

Derailment of coal train TM94

Moss Vale, New South Wales, on 28 June 2019



ATSB Transport Safety Report Rail Occurrence Investigation RO-2019-013 Final – 24 November 2020 Cover photo: Office of Transport Safety Investigations (OTSI)

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

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

Publishing information

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Addendum

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Safety summary

What happened

In the early hours of 28 June 2019, a fully loaded coal train TM94, travelling in New South Wales from Tahmoor colliery to Port Kembla, derailed one wheelset near Moss Vale. The train crew, initially unaware of the derailment, were notified by train control to stop and inspect the train. A member of the public, who had witnessed a problem with the train, had phoned train control to alert them of an issue. Once the train was stopped, a train crew member discovered that one wheelset on the trailing bogie of the 14th wagon had derailed. The derailed wheelset had travelled approximately 2.6 km past the point of derailment at 150.067 km. This caused damage to the track infrastructure, including approximately 4,350 concrete sleepers.

What the ATSB found

The ATSB investigation found that the derailment was caused by a through-axle failure, on a 7E5S-type axle. The axle failure occurred at the start of a radius transition, approximately 250 mm from the left-hand end of the axle. The fracture of the axle in the No. 1 wheelset led the No. 2 wheelset on the same bogie to derail.

A metallurgical analysis conducted after the derailment found that the axle had corrosion pitting on the axle surface adjacent to the likely fracture initiation point. The fracture surface featured a discoloured area of corrosion, which extended 16 mm into the axle cross section. This was evidence of a crack which existed prior to the final complete brittle failure of the remaining axle section.

An examination of maintenance records found that non-destructive testing had not been carried out on this wheelset during the last two maintenance activities in January and November 2016. Testing, if conducted, would likely have detected the initiation of the axle crack, which probably existed at that time.

What's been done as a result

As a result of this derailment, Pacific National commenced and completed a program of nondestructive testing of axles, in-situ, to ensure that no axles pose an immediate risk of failure. This included all 7E5S axles and involved ultrasonic testing.

A Rolling Stock Notice was also issued, to reinforce to Pacific National's wheel set overhaul contractors of the requirement to inspect and test the fillet radius for all axles where bearing removal is mandated.

Safety message

Rolling stock operators and maintainers should ensure that axle maintenance and inspection procedures include non-destructive testing of known defect areas as part of the regular maintenance program. Records of these inspections should be kept for the life of the asset within their asset management system.

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The occurrence

What happened

On 27 June 2019, at 1730,¹ a Pacific National train crew signed on at the Illawarra Bulk Terminal, Port Kembla, New South Wales to operate an empty coal train, TM93, to the Tahmoor colliery. The train arrived at the colliery at 2133 without incident, and the 45 wagons were loaded with coal.

At 2258, the train (now designated as TM94), operated by the same four-person train crew, departed Tahmoor colliery to return to the Illawarra Bulk Terminal at Port Kembla (Figure 1).



Source: Geoscience Australia, annotated by OTSI

TM94 operated normally as it travelled in the Down² direction on the Main South line towards Moss Vale.

The following morning, on 28 June 2019, at 0025, there was an emergency brake application caused by a vigilance penalty³ in the rear locomotive. TM94 stopped for a short time in the Mittagong to Burradoo section while a reset occurred. The train resumed the journey, passing through Berrima at 0036. At 0041, TM94 was travelling at 21 km/h, and accelerating gradually as it crossed onto the North Fork. The track speed for this section of track is 60 km/h. There were no additional speed restrictions in place at the time. The driver sounded the locomotive's horn as the train approached the Suttor Rd active level crossing at Moss Vale (Figure 2).

¹ The 24-hour clock is used in this report. Local time was Australian Eastern Standard Time (AEST): Coordinated Universal Time (UTC) + 10 hours.

² Up lines typically carry train movements towards Sydney, Down lines away from Sydney. (Note: TM94 was travelling in the Down direction on the Main South from Tahmoor to Moss Vale. After the train diverted off the Main South and entered the North Fork at Moss Vale the designated direction changed to the Up direction towards Unanderra.)

