Australian Government

Australian Transport Safety Bureau

Derailment of grain train 8838N

Narwonah, New South Wales, on 1 October 2017

ATSB Transport Safety Report

Rail Occurrence Investigation

RO-2017-014

Final – 26 May 2020

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Addendum

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Safety summary

What happened

On 1 October 2017, a Pacific National loaded grain train 8838N was travelling on the Australian Rail Track Corporation (ARTC) rail network from Nevertire to Manildra in north-western New South Wales. The train consisted of two locomotives and 23 wagons. The train was travelling south at Narwonah when 11 loaded grain wagons located at the rear of the consist derailed. An emergency brake application occurred due to the uncoupling, which brought the front portion of the train to a stand. There were no injuries but there was substantial damage to nine wagons and track infrastructure.

Derailed grain wagons

Source: OTSI

What the ATSB found

The ATSB found that the derailment occurred at a location with identified poor track condition around a rail joint on the down rail. This, and a short twist defect at the point of mount, contributed to the vertical unloading of wheels on the twelfth wagon in the consist (NGPF35911) and the subsequent derailment of that wagon and 10 trailing wagons.

Previously, there were track defects identified near the derailment site. The maintenance of defects in this section of track was not successful in preventing the defects from re-occurring. The train crew were operating the train at a speed of approximately 80 km/h; this was in excess of the 60 km/h specified by ARTC.

The measurement of three wagons, post-derailment, found that two of the three wagons were loaded in excess of the 81 t as recorded on the consist and that the grain was not loaded evenly in the three wagons.

What's been done as a result

Approximately 300 m of rail, fasteners and sleepers were replaced and 150 m of new formation was required around the derailment site. Thirteen 12-m track panels were constructed on site and lifted into place by cranes. The rail joints were welded and the track readjusted.

Changes have been made to the ARTC maintenance system to address systemic issues. ARTC have also commenced a work program titled ‘Asset Management Improvement Program’; this work focusses on improving the functionality of the Enterprise Asset Management System and its supporting business processes.

The rail infrastructure manager, in consultation with the rolling stock operator, reiterated the requirement for rolling stock to travel within the maximum speed as advertised in the relevant notices and to provide correct train manifest information.

Safety message

The incident highlights the importance of ensuring the track is free from any defects and that trains travel at or below the speed specified in the standards.

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The occurrence

What happened

On 1 October 2017, a two-person train crew signed on at the Pacific National Parkes depot at 0650,[1] the morning of the incident. They drove by car to Nevertire and relieved the train crew of 8838N. At the Nevertire siding, the locomotives were attached to the wagons. At 0920, 8838N departed Nevertire and proceeded towards Narromine. 8838N arrived at Narromine at 1025 and a run-around movement was conducted to reverse the locomotives to the opposite end of the train. This is normal practice for trains arriving from Nevertire and other locations on that line, and then proceeding towards Parkes.

Figure 1: Location map

This figure shows the path of 8838N from Nevertire to the location of the derailment at Narwonah and the intended path from Narwonah to Manildra.
Source: Geoscience Australia with annotations by ATSB

At 1055, the train departed Narromine and travelled approximately 20 km without incident. At 1123, in the section between Narwonah and Wyanga, at kilometrage 536.975,[2] the assistant driver noticed what he called a ‘kink’ in the track ahead as 8838N passed a 40 km/h speed warning board.[3] The train had partially travelled over the track irregularity when the driver noticed in his side mirror that there was dust coming from the rear of the train. A few seconds later, he saw derailed wagons (Figure 2).

1 The 24-hour clock is used in this report. Local time was Australian Eastern Daylight-saving Time.
2 NSW track kilometrage is measured from Central Station, Sydney.
3 This warning board was in place for a defect 2500 m ahead of the board.

Figure 2: Derailed wagons and grain spillage

Source: ATSB

At 1124, the driver of 8838N made a full emergency brake application and pressed the emergency button on the In-cab Communications Equipment (ICE) radio. This was to advise train control of the derailment. It is likely that due to uncoupling of the wagons, there was a loss of brake pipe pressure, which meant that an automatic emergency brake application had already commenced. A few minutes later, at 1126, the assistant driver called the Pacific National shift leader at Parkes to notify him of the derailment. The assistant driver then called the Pacific National integrated planning service.

At 1135, the driver secured the locomotive and joined the assistant driver in placing audible warning devices on the track to protect the front and rear of the train. Network control was advised that the audible warning devices had been placed on the track.

At 1145, the driver and the assistant driver inspected the derailment site and found the 12th to the 22nd wagon in the consist derailed. Nine wagons had derailed and were on their side and two wagons had derailed but remained upright. The last wagon, the 23rd wagon, did not derail.

The train crew were tested for drugs and alcohol following the derailment; all results were negative.

Context

Location

Narwonah is a rural location in north-western New South Wales, approximately 537 km by rail from Sydney. The incident occurred in a rural area bounded by farm paddocks on each side of the rail corridor (Figure 3).

