



Australian Government
Australian Transport Safety Bureau

Derailment of ore train 4413

Bonnie Vale, Western Australia | 14 May 2014



Investigation

ATSB Transport Safety Report
Rail Occurrence Investigation
RO-2014-008
Preliminary – 28 August 2014

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

Publishing information

Published by: Australian Transport Safety Bureau
Postal address: PO Box 967, Civic Square ACT 2608
Office: 62 Northbourne Avenue Canberra, Australian Capital Territory 2601
Telephone: 1800 020 616, from overseas +61 2 6257 4150 (24 hours)
Accident and incident notification: 1800 011 034 (24 hours)
Facsimile: 02 6247 3117, from overseas +61 2 6247 3117
Email: atsbinfo@atsb.gov.au
Internet: www.atsb.gov.au

© Commonwealth of Australia 2014



Ownership of intellectual property rights in this publication

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

Creative Commons licence

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

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

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

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

Addendum

Page	Change	Date

Contents

The occurrence	1
Events post derailment	3
Context	4
Location	4
Environmental conditions	4
Train and train crew information	4
Rolling stock	4
Train crew	4
Track Information	4
Track condition	5
Derailment - summary	6
Ongoing investigation activities	6
General details	7
Occurrence details	7
Train details	7
Sources and submissions	8
Sources of information	8
References	8
Australian Transport Safety Bureau	9
Purpose of safety investigations	9
Developing safety action	9

The occurrence

The information contained in this Preliminary report is released in accordance with section 25 of the Transport Safety Investigation Act 2003 and is derived from the initial investigation of the occurrence. Readers are cautioned that new evidence will become available as the investigation progresses that will enhance the ATSB's understanding of the accident as outlined in this Preliminary report. As such, no analysis or findings are included in this report.

At 0100¹ on 14 May 2014, train 3416, a scheduled bulk iron ore service, departed from the Binduli Triangle (650 km²), Western Australia, for Koolyanobbing East (458 km). The train, crewed by two drivers,³ travelled empty to Koolyanobbing East.

On arrival at Koolyanobbing East, the train was loaded with iron ore and made ready for departure as train 4413. At 0755, it departed Koolyanobbing East for the port of Esperance.

En route, train 4413 crossed with the Prospector passenger train at Beckwith (470 km) and then with train 3033 at Mount Walton (534 km). It continued on its journey towards Esperance, stopping at the Wallaroo loop (562 km) to cross with empty ore train 4414.

Figure 1: Location map – Western Australia



Source: NatMap Railways of Australia

¹ The 24-hour clock is used in this report and is referenced from Western Standard Time (WST), UTC + 8.0 hours.
² Distances are track kilometres measured from Perth terminus.
³ Two drivers operate alternately as a driver/observer pair.

At 1010, train 4413 departed the Wallaroo loop. The passage of the train through to Stewart (587 km) was uneventful. As the train entered the Stewart to Bonnie Vale section, the driver gradually accelerated towards 90 km/h, the maximum permitted track speed for ore trains in this section. From the 596 km to 599 km mark the track descended slightly. To limit the train from exceeding 90 km/h, the driver put the train into light dynamic braking,⁴ to maintain a speed of about 85 km/h.

At about 1048, just after traversing a culvert at 600.657 km, the locomotive shuddered. The train travelled a further 600 m when the driver felt a series of jerks of increasing severity throughout the train. Almost immediately, he observed that the end-of-train monitor⁵ was showing a zero reading. He did not observe a decrease in the train's brake pipe pressure or hear any audible alarm which would normally accompany a train parting event.⁶

The driver looked back in the rear vision mirror and observed clouds of dust and realised that the rear portion of the train had probably derailed. He slowed the train, bringing it to a stand about 3 km beyond the initial point of derailment (PoD). He then advised the train controller that the train was at stop within the Stewart to Bonnie Vale section, had probably derailed and that the second driver was going back to investigate.

Figure 2: Train 4413 End of Train – Derailed Ore Wagons



Source: ATSB

⁴ The trains' electric traction motors are used for regenerative/electric braking.

⁵ The end-of train monitor works in conjunction with an end-of-train marker, a device fitted to the trailing end of the last vehicle of a train. The system is used to indicate that the train is intact by monitoring brake pipe pressure.

⁶ A train parting event normally results in a loss of brake pipe integrity and an associated loss of brake pipe pressure.

Events post derailment

The second driver walked towards the rear of the train and progressively reported to the driver the extent of the derailment and associated damage (Figure 2). The driver relayed the information to the train controller.

The Stewart to Bonnie Vale section was subsequently closed and recovery personnel were dispatched from Kalgoorlie. The two drivers were also relieved and returned to Kalgoorlie.

On 15 May, track and train maintenance crews commenced recovery and restoration works. The track was re-opened to traffic on 17 May.

