Australian Government
Australian Transport Safety Bureau

Derailment of freight train 9305

Katunga, Victoria | 30 May 2016

Investigation

ATSB Transport Safety Report
Rail Occurrence Investigation
RO-2016-007
Final – 30 May 2017

Cover photo: Chief Investigator, Transport Safety, Victoria

This investigation was conducted under the *Transport Safety Investigation Act 2003* by the Chief Investigator, Transport Safety (Victoria) on behalf of the Australian Transport Safety Bureau in accordance with the Collaboration Agreement entered into on 18 January 2013.

Released in accordance with section 25 of the *Transport Safety Investigation Act 2003*

Publishing information

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

Page	Change	Date

Safety summary

What happened

At about 0025 on 30 May 2016, freight train 9305 derailed at a fractured welded rail joint at Katunga in northern Victoria. The train consisted of two locomotives and 37 flatbed wagons carrying empty containers. Twelve wagons located mid-consist (wagon positions 6 to 17) derailed resulting in severe damage to about 350 m of track. There were no injuries.

What the ATSB found

The ATSB found that the fracture was at a flash butt weld joining early twentieth century rail. The weld contained microscopic defects within the crystalline material structure that indicated improper material processing during flash butt welding, and had probably existed for many years.

It was concluded that the fracture was probably the result of higher than normal loading due to inadequate support of the rail. The loss of effective support was probably the result of deteriorated sleeper condition. The deferral of the replacement of select sleepers through the location had increased the potential for rail fracture, although it was not possible to directly link this decision to this fracture.

The condition of the fracture surfaces indicated that the fracture was probably present for several days prior to the passage of train 9305. After the rail's fracture, the loosening of the track fasteners allowed the lateral misalignment of the rail ends that led to the derailment of the train. The regime that may have detected the fractured rail before the track deteriorated to an extent that would result in derailment was ineffective for this track and its condition.

What's been done as a result

V/Line has revised their Technical Maintenance Plan schedule to clarify that front of train inspections cannot be used to replace hi-rail patrols on the Tocumwal line.

Further, V/Line intends undertaking a risk review of the appropriateness of its current condition based responses for sleeper condition, as set out the V/line standard for inspection and assessment. The ATSB has recommended that V/Line completes the risk review and implements safety actions to reduce the likelihood of derailment following a rail fracture.

Safety message

Systems of inspection should be designed to ensure detection of rail fractures before track deteriorates to a condition that results in train derailment.

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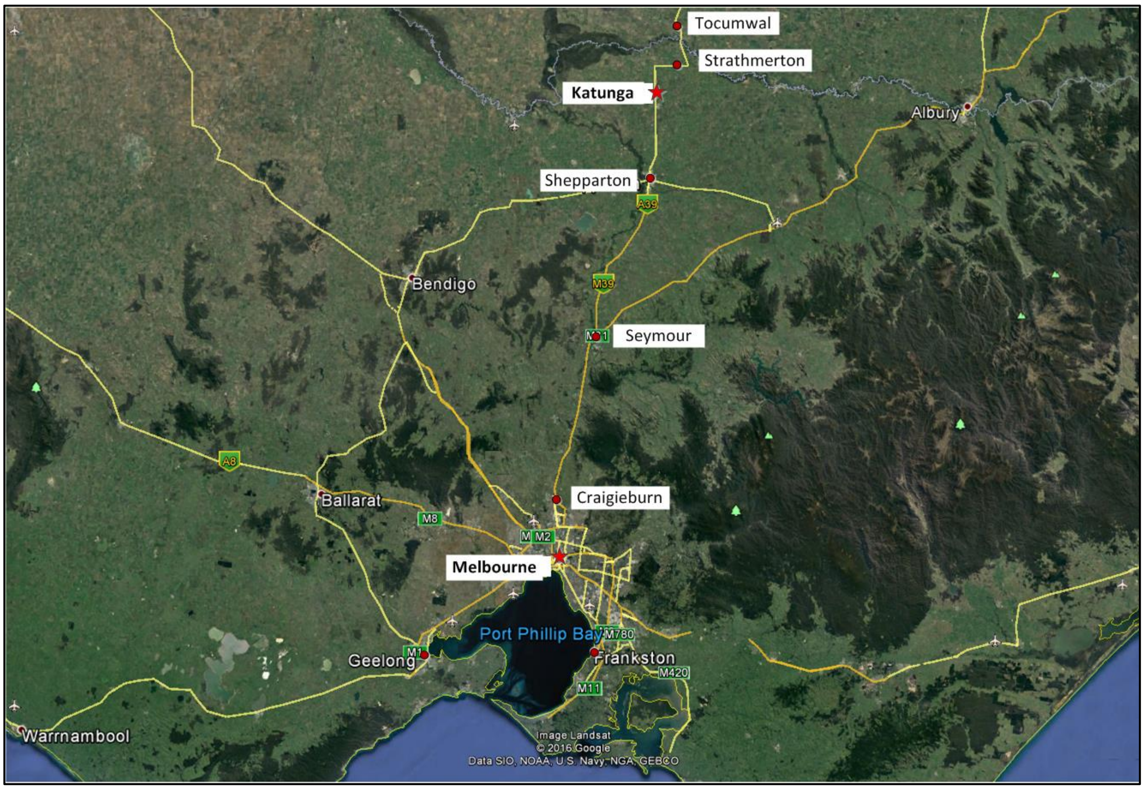
The occurrence

Train journey

At about 1915[1] on 29 May 2016, Pacific National freight train 9305 departed Tottenham Yard, Melbourne, bound for Tocumwal in New South Wales (Figure 1). The train was being operated on the V/Line broad gauge network by a crew of two and consisted of two locomotives hauling 37 flatbed wagons carrying empty containers.

Figure 1: Route of freight train 9305



Source: Copyright Map Data Google 2016 with annotations by Chief Investigator, Transport Safety (Victoria)

The train proceeded to Craigieburn and then onto Seymour. From Seymour all trains are required to work to safeworking by train order.[2] A train order was issued at about 2215 to travel from Seymour to Shepparton and the train arrived at Shepparton without incident. A second train order was issued at about 2335 at Shepparton for the journey to Tocumwal.