Figure 3: View to derailment site

Source: ATSB

Environmental information

At 1130, on the day of the accident, the temperature was recorded by the Bureau of Meteorology at Dubbo as 19°C.[4] This temperature had increased from a low of 3°C shortly after 0700 that morning. Over the previous week, a number of days recorded temperatures in the mid-30s. Based on the temperature on the day of the incident and the previous days, it is not considered likely that any track defect was a result of high temperatures. There was no rainfall recorded in the previous 24-hour period and the previous week reported only trace amounts of rainfall.

Train crew

The train was operated by a crew of two: a driver and an assistant driver. Both had been driving with Pacific National since 2010 and were qualified and familiar with the route.

Train control

The ARTC managed the track where the derailment occurred, with the movement of rail traffic controlled by a network controller based at the ARTC Network Control Centre North at Broadmeadow in New South Wales.

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4 Bureau of Meteorology observations at Dubbo were taken from the Dubbo airport automatic weather station. Dubbo is approximately 37 km from Narwonah.

Safety actions implemented

ARTC have advised that, in response to this incident, the following safety actions have been implemented:

- All damaged infrastructure was removed and approximately 300 m of rail, fasteners and sleepers were replaced.
- Approximately 150 m of new formation was repaired prior to establishing the bottom ballast on the capping layer.
- Thirteen 12-m track panels were constructed on site and lifted into place by cranes.
- The rail joints were welded and the track re-adjusted throughout the derailment site.
- Included the cause ‘train over speed transporting heavier axle loads than permitted’ into the strategic risk of train derailment.
- Reviewed Route Access Condition Notices 190007, 190008 and 190009. As a result, an amendment was made to the infrastructure assessment (below rail) section of procedures.

The ARTC consulted with Pacific National regarding:

- The requirements for rolling stock to travel within the maximum speed as advertised within the relevant Route Access Condition notices.
- The requirement for the operator to provide ARTC with the correct train manifest information prior to entering the ARTC network.

Also, as part of their strategic plan, ARTC have introduced a number of changes, including:

- The introduction of a new role within the maintenance provisioning centres titled ‘Asset Assurance Engineer’. This engineering role specialises in the track and civil disciplines. Two key components of this role are:
  - To ensure that quality maintenance is undertaken on ARTC’s assets by maintaining a level of oversight of work performed; and
  - To utilise network condition, operational performance and reliability data to support decision-making and prioritisation for maintenance and project works.

These objectives are targeted at addressing systemic issues identified during the Narwonah derailment investigation by:

- Ensuring that defect rectification work is undertaken to an acceptable quality;
- Ensuring that inspection activities are thorough and network issues are captured within ARTC’s Enterprise Asset Management System for planning and future rectification; and
- Interrogating network data to identify where reoccurring issues are developing and request project work to rectify.

ARTC has also commenced a work program titled ‘Asset Management Improvement Program’; this work focusses on improving the functionality of ARTC’s Enterprise Asset Management System and it’s supporting business processes. One of the key components of this program is the introduction of a review meeting at the maintenance provisioning centres. Here maintenance personnel, work coordinators and asset assurance engineers discuss network issues that have been raised or rectified since the previous meeting. This will provide an additional level of assurance that the appropriate priority has been assigned to network issues awaiting repair. It will also ensure that the repair works are scheduled to take place accordingly, and provides a forum where the asset assurance engineer is able to review work documentation to ensure quality maintenance is undertaken.

ARTC has continued to invest funding in the Central and North West areas of New South Wales in activities such as steel and concrete re-sleepering and rail joint removal programs. These upgrades are intended to improve the condition of the Central and North West track assets, as well as reducing the educed the likelihood of such defects that contributed to this derailment.

Safety analysis

Introduction

The derailment initiated when train 8838N travelled over a section of track at 536.989 km at approximately 80 km/h. Track observations showed evidence of the rail pumping[5] and movement of sleepers around a rail joint at this location on the down rail. Approximately 14 m further along the track, a short twist[6] defect of 22 mm was also identified. This section of the report will examine the interaction between the track and the train that led to the derailment.

Track condition

This track was standard gauge (1435 mm), consisted of 47 kg/m long welded rail, and had a curve of 3567 m radius at the point of mount (536.975 km). It was a mixture of steel and timber sleepers. The sleeper pattern was predominantly an alternating pattern of one steel sleeper to one timber sleeper. Occasionally, two steel sleepers or two timber sleepers were inserted into the pattern. According to the ARTC usage and installation standard,[7] variation in sleeper pattern is permitted as long as the pattern is generally maintained. In this case the pattern was generally maintained.

The steel sleepers were in good condition and were connected to the rail with standard resilient fasteners. Steel sleepers have inspection holes which allow for a visual or physical check of the level of ballast within the sleeper pod.[8] Steel sleepers have a lower mass than timber or concrete sleepers and depend on ballast to provide vertical and lateral support. The tamping[9] of ballast within the hollow section underneath the sleeper is an important aspect of steel sleeper performance. If the ballast is not tamped correctly, the result can lead to an inadequately filled pod or an unevenly filled pod.

