



Australian Government
Australian Transport Safety Bureau

Derailment of grain train 9150

Nunga, near Ouyen, Victoria | 9 November 2015



Investigation

ATSB Transport Safety Report
Rail Occurrence Investigation
RO-2015-022
Final – 15 May 2017

Cover photo: Buckled track on approach to level crossing

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

© Commonwealth of Australia 2017



Ownership of intellectual property rights in this publication

Unless otherwise noted, copyright (and any other intellectual property rights, if any) in this publication is owned by the Commonwealth of Australia.

Creative Commons licence

With the exception of the Coat of Arms, ATSB logo, and photos and graphics in which a third party holds copyright, this publication is licensed under a Creative Commons Attribution 3.0 Australia licence.

Creative Commons Attribution 3.0 Australia Licence is a standard form license agreement that allows you to copy, distribute, transmit and adapt this publication provided that you attribute the work.

The ATSB's preference is that you attribute this publication (and any material sourced from it) using the following wording: *Source:* Australian Transport Safety Bureau

Copyright in material obtained from other agencies, private individuals or organisations, belongs to those agencies, individuals or organisations. Where you want to use their material you will need to contact them directly.

Addendum

Page	Change	Date

Safety summary

What happened

On 9 November 2015, Pacific National train 9150 was travelling from Carwarp in north-western Victoria to Melbourne. The train consisted of two locomotives and 20 wagons, of which 19 were loaded with grain.

At about 1532, the train was travelling through Nunga, 8 km south of Ouyen, at about 80 km/h. The train had almost cleared the Janiels Road level crossing when the trailing bogie of the last wagon derailed. The train was brought to a stand about 1,400 m beyond the crossing with no injuries. The track sustained damage from the derailed wagon.

What the ATSB found

The ATSB found that the derailment was a result of the track buckling during the passage of train 9150. Instability in the track was the result of the rails creeping over time and bunching at the crossing, increasing their vulnerability to lateral misalignment in the hot conditions of that day.

It was found that the asset management systems used to identify problematic levels of rail creep (the longitudinal movement of rail over time) did not incorporate algorithms to flag creep that had accumulated over an extended period. There was a reliance on these systems by track maintenance staff, and in the absence of flags for the identification of cumulative creep, the potential for lateral instability at this location was not identified. General inspections did not provide an effective supplementary means of detecting the potential instability.

It was also found that creep management procedures did not ensure that creep defects were identified and managed in a timely manner and prior to the onset of hot weather.

What's been done as a result

V/Line has updated the network standard for the inspection and assessment of lateral stability. It has also included algorithms within the asset management system for the accurate assessment and generation of remediation work orders for cumulative creep, and to correct for fixed points within track, such as level crossings.

In addition, V/Line has amended its procedures to include a requirement to assess and correct rail creep prior to 1 November each year.

Safety message

Asset management systems that provide the primary triggers for rail creep management should consider all criteria that can affect the creep condition and ensure corrective action prior to the onset of extreme weather conditions.