Context

Location

The derailment occurred between Stewart and Bonnie Vale, about 54 km west of Kalgoorlie, at 600.729 km on the Defined Interstate Rail Network (DIRN) in Western Australia (Figure 1). The DIRN through this area runs in an east-west direction and links Western Australia with the eastern States.

Environmental conditions

The environmental conditions leading up to the incident were not considered exceptional and were unlikely to have contributed to the derailment.

Train and train crew information

Train 4413 was a regular Aurizon iron ore service that operated between Esperance and Koolyanobbing East. The train was configured as a distributed power unit⁷ (DPU) and comprised two locomotives at the head of the train (AC4301 leading and ACB4404 trailing) followed by 106 wagons then two locomotives mid-section (Q4017 leading and AC4304 trailing) followed by a further 54 wagons. The train had an overall length of 1,792 m and a gross mass 14,731 t.

Rolling stock

Examination of the derailed wagons primarily focused on wagon WOE33548K, which was considered as the first wagon to have derailed. It was evident that the leading wheel-set of its lead bogie had derailed to the left (in the direction of travel) and had travelled about 2.5 km past the PoD.

The wagon was examined by the ATSB both on site and at Aurizon's West Kalgoorlie maintenance facilities and found to be in compliance with maintenance specifications and operationally fit for purpose.

The ATSB concluded that there was no obvious indication of any mechanical deficiency with the train that may have contributed to the derailment. However, post derailment braking performance requires further examination because the available evidence indicates that the loss of brake pipe integrity (loss of air) did not result in immediate brake activation.

Train crew

The train crew comprised two drivers. The driver at the time of the derailment had about 14 years train driving experience. The second driver had 9 years train driving experience. Both drivers held the required qualifications to operate the train, were route certified and assessed as medically fit for duty.

Following the derailment both drivers underwent mandatory drug and alcohol testing, the results of which were negative. The available evidence also indicates that the performance of the drivers was not affected by fatigue.

Track Information

The track from Koolyanobbing East through to West Kalgoorlie substantially comprised a single line (bi-directionally signalled) with crossing loops strategically located throughout its length.

⁷ The placing of additional locomotives at intermediate points within a train and remotely controlling these locomotives from the lead locomotive.

The track through the derailment site was standard gauge (1,435 mm) and consisted of 60 kg/m continuously welded rail⁸ (CWR). The rail was fixed to concrete sleepers at approximately 667 mm spacing and secured by resilient fastenings.⁹ It was supported on a bed of ballast having a nominal depth of 300 mm under the sleepers. The track had been relaid with new 60 kg/m rail about 1 year earlier.

The track leading into the derailment site was straight (tangent track) with a slight downgrade of about 0.2% in the direction of travel.

Track condition

An examination of the track at the PoD showed evidence of flange climb on the left side running rail (direction of travel) and witness marks over a distance of about 5 m which indicated that the wheel flange crossed over the rail head (Figure 3).

Figure 3: Witness marks caused by a wheel flange at PoD (600.729 km) shown by line of stones on rail head



Source: ATSB

⁸ Continuous welded rail (CWR) – Track where the rail is joined by welding (and other non-moveable joints such as glued insulated joints) in lengths greater than 300 metres.

⁹ A fastening that provides a degree of elasticity between the sleeper and rail with the aim of avoiding the loosening of the fastening due to vibration, as well as enhancing the ability of the fastening system to resist longitudinal creep forces and buckling forces associated with continuously welded rail (CWR).

Damage to sleepers was observed only after the point where the wheel(s) subsequently dropped off the rail head. Beyond the drop off point, the wheels and bogies of derailed wagons advancing along the sleepers, progressively damaged the track structure both within the four foot¹⁰ and on the field side of the rail (left side direction of travel). This resulted in the loss of track structural integrity and the subsequent destruction of the track, with rolling stock ploughing into the ballast and resulting in the multi-wagon pile-up (Figure 2 and 3).

There was no evidence of spread in the section of track leading up to the PoD, so gauge widening was not considered to have been a factor in the derailment. Similarly, there were no signs of any broken/fractured rail immediately at or before the PoD.

Although the track structure leading into/out of the derailment site appeared to be in good condition, there were signs of lateral vehicle oscillations along the length of track leading up to PoD. This was characterised by flange contact wear along the head of the rails at regular intervals. There was also evidence of a vertical twist defect immediately after a culvert at 600.657 km.

The potential influence of the observed track conditions were supported by:

- Statements from the train drivers, who both indicated that the track was rough (side-to-side oscillations) leading into the derailment site and that the train had kicked heavily at or near the PoD
- Forward facing video evidence from train 4414¹¹ which had passed through the site earlier that morning (about 0940) and showed evidence of a sizeable track misalignment at or near the PoD
- Rear facing video from train 4413 (mid-section trailing locomotive AC4304) showing evidence of a substantial sideways kick as wagons behind locomotive AC4304 passed over the PoD.