At about 0025 when travelling through Katunga at about 61 km/h, the train crew felt a 'bump' and rough riding near the 228 km rail post. Shortly after there was a loss of brake pipe pressure resulting in a brake application. In response to this, the driver released the locomotive independent brake[3] and continued powering to maintain the train couplings in a draft condition.[4] The train then came to a stand with the lead locomotive about 295 m past the 228 km post.

[1] The 24-hour clock is used in this report and is referenced from Eastern Standard Time (EST), UTC +10 hours.

[2] Railway safeworking by train order involves the use of a paper instrument issued by a train controller authorising the driver to proceed into and through the nominated single-line section.

[3] An air brake system that operates on the locomotive independent of the train air brake system.

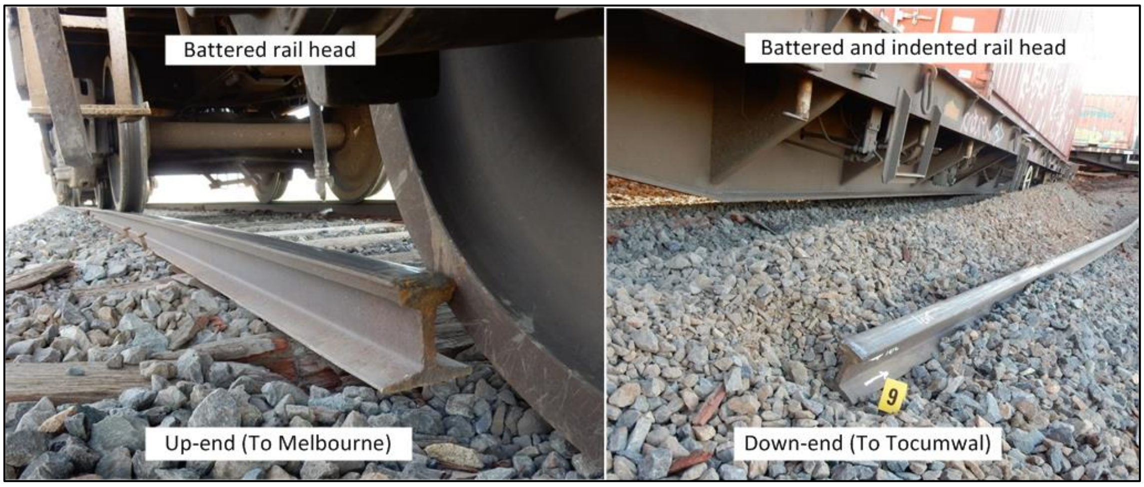
[4] A condition that maintains the coupler forces throughout the train in tension.

Once the train had stopped, a crew member investigated the cause of the brake application. On observing the derailed wagons, the crew advised Centrol[5] and secured the train. There were no injuries to the public or the train crew.

The derailment and damage

The train had derailed at a fractured flash butt welded rail joint in the east rail at about the 227.8 km mark (Figure 2).

Figure 2: Fractured rail



Source: Chief investigator, Transport Safety (Victoria)

The passage of train 9305 over the fractured rail had disturbed the joint sufficiently to laterally misalign the rail ends, such that a wheel flange impacted with the rail head on the Down-end. This resulted in further disarrangement of the rail and a loss of guidance for the following wagons. It is probable that the trailing axle of the leading bogie of wagon six was the first to derail.

Of the twelve wagons that derailed, wagon six, seven and eight stayed upright and generally followed the track alignment, while the rear bogie of wagon nine veered to the east of the track. The tenth wagon and the following eight wagons veered to the east of the line causing a separation between the ninth and tenth wagons. The separation caused the loss of brake pipe pressure and the subsequent application of the train brakes. The locomotive and the first nine wagons travelled about 137 m from the separated section of the train (Figure 3).

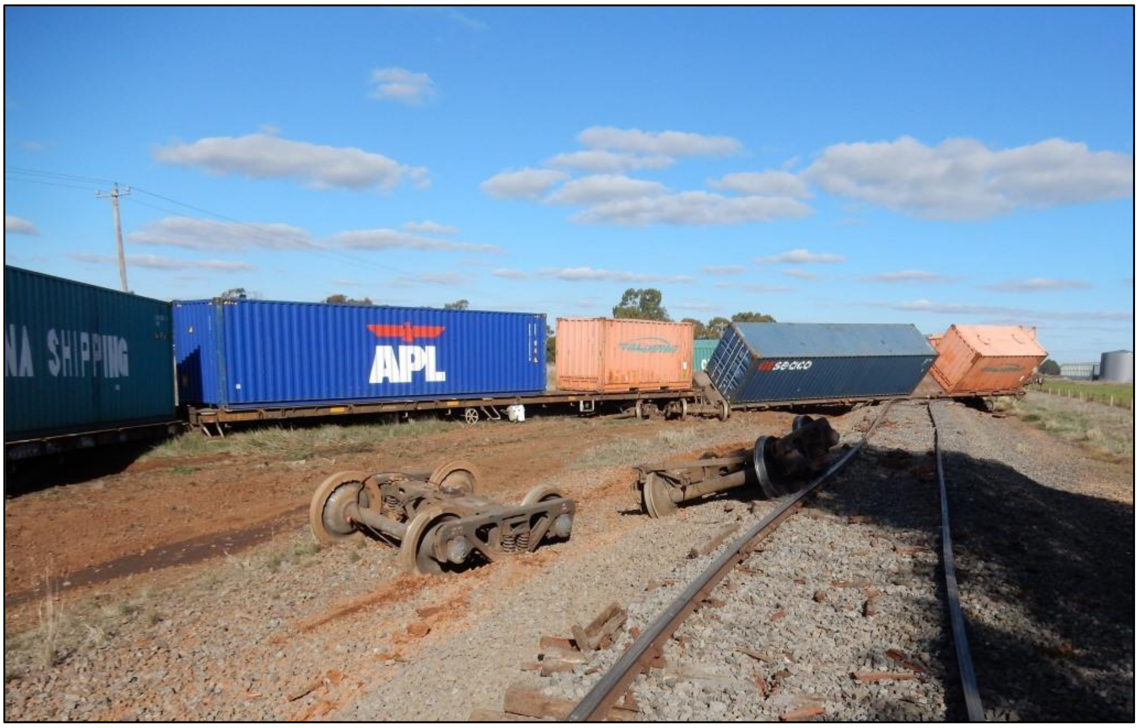
[5] Central Control - The operational control centre for Victoria's regional rail network.