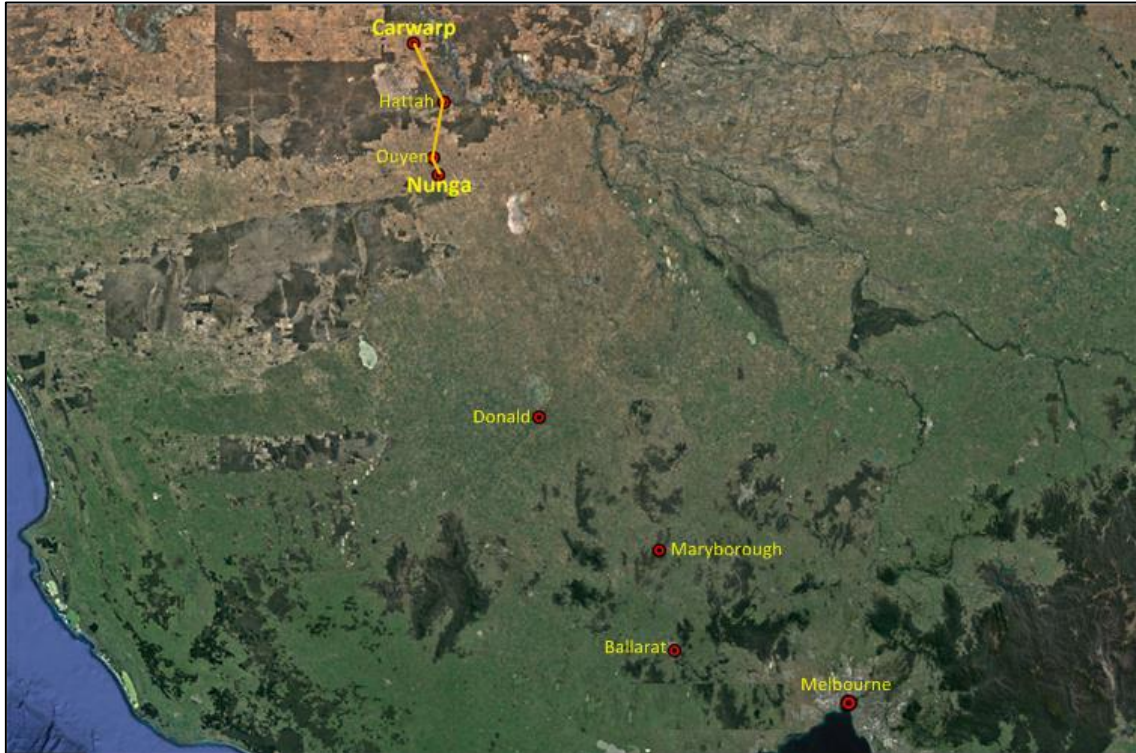
Contents

The occurrence	1
Context	3
Location	3
Track infrastructure	3
Lateral stability and the installation of jointed track	5
Inspection and other measures for managing lateral stability	6
Train	8
Similar occurrences	8
Safety analysis	10
Rail creep	10
Other track inspections	11
Timeframe for addressing identified creep	11
Track works	12
Track lateral instability	13
Findings	14
Contributing factors	14
Other factors that increased risk	14
Safety issues and actions	15
Rail creep	15
Other track inspections	16
Timeframe for addressing identified rail creep	17
Correcting rail creep for fixed points	18
General details	19
Occurrence details	19
Train details	19
Sources and submissions	20
Sources of information	20
Submissions	20
Australian Transport Safety Bureau	21
Purpose of safety investigations	21
Developing safety action	21

The occurrence

On 9 November 2015 at about 1205, train 9150 loaded with grain departed Carwarp in north-western Victoria destined for Kensington in Melbourne (Figure 1).

Figure 1: The route from Carwarp to Nunga and derailment location relative to Melbourne



Source: Google Earth annotated by Chief Investigator, Transport Safety (Vic)

The train proceeded to Hattah where it was held for about two hours and then to Ouyen where there was a crew change at about 1520. The train departed Ouyen at about 1525. The driver reported that after leaving Ouyen they conducted a successful ‘running test’ of the air brake.

The train was travelling at about 80 km/h as it approached the Janiels Road¹ level crossing in Nunga, about 8 km south of Ouyen. The crew did not observe anything unusual as they approached and passed over the crossing.

The train had almost cleared the crossing when, at about 1532, the trailing bogie of the last wagon derailed. Following the derailment, the track was observed to be laterally displaced just prior to the crossing (Figure 2).

The derailed wagon disturbed the continuity of the brake pipe, with a reported minor loss of air pressure. Alerted by this, the driver looked back and saw dust and ballast coming from the rear of the train. In response, he made a brake application and the train stopped about 1,400 m beyond the crossing (Figure 3).

¹ The level crossing accesses Dunkley Road.

Figure 2: Laterally displaced track just prior to the Janiels Road level crossing, looking in the train's direction of travel.



Source: V/Line annotated by Chief Investigator, Transport Safety (Vic)

Figure 3: The derailed trailing wagon and track damage



Source: Chief Investigator, Transport Safety (Vic)

Context

Location

Nunga is a sparsely populated area with a mostly flat landscape. The derailment occurred immediately north of the Janiels Road level crossing located 501.142 km² from Melbourne.

Weather

The forecast maximum temperature issued for the area was 35 °C. The maximum recorded temperature at Ouyen on the day of the derailment was 36.1 °C with 12.1 hours of sun, and it is probable that conditions at Nunga were similar.

Track infrastructure

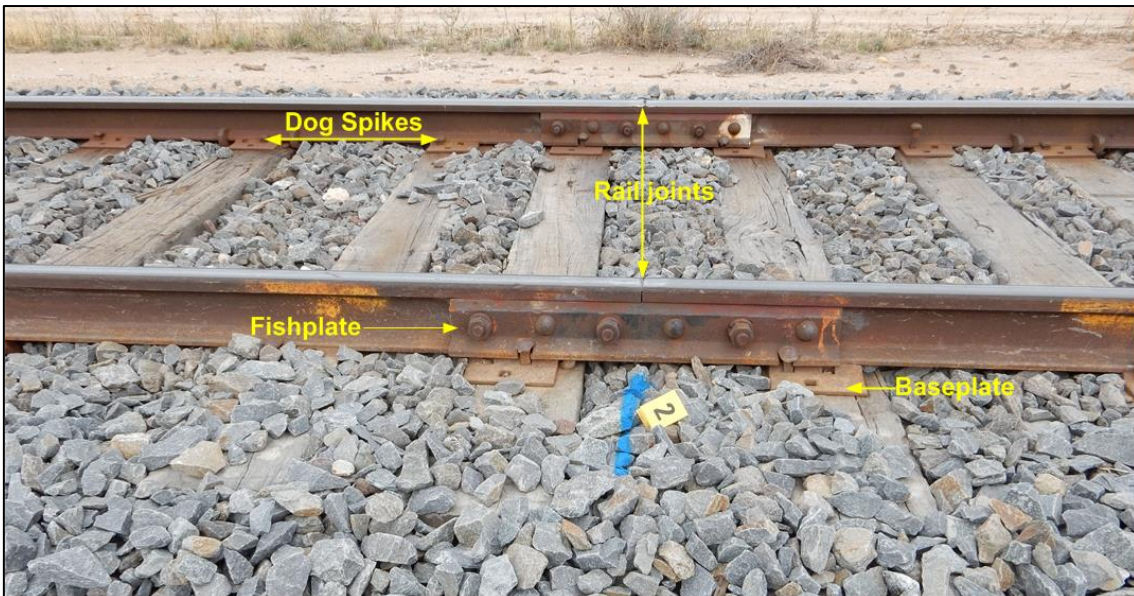
Classification and traffic

The regional rail network, that includes the section of track from Carwarp to Nunga, is managed by V/Line. The track was classified Class 3 meaning it could service freight traffic travelling up to 80 km/h. Freight trains generally travelled empty heading north, and returned loaded travelling south. Passenger traffic was not using this line.

