Australian Government
Australian Transport Safety Bureau

# Derailment of freight train 9054

Pyramid Hill, Victoria | 5 March 2013

Investigation

**ATSB Transport Safety Report**
Rail Occurrence Investigation
RO-2013-010
Final – 29 April 2015

Cover photo: Chief Investigator, Transport Safety (Vic)

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**Published by:** Australian Transport Safety Bureau
**Postal address:** PO Box 967, Civic Square ACT 2608
**Office:** 62 Northbourne Avenue Canberra, Australian Capital Territory 2601
**Telephone:** 1800 020 616, from overseas +61 2 6257 4150 (24 hours)
Accident and incident notification: 1800 011 034 (24 hours)
**Facsimile:** 02 6247 3117, from overseas +61 2 6247 3117
**Email:** atsbinfo@atsb.gov.au
**Internet:** www.atsb.gov.au



**Addendum**

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# Safety summary

## What happened

At 0055 on 5 March 2013, Pacific National grain train 9054 derailed at the O'Tooles Road level crossing near Pyramid Hill in northern Victoria. The train derailed about midway through the crossing at pre-existing fractures in one of the rails.

The train comprised three locomotives and 40 loaded grain wagons. Nineteen of the first 20 wagons derailed resulting in severe damage to wagons, a significant loss of grain load and damage to about 270 m of track. The train crew were uninjured.

## What the ATSB found

The ATSB found that a small section of one rail had broken away during the passage of the Swan Hill bound passenger service 8045 at about 2240 earlier that night. The fractures in the rail had occurred as a result of the rail's heavily corroded and wasted condition.

The poor condition of the rail had not been detected by the network manager, V/Line, which had relied on ultrasonic testing to identify rail defects. The track inspection regime did not include sufficient supplementary systems for monitoring the condition of buried track at unsealed level crossings.

The construction method used at unsealed crossings increased the risk of this type of failure. Burying the rail web and foot with road materials increased the potential for corrosion and limited the effectiveness of above-ground visual inspection.

This derailment follows a similar event at Warracknabeal in 2011 that was also investigated. Action taken by the network manager following that event did not fully address the identified limitations of the inspection regime for unsealed level crossings.

## What's been done as a result

Following the incident, V/Line examined 13 per cent of unsealed crossings in its network and the results were used to develop recommendations for other unsealed level crossings across the V/Line network. V/Line asset management systems are to be updated with improved maintenance requirements for unsealed crossings, and a review will be undertaken of crossing construction methods to determine whether the existing standard of construction is the most appropriate method. These safety actions are ongoing and their success at reducing risk will depend on the effectiveness of their implementation.

In addition, the effectiveness of ultrasonic inspection of rail at unsealed level crossings has been improved, including the development of additional procedures and training specific to the identification of corroded rail at level crossings.

## Safety message

The design, construction and inspection of level crossings at unsealed roads should ensure that track remains fit-for-purpose throughout the life of the asset. Inspection regimes must ensure that where technologies, such as ultrasonic testing, have identified limitations other measures are in place to identify track degradation.

