather than provide prescriptive solutions, these recommendations are designed to guide interested parties on the issues that need to be considered. Recommendations are directed to those agencies that should be best placed to action the safety enhancements intended by the recommendations, and are not necessarily reflective of deficiencies within those agencies.

### **VicRoads**

VicRoads has conducted an evaluation of the Lismore Skipton Road level crossing and the level of control has been altered from give way to stop. All signs and road markings have been upgraded to be in accordance with Standard 1742(7) 1993. This is an interim measure until work upgrading the level crossing protection from passive to active is complete.

### **National Transport Commission**

The National Transport Commission is developing a new model heavy vehicle driver fatigue legislative and policy package. The package is intended to address problems related to heavy vehicle driver fatigue, particularly the risks of long hours of work at times of circadian low points, such as between midnight and 0600, and the requirement for restorative sleep. It also focuses on the need to actively manage driver fatigue rather than relying on restricting hours of work.

#### **RR2006048**

The Australian Transport Safety Bureau recommends that VicRoads, in conjunction with the VRCSSC and rural councils, carry out an audit of all level crossings in Victoria to ensure that they comply with the relevant sighting distance guidelines, signage and road marking standards.

#### **RR2006049**

The Australian Transport Safety Bureau recommends that the Victorian Department of Infrastructure ensure that road and rail authorities jointly assess the risks associated with B double/higher mass limit vehicles using level crossings.

#### **RR2006050**

The Australian Transport Safety Bureau recommends that the Victorian Department of Infrastructure consider measures for raising public awareness of the need to drive according to the environmental conditions and of the increased risk at passive level crossings in times of reduced visibility.



**5.1 Velocity of truck**

The bed of the trailer body is 1.4 m above road level and the top of the trailer body 2.9 m above road level. Given the nature of the load, as a generally uniform body of citrus pulp, the centre of mass of the load is assumed to be around the mid point of the trailer, both vertically and horizontally. This gives a centre of mass height of about 2.15 m from road level and the centre of the trailer longitudinally.

Based on the assumptions made as to height and horizontal distance of the ‘throw’ the velocity is calculated from;

$$v = d \sqrt{\frac{g}{2\cos\theta(d\sin\theta - h\cos\theta)}}$$

Where;

$v$  = velocity of the vehicle or object at take off (m per second)

$d$  = distance travelled horizontally by the vehicle or objects centre of mass from take off to landing

$g$  = the acceleration due to gravity (9.81 m per second squared)

$h$  = distance travelled vertically by the vehicle or objects centre of mass from take off to landing (m) The value  $h$  is positive if the landing point is above the take off point and negative if the landing point is below the take off point

$\theta$  = the angle of take off as measured relative to a horizontal plane.

To provide a range of speeds at the origin of the ‘throw’ three sets of calculations have been examined. On the basis that the angle of the launch is not known, an angle of 45 degrees from a level plane will be assumed for the first two calculations. It should be noted that a 45 degree angle will provide a minimum launch velocity as it is the optimum trajectory angle. The equation then simplifies to;

$$v = d \sqrt{\frac{g}{d - h}}$$

Where;

$v$  = velocity of the vehicle or object at takeoff (m per second)

$d$  = distance travelled horizontally by the vehicle or objects centre of mass

$g$  = the acceleration due to gravity (9.81 m per second per second)

$h$  = distance travelled vertically by the vehicle or objects centre of mass from takeoff to landing (m). The value  $h$  is positive if the landing point is above the takeoff point and is negative if the landing point is below the takeoff point.