Track construction

Approaching the level crossing, the track was tangent (straight) over flat terrain. It was constructed using 47 kg/m rails supported on base plates and fixed to timber sleepers by dog spikes. Rails were welded into lengths of about 82 m that were joined using fish-plated connections (Figure 4).

Figure 4: Typical track condition at Nunga showing joints, rail fixtures and ballast



Source: Chief Investigator, Transport Safety (Vic)

² Rail-kilometres from a reference point in Melbourne.

Site track inspection

On the morning after the derailment an inspection was conducted of about 400 m of track on the approach side (by train 9150) of the Janiels Road level crossing. The weather conditions were similar to the day of the derailment.

Sleepers were in fair condition and the ballast condition and shoulder profile was generally good. Mechanical joints on both rail legs were closed.

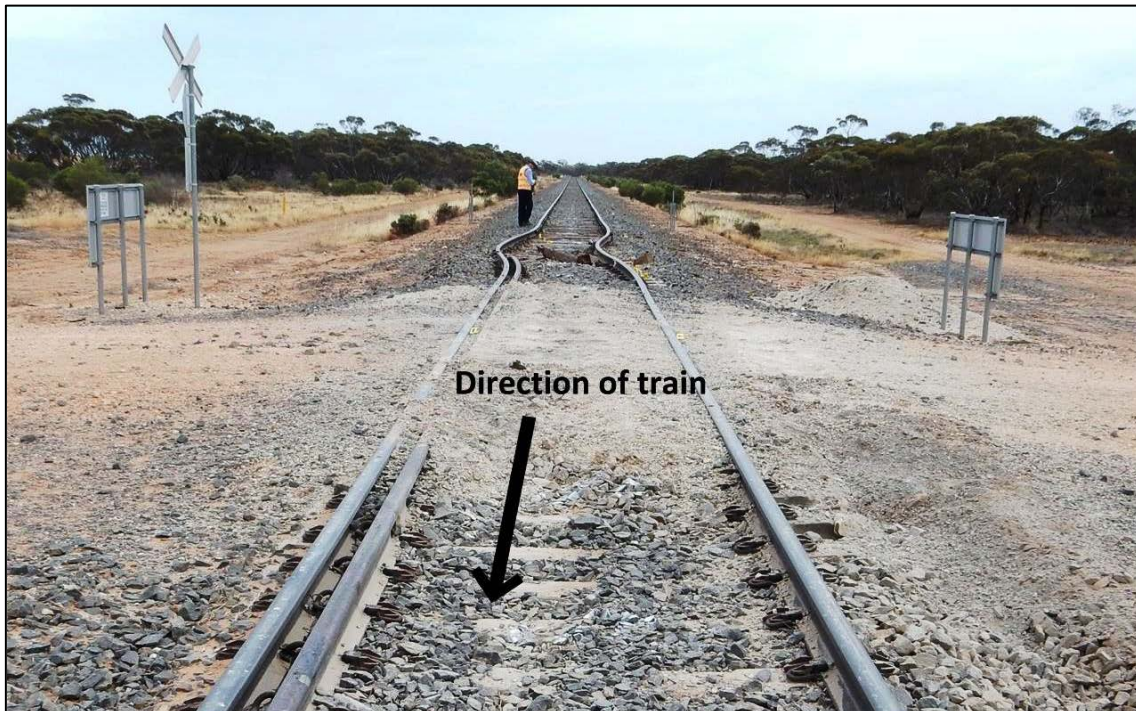
Recent track maintenance

The most recent works in the area were conducted in August 2015. Records indicated that tamping was conducted between 496 and 502.5 km on 23-24 August and ballast resurfacing from 28 August. The scope of these works did not include rail adjustment.³

Janiels Road level crossing

The Janiels Road level crossing was unsealed and consisted of a dual-gauge 11 m track panel that incorporated concrete sleepers supporting 47 kg/m rail affixed using resilient fasteners⁴ (Figure 5). Records indicate that the panel was installed in October 2008 as part of the Mildura Rail Corridor upgrade.⁵

Figure 5: Janiels Road level crossing, upgraded to dual-gauge rail configuration supported on concrete sleepers and affixed using resilient fasteners.



Source: Chief Investigator, Transport Safety (Vic)

³ Rail adjustment is the process of adding, removing or adjusting rail to reduce the risk of track fracturing or buckling at temperature extremes.

⁴ Pandrol fastclips and e-clips.

⁵ Upgrade works were conducted in the region during 2008-2009 and included:

- the installation of dual-gauge level crossing panels with concrete ties
- tie renewal
- mud spot removal
- ballast shoulder rehabilitation
- rail joint rehabilitation, welded and jointed
- track surfacing works
- rail stress and lateral stability management works.