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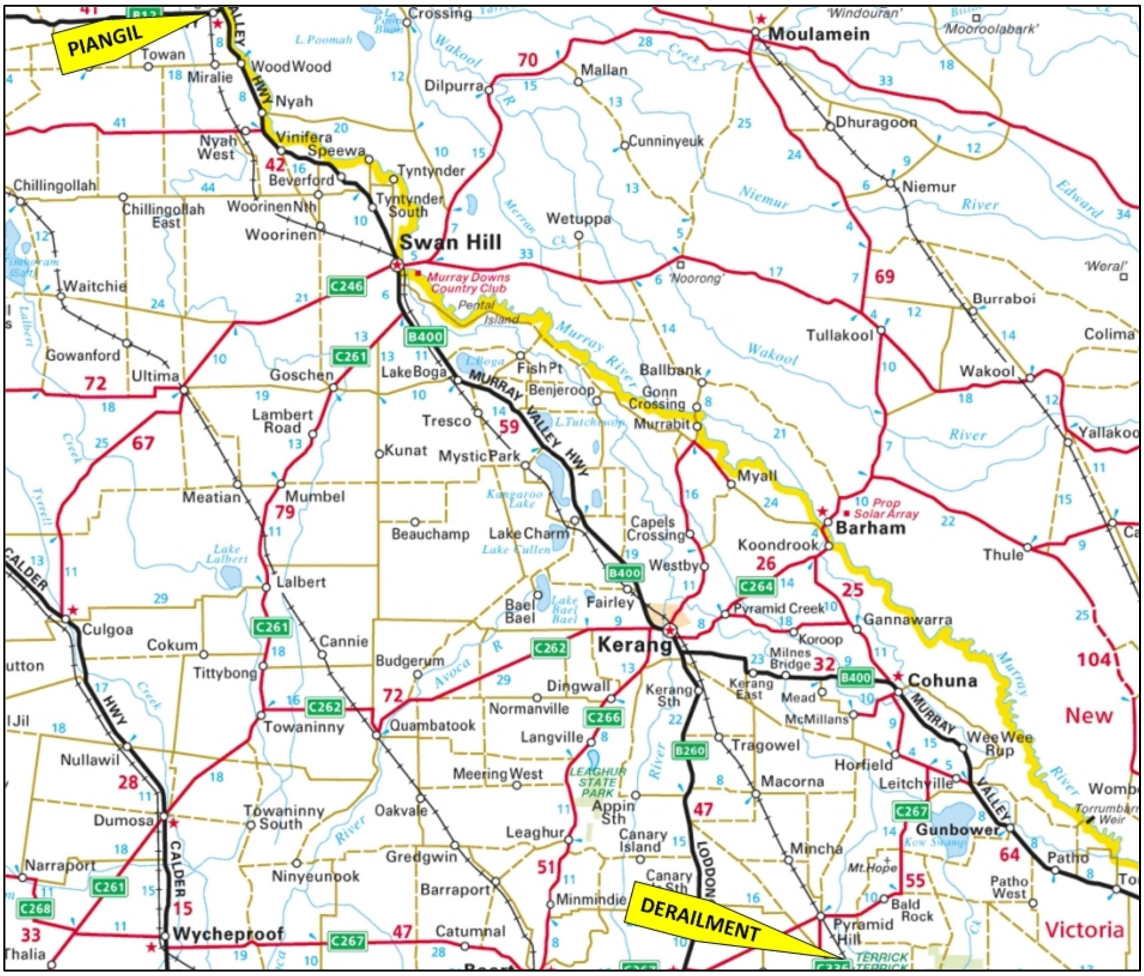
# The occurrence

At about 2240[1] on 4 March 2013, the Melbourne to Swan Hill locomotive hauled passenger service 8045 passed over the O'Tooles Road level crossing located south of Pyramid Hill in northern Victoria. The locomotive crew did not notice anything unusual. At the rear of the train, where the conductor was located, there was a bang under the train and the carriage dipped. This was almost certainly the result of the rail head fracturing and a short gap in the Up[2] rail being created.

On the same evening, Pacific National Train 9054 had departed Piangal at about 2115 destined for North Geelong. Its passage had been uneventful until approaching the O'Tooles Road level crossing at about 70 km/h at around 0055 on 5 March. Immediately prior to entering the crossing, the two drivers saw a short section of the left-hand (Up) rail missing and rail fragments on the road surface. One of the drivers estimated the section of missing rail to be between 150 and 300 mm long. There was insufficient time for the crew to react before the locomotive passed over the crossing.

**Figure 1: Geographical location of the derailment in northern Victoria**




Source: Copyright Melway Publishing 2013 with annotations by Chief Investigator, Transport Safety (Vic)

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[1] Australian Eastern Daylight Time.
[2] The Up rail is the left-hand rail when facing towards Melbourne.

The train derailed at the break in the rail that was about mid-crossing (Figure 2).

**Figure 2: The broken rail within the level crossing**

Source: Chief Investigator, Transport Safety (Vic)

The locomotives stayed on track, except for the derailment of one wheel set on the second locomotive, and came to a stand after losing brake-pipe pressure. Nineteen of the 20 wagons that passed over the fractured rail derailed. The derailment was severe with wagons toppling, leading to a significant loss of load and damage to about 270 m of track. No one was injured.

**Figure 3: Derailed wagons beyond the level crossing**


Source: Chief Investigator, Transport Safety (Vic)

# Context

## Train

The freight train consisted of three locomotives, led by BL32, hauling 40 loaded grain wagons of type VHGF and VHHX. The consist was about 656 m in length, had a mass of about 3000 t and, at Piangil, was examined and certified by the driver as fit to run. The mechanical condition of the train was not causal to this incident.

At the time of the incident the train was travelling at an indicated speed[3] of about 70 km/h. This indicated speed was five km/h above the 65 km/h limit for the BL locomotive[4] on this track. However, given the nature of the derailment, the speed of the train was not considered contributory to the incident.

**Figure 4: Train 9054**


Source: Chief Investigator, Transport Safety (Vic)

## Train crew

The train had a crew of two and, at the time of the incident, the trainee driver was at the controls under instruction. The medical and operational certification of the crew was current.