³ A vigilance penalty occurs when there is a lack of input by the train crew into the locomotive's vigilance device for a predetermined period.



Figure 2: Track configuration at derailment location

Source: ARTC, annotated by OTSI

At 0041, the 14th wagon in the train's consist (NHSH 42774Q) passed the 128A catchpoints, and the L1 axle journal separated from the rest of the axle. This created unloading of the R2 wheel, which resulted in the R2 wheel climbing the Down rail and the L2 wheel moving into the four foot⁴ and derailing. The train continued with the broken axle and the No. 2 wheelset derailed, there was no loss of brake pipe pressure. Approximately 80 m past the point of derailment, at 150.067 km, the axle box and suspension elements were found later on the Up side of the track (Figure 3).

⁴ The four foot is the area between the rails of a standard gauge railway.



Figure 3: Parts found on Up side of track near derailment location

Source: OTSI

At 0042, the front of train TM94 passed the Suttor Road crossing. A member of the public, a railway enthusiast, was at the level crossing filming the passing coal train. The member of public identified that there was a problem with the train from the sound and sparks coming from a wheelset, and phoned Network Control Centre South at Junee to inform them of the problem.

At 0044, the area controller at Junee called the train crew of TM94 and said that an issue had been reported. They requested that the train crew stop and check the train.

At 0046, the front driver brought TM94 to a stand at 147.550 km. The second driver from the front locomotive then left the cabin and inspected the train. They found the train had derailed one wheelset (R2/L2) of the 14th wagon in the consist (Figure 4 and 5). A short time later, the driver reported to Junee network control details of the derailment. The train crew were instructed to wait on site and at 0309, they were tested for drugs and alcohol. The results of these tests were negative.

Following the derailment, investigators from ARTC, OTSI and Pacific National attended the site. On-site evidence identified the location of the derailment at 150.152 km. The likely point of dropoff was identified from a mark on the Up Rail gauge face and the start of sleeper damage. The track sustained damage beyond this point for approximately 2.6 km. Following the incident, 4,350 concrete sleepers were replaced. The 128B turnout had damage to multiple areas, which required repair and replacement. There was also damage to the concrete pad at the Suttor Road level crossing (Figure 6). The significant damage to the concrete pad at the level crossing was almost entirely on the Down side, having been caused by the L2 wheel. The R2 wheel caused minimal damage to the concrete pad.



Figure 4: NHSH wagon diagram

Source: Pacific National, annotated by OTSI

Figure 5: DCA bogie on TM94



Source: OTSI



Figure 6: Level crossing damage

Source: OTSI

Context

Track information

The derailment occurred on the North Fork, which is a short section of curved track, approximately 336 m long. It joins the Main South line with the Moss Vale to Unanderra branch line. TM94 was travelling in the Down direction on the Down Main before it crossed to the North Fork, through the Suttor Road level crossing, and onto the single track bi-directional Moss Vale to Unanderra line.

This standard gauge railway line provides a direct route linking Wollongong and Port Kembla to the Main South line. It carries freight services (intermodal, coal and grain) and occasionally passenger services. The route includes a long steep descent when travelling in the Down direction.

The track at the derailment location was maintained by the Australian Rail Track Corporation (ARTC) and consisted of 53 kg/m rail. The sleepers on the approach to the derailment site were mostly concrete sleepers fastened with resilient clips. There were wooden sleepers with sleeper plates and dog fastenings supporting the points in the immediate area around the 128A catchpoints and stockrail.

Post-accident inspection of the track recorded the following track information:

- Sleepers were mostly concrete and with timber sleepers through the points.
- The rail profile was worn but within limits.
- Ballast was in good condition.
- Drainage was fair.
- Track gauge measured 1435 mm to 1457 mm.
- The 1457 mm-wide gauge was measured at the switch tip with 5-10 mm rail play.
- Track twist at the point of derailment did not exceed 19 mm as measured over 14 m.
- A left-hand curve existed from the main line onto the North Fork.⁵

All track at the site was within ARTC maintenance standards and met the requirements of ARTC class 1 track.