A visual inspection was conducted of steel sleeper inspection holes on 75 steel sleepers leading up to the derailment. The majority (82%) of inspection holes showed ballast close to the top of the hole. The depth of ballast inside the other 18% appeared to be more than the required 50 mm from the top of the hole. The investigation determined the amount of ballast in the sleeper pods was unlikely to have contributed to the derailment.

The condition of the timber sleepers in the vicinity of the derailment was fair to poor. The tracks were supported by baseplates which were affixed to the timber sleepers with dog spikes. Some spikes were loose or missing from the timber sleeper fastenings (Figure 4). The poor condition of the timber sleepers was likely to have contributed to track instability in this area.

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5 Pumping is a sleeper action where the sleeper moves vertically up and down as rail traffic passes over the sleeper. This movement often results in the degradation and contamination of the ballast structure.

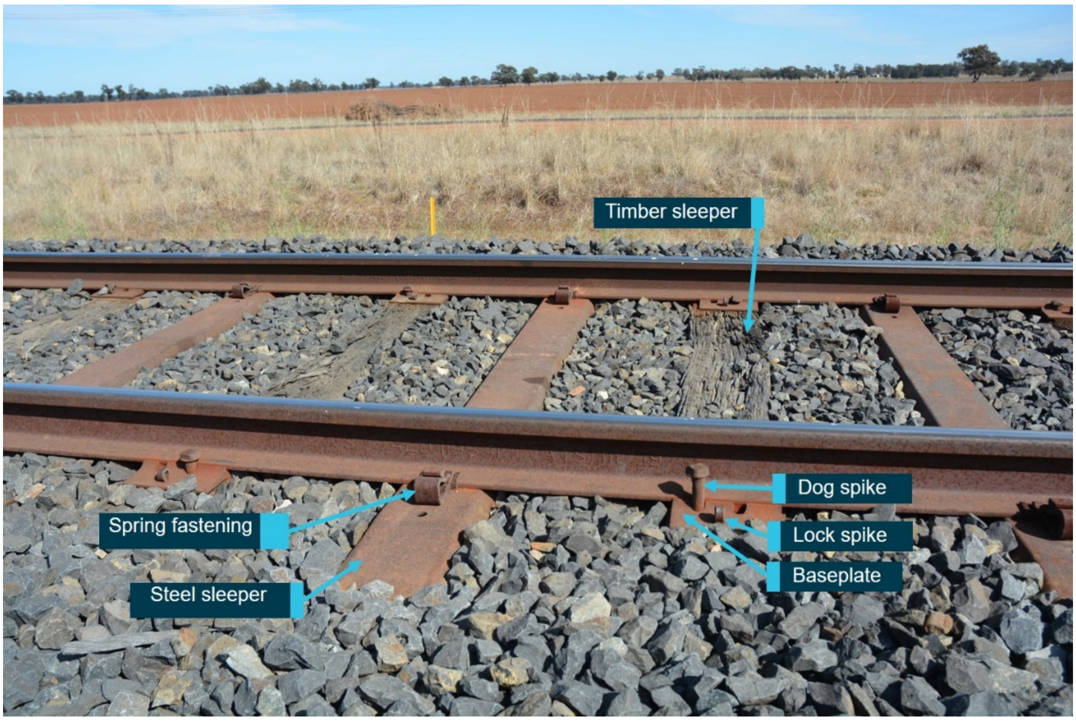
6 Variation in cross level when measured at different points along the track (usually every 2 m for a short twist and every 14 m for a long twist.)

7 ARTC Steel sleepers – Usage and installation standard ETC-02-03, version 1.0, 4 May 2015.

8 The space under a steel sleeper below the sleeper deck and between the side walls of the sleeper.

9 Tamping is the process by which ballast is packed in and around the sleepers of a track. In the case of tamping steel sleepers, the ballast is squeezed to lift it into the pod.

Figure 4: Track structure



This figure shows the track structure near the derailment at Narwonah.
Source: ATSB

The track was inspected and measured immediately following the derailment. The ATSB made the following observations at the rail joint on the down rail (536.989 km):

- Evidence of the down rail pumping vertically around the joint
- Movement of the timber sleepers around this joint
- Loose or missing dog and lock spikes
- Damage to the face of the joint
- A joint gap of approximately 20 mm.

An independent track inspector commissioned by Pacific National attended the site the day after the derailment. Post-derailment track measurements were taken using an 81-class locomotive representing an axle load of approximately 21 t. A summary of these measurements is shown in Appendix A.

This load testing revealed a short twist defect of 22 mm at the point of mount (536.975 km). At the rail joint on the down rail (536.989 km), the load testing also identified another short twist defect of 13 mm.