Both crew members signed-on for this shift at Swan Hill at 1900 on 4 March. After travelling to Piangil, they prepared train 9054 for its journey. There are no indications that crew roster scheduling or fatigue played a role in this incident.

The trip was uneventful until arriving at the broken rail at the O'Tooles Road level crossing, and the operation of the train is not considered to have been contributory to this incident.

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[3] Hasler (Strip-Chart Tachograph) Recorder.

[4] Due to its higher axle load.

## Previous train

V/Line service 8045 was comprised of an N-Class locomotive hauling three passenger cars with the trailing car having a conductor's compartment at the rear. The mechanical condition of this train was not causal to this incident.

It is almost certain that the head of the Up rail was displaced during the passage of this train, near its trailing end. As a result of the noise and dip at the rear car, the conductor looked back along the track but did not see anything. He considered contacting the locomotive driver but did not, believing they would have noticed anything out of the ordinary. The primary role of the conductor is to provide customer service. However, in hindsight, it would have been prudent for the conductor to contact the driver and report what he had experienced.

## Track and level crossing

The O'Tooles Road level crossing is located about six km SSE of the township of Pyramid Hill in northern Victoria and 242.302 rail km from Melbourne. The road is public access and services the local farming community. It was unsealed and comprised of soil, sand and gravel (Figure 5). The top surface of the road materials was found to be dry and that around the rail web and foot, moist. Post incident testing of the soil did not identify any unusual corrosive components.

The track through the crossing was classified as Class 3[5] and comprised 94 lb/yd (47 kg/m) rail fastened to timber sleepers using baseplates and dogspikes. The rolling brand of the rail indicated that the section was produced in 1971 to Australian Standard AS E22:1964.

**Figure 5: Level crossing surface and buried rail**

**Source: Chief Investigator, Transport Safety (Vic)**

V/Line could not identify when the crossing was installed or when it was last opened[6] for detailed inspection. A senior track worker on this line could not recall when the rails and sleepers were installed, but had recollection of the crossing being partially opened for inspection about seven years prior to the incident.

There was no record of track repair at the crossing in the previous 10 years. However, there was a top-up of road material in 2003, 2007, 2009 and 2011.

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5 Defined as minor passenger line and major freight line. Class 3 track nominal structural requirements are; timber sleepers with non resilient fastenings and sleeper plates, jointed 47 kg rail lengths of 87 m, ballast depth of 300 mm, and a ballast shoulder width of 400 mm.

6 A process that involves excavation to expose the track structure.

## Site inspection

The point of derailment (PoD) was at the rail fracture mid-crossing (Figure 6). All 20 wagons on the Down (Kerang) side of this point remained on track. Beyond the rail fracture on the Up (Melbourne) side, the track was severely damaged.

**Figure 6: Point of derailment**


**Source: Chief Investigator, Transport Safety (Vic)**

**Figure 7: Point of derailment following excavation**

**Source: Chief Investigator, Transport Safety (Vic)**

Damage to the derailed freight wagons was extensive and there was a significant loss of load (Figure 8).

**Figure 8: Extensive damage to derailed wagons**

Source: Chief Investigator, Transport Safety (Vic)

## Metallurgical examination

Twenty three pieces of broken rail and several rail fasteners were examined.

**Figure 9: A selection of the fractured rail examined**


Source: Chief Investigator, Transport Safety (Vic)

## Material properties

Tests performed on the rail established that the material was suitable for the application and that material defects had not contributed to the rail fractures. The material properties, microstructure and hardness were typical of that expected of rail produced prior to 1985.

## Corrosion and wasting of rail web

**Figure 10: Wasted rail, intact section**

**Source: Chief Investigator, Transport Safety (Vic)**

The external surfaces of the rail foot and the web had been wasted by corrosion. The thickness of the web in the intact section of rail was reduced to about 6.5 mm. Figure 10 shows the typical wasted cross section including a zone of more severe corrosion in the web below the rail head.

Where the head had separated at the horizontal web fracture, the web thickness was reduced further to 5.5-6 mm.

It was concluded that the corrosion had caused a loss of about 8 mm (4 mm either side) in the thickness of the web from its new condition.

## Fracture analysis

The fractures examined were predominantly horizontal or oblique in the rail web, and transverse in the head and foot of the rail.

It was estimated that the horizontal crack in the web had propagated about 2.5 m along the rail. The web separation was predominantly aligned with the more severely wasted band in the rail web below the rail head and had probably occurred by fatigue. Pitting in the rail web surface had acted as a stress concentration in the failure mechanism.