Train control information

Train movements on the Main South line from Goulburn to Moss Vale, and then between Moss Vale and Unanderra, at 91.080 km, are controlled from the ARTC Network Control Centre South at Junee. This is done under network rule ANSY 500 *Rail Vehicle Detection System*.

Train crew information

The four-person crew had two crew members located in the leading locomotive and two crew members in the trailing locomotive. Radio communication was maintained between the crew to coordinate actions. The train crew were appropriately qualified and held the required route qualifications. All members of the train crew said the train was operating as expected until Network Control Centre South at Junee notified them of the derailment.

Train information

Train TM94 was a coal service operated by Pacific National. This push/pull train was powered by three 82-class locomotives, consisting of one leading locomotive (8238) and two propelling locomotives (8209 and 8225) (Figure 7).

⁵ Lycopodium (2019) Derailment data capture Moss Vale 28 June 2019.

The train was 822 m in length and the gross mass was 4896 t. There were 45 loaded coal wagons in the consist, 36 were NHSH-type wagons and remaining nine were NHJF-type wagons (Figure 8). The train complied with all applicable operating standards regarding rolling stock and marshalling of wagons.



Figure 7: Two locomotives at rear of train TM94

Source: OTSI

Figure 8: Wagon (NHSH42774Q) with derailed wheelset



Source: OTSI

The wagon, which had the broken axle, was an NHSH-type wagon. Built by EPT Pty Ltd in 1983, these stainless steel-bodied coal hoppers have three large longitudinal bottom discharge doors. These wagons have a length of 16.7 m, a tare mass of 23.8 t and a gross mass of 100 t. The wagon was approved to operate at this mass as confirmed by the track owner's documentation. Initially single wagons, they were converted to operate as 3-pack sets with a permanent solid drawbar between wagons and an automatic coupler at both ends of the set. This wagon, NHSH42774Q, was the middle wagon in the 3-pack.

This wagon class was fitted from new with DCA-type rigid-framed bogies located at each end of the NHSH wagon. These bogies were formed by welded box sections and have a variably damped primary suspension. Each bogie has two wheelsets. The wheelset was made up of a solid axle, a wheel disc (920 mm diameter) pressed onto the axle, and an E-class package unit bearing at each end of the axle.

The failed axle was identified as 831444, it was a 7E5S-type axle. This axle was manufactured in 1983 and since 2002, has only been fitted to NHSH coal wagons. It was fitted to wagon NHSH42774Q in April 2018. The wheels were changed on this axle in November 2010 during a wheelset maintenance activity.

Environmental information

The overnight minimum temperature at Moss Vale on 28 June 2019 was 7.2°C, as recorded at a nearby weather station. The maximum temperature recorded that day was 15°C. There was a trace amount of rainfall recorded (0.2 mm) on the day of the incident. It was still dark when the incident occurred at 0042, sunrise was at 0706. There was localised fog reported at the derailment site. It was determined environmental conditions did not contribute to the incident.

Related incidents

According to records kept by Pacific National, including this failure, there have been three failures on this type of axle in the past 20 years. The other two failures have occurred near the centre of the axle barrel. One of these failures was the subject of an OTSI investigation and is outlined below.

On 23 November 2011, Pacific National coal service MC92 derailed eight wagons at Clifton, New South Wales. MC92, a 45-wagon train, was fully loaded with coal and was travelling south from Helensburgh to Inner Harbour at Port Kembla where it was to be unloaded. The investigation revealed that the barrel of the No. 3 axle of the eighth position wagon (NHFF 42702K) had broken and parted, causing both wheels to derail. The failure occurred approximately mid-way along the axle barrel. The investigation established that the break in the axle was attributable to the propagation of metal fatigue at the site of the fracture. The axle was the same type of axle as occurred at Moss Vale.