The derailment sequence likely commenced at the rail joint on the down rail. As the wheels on the rear bogie on the 14 th wagon traversed the rail joint, the wheels on the front bogie were approaching a 22 mm change in superelevation.[10] This likely caused the wagon (NGFP 35911 S) to roll and the left wheel on the lead axle of the leading bogie to unload. Wheel marks on the rail head showed that the flange of this wheel climbed the up rail and travelled on the top of the rail head for approximately 8 m and then dropped to the left side of the up rail. The opposite wheel dropped into the four foot[11] and the derailment of this wheelset precipitated the other ten wagons travelling behind to derail (Figure 5). The track defects, in the vicinity of this rail joint, likely contributed to the initiation of the derailment.

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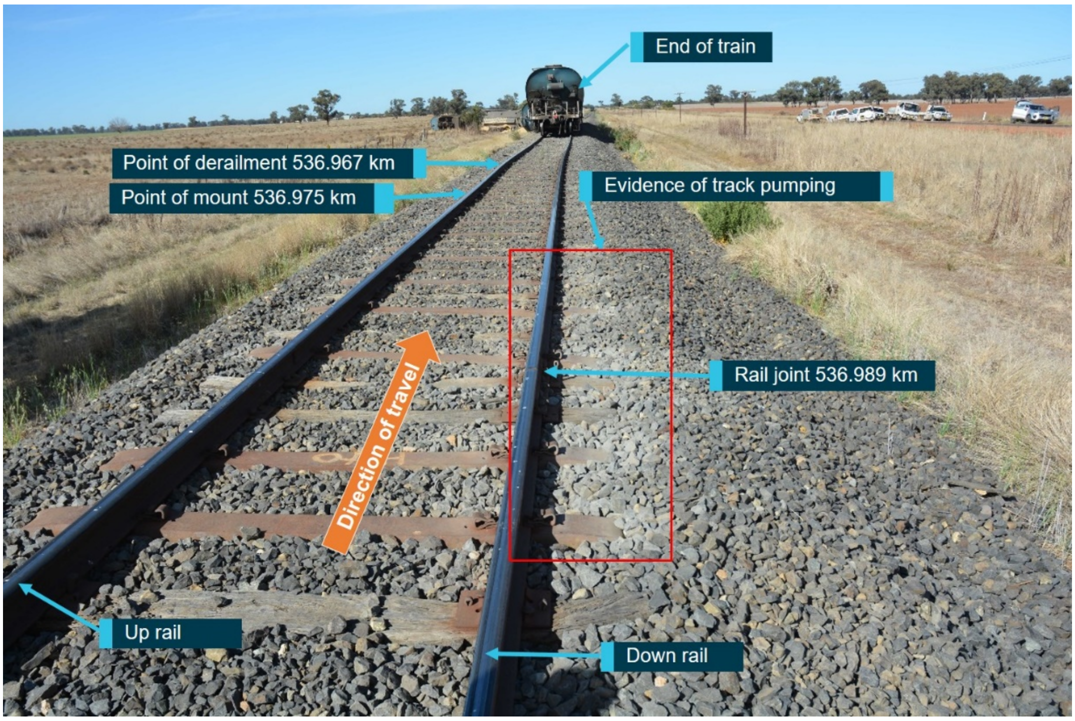
[10] Superelevation is the vertical distance that the outer rail is raised above the inner or grade rail.

[11] The four foot is the area between the rails of a standard gauge railway.

Figure 5: Derailment mechanism



This figure shows the expansion gap at the rail joint on the down rail at 536.989 km.
Source: ATSB

According to ARTC's code of practice,[12] short twists for the freight speed band of 60 km/h require a P1 maintenance response. The code of practice requires the track be inspected within 24 hours and repaired within 7 days. This action was taken.

According to the ARTC standard,[13] a gap at a rail joint should be between 0 mm to 12 mm at a neutral temperature between 25°C to 35°C. A measurement taken on the afternoon of the derailment, with the temperature at approximately 19°C, showed a gap of approximately 20 mm on the down rail joint at 536.989 km (Figure 6). The ARTC Track and Civil response code for this measurement specifies an A7 response which is defined as a routine inspection.[14]

Historical inspection records and track measurements were also provided by ARTC. The track had previously been inspected by an ARTC AK track geometry recording car and ultrasonic inspection vehicles; this took place on 6 September 2017, 22 days before the derailment. This electronic inspection revealed the presence of an 18 mm twist defect next to the rail joint on the down rail, and 11 m from the point of mount. This track geometry defect was notified to the track maintenance team who repaired the defect, with localised tamping, on the 7 September 2017.

ARTC track maintenance teams also patrol and inspect the track regularly to detect and repair defects. An ARTC track maintenance team had patrolled this section of track on 26 September 2017 and a track stability inspection was conducted on 28 September 2017. Both the track patrol and the track inspection recorded no defects in the section of track around the derailment.

The detailed track geometry inspection and the track patrols were conducted in accordance with ARTC's Civil Technical Maintenance Plan ETE-00-03.

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[12] ARTC *Track and Civil Code of Practice Response Booklet ETW-00-01*. Version 1.1 issued 21 April 2015.

[13] ARTC *Standard ETM-06-09 welded track stability analysis*. Version 1.0 issued 22 March 2017.