The transverse fractures of the rail foot exhibited a mixture of corroded and dirt covered fracture surfaces. One of the transverse breaks in the foot exhibited heavy corrosion and abrasion and it is considered that this fracture had occurred by fatigue and had existed for an extended period of time. Other foot fractures were found to be free from heavy corrosion and exhibited chevrons characteristic of instantaneous overload, and were considered to have occurred shortly before, or at the time of, the incident.

The transverse rail head fractures examined were consistent with instantaneous overload failure and were considered to have occurred shortly before or at the time of the incident. Internal metallurgical defects which could be interpreted as stress concentrators were not detected. Fatigue or other long term failure mechanisms were also not detected in the rail head fractures.

Based on the detailed fracture analysis, the following failure sequence was concluded:

- The wasting of the rail web by corrosion contributed to a loss in load bearing capability.
- The corrosion pitting of the rail surface contributed to stress concentration.
- The stress concentration contributed to fatigue propagation in the web of the rail under the applied service loadings.
- A horizontal fatigue crack propagated longitudinally in the web.
- The cracking progressed downwards from the web fracture to the foot in at least one location, leading to a long term transverse fracture in the foot.
- Further transverse fractures occurred by overload in the rail foot and the rail head during the passage of recent trains or at the time of the incident.

## Rail foot and fastenings

There was evidence of heavy corrosion of the rail baseplates (Figure 11). Wear also indicated that relative movement of the rail fixtures had been occurring for some time.

The foot of the rail exhibited a pattern of wasted notches along both edges, consistent with dog spike locations.

Wastage of rails at dog spikes is known to occur where corrosion conditions are favourable. This type of corrosion can be exacerbated by relative movement between rails and dog spikes when spikes are loose or broken.

Dog spikes were likewise heavily corroded and worn (Figure 12).

**Figure 11: Typical base plate**

Source: Chief Investigator, Transport Safety (Vic)

**Figure 12: Typical corroded and worn dog spike**

Source: Chief Investigator, Transport Safety (Vic)

## Ultrasonic testing

Ultrasonic testing of the intact section of rail by a range of probes did not identify any significant transverse defects, non-metallic inclusions or segregation in the rail material.

## Track inspection

A number of track inspection methods were employed by V/Line for Class 3 passenger lines. Inspections at O'Tooles Road level crossing included:

| Type of inspection | Interval | Tolerance | Last performed |
|---|---|---|---|
| Walking | 1 year | 30 days | 11 May 2012 |
| Ultrasonic | 1 year | 30 days | 10-11 May 2012 |
| Track geometry | 3 months | 14 days | 5 February 2013 |
| Visual (road-rail vehicle or from front of train) | Maximum 3 days | N/A | 1 March 2013 |

The walking and track geometry inspections were within the required inspection schedule and did not identify anything out-of-order at the crossing. The most recent visual inspection was carried out by road-rail vehicle and was nominally one day overdue. This inspection did not identify anything unusual at the level crossing and it is unlikely there was any above ground, visually detectable defect at the time of this inspection. It is probable that the first visible fracture in the rail head did not present until after the passage of train 8045 on the same night as the derailment.

There were no reports of rough riding at this location in the previous three months.

## Ultrasonic inspection

### *Background*

Ultrasonic testing on the regional network in Victoria was conducted by Speno Rail Maintenance Australia Pty Ltd (Speno) under contract to V/Line. Testing vehicles are equipped with a range of transducers and collected data is analysed and assessed in real time against alarm parameters set by the operator located in the test vehicle.

### *Most recent inspection of track through O'Tooles Road level crossing*

The most recent ultrasonic inspection of the track section encompassing the O'Tooles Road level crossing was conducted on the night of 10-11 May 2012. The testing was conducted in vehicle FL-6, working in conjunction with a hand testing operator in a chase vehicle. The ultrasonic test information was assessed in real time by a technician in FL-6. However, the data covering the track at this crossing was not stored as it should have been due to system technical issues. As a result, the ultrasonic test data for this crossing was not available for review by the ATSB.

Following the incident and as a result of the data storage anomalies, V/Line identified with Speno the need for a review of test data management including data storage, retrieval, protection and back-up.

### *The vehicle operator and training*

The technician responsible for the real time assessment of the collected data at this crossing on 10-11 May 2012 was employed by Speno in 2000 and had progressed to the position of Senior Operator/Supervisor. This progression involved on and off the job training including completion of Level 2 ultrasonic testing training with the Australian Institute for Non-destructive testing. Training within Speno used a competency based assessment methodology.