Figure 3: Separated section of train and track damage, looking towards Tocumwal

Source: Chief investigator, Transport Safety (Victoria)

Wagons 10 to 17 ended in various states of disarrangement (Figure 4). The leading end of wagon 18 had lifted off the bogie centre bowl while the last nineteen wagons remained on the track. The derailment resulted in about 350 m of track damage.

Figure 4: Disarranged wagons separated bogies and damaged track



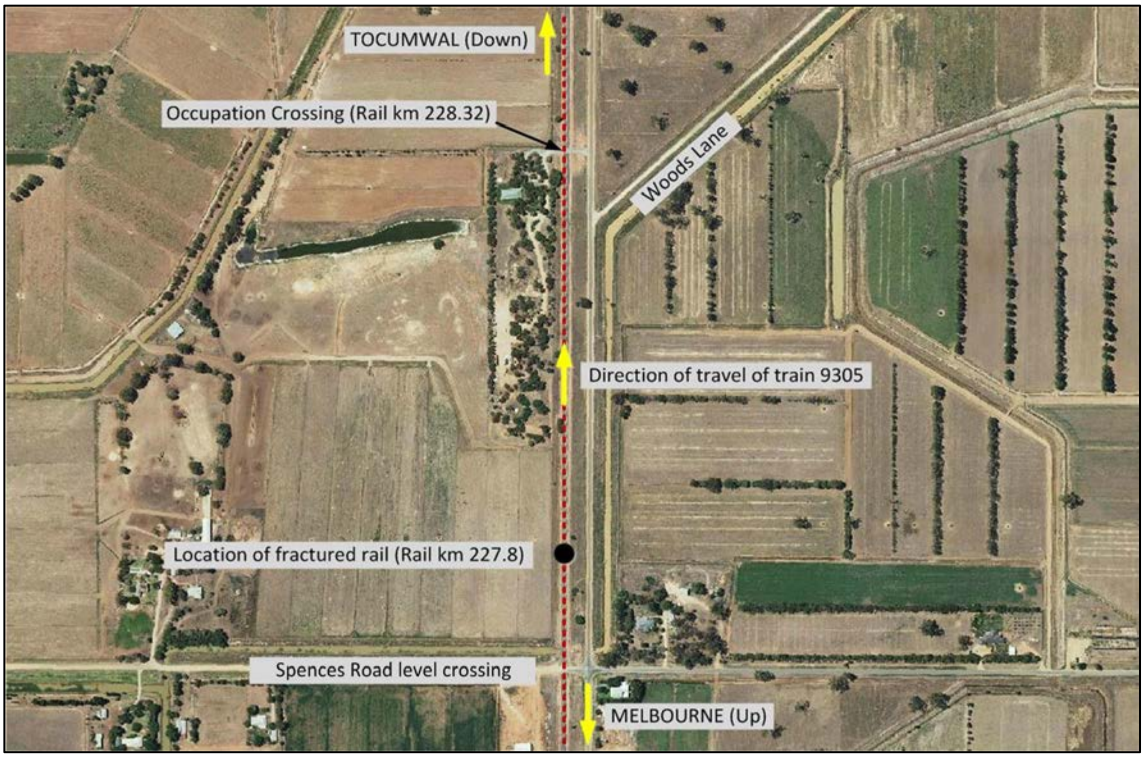
Source: Chief investigator, Transport Safety (Victoria)

Context

Location

The derailment occurred on a section of tangent track about 180 m north of the Spences Road level crossing (Figure 5).

Figure 5: Derailment location in Katunga, Victoria



Source: MapInfo Professional annotated by Chief Investigator, Transport Safety (Victoria)

Infrastructure

The line between Shepparton (182 km) and Tocumwal (252.6 km) was classified by V/Line as Class 4[6] track. The V/Line standard[7] for Class 4 track construction specified timber sleepers with non-resilient fasteners, sleeper plates, 47 kg/m rail (80 lb/yd[8] for existing track) in maximum lengths of 82 m mechanically jointed. The load limit for the Shepparton to Tocumwal line was 19 t axle load at a maximum speed of 65 km/h. Higher axle loads were allowed for approved locomotives.

At the derailment location, the track (considered 'existing track') consisted of 80 lb/yd rail that had been welded to form approximately 27.5 m lengths that were mechanically joined by fishplates. Rail was secured to timber sleepers using base plates and dog spikes. The sleeper spacing from centre to centre was 600 mm at the location of the fracture. The rolling marks indicated that the rail through the area was manufactured in Lorain, USA in the period 1911-1913. The rolling marks on the fishplates indicated that they had been manufactured by BHP in Australia in 1958. The topography of the incident area was flat, with sand and gravel soil with good drainage. The 27.5 m

[6] Categorised as a Major Freight Line.
[7] Use and Laying of Rail, Document No: NIST 2650.
[8] About 40 kg/m.

section of rail at the derailment location had been fabricated by flash butt welding two 7.7 m lengths to either end of a 12.1 m length of rail.

The flash butt welding process consists of heating the rail ends by means of an electric arc struck between the ends, and when in a plastic state forcing the rail ends together to effect the weld. Flash butt welding was usually undertaken in a factory facility. The date these welds were made is unknown, but was probably within the first half of the twentieth century.

Rail traffic

From January to May 2016, the freight rail traffic in the Up direction averaged 1.2 trains per day and the average tonnage was about 2000 t, mostly loaded. Under loaded conditions, the maximum wagon axle load is about 19 t. In the same period, the rail traffic in the Down direction also averaged 1.2 trains per day and the average tonnage was about 700 t, mostly unloaded.