[14] This means it is subject to the normal scheduled inspection of 42 days with a 20% latitude.

Figure 6: Rail joint

This figure shows the expansion gap at the rail joint on the down rail at 536.989 km.
Source: ATSB

Train information

The train involved in the incident was Pacific National freight service 8838N. The train consisted of 2 locomotives and 23 wagons, with a total mass of 1852 t. The total length of the train was 371 m. The two 81-class locomotives were positioned at the front of the train (locomotive 8132 and 8110) (Figure 7). Each locomotive had a total mass of approximately 129 t. Of the 23 grain hopper wagons, seven were NGKF-type with 16 wagons NGPF wagons (Figure 8).

Figure 7: 81-class locomotive at front of train 8838N

Source: ATSB

Figure 8: NGPF wagon

Source: ATSB

The wagons were inspected following the derailment. Apart from the damage sustained as a result of the derailment, the wagons, bogies and wheels were in good condition. The wheel rims of the first wagon to derail (NGPF 35911) were checked on site and no defects were observed. Wheel rim thickness, wheel tread and flange height were all within specification.

The dataloggers on both locomotives (8132 and 8110) were taken by the ATSB for examination. They were of the Hasler-type tape-recording device. They record the following parameters: time, speed, distance, power/idle for the brake handle position, vigilance, and brake pipe pressure.

The time trace on locomotive 8110 was not recorded. Minor alignment adjustments were required to correctly align the various traces for analysis. Wheel diameters were corrected to the diameters as measured on 3 October 2017. According to the recordings from the lead locomotive during the journey from Narromine, 8838N had a recorded maximum speed of 86 km/h. A speed of 82 km/h was recorded immediately prior to the brake pipe pressure dropping. Two seconds later, the power was reduced to idle. The brake pipe pressure began to drop 572 m before the train came to a stop.

According to the ARTC, notices are issued to operators on the network. These notices may advertise temporary or permanent changes to the standard. A Route Access Condition Notice issued on 27 April 2017 stated that operation of rollingstock to a maximum axle load of 21 t should travel at a maximum speed of 60 km/h between Dubbo and Goobang Junction.[15] The train 8838N was travelling above the specified speed for the axle loading of the wagons.

In relation to the speed of a train and the effect on a derailment. The Railcorp derailment handbook highlights that:

> The effect of speed in the presence of a track irregularity is to increase the impact forces between wheel and rail, and increase the instability of a vehicle excited by the track defect. Every vehicle has a natural rhythm or frequency for each of its normal movements (roll, pitch, bounce and yaw). The vehicle responds when the track condition disturbs or excites the vehicle. The vehicle will respond

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[15] TOC waiver Reference number 17046, *Six month extension of trail operation of 21 tal wagons at 60 km/h on Central and North West Routes.* Issued 27 April 2017, in force until 31 October 2017.

> most when the exciting rhythm matches the vehicle's natural frequency. Speed and load limits are set to match what the track structure can sustain.[16]

The train 8838N was travelling at 82 km/h immediately before the derailment, where the specified speed for this axle loading was 60 km/h. It is likely that this increased the risk of derailment. Also, if other wagons had travelled frequently over this track at increased speeds, this may have led to a more rapid deterioration of the track.

Following the derailment, the last three wagons were weighed on site by an independent contractor using a calibrated device. These three wagons had remained upright following the derailment. The axle loads and total weight for each wagons are shown below in Table 1.

Table 1: Static axle weights for last three wagons of 8838N

WAGON	AXLE D	AXLE C	AXLE B	AXLE A	TOTAL
NGPF35997	20.09 t	20.09 t	21.68 t	21.88 t	83.74 t
NGPF35941	19.48 t	19.58 t	21.32 t	21.88 t	82.26
NGPF36034	19.27 t	19.58 t	20.09 t	20.14 t	79.08

Source: ARTC

The actual weight for two of the three wagons was found to be higher than the recorded consist mass of 81 t (Appendix B). The consist shows wagon NGPF35997 as having a weight of 81 t while its actual measurement was 83.74 t. Wagon NGPF35941 was also over the recorded consist weight by one tonne, while NGPF36034 was approximately two tonnes under the consist weight. Variation between the wagon mass and the mass recorded on the train consist has been an issue in past rail investigations.[17] As this was only a sample of three wagons, it is unknown if the other wagons had an issue with wagons being loaded more than the consist.

The measured weight of the last three wagons has a weight disparity between axles, from a minimum of 19.27 t to a maximum of 21.88 t. This axle loading was in excess of the 70 km/h speed requirement of the ARTC Route Access Standards. This constituted a difference of more than 2.5 t, indicating a possibility of uneven loading of the grain into the wagons or of the load shifting as a result of the derailment forces. As only three of the 23 wagons in the consist were weighed, it could not be determined if the other wagons had any uneven loading. A rail derailment handbook states that:

> Improperly distributed loading or eccentric loading creates unbalanced forces which, when combined with the dynamic forces of a moving train can cause derailment.[18]

Wagon loading imbalance, lateral or longitudinal, may be expressed as a percentage and too much of an imbalance can increase the risk of derailment. It has been found that: 'longitudinal imbalance may also cause derailment. The bogie under the lighter end of the vehicle is more likely to derail when subjected to normal train action or cross level and profile irregularities than a bogie under a balanced load… an imbalance of 15% has been found to be the threshold of instability.'[19]

Calculations of the longitudinal loading imbalance of the last three wagons was approximately 4%. This level of imbalance is well below the threshold where it would be considered likely a contributory factor to a derailment.