Local operational conditions

There was no speed restriction on this section of track at the time of the derailment. This meant that the maximum permitted line speed for train 9150 was 80 km/h.

Lateral stability and the installation of jointed track

Jointed track

Jointed track made of 82 m welded lengths of rail has expansion gaps that provide a nominal range of 12 degrees in rail temperature in which the rail is stress free.

Construction

V/Line standard *NIST-2650 Use and Laying of Rail* specified procedures to ensure that rail stress remained within the prescribed limits at the extremes of rail temperature. For jointed 82 m lengths of rail, the network standard specified that the gap between rail ends should be fully open (11 mm) when laid at a rail temperature between 25-27 °C, and fully closed (rail ends butted together) when laid at a rail temperature between 37-38 °C. Gap requirements were specified for installation temperatures between these limits, and other procedures prescribed for temperatures outside the 25-38 °C range.

Correctly installed rails would therefore be effectively stress free within the working limits of the expansion gap at rail temperatures of between about 26 and 38 °C. At temperatures below about 26 °C, the contracted rails would be in tension, and at temperatures above 38 °C joints would be expected to be fully closed and the rails in compression.

The temperature range at which jointed rail is stress free can be affected by rail creep, the longitudinal movement of rail over time. Creep can result in rail bunching in some areas and being stretched in others. Bunching results in excess rail through a location, and the lowering of the stress free temperature range.

Rail stress in hot conditions

Rail temperatures in excess of 50 °C in the region are not uncommon. Rail temperatures can typically be 50 per cent more than ambient⁶ or higher, depending on several environmental factors including solar radiation. As a result, in hot weather rail temperatures will normally exceed 38 °C, the nominal upper limit of the stress free temperature range, resulting in rails being in a longitudinally compressed condition. Track stability then relies on rail fastenings and track supporting formations, including ballast, to resist the forces that induce rails to buckle (move laterally) when in compression.

Where there has been creep resulting in the bunching of rail, the rail will enter a state of longitudinal compression at a lower temperature to that intended at installation. The result is that in hot weather these compressive forces will be greater and lateral buckling forces on fixings and track support higher. The potential for the lateral misalignment of rail is therefore increased.

⁶ Wu Y., Munro P., Rasul M.G., Khan M.M.K., A review of Recent Developments in Rail Temperature Prediction for use in Buckling Studies, RTSA Conference on Railway Engineering, Wellington, 2010.

Inspection and other measures for managing lateral stability

Regimes

The condition of track to withstand hot weather is managed in a number of ways, including:

- general inspections
- the management of rail creep
- heat related speed restrictions (WOLO⁷) and heat patrols.

General inspections

Track inspection requirements and their frequencies are specified in V/Line procedures. For Class 3 track, V/Line procedures specified that track patrols should be conducted weekly. Track patrols could be conducted by road-rail vehicle or front-of-train and were expected to identify the following defects and conditions that may relate to lateral stability:

- lateral misalignments
- poor track geometry
- sharp or flat areas in curves
- track movement.

On this line, track patrol inspections were predominantly by road-rail vehicle.

The most recent track patrol through this location prior to the derailment was conducted by road-rail vehicle on 3 November 2015; no defects were identified.

For Class 3 track, V/Line procedures also specified annual walking inspections that included in their scope the following observable conditions related to lateral stability:

- longitudinal movement (creep) through fastener assemblies
- lateral movement of track and track geometry issues
- rail, weld or joint misalignment
- joints that were frozen or had incorrect gaps
- deficient ballast profile
- poorly consolidated ballast
- wet and/or contaminated ballast
- poor ballast quality
- pumping sleepers, or other signs of poor track support
- poor sleeper/fastening condition.

The most recent walking inspection was recorded as being conducted on 30 September 2015. This inspection did not identify any conditions at the derailment location requiring remedial action.

Management of rail creep

V/Line procedures defined creep as the longitudinal movement of rails in the track, caused by the action of traffic on the line. They described rail creep as typically occurring:

- on grades
- at location where trains brake
- in the direction of predominant track tonnage
- in track with poor condition sleepers, fasteners and anchors.

⁷ WOLO was a railway telegraph code to notify of heat-related restrictions, and continues to be used in the industry.

Rail creep changes the stress condition of the rails and therefore its management over time is a critical part of ensuring track stability. Creep that results in the bunching of rail at a particular location will result in higher compressive forces within the rail. These forces may become extreme in hot weather, and increase the potential for a rail to buckle. This is most likely to occur on the approaches to fixed points, like turnouts and level crossings, against which rail can bunch.

Creep is monitored using permanent trackside points called creep monuments that are typically 1 km apart. V/Line procedures required each creep measurement at each monument to be compared with the previous measurement and also to be assessed for long term accumulation since the creep point was last reset (Figure 6).

Figure 6: V/Line limits for rail creep

	Change in creep since previous measurement	Cumulative gain or loss of rail between adjacent monitoring points (extrapolated to 1000 m)
Priority 1 (C1 Defect)	50 mm or more	100 mm or more
Priority 2 (C2 Defect)	30 mm or more	50 mm or more

Source: V/Line network standard NIPR- 2708

The track maintenance group responsible for the section measured rail creep in the autumn and spring of each year. These measurements were recorded in a centralised asset management system and creep exceedance reports generated. These exceedance reports were then assigned to the section track supervisors for remediation.