Metallurgical examination of rail

Rail Chemistry

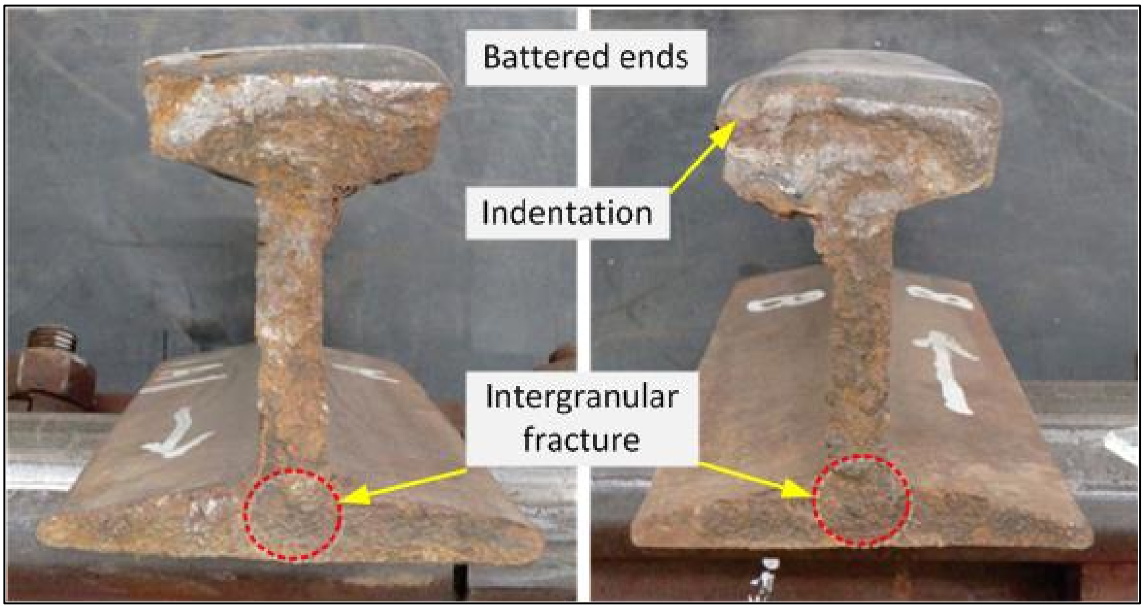
The steel rail had a carbon content varying between 0.50 and 0.75 per cent. The steel also contained small percentages of manganese, silicon, phosphorus and sulphur.

The rail head hardness was typical of rail material utilised in Australia before 1985 and was appropriate for the application.

Weld fracture

The rail head at the fractured weld had been battered on both sides of the break. Both ends were battered to a depth of about 10 mm. Mechanical damage to this depth indicated the passage of bi-directional rail traffic over the broken joint after fracture. There was also significant mechanical damage to the fracture surfaces and corrosion. At the intersection of the web and the foot, the fracture surface exhibited a region of predominantly intergranular fracture where significant grain boundary oxidation was observed (Figure 6).

Figure 6: Fractured weld ends, the Up-side rail is on the left and the Down-side rail on the right. The area of intergranular fracture is identified.



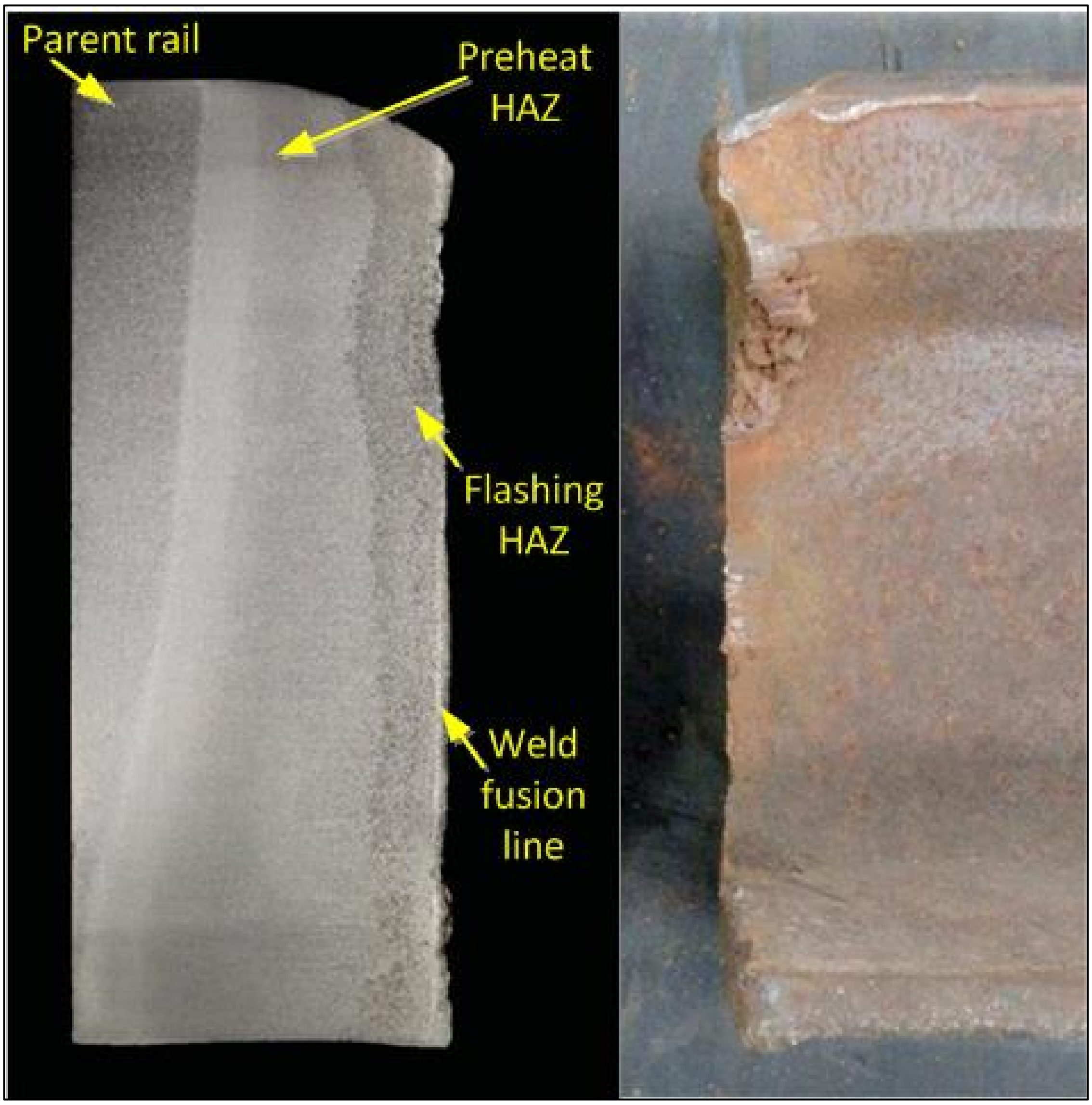
Source: ALS Global annotated by Chief Investigator, Transport Safety (Victoria)

The damage to the fracture surfaces had destroyed a significant amount of the fracture detail. The undamaged fracture surfaces of the rail head and web exhibited a coarse dimpled appearance consistent with instantaneous overload fracture. These features were indicative of ductile-fast fracture.