According to the train consist, the gross mass of the wagons ranged from 81 t to 79.50 t. The sample of three wagons weighed following the derailment showed that the recorded weights on

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16 RailCorp Engineering Manual, *Derailment Investigation – Track and Rolling Stock, TMC* 213 V 1.0, Issued June 2011. p.94.

17 ATSB report RO-2017-001: *Runaway of grain train 8960 Dombarton to Unanderra, NSW*.

18 Queensland Rail course notes*, Derailment Cause Analysis* version 2.4, August 2006. p.103.

19 Rail Industry Safety and Standards Board *Derailment Investigation and Analysis Guideline* version 1.1, 27 November 2014. p.134.

the consist was inaccurate. The recorded weights were based on an estimate made by the load operator when loading the grain at the GrainCorp loading point at Nevertire.

Findings

From the evidence available, the following findings are made with respect to the derailment of grain train 8838N at Narwonah, New South Wales on 1 October 2017. 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

- The poor track condition around the rail joint on the down rail (536.989 km) and the short twist defect at the point of mount (536.978 km) contributed to the vertical unloading of wheels on the twelfth wagon in the consist (NGPF35911) and the subsequent derailment of that wagon and 10 other wagons of train 8838N.
- **There were track defects identified in the vicinity of the derailment site prior to the derailment. The maintenance of defects in this section of track was not successful in preventing the defects from re-occurring. [Safety issue]**
- The train crew were operating the train at a speed of approximately 80 km/h; this was in excess of the 60 km/h specified by ARTC.

Other factors that increased risk

- A post-derailment static measurement on the last three wagons revealed that the two of the three wagons were loaded in excess of the 81 t as recorded on the consist. One wagon, NGPF 35941, weighed 82.26 t and another wagon, NGPF 35997, weighed 83.74 t. It is possible that other wagons on train 8838N were also loaded in excess of the weight recorded on the consist.
- There was a difference in measured axle loads on the last three wagons on train 8838N. These post-derailment measurements indicate that the grain was not loaded evenly in the wagons. It is possible that other wagons on the train were also unevenly loaded, however the load shifting may have been a result of the derailment forces.
- There was no calibrated equipment to measure the weight of the commodity transferred to the wagons at the loading terminal at Nevertire. There was no other wayside point to determine the actual weight of the wagons. This means there was the potential to have overloaded wagons operating on the network.

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 [aviation, marine, rail - as applicable] industry, the ATSB may issue safety recommendations or safety advisory notices as part of the final report.

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.

The initial public version of these safety issues and actions are provided 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.

Track maintenance

Safety issue number:	RO-2017-014-SI-01
Safety issue owner:	ARTC
Operation affected:	Rail infrastructure
Who it affects:	All rail operators operating on ARTC track

Safety issue description

There were track defects identified in the vicinity of the derailment site prior to the derailment. The maintenance of defects in this section of track was not successful in preventing the defects from re-occurring.

Proactive safety action

Action number: RO-2017-014-NSA-013

ARTC have advised that they have included the cause ‘train over speed transporting heavier axle loads than permitted’ into the strategic risk of train derailment.

ARTC have also reviewed Route Access Condition Notices 190007, 190008 and 190009. As a result, an amendment was made to the infrastructure assessment (below rail) section of procedures which added the requirement that:

> ‘The proposer for the change, shall assign the management responsibility for assessing the impact on track degradation and maintenance requirements under the influence of increased axle loads.’

The change was published on the ARTC homepage under *Route Access Standards Amendments* and the documents re-issued on 22 February 2019.

The ARTC consulted with Pacific National regarding:

- The requirements for rolling stock to travel within the maximum speed as advertised within the relevant Route Access Condition notices.

- The requirement for the operator to provide ARTC with the correct train manifest information prior to entering the ARTC network.

Also, as part of their strategic plan, ARTC have introduced a number of changes, including:

- The introduction of a new role within the maintenance provisioning centres titled 'Asset Assurance Engineer'. This engineering role specialises in the track and civil disciplines. Two key components of this role are:
  - To ensure that quality maintenance is undertaken on ARTCs assets by maintaining a level of oversight of work performed; and
  - To utilise network condition, operational performance and reliability data to support decision making and prioritisation for maintenance and project works.

These objectives are targeted at addressing systemic issues identified during the Narwonah derailment investigation by:

- Ensuring that defect rectification work is undertaken to an acceptable quality;
- Ensuring that inspection activities are thorough and network issues are captured within ARTCs Enterprise Asset Management System for planning and future rectification; and
- Interrogating network data to identify where reoccurring issues are developing and request project work to rectify.