The asset management system used by V/Line changed on 1 July 2015. Both the previous and new system had been tailored by V/Line to meet its business requirements. The rules for creep management were the same in each system. Both systems included algorithms for evaluating the ‘creep since previous measurement’ but neither evaluated cumulative creep. When transitioning from the old to new system, the previous two creep measurements (autumn 2015 and spring 2014) were transferred to the new database. Creep data prior to autumn 2014 was not transferred to the new system.

Additional heat-related controls

In hot weather the risk of rail misalignment is elevated. Additional controls to manage this risk took the form of reduced train speeds (WOLO) and heat patrols. For this section of line, WOLO precautions were implemented when temperatures were forecast to exceed 36 °C. This temperature was consistent with or lower than other Australian regional networks and was established in the context of the condition of the network and other network measures for controlling track lateral stability.

The WOLO train speed for this section of track was 65 km/h and generally applied between 1200 and 2000 unless otherwise specified. Notices could also be utilised to prohibit trains from operating.

The forecast temperature on 9 November 2015 was 35 °C and as a result, heat-related controls were not applied. The actual temperature was not significantly different to that forecast. The maximum temperature recorded at Ouyen was 36 °C and the maximum temperature reached at Nunga was likely similar.

Train

Crew

The train crew of two were both based at Maryborough and on this day were rostered to work Train 9150 from Ouyen to their home depot. Both were qualified for their respective duties and had met the medical requirements for their roles.

Consist

Train 9150 consisted of two locomotives, G548 and X44, and 20 grain hopper wagons coded either VHGF or VHHX with a total length of 340.228 m. The X class locomotive (116 t) was being hauled dead (shut down).

The total trailing mass was 1,576 t with 19 wagons loaded and one (the 12th) unloaded due to a defect with its discharge doors. Of the loaded wagons, five wagons were recorded as having a gross mass of 75 t and the remaining wagons being 76 t. The derailed wagon, VHHX 00712D, had a recorded gross mass of 75 t. All recorded wagon masses met the network load restriction requirements.

Post-derailment inspection of the derailed bogie found that, apart from consequential damage related to the derailment, the bogie was in good condition. There were no indications of bogie hunting (instability).

Train operation

The train was being operated at about 80 km/h, consistent with the permitted maximum speed for this section. There was nothing identified in the handling of train 9150 that may have contributed to the derailment.

Similar occurrences

The ATSB has investigated two other train derailments on the Mildura line that occurred in years 2014-2015.

RO-2014-003 – Derailment of grain train 9130 at Emu, Victoria on 12 February 2014

On 12 February 2014 at around 1400, 10 wagons of a loaded grain train travelling south from Birchip to North Geelong derailed at Emu in North Central Victoria. Emu is located about 223 km south of Nunga between Dunolly and St Arnaud. The derailment occurred on the approach to a set of trailable points at the Melbourne end of Emu Loop that was also a short distance from the Emu Road level crossing.

The ATSB investigation concluded that the derailment was the result of the lateral misalignment of the track that developed during the passage of the train in the hot conditions of that day. The points had provided a fixed point against which the rails bunched. It was found that V/Line's processes for responding to identified rail creep defects did not ensure remedial action before the onset of warmer seasonal conditions.

In response to the safety issue identified in the ATSB investigation, V/Line advised that it had completed its review and update of its track standard for the inspection and assessment of lateral stability and indicated that a plan for implementation of the standard would be completed by October 2016.

RO-2015-029 - Derailment of freight train 9156 at Ouyen, Victoria on 29 December 2015

On 29 December 2015 at around 1700, 12 wagons of a loaded grain train travelling south from Carwarp to Geelong derailed on the north (approach) side of the William Street level crossing in Ouyen. This derailment occurred about 8 km north of Nunga, was heat-related and the subject of an ATSB investigation.

Safety analysis

Based on available evidence, the ATSB concluded that the derailment originated at a lateral track misalignment (buckle) just north of the Janiels Road level crossing.

The following analysis is focused on the management of rail creep. Rolling stock and driver performance (train handling) were not factors that contributed to the derailment.

Rail creep

Rail is prone to creep in the direction of predominant traffic tonnage, bunching at fixed points such as level crossings and turnouts. This was the scenario present at the Janiels Road level crossing.

The nearest creep monument to the north of the Janiels Road level crossing (501.142 km) was at the 502 km post. The measured values of creep at this monument are shown at Figure 7, with a correction also included to account for the distance to the crossing fixed point.⁸

Figure 7: Creep measurements for monument at 502 km.