The fractured rail was longitudinally sectioned and evaluated by macro etching. The macro etching confirmed that the rail had been flash butt welded at the failed point. The macro etching revealed that the parent material was homogenous with no significant segregation of non-metallic inclusions.

In addition to the parent material, the evaluation revealed three distinct areas; a weld fusion line, a weld flash Heat Affected Zone (HAZ) and a HAZ produced during pre-heating prior to welding (Figure 7). The two Heat Affected Zones are consistent with in-plant flash butt welding processes. The fusion line hardness of the subject rail was consistent with the parent-rail material hardness. The peak HAZ hardness was 264HV (Vickers), 2.5 mm from the break and is not excessive for the application.

Figure 7: Macro etched longitudinal section of rail on the left showing that the fracture had occurred predominantly in the HAZ adjacent to the weld fusion line. The rail prior to sectioning is shown on the right.



Source: ALS Global annotated by Chief Investigator, Transport Safety (Victoria)

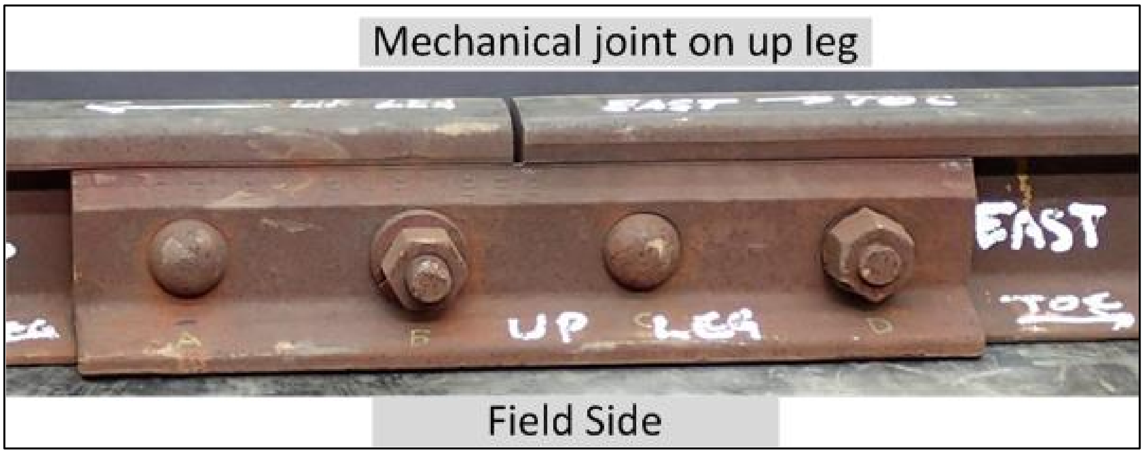
Laying rail and managing stress

Mechanical joints

In jointed track, the mechanical joints have an expansion gap (Figure 8) that results in stress free rail within a defined temperature range. This longitudinal rail movement at the joint reduces the probability of rail fractures in cold temperatures due to rail contraction. Correct joint set-up and ongoing maintenance is required to ensure joints perform this function.

A mechanical joint adjacent to the fractured weld on the east rail was visually and mechanically examined (Figure 8). Based on bolt torques and wear on the fishing surfaces, the examination concluded that the rail had been expanding and contracting at the mechanical joint.

Figure 8: Mechanical joint adjacent to fractured weld on the East rail



Source: Chief Investigator, Transport Safety (Victoria)

A mechanical joint on the west rail opposite the joint on the east rail was also examined. Again, the abrasive wear on the fishing surfaces was consistent with the expansion and contraction of the rail at the mechanical joint.

V/Line construction standards[9] specified the method of laying rail to achieve design levels of maximum tensile and compressive stress. For jointed rail of 27 m length, the standard specified that the gap between rail ends should be 11 mm (the nominal maximum gap) for rails laid at a rail temperature between -2 °C to 7 °C, and fully closed (rail ends butted together) when laid at rail temperatures of 35 °C to 38 °C. The standard also specified other gap requirements for installation temperatures between 7 °C and 35 °C. If laid in this manner, at temperatures below the lower range (-2 °C to 7 °C) the rails would be in tension, and at temperatures above the upper range (35 °C to 38 °C) the rails would be in compression.

Gaps at seven pairs of mechanical joints on the Up side (towards the crossing) of the fractured weld were measured following the derailment, at an ambient temperature of about 15 °C. Gaps on the Up leg averaged 12 mm[10] and the gaps on the down leg averaged 10 mm. There was no indication that these joints had been recently lubricated, however there were signs that the joints were working.[11]

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9 Use and Laying of Rail – NIST 2650, p.13.

10 While the nominal maximum (nominal) joint gap is 11 mm, greater gaps can exist in practice due to variations in bolt diameter and wear or elongation of rail holes. It is not uncommon to find joints that can extend to a gap of 15 mm.

11 Expansion and contraction of the rail at the mechanical joint.

Creep measurements

Creep is the longitudinal movement of rail caused by the motion of rail traffic on the line. Creep typically takes place on grades, where trains brake and in the direction of predominant or loaded traffic. Rail creep can affect the stress condition of the rails. Creep monitoring points (monuments) are located alongside the track (one kilometre apart) and regular measurements are taken to ensure that the longitudinal movement of the rail is within acceptable limits.

Creep measurements recorded at the 228 km point between 2009 and April 2016 indicated a slow movement of the rails in the Up direction (towards Melbourne). The location of the weld fracture (227.8 km) was between the Spences Road level crossing and 228 km. The creep measurements indicated movement towards the fixed point of the crossing.

Track inspection

V/Line's track inspection and maintenance procedure required *track patrol inspections*, *general inspections* and *detailed inspections* to be carried out at specified frequencies. For the Shepparton to Tocumwal line, *track patrol inspections* were required to be performed by road-rail vehicle or front of train riding once a week. *General inspections* by track walking and *detailed inspections* by a track geometry recording vehicle were to be carried out annually. Ultrasonic testing using a rail flaw detection (RFD) vehicle was to be conducted every two years.