Safety analysis

Introduction

The analysis section of the report explores the likely reasons for the fracture, axle maintenance and inspection measures.

The following areas were excluded from further analysis as there was no evidence to show that they contributed to the axle failure:

- train's braking and control system
- signalling and train control issues
- track and infrastructure
- the actions of the train crew.

Metallurgical aspects of the axle failure

All parts of the derailed bogie, wheelset, and the available associated parts recovered from site were examined and photographed by technical analysts at a Pacific National workshop at Port Waratah. This included investigators from OTSI and the Office of the National Rail Safety Regulator (ONRSR). Testing requirements were discussed with personnel from OTSI, Bureau Veritas, the ONRSR and Pacific National. Pacific National engaged the technical services of Bureau Veritas to conduct a metallurgical analysis of the axle.⁶

The scope and steps for the metallurgical investigation was agreed upon by these specialists before the axle was taken to the Bureau Veritas testing facility in Newcastle.

The evidence from the metallurgical inspection has identified the following:

- the axle complied with industry specification requirements
- · the composition of the axle met the chemical requirements of the standard
- the mechanical testing conducted on the axle showed it met the mechanical requirements of the standard.

The metallurgical report concluded that the position of the fracture face was approximately 250 mm from the end of the axle. This was at the start of a radius transition where the axle diameter increased from the 144.5 mm to 177.8 mm (Figure 9).

After examination of the fracture face, Bureau Veritas metallurgists concluded that the axle failure was the result of the propagation of a fatigue crack that extended over 60% of the axle cross section. Although no clear initiation point was visible, a discoloured area, which extended 16 mm into the section, likely represented the position of the initiation of the fatigue crack (Figure 10). There was a line of surface corrosion pits next to the fracture face that was likely to have provided the stress concentration for fatigue initiation (Figure 11).

At the other end of the axle, no cracking or pitting was evident; however, there was a line of grease around the same location at the start of the radius transition. Due to post-incident events, it was not possible to determine if the broken end of the axle had the same treatment with grease.

Analysis conducted on the crack propagation found it likely that the axle was defect-free in November 2010, when the wheel change maintenance activity took place. The period between this event and the fracture was 8.5 years. It is likely that the fatigue crack was present at the January and November 2016 wheel maintenance events where wheel bearings were replaced, but was undetected.

⁶ Bureau Veritas 2019, *Examination of a rail wagon bogie axle failure*, 19-2888483-2.





Source: Pacific National, annotated by OTSI

Figure 10: Fracture surface face of axle remaining within bogie



Source: OTSI



Figure 11: Corrosion pitting on axle surface next to fracture ignition point

Source: Bureau Veritas

Axle inspection and maintenance

Pacific National has in place a number of measures to monitor and manage the condition of its rolling stock. Train inspection standards and procedures are described in the Pacific National Train Inspection Manual. Wagon maintenance standards and procedures are described in the Pacific National Wagon Maintenance Manual. A number of visual and audible examinations are carried out regularly. These include but are not limited to the following:

- Terminal departure and arrival examinations. These are conducted at a low speed, usually about 10km/h. A terminal operator stands near the track and looks and listens for any abnormalities as the train passes.
- Roll-by examinations. These are conducted by train crew on one train as another train passes by. One train might be stationary or both might be operating at track speed. After the roll-by inspection, radio communication occurs between crews to verify that no defect was present. Roll-by examinations were also carried out by staff standing trackside at unloading points. There was no requirement to undertake these inspections at loading locations. Therefore, no roll-by inspection had been conducted at Tahmoor before the train departed for Port Kembla.
- Full examination (FX). These full inspections are conducted while the train is stationary at a maintenance facility or terminal by examining staff at regular intervals (for coal trains operating in the south-west area, these are at 7-day intervals). Note that the previous inspection for this train was on 21 June 2019, 7 days before the derailment.
- Unit Train Maintenance (UTM). A more structured static full examination is conducted during UTM at a maintenance facility at regular intervals (for coal trains operating on the south-west area, these are at 42-day intervals). This train had its last UTM on 30 May 2019, within the 42-day requirement.
- Scheduled Maintenance. During scheduled maintenance, wagons are lifted off their bogie. This
 allows for a visual inspection of the wheelset and barrel of an axle to take place. The required
 period for scheduled maintenance on coal wagons is three years. Bogie NDCA 295 had a
 scheduled maintenance completed on 19 April 2018. An inspection of the bogie following the
 derailment found it in a good operating condition with low wheel wear. There was no defects
 found with any other part of the journal bearing, suspension, adjacent wheelset or bogie frame.