	Up (eastern) rail			Down (western) rail		
	Creep reading (mm)	Change since previous	Corrected for 1,000 m (mm)	Creep reading (mm)	Change since previous	Corrected for 1,000 m (mm)
2009 autumn ⁹	0	0	0	0	0	0
2009 spring	5	5	6	5	5	6
2010 autumn	-10	-15	-12	5	0	6
2010 spring	15	25	17	25	20	29
2011 autumn	15	0	17	50 (25) ¹⁰	25 ¹¹	58 (29)
2011 spring	35	20	41	65 (70)	40 ¹²	76 (82)
2012 autumn	33	-2	38	83 (86)	13 ¹³	97 (100)
2012 spring	30	-3	35	85	-1 ¹⁴	99
2013 autumn	50	20	58	95	10	111
2013 spring	45	-5	52	95	0	111
2014 autumn	45	0	52	100	5	116
2014 spring	50	5	58	110	10	128
2015 autumn	55	5	64	120	10	140
2015 spring	95	40	111	150	30	175

Source: Tabulation of V/Line supplied data

⁸ The V/Line standard prescribed that creep measurements be corrected to a nominal 1000 m rail length. For the 502 km, the distance to the level crossing (501.142) is 858 m, resulting in a correction to creep readings of 1000/858.

⁹ Creep was reset to zero in 2009 at the completion of major rail works.

¹⁰ Second readings are shown in brackets.

¹¹ Difference between 2010 spring and first reading in 2011 autumn.

¹² Difference between second reading 2011 autumn and first reading 2011 spring, identified in the system as a C2 defect.

¹³ Difference between second reading 2011 spring and first reading 2012 autumn. The system evaluated the difference between the second reading 2011 autumn and first reading 2012 autumn as 58 mm and flagged a C1 creep defect.

¹⁴ Difference between second reading 2012 autumn and the reading 2012 spring.

In the period from 2011 autumn to 2012 autumn, two creep defects were flagged in the Down rail. As a result and following the 2012 autumn measurements, 40 mm of rail was cut from the rail at the 502.05 km point. There is no record of how the rail was adjusted either side of this point to accommodate the removal of rail and the effect on the rail at Janiels Road is unknown.

By the spring of 2015, cumulative creep on both rails had significantly exceeded defect criteria. However, the system did not flag this exceedance to track supervisors. Neither the previous nor the new asset management systems included algorithms to identify and assess creep that had accumulated since the last creep reset. The asset management systems only compared creep measurements with the previous two readings. As a result, the slow but regular rail creep southward towards the Janiels Road level crossing was not identified for remedial action.

The 2015 spring measurement for the Up rail was sufficient to flag a C2 defect when compared to the previous two readings. However, this measurement had not been processed by the time the derailment occurred.

The system also did not correct the creep measurements to take account of the Janiels Road level crossing acting as a fixed point. Given that the monument was 858 m from the crossing, this correction would not have been significant in this instance. However, in other scenarios, this could result in significant underestimation of potential lateral instability at a fixed point.

Other track inspections

The scope of annual walking inspections included checking that joints were not frozen or had incorrect gaps. However, the consistent assessment of gaps requires inspection within a specific (and known) rail temperature range and it was unlikely that the annual walking inspection would provide a reliable assessment of rail stress condition. The most recent walking inspection through Nunga was undertaken on a warm day with a maximum temperature of about 34 °C. As a result, the rail joints were probably closed during that inspection.

There was no other inspection regime that might have consistently identified changes in rail stress condition at high risk locations. The network placed a high reliance on the asset management system to initiate closer inspection of track potentially affected by creep.

Timeframe for addressing identified creep

The 2015 spring creep measurement in the Up rail met the criteria of a priority 2 defect when compared to the 2015 autumn measurement. The spring creep measurement was made in the days leading up to 27 October 2015 and supplied to the asset management team prior to the procedural deadline of 30 October. Records indicated that this measurement was up-loaded into the asset management system after the derailment and a work order to assess the defect raised on 20 November 2015. The work order specified a 'latest completion date' of 29 December 2015 (60 days from 30 October) and under the Job Plan Details it was noted that 'The assessment must be undertaken within 60 days and in any case prior to 31 October in same year as inspection'. The work order deadlines were contradictory and the 31 October date unachievable given the deadline of 30 October for taking the creep measurements.

Due to lag in the system and the timeframes for completion of each phase, the requirement to complete creep measurements by 30 October meant that remedial action would extend into November and potentially December.

The processes used for responding to a creep defect included:

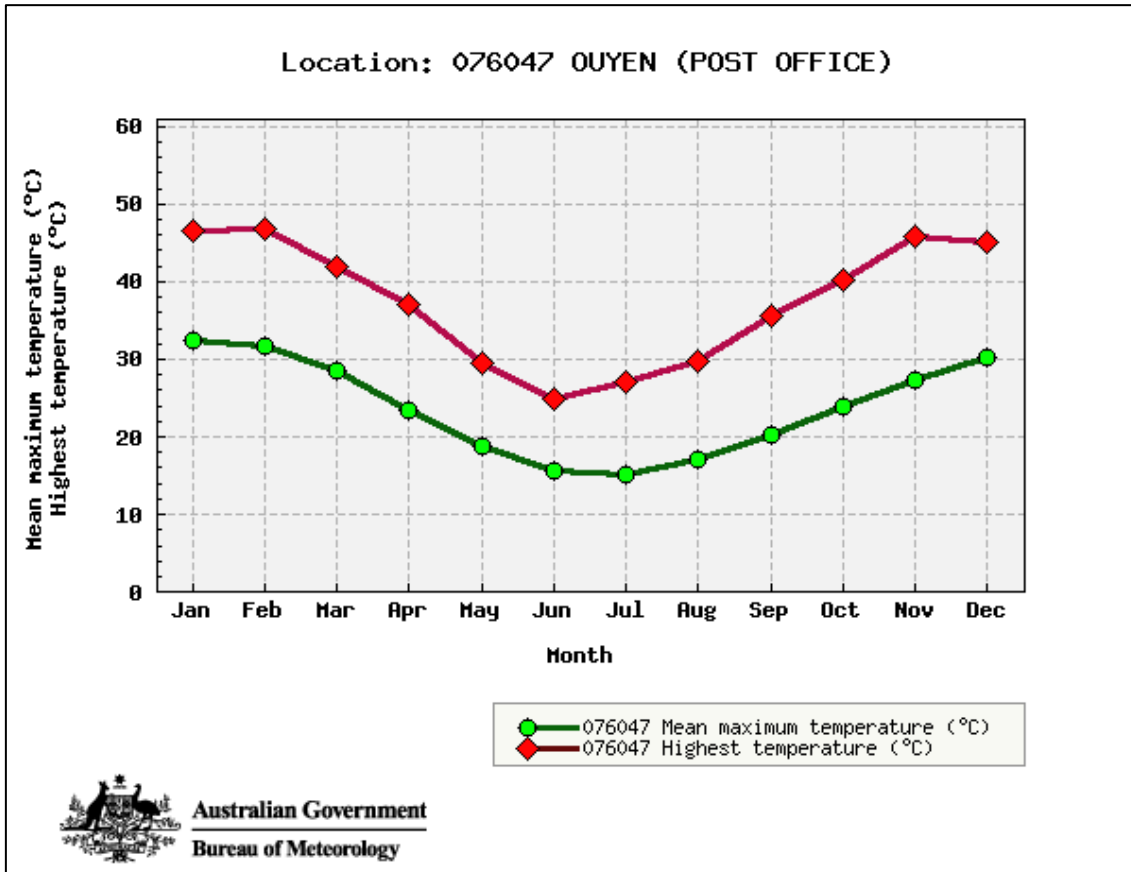
- checking the creep measurement for accuracy
- if the creep defect was confirmed, checking joints 1 km either side of the creep monument
- as required, releasing rail and making rail adjustments
- recording any rail adjustments and creep resets in the asset management system.

If the full process of creep measurement, assessment, and remedial action had been completed before the 9 November, the derailment would probably have been avoided.

Climate statistics for Ouyen indicate a mean maximum temperature (Figure 8, green graph) for November of 27.4 °C and a maximum recorded temperature (Figure 8, red graph) for November comparable with the summer months of December-February. This suggests that in this district creep related defects should be addressed prior to November.

The ATSB investigation into the derailment at Emu on 12 February 2014 raised the issue of timeliness of response to creep defects.

Figure 8: Climate statistics for Ouyen, showing mean maximum temperatures (green) and highest recorded temperatures (red) by month.



Source: Bureau of Meteorology

Track works

The track between 496 and 502.5 km underwent tamping and ballast resurfacing works in August 2015. This disturbance probably made the track more susceptible to creep. There was an acceleration in rail creep that year leading to the creep between 2015 autumn and 2015 spring (Figure 7) exceeding the C2 (priority 2) defect limit.

Track lateral instability

Rail creep over a long period had led to bunching of rails on the north side of the Janiels Road level crossing. While cumulative rail creep was excessive at the 502 km post, the movement between this post and the crossing was unlikely to have been uniform. It is probable that bunching was most severe closer to the fixed point, the level crossing. The concrete-sleepered dual-gauge panel installed in 2008 would have been a stronger anchor point than the previous timber installation.

The rail creep had led to joint gaps closing at lower temperatures reducing the rail stress free temperature and resulting in higher compressive forces in the rails in hot conditions.

In the ambient and solar conditions of the afternoon of the 9 November 2015, the rail temperature was probably in the mid-50s °C and the rails in a state of severe longitudinal compression. The track-train dynamics generated by the passage of 9150 at 80 km/h, in combination with this compression, resulted in lateral loads that could not be contained by the rail and track support, and the rails buckled.

Findings

From the evidence available, the following findings are made with respect to the derailment of train 9150 at Nunga, Victoria on 9 November 2015. 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

- Rail creep over a prolonged period resulted in the bunching of rail on the north side of Janiels Road level crossing. This rendered the rails vulnerable to lateral instability in the hot weather of 9 November 2015 and a lateral misalignment developed during the passage of train 9150.
- **Asset management systems that were used to identify problematic levels of rail creep did not evaluate nor assess cumulative creep. [Safety Issue]**
- **There was no supplementary system of inspection that was effective in identifying rail creep in jointed track. The network placed a high reliance on the asset management system to initiate closer inspection of track potentially affected by creep. [Safety Issue]**
- **The procedures for measuring, assessing and remediating rail creep in spring did not ensure creep defects were addressed in a timely manner and prior to the onset of hot weather. A creep defect identified by the spring measurements was not corrected before the derailment.[Safety Issue]**
- The track underwent works in August 2015 that probably made it more susceptible to creep.