The maintenance procedures provided specific guidelines for the assessment of non-welded joints (mechanical) and welded joints. Cracks in fishplates, loose or damaged bolts, rail-end batter and joint gaps are identified as areas for assessment in mechanical joints. For general inspection of rails and welded joints, corrosion, gauge corner or other cracking, piped rail, corrugations, shelling, rust streaks, and damaged rail were specified areas of assessment.

The most recent track patrol inspection before the incident was completed on 24 May 2016. This inspection, conducted from the front of a train, did not identify any defects at the derailment location.

A 'Work Order' for the most recent track walking inspection before the derailment for this section (182 to 253 rail km) records that it was completed on 30 October 2015 with no noted defects at the derailment location.

Measurement of the track geometry was carried out in March 2016 and no abnormal readings were recorded in the vicinity of the broken rail weld (227.8 km).

Rail flaw detection

The annual ultrasonic testing for internal rail defects involved operating an RFD vehicle. When a defect was detected by the RFD car, the location was noted and a manual inspection using hand-held ultrasound equipment was carried out. The defect was then categorised according the class of rail line, type and size of defect.

The last RFD inspection on the Shepparton to Tocumwal section of track was carried out about 12 months before the derailment on 5 May 2015 and no defects were observed at the location of the weld fracture. Following the derailment, recordings of the ultrasonic response at the fracture location were reviewed and there were no identifiable indications of microscopic material defects at the fracture location.

Detailed track condition inspection

A detailed asset inspection was conducted in 2014. The inspection identified 13 ineffective sleepers from 227.700 and 228.000 km, including three nominally within 50 m of the fractured weld. The Work Orders to replace the sleepers were subsequently cancelled, and V/Line advised that the sleeper replacement did not occur.

Train and crew information

Pacific National freight train 9305 consisted of two locomotives XR553 and XR554 hauling 37 flatbed wagons carrying empty containers. The containers were interspersed evenly on the wagons along the train. The trailing load of the consist had a total mass of 971 t, and the total mass including locomotives was 1215 t. The total length of the train was 768 m.

Train 9305 was crewed by two drivers who were appropriately qualified and certified for the route. The drivers were tested for the presence of alcohol after the derailment and returned zero results.

Post-incident rolling stock inspection

Inspection of the leading bogie of the first wagon that derailed identified the presence of wear in the friction wedge pockets. This wear was within condemning limits[12] and there were no signs that the bogie had been hunting. Wheel tread damage was the result of the derailment. The condition of the rolling stock did not contribute to the derailment.

[12] A permissible limit determined by the use of a specific gauge.

Safety analysis

Derailment

The derailment occurred as a result of a fracture at a flash butt welded rail joint. The condition of the fracture surfaces indicated that the fracture had occurred prior to the passage of train 9305. Battering of the fractured rail indicated bi-directional traffic across the fracture, and corrosion and fracture surface damage suggested the fracture had been present for several days.

The battering of rail head ends indicated that vertical displacement of the rail had been possible in the period following the fracture. In addition, dog spikes on the Up-side of the fracture had been lifted and were loose suggesting that the passage of trains had resulted in the deterioration of rail fixings around the fracture. This deterioration was sufficient to allow the development of a lateral discontinuity at the fracture during the passage of train 9305 resulting in the derailment of the train.

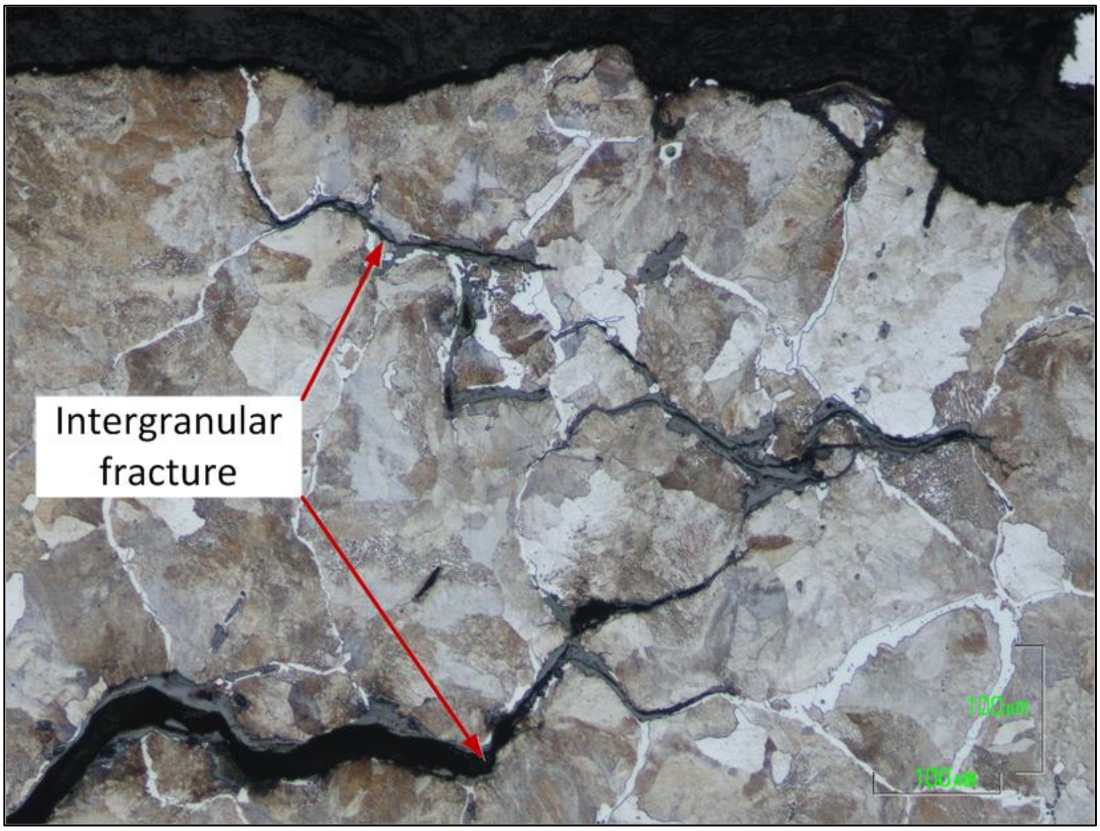
Weld fracture mechanism

The fracture occurred predominantly in the Heat Affected Zone adjacent to the weld fusion line and fracture surfaces were consistent with instantaneous overload fracture.