Because the velocity of the citrus pulp on the truck is the same as the truck the projection velocity will be close to the speed of the truck at impact. Although the

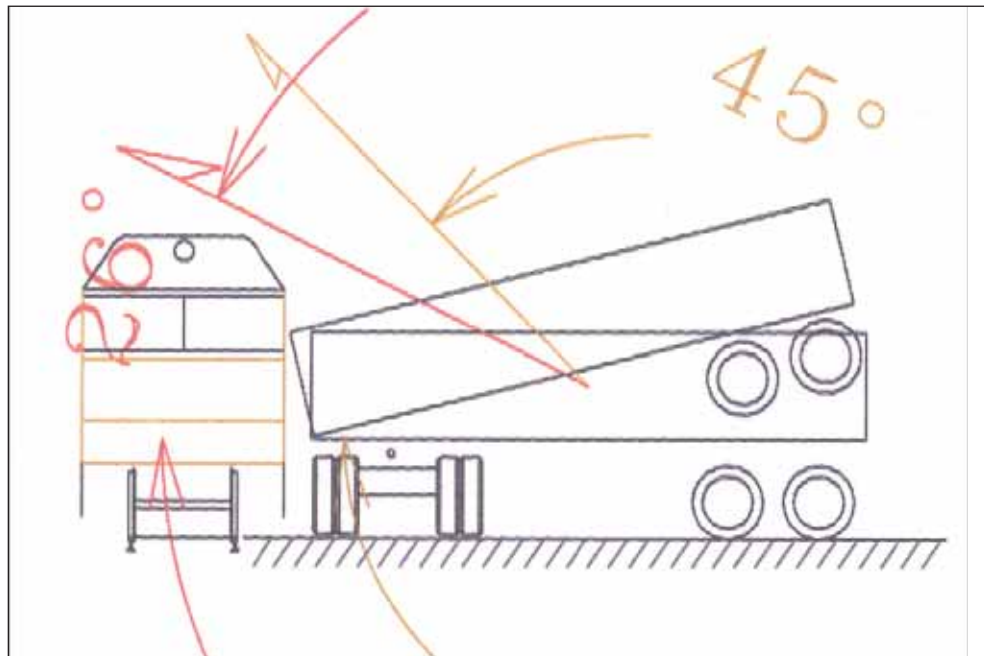
load was covered with a tarp, the resistance in terms of the tarp restraining or restricting such a mass at the point of 'throw' was said to be negligible.

The first calculated projection is at 45 degrees with the trailer hard against the side of the train to the midpoint and extremity of the citrus pulp on the opposite side of the road. The distances from the centre of mass of the trailer to the midpoint and extremity of the citrus pulp in this instance are 23.93 m and 42.28 m respectively. This calculates to speeds between 53 km/h and 71 km/h.

The second calculated projection is at 45 degrees with the trailer extended behind the truck and rotation of the trailer occurring as the truck contacts the train. The distances from the centre of mass of the trailer in this example to the midpoint and extremity of the citrus pulp on the opposite side of the road are 32.31 m and 50.61 m respectively. This calculates to a speed between 62 km/h and 78 km/h. However, it is thought unlikely that the trailer would have rotated at this point as the full effect of the negative acceleration would not yet have applied.

The third calculation is with the trailer hard against the side of the train to the midpoint and extremity of the citrus pulp on the opposite side of the road. In this instance though, the minimum angle of launch necessary to clear the top of the locomotive is taken into account. This angle is 26 degrees. The distances from the centre of mass of the trailer to the midpoint and extremity of the citrus pulp remain the same as the first calculation (23.93 m and 42.28 m respectively). However, an angle of projection at 26 degrees requires a faster launch speed to reach these distances. These speeds calculate to 57 km/h to 78 km/h.

**Figure 1:** Scaled representation showing the trailer against the side of NR 33 with the possible angle of projection from the centre of mass of the load to clear the locomotive.



## 5.2 Stopping distance of truck

The stopping distance (reaction time plus braking distance) for the truck given the range of calculated speeds and reasonable assumptions as to the friction value for the road surface can be calculated. The range of speed used is 53 km/h to 78 km/h and the reaction time is 2.5 seconds. Research has shown that average reaction time in an unexpected situation exhibited by a person unaffected by drugs, fatigue, illness etc usually ranges from 1 to 1.5 seconds. However, many drivers will take longer to react. Therefore, for design purposes such as highway design manuals and sighting distance calculations for level crossings, a figure of 2.5 seconds is typically applied to ensure that sufficient reaction time is allowed for the majority of motorists.