Noting that the ultrasonic testing at this crossing had occurred 10 months prior to the derailment, the technician could not recall specific events before or during the shift, nor whether anything of note was identified at the O'Tooles Road Level crossing on that night.

The technician was on his tenth consecutive night shift since his most recent break. Most of the shifts leading up the night of 10-11 May commenced in the evening and were completed in the early hours of the following morning, with time on track ranging from four to eight hours. On 10 May, the shift commenced at 1830 and was completed at 0400 the next morning. The test vehicle passed over the O'Tooles Road crossing at around 0100, at which time analysis suggests the roster should not have induced fatigue.

## Similar occurrence

### *Warracknabeal*

A freight train derailed in similar circumstances about two years prior on the Murtoa to Hopetoun freight line at the Mellis Road level crossing near Warracknabeal, about 160 km west of the Pyramid Hill. The crossing formation was similar to the O'Tooles Road site, with web and rail foot covered with road material (Figure 13).

**Figure 13: Mellis Road level crossing, Warracknabeal**

**Source: Chief Investigator, Transport Safety (Vic)**

The investigation[7] concluded that the rail was heavily corroded and the web wasted, leading to a loss of load bearing capacity. A horizontal web fracture about 1400 mm in length had developed leading to head separation and the collapse of the rail under load. The previous ultrasonic inspection had identified some ultrasonic indications, however; the indications did not meet the criteria for reporting and a closer (manual) inspection of the site was not undertaken.

[7] Chief Investigator, Transport Safety Rail Safety Investigation Report No. 2011/07.

**Figure 14: Wasted rail, Warracknabeal**

Source: Chief Investigator, Transport Safety (Vic)

Similar to the degraded rail at the O'Tooles Road crossing, the rail web had been reduced to a thickness of about 5.5 mm and exhibited a band of greater wastage just below the rail head (Figure 14). The head separation had occurred in this zone.

Recommendations were made to V/Line to review ultrasonic testing protocols and, noting the reliance on ultrasonic inspection to detect rail defects, to holistically review the condition monitoring of track at level crossings with unsealed roads.

A recommendation was also made to V/Line to review the standard of construction of level crossings at unsealed roads, noting the potential for a corrosive environment and the limitations to the visual inspection of the track, including rails and support structures.

# Safety analysis

## Rail deterioration at O'Tooles Road level crossing

Along the full length of the rail examined, the rail web was most severely wasted in a horizontal band approximately 20 mm wide, commencing about 50 mm below the top surface of the rail head (Figure 15). This suggested the presence of a localised interface between moisture and air that provided the conditions under which the most vigorous corrosion was likely to occur.

**Figure 15: Corrosion band on intact rail**


Source: Chief Investigator, Transport Safety (Vic)

The wasting of the rail web by corrosion led to a loss of load bearing capacity in the rail and the corrosion pitting of the rail surface had produced notches which contributed to stress concentration. This subsequently resulted in the development of a horizontal crack within and along the web, head separation and ultimately rail foot and head fractures.

Corrosion rates for unprotected carbon steel in soils are typically considerably higher than in atmospheric environments, and may approach 0.5 mm per annum[8]. At this rate, it would take eight years to produce an eight mm loss of web thickness (four mm each side of the rail web). The rate of corrosion reduces significantly with less favourable conditions with a commensurate increase in the time required to produce this level of corrosion.

The Pyramid Hill area has a predominantly dry climate with an annual rainfall at of about 375 mm. In late 2010 and early 2011 unusually high rainfall led to widespread floods and soil moisture would have been considerably higher than normal during this period, and may have contributed to an accelerated rate of rail corrosion at that time. In any case, the extent of wasting suggests that the rail has been deteriorating for many years.

[8] Australian Standard 2312:2002 'Guide to the protection of structural steel against atmospheric corrosion by the use of protective coatings' – Appendix C, Section C4.

## Track inspection regime

The track inspection regime placed a high reliance on the annual ultrasonic inspection to identify rail defects at unsealed level crossings. When this regime did not identify the corroded and wasted rail at the O'Tooles Road crossing, there was no other system in place that was likely to identify this deterioration. The 'above-ground' visual inspections would not have detected degraded rail and there was no structured and scheduled opening-up of the crossing for closer examination.