Pre-existing defect

Metallographic examination of the fracture exhibited a mixed mode (transgranular and intergranular) cracking mechanism. The fracture surface at the foot-web intersection of the fractured weld exhibited a predominantly intergranular brittle fracture mode (Figures 6 and 9).

Figure 9: Photomicrograph of the etched microstructure of the rail fracture surface. The foot-web intersection of fractured weld exhibited an intergranular fracture mode.



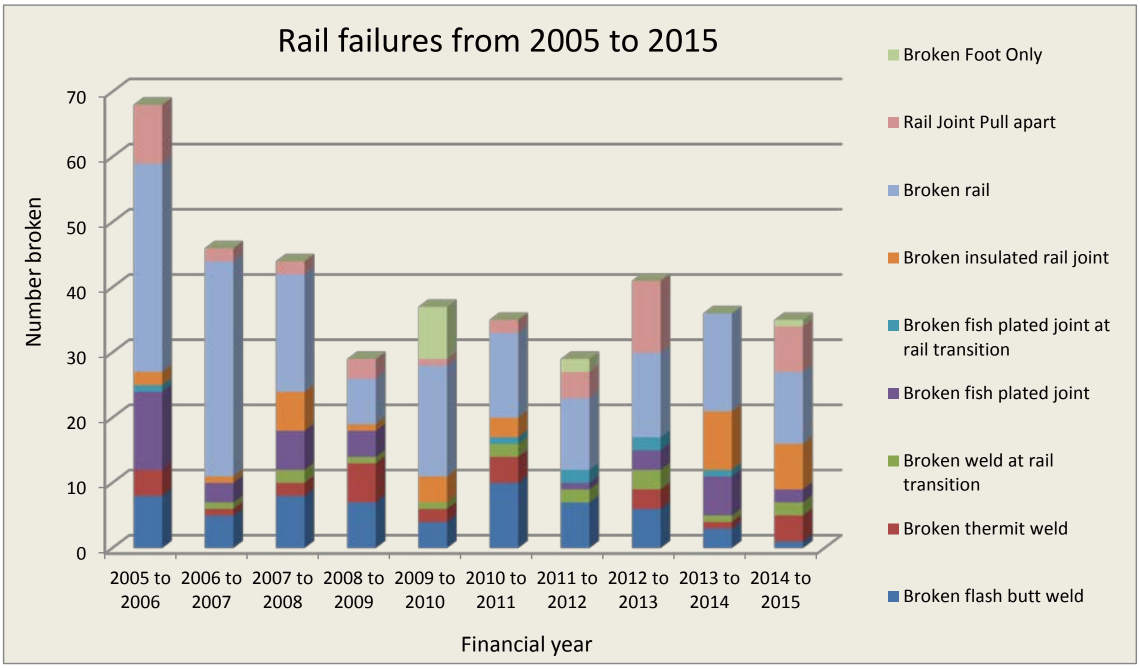
Source: ALS Global annotated by Chief Investigator, Transport Safety (Victoria)

Intergranular brittle fracture occurs by separation at or adjacent to the grain boundaries (where significant oxidation was observed). This type of fracture is indicative of improper material processing during flash butt welding.

History of weld failures

V/Line advised that there were about 330,000 flash butt welds and about 180,000 thermit welds[13] on their operating network. From 2005 to 2015, there were 59 flash butt weld failures, 27 thermit weld failures and a range of other fractures (Figure 10). The flash butt failures represented 15 per cent of the total annual rail failures and the failure rate is similar to other welded connections on the network.

Figure 10: Rail failures from 2005 to 2015.



Source: V/Line Pty Ltd, annotated by Chief Investigator, Transport Safety (Victoria)

Loading of rail

Rail tension

There was no evidence to suggest that rail creep or frozen joints had resulted in higher than normal rail tension. The rail joints between the fracture and level crossing were 'working' and so provided for rail expansion and contraction. In addition, the recorded rail creep was southwards towards the crossing making high rail tension in cold weather less likely.

Temperatures recorded at Tocumwal (24 km from Katunga) indicated low overnight temperatures during the last week of May, with a minimum of 3 °C. Considering the measured joint gaps between the fracture and the crossing, these low overnight temperatures probably resulted in some tension in the Up (east) rail. However, this tension is unlikely to have been excessive and would have been within the normally expected range. It was therefore concluded that excessive rail tension was not likely to have contributed to the fracture.

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13 Exothermic welding using molten metal to join rail ends. This method of connection is normally conducted on site and uses an Aluminothermic reaction to create the heat necessary to melt the joining metal.

Bending stress

In the absence of excessive rail tension, higher than normal bending stress within the rail most likely led to the fracture. The failure mechanism by instantaneous overload, as confirmed by metallurgical examination, is consistent with this loading scenario.

Bending stresses are developed in a rail during the passage of a train and increase when the support provided to the rail is inadequate or uneven. Site observations identified that support of the rail was probably compromised by the deteriorated condition of sleepers.

Following a period of dry weather, the month of May received more than double its normal rainfall and this may have had some influence on the condition of the support.

Asset condition

Inspections

A walking inspection seven months prior to the derailment and weekly track patrols were scheduled in accordance with network procedural requirements and there was no specific deficiency in the application of the inspection regime identified.

However, in this instance these inspections did not identify a deterioration in track support at the derailment location. The absence of any rail top defects or other track geometry anomalies through this location may have reinforced a belief that sleepers were providing adequate support.

Deferment of sleeper replacement

Asset assessments in 2014 had identified several ineffective sleepers through this location and work orders were raised for sleeper replacement. V/Line advised that these work orders were subsequently cancelled. It was not possible to identify whether those sleepers identified for replacement directly influenced the rail fracture leading to this derailment. However, the action to defer sleeper replacement probably increased the risk of rail fracture through the location.

