Australian Government
Australian Transport Safety Bureau

Derailment of freight train 6CM3

Junee, New South Wales, on 7 June 2019

ATSB Transport Safety Report
Rail Occurrence Investigation
RO-2019-011
Final – 12 June 2020

This investigation was conducted under the *Transport Safety Investigation Act 2003* (Commonwealth) by the Office of Transport Safety Investigations (NSW) on behalf of the Australian Transport Safety Bureau in accordance with the Collaboration Agreement.

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Addendum

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Safety summary

What happened

On 7 June 2019, Pacific National (PN) were operating freight train 6CM3 between Griffith, New South Wales and Appleton Dock, Victoria.

The train arrived at the Junee Down Platform for a scheduled driver change. The relieved train crew performed a roll-by inspection when the train departed at 2159. During the roll-by inspection, the relieved train crew detected the 40th and 41st wagons had derailed and contacted the driver by radio to stop.

The derailment blocked the Olympic Highway level crossing at Junee and disrupted freight and passenger services. The Down Platform road required repairs and was unfit for use until 10 June 2019.

What the ATSB found

The ATSB found that the 40th and 41st wagons derailed at a broken rail near 119A points. The broken rail allowed wheels from 6CM3 to derail, damaging the wagons and infrastructure.

It was found that rails forming turnouts between main lines were not being ultrasonically tested following a change in maintenance practices. A likely detectable rail defect went undetected with the rail breaking in two places on two different occasions.

The crew performing the roll-by inspection detected the derailed wagons preventing the escalation of this occurrence.

What's been done as a result

The Australian Rail Track Corporation identified rails forming turnouts that were not previously subjected to ultrasonically testing and included these in the asset management register. Scheduled testing of these identified assets has been included in the ultrasonic testing contractor’s annual testing program.

Safety message

Rail infrastructure managers should ensure that inspection techniques effectively monitor and report on asset condition. Risk controls should also be continuously assessed to control risk to an acceptable level through the life cycle of the asset, in particular, when changes are made to inspection regimes.

The occurrence

What happened

On 7 June 2019, Pacific National (PN) were operating freight train 6CM3 between Griffith, New South Wales and Appleton Dock, Victoria.

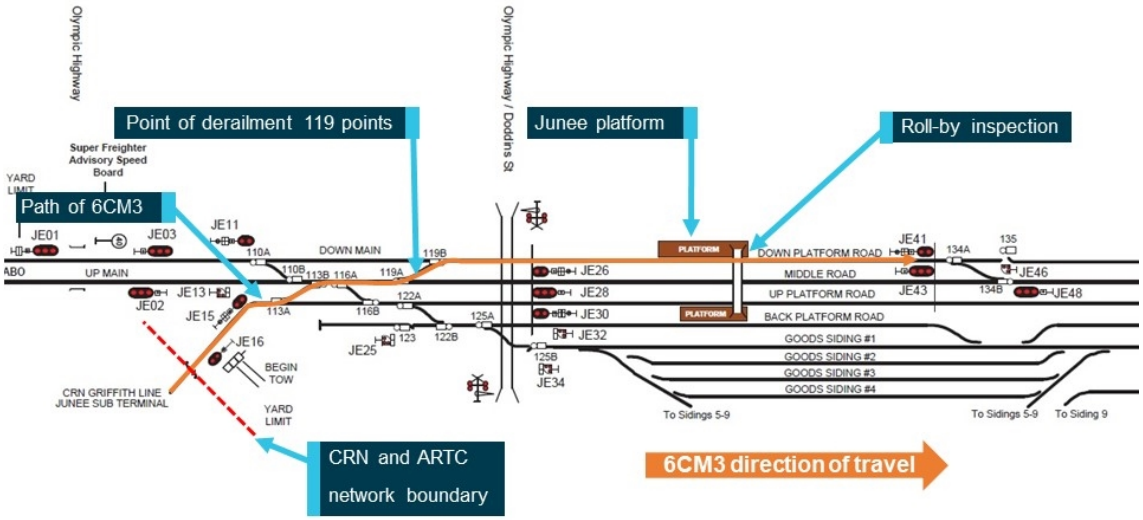
Train 6CM3 operated between Griffith and Junee on the Country Regional Network (CRN)[1], arriving at the boundary of the CRN and Australian Rail Track Corporation (ARTC) network at approximately 2147.[2]

The train crossed from the CRN network through 113 and 119 points in the Down[3] direction, arriving at the Junee platform at 2154 for a crew change. At 2159, the train departed in the Down direction with the relieved crew performing a roll-by inspection[4] from the platform. During the roll-by inspection, the crew detected the train had derailed and contacted the driver by radio to stop the train (Figure 1).