 Although used to detect wheel defects not axle defects, a review of ARTC trackside Wheel Impact Load Detector (WILD) data was undertaken by Pacific National. A review of the data from February 2016 revealed that this wheelset had no recorded wheel impacts during its operation. In addition, there was no record of wayside alarms for high wheelset temperature for the wagon or wheelset during TM94's journey from Tahmoor to Moss Vale.

Axles are designed to be highly reliable with an infinite service life if manufactured, operated and maintained within their prescribed design conditions. For this axle, the peak in-service stress loadings were below the endurance limit of the axle material. In the absence of a crack initiation event, which may increase the localised stress level, such as damage or corrosion, fatigue cracking should not occur.

Identifying an axle defect can be difficult, especially in the early stages of crack propagation and in locations obscured by other items. 'The axle inspection process relies on human performance for preparation, inspection and re-installation. The non-destructive testing of axles relies to a great extent on the professional judgement of the inspection staff in interpreting equipment readings.'⁷

The three most recent wheelset maintenance events for axle 7E5S 831444 are shown in Figure 12.

Date	Event	Comment	Wagon
16/11/2010	Wheel shop maintenance, wheel change.	Documentation inspection records not available.	NHSH42668Y
14/01/2016	Wheel shop maintenance, bearing change and lathe turn.	Remove bearing, clean, apply rust inhibitor, install bearing, no crack inspection mandated.	NHSH43070G
08/11/2016	Wheel shop maintenance, bearing change and lathe turn.	Remove bearing, clean, apply rust inhibitor, install bearing, no crack inspection mandated.	NHBH42798R
29/06/2019	Axle failure.	Derailment at Moss Vale.	NHSH42774Q

Figure 12: Maintenance history for axle 7E5S 831444

Source: Pacific National

The Wagon Maintenance Manual applicable in November 2010 required that:

2.2.1 All wheels and axles that enter the workshop shall be inspected for defects in compliance with the procedures and limits below. Axles shall be inspected and tested in accordance with the standards whenever bearings are removed during reconditioning of the wheelset.

2.4.2.1 Axles shall be tested for the presence of flaws and failures as specified hereafter by using ultrasonic and/or magnetic particle (wet or dry) procedures. Workshops undertaking the rework of axles and wheelsets shall develop and implement accredited procedures for the performance of these tests.⁸

Evidence shows that the requirements of the Wagon Maintenance Manual were not followed by the maintenance contractor, and this was not detected in subsequent audits conducted by Pacific National. Not conducting non-destructive testing on the axle when the wheels were changed during wheel shop maintenance in 2010 was a deviation proven industry practice and the specified requirements by Pacific National.

No specific documentation was available for the wheelset maintenance activity in November 2010. The Wagon Maintenance Manual states that electronic records should be kept for a minimum of 12 years.

⁷ UK Rail Safety and Standards Board (2012) Research into the effects of human factors in axle inspection T774.

⁸ Pacific National Wagon Maintenance Manual Axles WMM 09-03 08. Version 29 September 2009.

2.4.4.1 An electronic record is to be kept by the service provider of axle inspection and testing including axle number, date of inspection, type of tests carried out and the results of each axle for a minimum period of 12 years. Axle records shall incorporate previous test results. ⁹

The maintenance records also indicate that non-destructive testing was not carried out during wheelset maintenance activities in January and November 2016 as 'no crack inspection was mandated'. The Pacific National Wagon Maintenance Manual 09-03_08 Axles specifies that non-destructive testing should have been carried out.