The documentation clarifying the rationale for cancelling the replacement of sleepers could not be identified by V/Line. Several factors might influence decisions to cancel work orders including judgements as to the serviceability of the track, risks associated with the type and volume of traffic, funding and resource allocation. In this instance, the rationale for the deferment of the work program could not be ascertained due to the lack of documentation. Assessing the risk of deferring a work program and documenting the process is crucial to ensuring a verifiable and transparent decision making process.

The fracture

Pre-fracture weld defect

It is unlikely that the defects found within the weld would be detected by ultrasonic testing used in an automated RFD vehicle or currently available train borne monitoring equipment. The defects that were located on grain boundaries within the crystalline material structure were small and discontinuous and would produce specular multi-directional ultrasonic responses. These responses would produce a multi peak indication similar to lower level 'noise' signals and would be expected to be below the threshold that would cause a defect alarm. The microscopic defects observed would need to propagate by fatigue to produce a macroscopic planar defect before a detectable ultrasonic return signal could be produced. While some microscopic fatigue was observed, it had not progressed to macroscopic levels in this case.

Fracture detection

The condition of the fracture surfaces indicated that the fracture was probably present for at least two days prior to the derailment. Rail fractures cannot be completely eradicated and the network has about 30 fractures per annum. Therefore, there is a strong imperative to identify the presence of the fracture before the track deteriorates to a condition that could cause derailment.

The fracture was present during the passage of several trains. In the previous 48 hours, three Melbourne-bound and one Tocumwal-bound trains had traversed the location, one in daylight hours. There were about two trains per day preceding this. However, there were no rough riding or track irregularities reported by train drivers prior to the derailment even though other trains had travelled over the fracture. Given the section was jointed, it may have been difficult for train crew to detect the presence of the fracture.

A track patrol inspection was carried out by front of train riding on 24 May 2016, six days before the derailment. It is unknown whether the fracture was already present, although track patrol by hi-rail may have been a more effective means of detecting the fracture. If the fracture occurred after this patrol, there were no other means of identifying this fracture.

Once the rail had fractured, the configuration and condition of the track meant that dog spikes probably became dislodged relatively quickly reducing the opportunity for the fracture to be identified by track patrol prior to the loss of gauge. Risk mitigation measures used to identify fractured rail were not effective for the configuration and condition of this track.

Findings

The following findings are made with respect to the derailment of freight train 9305 at Katunga, Victoria on 30 May 2016. These findings should not be read as apportioning blame or liability to any particular organisation or individual.

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

- There were microscopic defects within the weld zone that were probably the result of improper material processing during the flash butt welding of the joint.
- The loading of the rail at the weld was probably higher than normal due to inadequate support of the rail, and this inadequate support was not identified.
- The rail fracture was not detected before the passage of train 9305.
- **The inspection regime to identify rail fractures was ineffective for the condition of this track. [Safety Issue]**
- During the passage of train 9305, the rail ends at the already fractured weld laterally misaligned resulting in the derailment of the train.

Other factors that increase risk

- Remediation works to replace deteriorated sleepers was deferred by V/Line.

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.

Depending on the level of risk of the safety issue, the extent of corrective action taken by the relevant organisation, or the desirability of directing a broad safety message to the rail industry, the ATSB may issue safety recommendations or safety advisory notices as part of the final report.

Rail fractures

Number:	RO-2016-007-SI-01
Issue owner:	V/Line Pty Ltd
Operation affected:	Rail: Rail transport
Who it affects:	All operators of rail freight

Safety issue description:

The inspection regime to identify rail fractures was ineffective for the condition of this track.

Response to safety issue by V/Line Pty Ltd

Action number: RO-2016-007-SI-001

V/Line has revised their Technical Maintenance Plan schedule to clarify that front of train inspections cannot be used to replace hi-rail patrols on the Tocumwal line.

Further, V/Line intends undertaking a risk review of the appropriateness of its current condition based responses for sleeper condition, as set out in the V/line standard for inspection and assessment.

ATSB comment in response:

The ATSB accepts that the replacement of front of train inspection with hi-rail patrols will increase the opportunity to detect fractured rail. The ATSB also considers that the proposed risk review, when completed, has the potential to result in a safety action that reduces the likelihood of a derailment following a fracture. The ATSB considers that the safety issue has been partially addressed and has issued the following safety recommendation.

ATSB safety recommendation to: V/Line Pty Ltd

Action number: RO-2016-007-SR-001

The ATSB recommends that V/Line completes the risk review and implements safety actions to reduce the likelihood of derailment following a rail fracture.

Action status: Released

Additional safety action

Whether or not the ATSB identifies safety issues in the course of an investigation, relevant organisations may proactively initiate safety action in order to reduce their safety risk. The ATSB has been advised of the following proactive safety action in response to this occurrence.

V/Line has advised that, since the derailment of freight train 9305, a joint servicing program has been completed, with all mechanical joints lubricated, bolts repaired, and fishing surfaces lubricated. V/Line has also redeveloped its ultrasonic inspection and assessment standard to include more specific instructions and requirements for ultrasonic testing, including a requirement to report non-sizable defects in more detail. Further, it has conducted ultrasonic inspections of an additional 100 flash butt welds and 50 thermit welds on the Tocumwal line. They reported that no defects were detected during these inspections.

General details

Occurrence details

Date and time:	30 May 2016 – EST	
Occurrence category:	Serious incident	
Primary occurrence type:	Derailment	
Location:	Katunga, Victoria	
	Latitude: 35° 58.845' S	Longitude : 145° 27.601' E

Train details

Train operator:	V/Line Pty Ltd	
Registration:	9305	
Type of operation:	Freight	
Persons on board:	2	Passengers – 0
Injuries:	Crew – Nil	Passengers – Nil
Damage:	Substantial	

Sources and submissions

Sources of information

The sources of information during the investigation included:

- V/Line Pty Ltd
- ALS Industrial Pty Ltd
- Asciano Limited
- Speno Rail Maintenance Australia Pty Ltd

References

Use and Laying of Rail – NIST 2650 – V/Line Procedural document.

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.

Submissions were received from V/Line Pty Ltd and The Office of the National Rail Safety Regulator (ONRSR). The submissions 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 operations involving the travelling public.

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
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Investigation

ATSB Transport Safety Report
Rail Occurrence Investigation
Derailment of freight train 9305, Katunga, Victoria 30 May 2016

RO-2016-007
Final – 30 May 2017