The ARTC network control centre south was advised of the incident, and safeworking protection was applied to protect the site. Inspection of the derailment site identified that the 40th and 41st wagons had derailed. The two wagons had run in a derailed state from near 119 points at 485.348 km[5] to alongside the platform at 485.688 km (Figure 2).

The derailment blocked the Olympic Highway level crossing at Junee and disrupted freight and passenger services on the Main South Line.[6] The Down Platform road required repairs and was unfit for use until 10 June 2019.

Figure 1: Junee network diagram



The path of train 6CM3 is shown in orange and depicts the train crossing from the Country Regional Network to the Australian Rail Track Corporation network by crossing points 113 and 119.
Source: Australian Rail Track Corporation, modified and annotated by OTSI

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1 The Country Regional Network is operated and managed by John Holland Rail as the rail infrastructure manager (RIM).

2 Times shown in 24 hour time as Australian Eastern Standard Time (AEST).

3 The Down track refers to the direction of travel for trains heading away from Sydney, the Up track refers to trains heading towards Sydney.

4 Roll-by inspections are a visual inspection of moving rail traffic to identify equipment, loading security or other defects or failure.

5 The kilometre distance is measured from Platform 1, Central Station, Sydney, New South Wales.

6 The Main South Line is a rail line that runs from Sydney to Melbourne and is used to transport freight and passengers between the two locations. ARTC manages the Main South Line from Macarthur on the outskirts of Sydney to Melbourne.

Figure 2: Derailment site

Source: Australian Rail Track Corporation and Pacific National, annotated by OTSI

Safety analysis

The rail was found to be broken in two places in the closure rail[7] between 119A and 119B points at 485.348 km (Figure 3). The two rail breaks showed different failure characteristics indicating the likely failure sequence (Figure 4):

- Break one exhibited signs of oxidation across the full face of the rail, end batter[8] and some worn areas on the fracture face. A small section of the rail head showed signs of fatigue cracking that likely initiated from rolling contact fatigue (RCF)[9] at the gauge face. The smooth areas of the fracture face indicate wear between the two faces as a result of vertical displacement of the broken rail.
- Break two exhibited light oxidation at a fatigue crack that likely initiated from RCF. The remainder of the fracture face showed signs of a brittle overload fracture, with no visible oxidation.

Oxidation across the full fracture face of break one indicated it had occurred sometime before break two. The weight of the wagons passing over the broken rail likely created a bending moment,[10] causing increased stress in the rail head. The increased stress likely led to the progression of the fatigue crack (break two). While train 6CM3 was crossing through points 119A, the rail likely broke (break two) with sudden brittle fracture.

There was deformation and evidence of flange marks (point of mount) at break two, with witness marks to the point of drop approximately 4.5 m from the point of mount. A total of eight wheels derailed on the 40th and 41st wagons, although the first wheel to derail could not be established.

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7 Closure rail - a rail located between switch and crossing components of the turnout.