In 2012, the NSW Independent Transport Safety Regulator (ITSR),¹⁰ conducted compliance inspections on a number of wagons in service. This was following a derailment at Clifton, NSW which was also caused by a broken 7E5S axle on a Pacific National NHFF-type coal wagon. Approximately 80 axles were inspected for evidence of defects. Three of these axles, which had all been recently inspected at a major overhaul maintenance centre, were found to have significant defects. These axles were removed from service. As a result of these inspections, ITSR issued a transport safety alert on 12 April 2012.¹¹ The alert requested owners of rolling stock, maintainers, overhaulers and transporters of bogies and wheelsets to reassess:

- 'the coverage of this matter (includes both surface and sub-surface defects) in their standards, operating practices, risk registers, asset management systems and other relevant documentation,
- the maintenance and inspection procedures that manage the possibility of defective (includes manufacturing defects), abused or poorly maintained axles and/or other risk control measures, such as ultrasonic testing and dye penetrant inspection, to verify that axle barrels are fit for the defined purpose. This should also include an appropriate final visual inspection process (of the axle barrel area) just prior to fitment to a wagon,
- the training, competency and assessment of personnel who inspect, handle, transport and assemble wheelsets or bogies, and
- the adequacy of processes for monitoring compliance with the relevant in-field and preventative maintenance instructions and procedures.^{'12}

Remedial actions

Since the axle failure at Moss Vale, Pacific National have engaged a number of independent entities to undertake investigations assessing the failure mode of this 7E5S axle failure and the fatigue life of both 7E5S and 7E3S axle types.

Pacific National commenced and completed a program of non-destructive testing of axles in-situ to ensure that no axles pose an immediate risk of failure. This included all 7E5S axles and involved ultrasonic testing. During wheel shop maintenance activities, Pacific National requires the removal of bearings from axles at workshops to allow magnetic particle testing, with the exception of K and G Class which do not necessarily require removal. This allows more accurate detection of initial indications of cracking in the radius transition area of the axle.

A Rolling Stock Notice (RSN) was also issued, to reinforce to Pacific National's wheel set overhaul contractors of the requirement. Pacific National have included a new check to the wheel shop audit checklist, requiring confirmation that the specified corrosion inhibition is being applied to the axle.¹³

⁹ Pacific National Wagon Maintenance Manual Axles WMM 09-03 08. Version 29 September 2009.

¹⁰ The functions of NSW ITSR were incorporated into the Office of National Rail Safety Regulator on 20 January 2013. ONRSR is an independent body corporate established in 2012.

¹¹ ITSR Transport Safety Alert, Catastrophic failure of freight axles in the barrel area, TSA no. 40, issued 12 April 2012.

¹² Ibid.

¹³ Pacific National Rolling Stock Notice RSN E 19-065v4 Axle Inspection Requirements issued 1 June 2020.

Pacific National have implemented a process with some wheel shops to machine the fillet radius of axles in order to restore the fillet radius to a defect-free state. Pacific National have also purchased a quantity of new axles to replace any found to have cracking or corrosion pitting.

Findings

From the evidence available, the following findings are made with respect to the derailment of train TM94 near Moss Vale, New South Wales, on 28 June 2019. 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 derailment occurred due to an axle fracturing inboard of the L1 bearing journal on the 14th wagon in the consist (NHSH 42774Q). The fracture occurred on wheelset number 7E5S 831444, approximately 250 mm from end of the axle.
- The axle failed due to the initiation and propagation of a crack at the beginning of a radius transition curve at the end of the bearing journal. There were a series of surface corrosion pits next to the fracture face that may have provided the stress concentration for fatigue initiation. A discoloured area which extended 16 mm into the section likely represented the position of the initiation of the fatigue crack; this had progressed approximately across 60% of the axle cross-section before brittle failure occurred.
- Axle testing on wheelset number 7E5S 831444 was not carried out during the two most recent wheelset maintenance events in January 2016 and November 2016. It is likely the axle crack existed at the time of these maintenance activities. [Safety issue]

Other factors that increased risk

• Inspection records for the December 2010 wheelset maintenance activity and wheel change on wheelset number 7E5S 831444 were not available. It is a requirement specified in Pacific National's Wagon Maintenance Manual that records be retained for a period of 12 years. [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 [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.