Since the incident, an audit by the network manager of unsealed level crossings in its network confirmed the systemic and broader nature of the limitations in the regime for monitoring the condition of buried track. Following the Pyramid Hill derailment, 126 higher risk sites were inspected, from the total population of about 1000 unsealed road crossings on the regional network. A detailed assessment of the rail, sleepers and fastenings was undertaken at these locations. Of the sites inspected, 111 had sufficient data for assessment and analysis. Two (two per cent) sites were identified as having priority faults due to web reduced thickness. Deterioration of the rail foot was the predominant finding, with 58 per cent having foot height loss meeting the criteria for priority attention. Deterioration was also found in fixtures and about 25 per cent had sleepers identified as ineffective. On the Bendigo - Swan Hill section (that takes in Pyramid hill) 30 per cent of unsealed crossings were inspected of which 21 per cent were identified as requiring immediate remedial works. This compares to 12 per cent across the full sample set.

## Ultrasonic inspection

Level crossings at unsealed roads can present difficulties for automated ultrasonic testing due to contamination of the rail head and the presence of corrosion on the underside of the rail that can disrupt return signals. Post-incident testing by Speno also found that their current technologies and methods may not detect a narrowing web. Laboratory experiments identified that rail with a web thickness of six mm could return a back-wall echo response above the testing reference level and therefore may not trigger an automated alarm in the test vehicle. Reliance would then be placed on the operator identifying other ultrasonic indications.

In this instance, there were probably such ultrasonic indications at the crossing that suggested, as a minimum, the presence of corrosion. Ultrasonic (laboratory) testing of the intact rail that had been in track adjacent to the web separation revealed multiple intermittent indications with both normal (zero degree) and 45 degree probes. Intermittent responses were consistent with corrosion pitting of the rail web.

The skill and awareness of the technician becomes a critical element in the track assessment process. Systems that support the technician and the effectiveness of ultrasonic testing are likewise critical. Post-incident system audit and review identified several opportunities for improving ultrasonic testing at crossings including the review of protocols for hand testing, the development of an effective validation process for the rail flaw detection measurement system, the review of the preparation of rail surface condition at level crossings, and the reduction in vehicle speed when conducting automated ultrasonic testing over crossings.

## Construction of level crossing at unsealed roads

This incident, the Warracknabeal derailment and post-incident audit of other crossings has identified long term issues with the condition of buried track in regional Victoria. Covering of rails, fixtures and track support with loose road material increases the potential for corrosion and more rapid track degradation. It also limits the ability to conduct efficient and effective visual inspection.

The network standard for level crossing construction did not directly address the challenges of unsealed roads. The standard primarily addressed crossings at roads with paved (sealed) surfaces, other than a reference to the application of a bituminous coating to rail that would contact fill material. The particular challenges related to drainage, the rail and track environment and the mechanisms for inspection, were not addressed within the standard.

## Action following a similar event

The derailment at Warracknabeal two years prior was the result of similar rail corrosion and deterioration. In response to the incident, the frequency of ultrasonic inspection on freight lines was increased from every three years to every two years[9], and Speno re-emphasised with its operators the requirement to hand test if indications of corrosion were identified during automated ultrasonic testing. V/Line advised that their focus of action in that instance had been to identify any other locations that had similar very old rail[10], believing this to be the main driver for its deteriorated condition.

The investigation had identified limitations in the condition monitoring of track at unsealed level crossings. Transport Safety Victoria (TSV), the rail safety regulator at that time, advised that they had confirmed that the investigation recommendations had been entered into V/Line's internal corrective action system but that there was no other audit activity undertaken that related to track condition monitoring at unsealed crossings due to competing priorities.

Following the less severe derailment at Warracknabeal, an opportunity was missed to undertake a wider review of track condition monitoring at unsealed crossings and to review the standard of construction at such crossings.

[9] For passenger lines, the requirement for annual ultrasonic testing was unchanged.
[10] The rail in that instance was produced in 1908.

# Findings

**Safety issues, or system problems, are highlighted in bold to emphasise their importance.** A safety issue is an event or condition that increases safety risk and: (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 operating environment at a specific point in time.

## Contributing factors

- The buried rail was heavily corroded, leading to a loss of web thickness and load bearing capability. This subsequently resulted in the development of a longitudinal crack within the web, head separation and ultimately rail fracture.
- **The track inspection regime did not identify the deteriorated rail condition at the O'Tooles Road level crossing. The regime placed an over-reliance on ultrasonic testing and did not include sufficient supplementary systems for monitoring the condition of buried track at unsealed level crossings. [Safety issue]**

## Other factors that increased risk

- **The ultrasonic testing regime was not effective in consistently identifying corrosion and wasting of the rail web at unsealed level crossings. [Safety issue]**
- **The method of constructing crossings at unsealed roads heightened the potential for corrosion and track degradation and limited the opportunity for effective visual inspection. The network standard for crossing construction did not directly address the particular challenges of unsealed roads. [Safety issue]**
- Safety action taken by V/Line following the Warracknabeal investigation did not address the identified limitations of the inspection regime for unsealed level crossing, heightening the risk of a similar event.