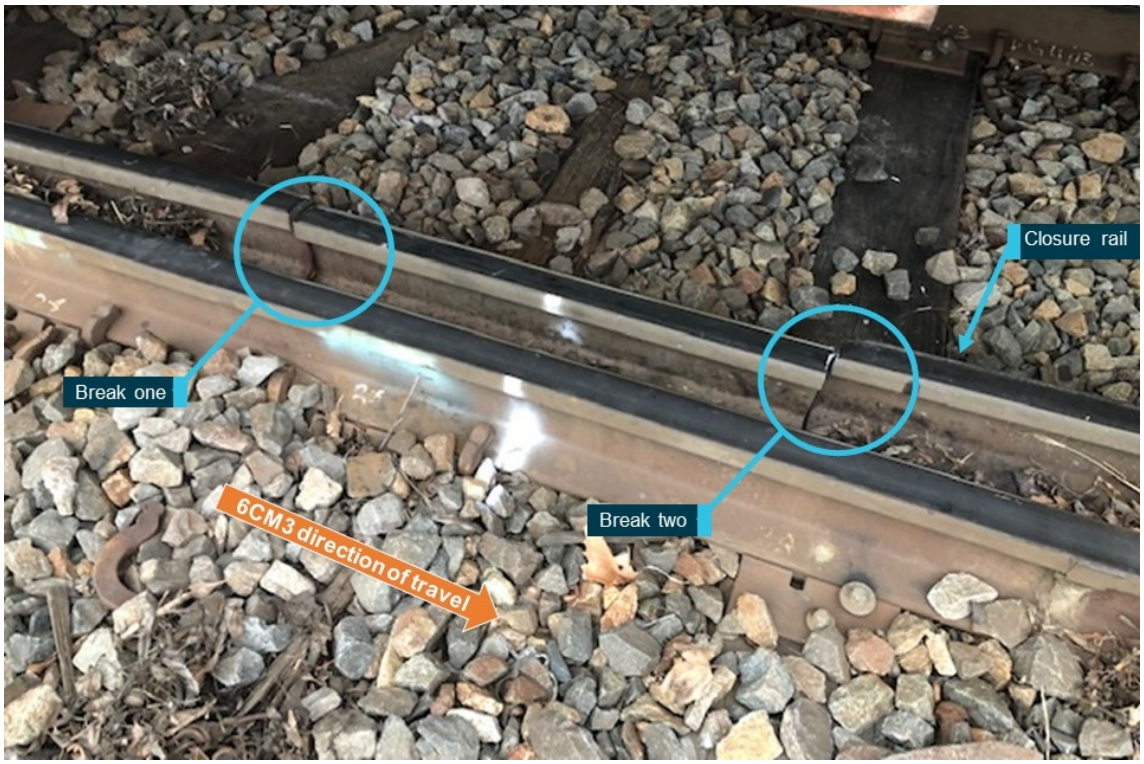
8 End batter - a permanent plastic deformation of a rail end at a joint or break resulting from wheel impacts due to a discontinuity (gap) in the running surface.

9 Rolling contact fatigue – a fatigue crack that initiates due to the development of excessive shear stresses at the wheel and rail contact interface.

10 Bending moment – a reaction induced when an external force (wagons) is applied and causes an object to bend.

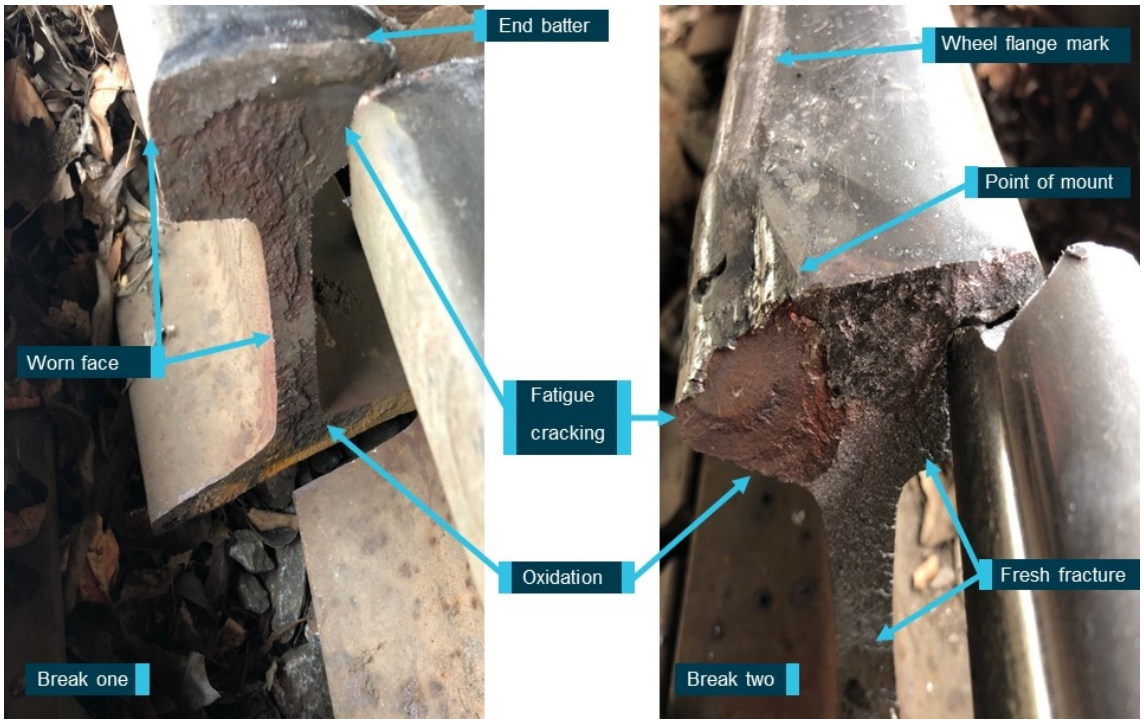
The roll-by inspection detected the derailment within approximately 340 m, preventing further damage to infrastructure. This train could have continued to operate in a derailed state had it not been detected. The condition and operation of train 6CM3 was unlikely to have increased the risk of derailment with the wheels derailing at the broken rail.