ARTC has also commenced a work program titled 'Asset Management Improvement Program'; this work focusses on improving the functionality of ARTC's Enterprise Asset Management System and it's supporting business processes. One of the key components of this program is the introduction of a review meeting at the maintenance provisioning centres. Here maintenance personnel, work coordinators and asset assurance engineers discuss network issues that have been raised or rectified since the previous meeting. This will provide an additional level of assurance that the appropriate priority has been assigned to network issues awaiting repair. It will also ensure that the repair works are scheduled to take place accordingly, and provides a forum where the asset assurance engineer is able to review work documentation to ensure quality maintenance is undertaken.

ARTC has continued to invest funding in the Central and North West areas of New South Wales in activities such as steel and concrete re-sleepering and rail joint removal programs. These upgrades have improved the condition of the Central and North West track assets, as well as reducing the occurrence of such defects that contributed to this derailment.

Status of the safety issue

Issue status: Closed

Justification: The safety action addresses the issue at the location of the derailment and changes have been made to address maintenance issues on a more systemic level.

General details

Occurrence details

Date and time:	1 October 2017 – 1130 AEST	
Occurrence category:	Accident	
Primary occurrence type:	Derailment	
Location:	Narwonah, New South Wales	
	Latitude: 32º 23.53' S	Longitude: 148º 9.12' E

Train details

Train operator:	Pacific National	
Registration:	8838N	
Type of operation:	Freight – a wheat service consisting of 2 locomotives and 23 wagons	
Departure:	Narromine	
Destination:	Manildra	
Persons on board:	Crew – 2	Passengers – 0
Injuries:	Crew – 0	Passengers – 0
Damage:	Substantial	

Sources and submissions

Sources of information

The sources of information during the investigation included:

- ARTC
- Pacific National
- Office of National Rail Safety Regulator.

References

ARTC Route Access Standard (RAS I5).

ARTC Standard ETM-06-09 welded track stability analysis. Version 1.0 issued 22 March 2017.

ARTC Steel sleepers – Usage and installation standard ETC-02-03, version 1.0, 4 May 2015.

ARTC Track and Civil Code of Practice Response Booklet ETW-00-01. Version 1.1 issued 21 April 2015.

ARTC TOC Waiver 17046 Six month extension to 21-TAL wagons at 60 km/h on Central and North West Routes. Issued 27 April 2017.

ATSB report RO-2017-001: Runaway of grain train 8960, Dombarton to Unanderra, NSW on 22 April 2017.

Office of the National Rail Safety Investigator, *Incident Field Report Derailment Narwonah 1 Oct 2019*, Doc. ID. A805760. 8 November 2017.

Pacific National and Opus Rail, Derailment Track Inspection Parkes – Narromine branch line, 30 October 2017.

Queensland Rail course notes*, Derailment Cause Analysis* version 2.4, August 2006.

RailCorp Engineering Manual, Derailment Investigation – Track and Rolling Stock, TMC 213 V 1.0, Issued June 2011.

Rail Industry Safety and Standards Board – *Glossary of Railway Terminology*, Version 1.0, 3 December 2010.

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 the ARTC, Pacific National, the Office of National Rail Safety Regulator and Transport for New South Wales. Submissions were received from the ARTC, Pacific National and the Office of National Rail Safety Regulator. The submissions were reviewed and, where considered appropriate, the text of the report was amended accordingly.