The bituminous seal of the Lismore Skipton Road was in a 'travelled' condition and would, with moisture on it, return friction values in the range of 0.4 to 0.65<sup>25</sup>. Adjustment for truck tyres would give a range of 0.3 to 0.49 (dry ranges for trucks are 0.4 to 0.53). A mid range friction value of 0.395 is assumed.

The truck and trailer combination involved in the accident was not equipped with ABS braking. In emergency stopping situations, drivers will generally brake rapidly and hard. This will cause the wheels to lock rapidly on non ABS equipped vehicles. It is for this reason that dynamic friction (in lieu of static friction) is used in calculating vehicle speeds/stopping distances under emergency braking.

Total stopping distance for a vehicle is the sum of the reaction distance and the braking distance and is written;

$$d_s = t_r v + \frac{v^2}{2gf}$$

Where;

$d_s$  = total stopping distance in m

$t_r$  = the reaction time in seconds (2.5 seconds)

$v$  = the initial velocity of the vehicle in m per second

$g$  = the acceleration time due to gravity (9.81 m per second)

$f$  = the co-efficient of longitudinal friction (0.395).

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25 FRICKE. L. B., *Traffic Accident Reconstruction. Volume 2 of The Traffic Accident Investigation Manual*. Traffic Institute, Northwestern University. Page 62-14

### 5.3 Sighting distance passive level crossings, Victoria

In regard to the Lismore Skipton Road level crossing (road/rail interface at 90 degrees, road gradient almost level), the requirements of the Rural Road Design are calculated as follows:

$$S_1 = \frac{R_t V_v}{3.6} + \frac{V_v^2}{254F} + L_d + C_v$$

Where:

$S_1$  = the minimum distance of an approaching road vehicle from the nearest rail when the driver of the vehicle can see an approaching train

$R_t$  = reaction time (2.5 seconds)

$V_v$  = vehicle velocity (110 km/h)

$F$  = coefficient of friction (0.26)

$L_d$  = distance from the driver to the front of the vehicle (1.5 m)

$C_v$  = clearance from holding line to nearest rail (8 m).

$$S_2 = \frac{V_t}{3.6} \left( R_t + \frac{V_v}{35.4F} \right)$$

Where:

$S_2$  = minimum required distance of an approaching train from the point of impact with a road vehicle, when the driver first sees a train in order to safely stop at the holding line:

$V_t$  = the maximum speed of the train approaching the level crossing (115 km/h).

## 5.4 Submissions

Section 26, Division 2, and Part 4 of the *Transport Safety Investigation Act 2003*, requires that the Executive Director may provide a draft report, on a confidential basis, to any person whom the Executive Director considers appropriate, for the purposes of:

- a) Allowing the person to make submissions to the Executive Director about the draft; or
- b) Giving the person advance notice of the likely form of the published report.

The final draft of this report was provided for comment to the following directly involved parties:

- a) The National Transport Commission
- b) The Australian Rail Track Corporation
- c) Public Transport Safety Victoria (DOI)
- d) Pacific National
- e) Patrick Corporation
- f) VicRoads

Plus a small number of individuals.

Submissions were received from:

The Chief Executive of the National Transport Commission, the General Manager Road Safety VicRoads, the Acting Manager Investigations Public Transport Safety Victoria, Wheelhouse Fertiliser Pty Ltd, the General Manager Risk and Safety of the Australian Rail Track Corporation and the General Manager Safety Health and Environment of Pacific National Pty Ltd.

### ***Pacific National Pty Ltd submitted that:***

Pacific National has reviewed this draft report and acknowledges the documented findings and safety factors which contributed to this incident. Pacific National is of the opinion that this incident was fundamentally a road user issue and that the train crew were operating in accordance with Pacific National and Track Network Manager rules and procedures.

Pacific National feels that a further safety action should be listed within the report which places some pressure on the Victorian Railway Safety Steering Committee (VRCSSC) to ensure that those level crossings currently listed for upgrade, in the Level Crossing Upgrade Program, are completed in a timely manner in accordance with the schedule.