Axle testing

Safety issue number:	RO-2019-013-SI-01
Safety issue owner:	Pacific National
Operation affected:	Rail rolling stock maintenance
Who it affects:	All owners and maintainers of rolling stock

Safety issue description

Axle testing on wheelset number 7E5S 831444 was not carried out during the two most recent wheelset maintenance events in January 2016 and November 2016. It is likely the axle crack existed at the time of these maintenance activities.

Proactive safety action

Action taken by:	Pacific National
Action number:	RO-2019-013-NSA-009
Action type:	Proactive safety action
Action status:	Closed

Safety action taken: Pacific National issued a Rolling Stock Notice to reinforce to Pacific National's wheel set overhaul contractors of the requirement to conduct non-destructive testing. Following this incident Pacific National commenced and completed a program of non-destructive testing.

ATSB comment/response: ATSB is satisfied that the actions taken by Pacific National have addressed the safety issue.

Maintenance records

Safety issue number:	RO-2019-013-SI-02
Safety issue owner:	Pacific National
Operation affected:	Rail rolling stock maintenance
Who it affects:	All owners and maintainers of rolling stock

Safety issue description

Inspection records for the December 2010 wheelset maintenance activity and wheel change on wheelset number 7E5S 831444 were not available. It is a requirement specified in Pacific National's Wagon Maintenance Manual that records be retained for a period of 12 years.

Proactive safety action

Action taken by:	Pacific National
Action number:	RO-2019-013-NSA-010
Action type:	Proactive safety action
Action status:	Closed

Safety action taken: Pacific National has reinforced the requirement to wheel set overhaul contractors of the requirement to maintain records for a period of 12 years.

ATSB comment/response: ATSB is satisfied that the actions taken by Pacific National have addressed the safety issue.

General details

Occurrence details

Date and time:	28 June 2019 – 0040 AEST		
Occurrence category:	Accident		
Primary occurrence type:	Derailment		
Location:	Moss Vale, New South Wales		
	Latitude: 34º 32.536' S	Longitude: 150º 22.663' E	

Train details

Train operator:	Pacific National	
Registration:	TM94	
Type of operation:	Freight - coal	
Departure:	Tahmoor, New South Wales	
Destination:	Port Kembla, New South Wales	
Injuries:	Crew – 4	Passengers – 0
Damage:	Substantial	

Sources and submissions

Sources of information

The sources of information during the investigation included the:

- Australian Rail Track Corporation
- The Office of National Rail Safety Regulator
- Pacific National.

References

Independent Transport Safety Regulator 2012, *Transport Safety Alert - Catastrophic failure of freight axles in the barrel area,* TSA no. 40, issued 12 April 2012.

Pacific National 2009, Wagon Maintenance Manual Axles WMM 09-03 08, Version 29 September 2009.

Pacific National 2020, *Rolling Stock Notice Axle Inspection Requirements*, RSN E 19-065v4 issued 1 June 2020.

UK Rail Safety and Standards Board 2012, *Research into the effects of human factors in axle inspection T774*.

Submissions

Under section 26 of the *Transport Safety Investigation Act 2003*, the ATSB may provide a draft report, on a confidential basis, to any person whom the ATSB considers appropriate. That section 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 following directly involved parties: Australian Rail Track Corporation, Office of National Rail Safety Regulator, Pacific National and Transport for NSW.

Submissions were received from:

- Office of National Rail Safety Regulator
- Pacific National.

The submissions were reviewed and, where considered appropriate, the text of the report was amended accordingly.

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.

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.