Figure 3: Broken rail segment



Source: Pacific National, annotated by OTSI

Figure 4: Broken rail analysis



Source: Australian Rail Track Corporation, annotated by OTSI

The track at Junee is subjected to routine inspection and testing in accordance with ARTC maintenance standards, including visual and ultrasonic rail defect testing. The most recent maintenance inspections completed for points 119A were:

- 24 January 2019 – Detailed visual inspection of points.
- 10 April 2019 – Manual detailed ultrasonic testing of turnout.
- 3 June 2019 – Track patrol visual inspection.

Maintenance records indicated that there were no known faults with points 119A prior to the derailment. It is very likely that the rail was visibly broken (break one) at the time of the track patrol[11] performed on 3 June 2019 but the break was not detected. Track patrols provide a level of assurance but are limited to large or obvious defects. It is also likely the manual detailed ultrasonic testing of turnout inspection completed on 10 April 2019 did not test the closure rail at the location of the break.

In 2017, ARTC changed the requirements for ultrasonic rail testing of turnouts in New South Wales (NSW). This change aligned the testing with other interstate areas where testing was conducted using continuous ultrasonic testing vehicles. Prior to this, in NSW, all rails in turnouts were subjected to 6-monthy manual hand-held ultrasonic testing.

It was found that at the time of the derailment, rails within turnouts between main lines were not being tested by ultrasonic testing vehicles. There were also no specific requirements in the ultrasonic testing contract for the testing of turnouts between main lines.

At the time of implementing the change to the inspection requirements, the change management process did not detect the loss of the risk control associated with ultrasonic testing of turnouts. Additionally, following the change in 2017, it was unclear which areas of turnouts continuous ultrasonic testing could test and which areas needed manual hand-held ultrasonic testing.

Findings

These findings should not be read as apportioning blame or liability to any particular organisation or individual.

- The derailment of two wagons of train 6CM3 occurred due to a broken rail at 119 points. It is likely detectable fatigue cracks were not identified before the rail broke as the rail was not ultrasonically tested.
- ARTC maintenance practices did not ensure that rails forming turnouts between main lines were ultrasonically tested as part of scheduled testing.
- ARTC's change management process did not identify the loss of a risk control (ultrasonic testing) at the time of changing the requirements for ultrasonic rail testing in turnouts within NSW.
- A roll-by inspection detected the derailed wagons preventing further damage.

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.

Australian Rail Track Corporation

As a result of this occurrence, the rail infrastructure manager has advised the ATSB that they are taking the following safety actions:

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[11] Track patrols are a visual inspection typically performed from a road-rail vehicle or on foot of various elements within the rail corridor (rail, sleepers, points and crossings).

Asset maintenance

Turnouts between main lines not previously subjected to continuous ultrasonic testing have been identified and included in ARTC's maintenance asset register. Ultrasonic testing of turnouts not tested previously has been completed. The ultrasonic testing contractor has included these identified assets in the annual testing program.

Maintenance standard *ETE-01-03 Non-Destructive Testing of Rail (for Internal & Surface Defects)* is currently under review.

General details

Occurrence details

Date and time:	7 June 2019 – 2200 AEST	
Occurrence category:	Incident	
Primary occurrence type:	Derailment	
Location:	Junee, New South Wales	
	Latitude: 34º 52.202' S	Longitude: 147º 35.031' E

Train details

Train operator:	Pacific National	
Registration:	6CM3	
Type of operation:	Freight	
Departure:	Griffith, New South Wales	
Destination:	Appleton Dock, Victoria	
Injuries:	Crew – Nil	Passengers – N/A
Damage:	Substantial	

About the ATSB

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.

About this report

Decisions regarding whether to conduct an investigation, and the scope of an investigation, are based on many factors, including the level of safety benefit likely to be obtained from an investigation. For this occurrence, a limited-scope, fact-gathering investigation was conducted in order to produce a short summary report, and allow for greater industry awareness of potential safety issues and possible safety actions.