## Other findings

- The head of the Up rail was almost certainly displaced during the passage of the V/Line passenger service 8045, about two hours prior to the derailment.

# Safety issues and actions

The safety issues identified during this investigation are listed in the Findings and Safety issues and actions sections of this report. The Australian Transport Safety Bureau (ATSB) expects that all safety issues identified by the investigation should be addressed by the relevant organisation(s). In addressing those issues, the ATSB prefers to encourage relevant organisation(s) to proactively initiate safety action, rather than to issue formal safety recommendations or safety advisory notices.

All of the directly involved parties were provided with a draft report and invited to provide submissions. As part of that process, each organisation was asked to communicate what safety actions, if any, they had carried out or were planning to carry out in relation to each safety issue relevant to their organisation.

## Track inspection regime

| | |
|---|---|
| Number: | RO-2013-010-SI-01 |
| Issue owner: | V/Line Pty Ltd |
| Operation affected: | Rail |
| Who it affects: | Owners and operators of rail infrastructure. |

### *Safety issue description:*

The track inspection regime did not identify the deteriorated rail condition at the O'Tooles Road level crossing. The regime placed an over-reliance on ultrasonic testing and did not include sufficient supplementary systems for monitoring the condition of buried track at unsealed level crossings.

#### *Proactive safety action taken by V/Line*

Action number: RO-2013-010-NSA-093

Following the incident, V/Line examined 13 per cent of unsealed crossings in its network. The results of inspections were used to develop recommendations for other unsealed level crossings across the V/Line network.

V/Line's Enterprise Asset Management System (EAMS) will be updated with improved maintenance requirements for unsealed crossings, and an Asset Condition Criticality and Risk Index (ACCRI) assessment is underway to determine priority asset maintenance requirements, including those for unsealed crossings.

Other specific actions advised by V/Line include:

- The RFD (Rail Flaw Detection) regime was audited, and V/Line subsequently worked with Speno to improve ultrasonic test processes.
- A further review has highlighted a number of high risk locations for priority attention and the buried crossings program will increase during 2015-16.
- Unsealed crossings showing signs of drainage/formation failure will be brought forward in the Annual Works Plan (AWP).
- Rails in unsealed crossings will be painted prior to installation (web and foot).

#### ATSB comment in response

This is a complex safety issue that potentially affects a large number of crossings in the regional network. The safety actions advised by V/Line will assist in reducing the risk associated with this safety issue; however, it is recognised that the success of these actions is dependent on their effective implementation. Also, the risks associated with the latent condition of yet to be inspected unsealed level crossings must be managed.

#### Current status of the safety issue

Issue status: Safety action pending

Justification: V/Line has initiated actions that, subject to their effective implementation, should improve the knowledge of asset condition and the management of risks associated with the deterioration of track at unsealed level crossings.

## Ultrasonic inspection

| | |
|---|---|
| Number: | RO-2013-010-SI-02 |
| Issue owner: | Speno Rail Maintenance Australia |
| Operation affected: | Rail |
| Who it affects: | Owners and operators of rail infrastructure. |

### Safety issue description:

The ultrasonic testing regime was not effective in consistently identifying corrosion and wasting of the rail web at unsealed level crossings.

#### Proactive safety action taken by Speno

Action number: RO-2013-010-NSA-094

Speno has undertaken safety actions to improve the effectiveness of its ultrasonic inspection of rail at unsealed level crossings. Capability improvements include the introduction of procedures for the identification of corroded rail at level crossings, and associated staff training. Specific procedural inclusions to enhance detection of deteriorated rail include:

- A reduced test vehicle speed of five km/h for testing at level crossings
- Criteria and protocol for re-inspection in the case of any identified discontinuities
- Criteria and protocol for follow-up hand testing and engineering inspection
- Enhanced reporting requirements.

#### Current status of the safety issue

Issue status: Adequately addressed

Justification: The ATSB is satisfied that the action taken by Speno has increased the effectiveness of its ultrasonic inspection of corrosion defects in rail at unsealed level crossings.

## Construction of level crossing at unsealed roads

| | |
|---|---|
| Number: | RO-2013-010-SI-03 |
| Issue owner: | V/Line Pty Ltd |
| Operation affected: | Rail |
| Who it affects: | Owners and operators of rail infrastructure. |

### *Safety issue description:*

The method of constructing crossings at unsealed roads heightened the potential for corrosion and track degradation and limited the opportunity for effective visual inspection. The network standard for crossing construction did not directly address the particular challenges of unsealed roads.