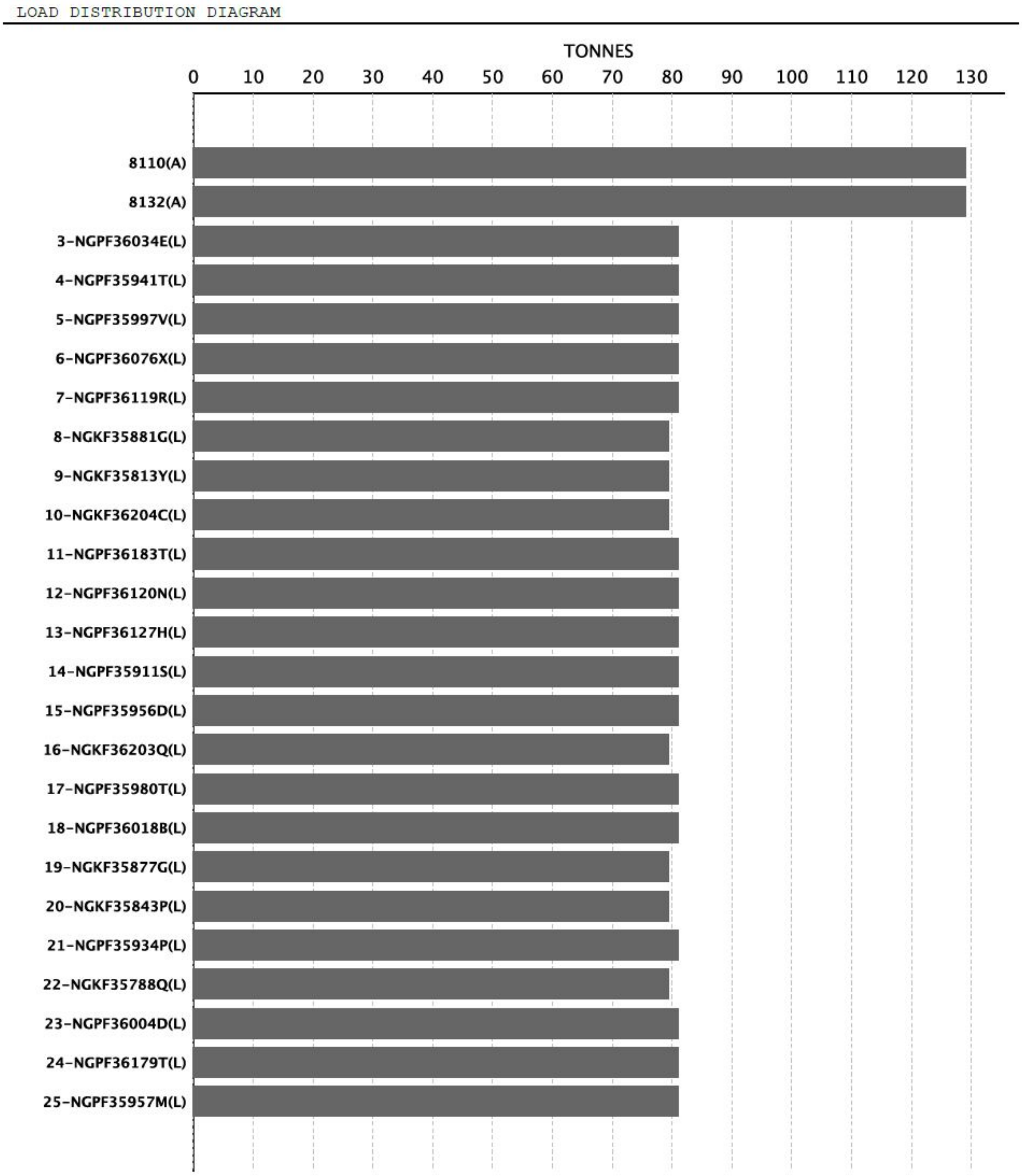
Appendices

Appendix A – Post-derailment track measurements

Location (km)	Gauge (mm)	Super (mm)	Depress up rail (mm)	Depress down rail (mm)	Effective super (mm)	2m twist (mm)	2m twist defect category	14 m twist (mm)	14m twist defect category
537.000	1437	17	3	9.5	23.5	-2	N	N	N
536.998	1436	17	9	5.5	13.5	10	N	N	N
536.996	1434	21	5.5	2	17.5	-4	N	N	N
536.994	1435	28	8.5	5	24.5	-7	N	3.5	N
536.992	1434	30	7.5	4	26.5	-2	N	9	N
536.990 (down rail joint)	1434	36	4	8	40	-13.5	N	21	N
536.988	1429	50	8	11.5	53.5	-13.5	N	32	N
536.986	1436	46	8.5	6	43.5	10	N	20	N
536.984	1437	38	4	6	40	3.5	N	26.6	N
536.982	1435	33	6	13	40	0	N	22.5	N
536.980	1436	26	6.5	16	35.5	4.5	N	11	N
536.978 (POM)	1437	11	8.5	11	13.5	22	P1	-13	N
536.976	1436	11	5.5	2	7.5	6	N	-32.5	N
536.974	1433	10	3.5	3.5	10	-2.5	N	-43.5	P2
536.972	1435	12	6	7.5	13.5	-3.5	N	-30	N
536.970	1435	15	6.5	6	14.5	-1	N	-25.5	N
536.968 (POD)	1434	15	3	6	18	-3.5	N	-22	N
536.966	1434	15	3	3.5	15.5	2.5	N	-20	N
536.964	1430	13	9	12	16	-0.5	N	2.5	N
536.962	1423	13	5.5	5.5	13	3	N	5.5	N
536.960	1422	14	11.5	9.5	12	1	N	2	N
536.958	1423	12	7	9	14	-2	N	0.5	N

Note: these measurements were taken using the static load of a locomotive.

Appendix B – Load diagram 8838N



Australian Transport Safety Bureau

The 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 the ATSB's 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.

Terminology used in this report

Occurrence: accident or incident.

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

Contributing factor: a factor that, had it not occurred or existed at the time of an occurrence, then either:

(a) the occurrence would probably not have occurred; or

(b) the adverse consequences associated with the occurrence would probably not have occurred or have been as serious, or

(c) another contributing factor would probably not have occurred or existed.

Other factors that increased risk: a safety factor identified during an occurrence investigation, which did not meet the definition of contributing factor but was still considered to be important to communicate in an investigation report in the interest of improved transport safety.

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