Other factors that increased risk

- **Asset management systems used to identify problematic levels of rail creep did not correct for fixed points between creep monuments. [Safety Issue]**

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.

The initial public version of these safety issues and actions are repeated separately on the ATSB website to facilitate monitoring by interested parties. Where relevant the safety issues and actions will be updated on the ATSB website as information comes to hand.

Rail creep

Number:	RO-2015-022-SI-01
Issue owner:	V/Line Pty Ltd
Operation affected:	Rail: Infrastructure
Who it affects:	Managers of rail networks

Safety issue description:

Asset management systems that were used to identify problematic levels of rail creep did not evaluate nor assess cumulative creep.

Proactive safety action taken by V/Line Pty Ltd

Action number: RO-2015-022-NSA-037

V/Line advised that it has updated the network standard for the inspection and assessment of lateral stability to include rules for the assessment of cumulative rail creep. It has also applied those rules in algorithms within the asset management system for the accurate assessment and generation of remediation work orders for cumulative creep.

Creep history not included in the new asset management system is being separately considered together with field validations.

Current status of the safety issue

Issue status: Adequately addressed.

Justification: The proactive safety action taken addresses the monitoring of future cumulative creep. The assessment of older records together with field validations should identify latent cumulative creep.

Other track inspections

Number:	RO-2015-022-SI-02
Issue owner:	V/Line Pty Ltd
Operation affected:	Rail: Infrastructure
Who it affects:	Managers of rail networks

Safety issue description:

There was no supplementary system of inspection that was effective in identifying rail creep in jointed track. The network placed a high reliance on the asset management system to initiate closer inspection of track potentially affected by creep.

Proactive safety action taken by V/Line Pty Ltd

Action number: RO-2015-022-NSA-036

V/Line advised that the network standard for the inspection and assessment of lateral stability has been amended to provide specific guidance in respect of joint gap analysis to complement the measure of cumulative creep. Tables and instructions are provided within the standard to evaluate Stress Free Temperature (SFT) through joint gap assessment.

Current status of the safety issue

Issue status: Partially addressed.

Justification: The proactive safety action taken provides the methodology to be used to evaluate the stress condition of rail in instances where there is evidence of creep or incorrect stress. However, there is limited enhancement in the scope of inspection, and there continues to be a high level of reliance on asset management systems to identify rail creep in jointed track. The ATSB recognises that improvements have been made in the asset management systems, as described under safety issues RO-2015-022-SI-01 and RO-2015-022-SI-04.

Timeframe for addressing identified rail creep

Number:	RO-2015-022-SI-03
Issue owner:	V/Line Pty Ltd
Operation affected:	Rail: Infrastructure
Who it affects:	Managers of rail networks

Safety issue description:

The procedures for measuring, assessing, and remediating rail creep in spring did not ensure creep defects were addressed in a timely manner and prior to the onset of hot weather. A creep defect identified by the spring measurements was not corrected before the derailment.

Proactive safety action taken by V/Line Pty Ltd

Action number: RO-2015-022-NSA-038

V/Line advised that the network standard for the inspection and assessment of lateral stability has been amended to include the requirement to measure and correct Stress Free Temperature (SFT) prior to the onset of the summer period (1 November to 31 March), with additional controls for any loss of rail stress detected during the summer period. The Technical Maintenance Plan has been amended to ensure creep measurements are completed 3 weeks prior to the summer season, to permit sufficient time for creep condition assessment and stress free temperature testing and correction.

Current status of the safety issue

Issue status: Adequately addressed.

Justification: The proactive action taken should address the safety issue.

Correcting rail creep for fixed points

Number:	RO-2015-022-SI-04
Issue owner:	V/Line Pty Ltd
Operation affected:	Rail: Infrastructure
Who it affects:	Managers of rail networks

Safety issue description:

Asset management systems used to identify problematic levels of rail creep did not correct for fixed points between creep monuments.

Proactive safety action taken by V/Line Pty Ltd

Action number: RO-2015-022-NSA-039

V/Line advised that cumulative creep processes have been amended with specific analysis and response specified in the network standard (that includes correction for fixed points) and reflected in the asset management system. V/Line advised that fixed points have been identified and entered into the asset management system.

Current status of the safety issue

Issue status: Adequately addressed.

Justification: The proactive action taken should address the safety issue.

General details

Occurrence details

Date and time:	9 November 2015 – 1545 EDT	
Occurrence category:	Incident	
Primary occurrence type:	Derailment	
Location:	Nunga, near Ouyen, Victoria	
	Latitude: 35° 7.995' S	Longitude : 142° 21.369' E

Train details

Train operator:	Pacific National	
Registration:	Train 9150	
Type of operation:	Freight	
Persons on board:	Crew – 2	Passengers – nil
Injuries:	Crew – nil	Passengers – nil
Damage:	Minor	

Sources and submissions

Sources of information

- V/Line Pty Ltd
- Pacific National

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, Pacific National and the Locomotive Drivers.

Submissions were received from V/Line Pty Ltd. 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

Facebook [atsbgovau](https://www.facebook.com/atsbgovau)

Investigation

ATSB Transport Safety Report Rail Occurrence Investigation

Derailment of grain train 9150 Nunga, near Ouyen, Victoria on
9 November 2015

RO-2015-022

Final – 15 May 2017