#### *Proactive safety action taken by V/Line*

Action number: RO-2013-010-NSA-095

V/Line has advised that, while it considers the current method of construction of unsealed level crossings to be fit for purpose, it will review the available construction methods across other rail networks and determine whether the existing standard of construction is the most appropriate method.

#### *ATSB comment in response*

Post-incident survey of unsealed crossings identified that the track at a significant portion of crossings was in a deteriorated condition that warranted immediate remedial action. This indicated both a failure of the condition monitoring regime and greater rates of rail and track deterioration at unsealed crossings. The ATSB is of the view that opportunities may exist to improve the construction at such crossings, and the V/Line review of available construction methods is welcomed.

#### *Current status of the safety issue*

Issue status: Safety action pending

Justification: The review of available construction methods is an appropriate step to identifying opportunities for alternative crossing construction, particularly at identified higher risk sites. The ATSB is of the view that a construction standard for unsealed level crossings should be developed to supplement the enhancement initiatives in asset management and condition monitoring.

# General details

## Occurrence details

| | | |
|---|---|---|
| Date and time: | 5 March 2013 - 0055 EDT | |
| Occurrence category: | Serious incident | |
| Primary occurrence type: | Derailment | |
| Location: | Pyramid Hill, Victoria | |
| | Latitude: 36° 6.524' S | Longitude: 144° 9.046' E |

## Train details

| | | |
|---|---|---|
| Train operator: | Pacific National | |
| Registration: | Train No. 9054 | |
| Type of operation: | Rail - freight | |
| Persons on board: | Crew – 2 | Passengers – N/A |
| Injuries: | Crew – Nil | Passengers – N/A |
| Damage: | Severe damage to 19 derailed wagons | |

# Sources and submissions

## Sources of information

The sources of information during the investigation included:

- V/Line Pty Ltd
- Speno Rail Maintenance Australia Pty Ltd
- Pacific National
- Crew of trains 9054 and 8045.

## References

Australian Standard 2312:2002, *Guide to the protection of structural steel against atmospheric corrosion by the use of protective coatings,* Appendix C, Section C4.

## Submissions

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

A draft of this report was provided to V/Line Pty Ltd, Speno Rail Maintenance Australia Pty Ltd, Pacific National, the Office of the National Rail Safety Regulator and involved train crew.

Submissions received were reviewed and where considered appropriate, the text of the report was amended accordingly.

# Australian Transport Safety Bureau

The Australian Transport Safety Bureau (ATSB) is an independent Commonwealth Government statutory agency. The ATSB is governed by a Commission and is entirely separate from transport regulators, policy makers and service providers. The ATSB's function is to improve safety and public confidence in the aviation, marine and rail modes of transport through excellence in: independent investigation of transport accidents and other safety occurrences; safety data recording, analysis and research; fostering safety awareness, knowledge and action.

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 identify and reduce safety-related risk. ATSB investigations determine and communicate the factors related to the transport safety matter being investigated.

It is not a function of the ATSB to apportion blame or determine liability. At the same time, 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 initiate proactive safety action that addresses safety issues. Nevertheless, the ATSB may use its power to make a formal safety recommendation either during or at the end of an investigation, depending on the level of risk associated with a safety issue and the extent of corrective action undertaken by the relevant organisation.

When safety recommendations are issued, they focus on clearly describing the safety issue of concern, rather than providing instructions or opinions on a preferred method of corrective action. As with equivalent overseas organisations, the ATSB has no power to enforce the implementation of its recommendations. It is a matter for the body to which an ATSB recommendation is directed to assess the costs and benefits of any particular means of addressing a safety issue.

When the ATSB issues a safety recommendation to a person, organisation or agency, they must provide a written response within 90 days. That response must indicate whether they accept the recommendation, any reasons for not accepting part or all of the recommendation, and details of any proposed safety action to give effect to the recommendation.

The ATSB can also issue safety advisory notices suggesting that an organisation or an industry sector consider a safety issue and take action where it believes it appropriate. There is no requirement for a formal response to an advisory notice, although the ATSB will publish any response it receives.

**Australian Transport Safety Bureau**

**Enquiries** 1800 020 616
**Notifications** 1800 011 034
**REPCON** 1800 011 034
**Web** www.atsb. gov.au
**Twitter** @ATSBinfo
**Email** atsbinfo@atsb.gov.au

Investigation

**ATSB Transport Safety Report**
Rail Occurrence Investigation

Derailment of freight train 9054, Pyramid Hill, Victoria on 5 March 2013

RO-2013-010
Final – 29 April 2015