This is suggested due to the fact that Pacific National is currently involved in a number of level crossing safety projects, alongside rail industry partners, rail safety regulators and State and Territory Governments, and see a critical need to achieve improved road user level crossing safety across Australia, in order to reduce the safety risk to rail employees and members of the broader community. This need has been highlighted in recent major level crossing incidents such as Trawalla Vic (on 28 April 2006), Lismore Vic (on 25 May 2006), Wingeel Loop Vic (on 15 November 2006) and the XPT passenger train level crossing collision near Albury NSW (on 5 June 2006).

In addition to the current level crossing safety improvement programs, Pacific National calls on the various Governments to urgently develop a strategy to fund the upgrade of all existing “passively protected” level crossings to “active protection” (lights and bells as a minimum standard) on the Defined Interstate Rail Network (DIRN), and other regional rail corridors with route speeds of 100 km/h or greater.

## 5.5 Reference information

Australian Transport Safety Bureau Monograph 10 (2002). Level crossing accidents: fatal crashes at level crossings.

Australian Transport Safety Bureau. Report on fatal collision between steam passenger train 8382 & loaded B- double truck at Benalla on 13 October 2002.

Australian Transport Safety Bureau. Report on fatal collision between passenger train 5AL8 and vehicles at the Salisbury Interchange level crossing on 24 October 2002.

Australian Transport Safety Bureau. Report on fatal collision between passenger train 3C37 and a Ford Falcon Station Wagon at the Hesp Road/Bennett Road level crossing, Aloomba on 23 May 2003.

Australian Transport Safety Bureau. Report on fatal level crossing collision at Edith Street, Horsham on 11 August 2005.

Wigglesworth, E.C., (2001). Passive railroad-highway grade crossings: What are the research priorities? <http://www.rtsa.com.au/conferences/crossings/Papers/wig/wig.doc>.

## 5.6 Media release

The Australian Transport Safety Bureau has found that heavy fog and the inappropriate speed of a truck in the conditions were the main contributors to a collision with a freight train at the Lismore Skipton Road level crossing at Lismore, Victoria on 25 May 2006. The 34 year old driver of the truck was fatally injured in the accident which closed the main Adelaide to Melbourne rail line for a period of six days with the total damage bill estimated at \$13.5 million.

The collision occurred when the truck drove into the side of the second locomotive while the train was on the level crossing. This collision occurred shortly before sunrise with visibility in the fog as low as 20 metres and certainly no greater than 50 metres. The passive level crossing was fitted with give-way signs for road users and was not protected by lights or bells to indicate the presence of a train.

The truck was a 19 metre loaded rigid tipper/quad axle combination that was travelling south on the Lismore Skipton Road. The train was 1.3 kilometres long, weighed over 4300 tonnes, and was being hauled by three locomotives travelling east from Adelaide to Melbourne.

The locomotive data logger revealed that the speed of the train at impact was 112 km/h, that the locomotive horn was sounded twice before the collision and that the train's headlight was illuminated. The ATSB calculated the speed of the truck as being between 53 and 78 km/h, with the likelihood that it was towards the upper end of this range.

The force of impact was such that the second and third locomotives of the train were derailed and this resulted in a 'domino' effect that subsequently derailed 41 of the train's 64 freight wagons.

Other safety factors identified in the investigation that did not directly contribute to the collision were the possibility that the truck driver may have been suffering some effects of fatigue and also that the level crossing approach signage and sighting distances did not comply with relevant standards and guidelines. The investigation also noted that in times of reduced visibility it may not be possible for a motorist to safely negotiate a level crossing protected only by give way or stop signs based on sighting distances alone.

The report acknowledges the work being undertaken by the Australian Transport Council and the Australasian Railway Association in regard to the National Railway Level Crossing Safety Strategy and the safety actions already taken or underway by the National Transport Commission and VicRoads.

Recommendations are made to VicRoads and the Department of Infrastructure in relation to ensuring that other passive level crossings in Victoria are to standard, ensuring that road and rail authorities jointly assess the risks of large road vehicles traversing level crossings, and increasing road user education regarding the risks of passive level crossings.