Derailment - summary

The available evidence, as detailed above, indicates that the derailment of ore train 4413 near Bonnie Vale in Western Australia was the result of flange climb.

There was evidence of lateral track vehicle oscillations along the length of track leading up to the PoD and a twist defect immediately after the culvert at 600.657 km. Although the locomotives and ore wagons appeared to be in good condition it is considered that the vehicle oscillations may have been of sufficient magnitude to cause the leading wheel of wagon WOE33548K to unload, mount the rail head at 600.729 km and derail.

Ongoing investigation activities

The ATSB investigation is continuing and will focus on:

- The dynamic behaviour of WOE class wagons.
- Train braking performance, in particular when configured with mid-power locomotives.
- Track inspection and maintenance procedures, including defect reporting processes used by the infrastructure manager and the rolling stock operator.

¹⁰ The area between the rails of a standard gauge railway.

¹¹ Forward facing video evidence was not available from train 4413, train that derailed, due to a technical failure of the train's forward facing video recorder.

General details

Occurrence details

Date and time:	14 May 2014 – 1048 WST	
Occurrence category:	Serious incident	
Primary occurrence type:	Derailment - Running Line	
Location:	Trans Australian Railway near 600.729 km - Kalgoorlie	
	Latitude: 30° 53.158' S	Longitude: 120° 56.172' E

Train details

Train operator:	Aurizon	
Registration:	4413	
Type of operation:	Bulk Freight	
Persons on board:	Crew – 2	Passengers – Nil
Injuries:	Crew – Nil	Passengers – Nil
Damage:	Substantial	

Sources and submissions

Sources of information

The sources of information during the investigation included the:

- Aurizon
- Data loggers and CCTV from locomotives AC4301 and AC4304
- Brookfield Rail

References

Bureau of Meteorology - Weather Observations for Kalgoorlie-Boulder (14 May 2014)

RISSB Glossary of Railway Terminology - Guideline

Australian Transport Safety Bureau

The Australian Transport Safety Bureau (ATSB) is an independent Commonwealth Government statutory agency. The ATSB is governed by a Commission and is entirely separate from transport regulators, policy makers and service providers. The ATSB's function is to improve safety and public confidence in the aviation, marine and rail modes of transport through excellence in: independent investigation of transport accidents and other safety occurrences; safety data recording, analysis and research; fostering safety awareness, knowledge and action.

The ATSB is responsible for investigating accidents and other transport safety matters involving civil aviation, marine and rail operations in Australia that fall within Commonwealth jurisdiction, as well as participating in overseas investigations involving Australian registered aircraft and ships. A primary concern is the safety of commercial transport, with particular regard to fare-paying passenger operations.

The ATSB performs its functions in accordance with the provisions of the *Transport Safety Investigation Act 2003* and Regulations and, where applicable, relevant international agreements.

Purpose of safety investigations

The object of a safety investigation is to identify and reduce safety-related risk. ATSB investigations determine and communicate the factors related to the transport safety matter being investigated.

It is not a function of the ATSB to apportion blame or determine liability. At the same time, an investigation report must include factual material of sufficient weight to support the analysis and findings. At all times the ATSB endeavours to balance the use of material that could imply adverse comment with the need to properly explain what happened, and why, in a fair and unbiased manner.

Developing safety action

Central to the ATSB's investigation of transport safety matters is the early identification of safety issues in the transport environment. The ATSB prefers to encourage the relevant organisation(s) to initiate proactive safety action that addresses safety issues. Nevertheless, the ATSB may use its power to make a formal safety recommendation either during or at the end of an investigation, depending on the level of risk associated with a safety issue and the extent of corrective action undertaken by the relevant organisation.

When safety recommendations are issued, they focus on clearly describing the safety issue of concern, rather than providing instructions or opinions on a preferred method of corrective action. As with equivalent overseas organisations, the ATSB has no power to enforce the implementation of its recommendations. It is a matter for the body to which an ATSB recommendation is directed to assess the costs and benefits of any particular means of addressing a safety issue.

When the ATSB issues a safety recommendation to a person, organisation or agency, they must provide a written response within 90 days. That response must indicate whether they accept the recommendation, any reasons for not accepting part or all of the recommendation, and details of any proposed safety action to give effect to the recommendation.

The ATSB can also issue safety advisory notices suggesting that an organisation or an industry sector consider a safety issue and take action where it believes it appropriate. There is no requirement for a formal response to an advisory notice, although the ATSB will publish any response it receives.

Australian Transport Safety Bureau

Enquiries 1800 020 616

Notifications 1800 011 034

REPCON 1800 011 034

Web www.atsb.gov.au

Twitter @ATSBinfo

Email atsbinfo@atsb.gov.au

Investigation

ATSB Transport Safety Report

Rail Occurrence Investigation

Derailment of ore train 4413, Bonnie Vale, Western Australia
14 May 2014

RO-2014-008

Preliminary – 28 August 2014