Final report RO-2018-101: Metropolitan passenger train, derailment,
Britomart Transport Centre, Auckland, 9 May 2018

Final Report

Rail inquiry RO-2018-101
Metropolitan passenger train

Derailment

Britomart Transport Centre, Auckland

9 May 2018

Approved for publication: September 2019

Transport Accident Investigation Commission

About the Transport Accident Investigation Commission

The Transport Accident Investigation Commission (Commission) is a standing commission of inquiry and an independent Crown entity responsible for inquiring into maritime, aviation and rail accidents and incidents for New Zealand, and co-ordinating and co-operating with other accident investigation organisations overseas. The principal purpose of its inquiries is to determine the circumstances and causes of occurrences with a view to avoiding similar occurrences in the future. Its purpose is not to ascribe blame to any person or agency or to pursue (or to assist an agency to pursue) criminal, civil or regulatory action against a person or agency. The Commission carries out its purpose by informing members of the transport sector and the public, both domestically and internationally, of the lessons that can be learnt from transport accidents and incidents.

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Important notes

Nature of the final report

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Citations and referencing

Information derived from interviews during the Commission's inquiry into the occurrence is not cited in this final report. Documents that would normally be accessible to industry participants only and not discoverable under the Official Information Act 1982 have been referenced as footnotes only. Other documents referred to during the Commission's inquiry that are publicly available are cited.

Photographs, diagrams, pictures

Unless otherwise specified, photographs, diagrams and pictures included in this final report are provided by, and owned by, the Commission.

Verbal probability expressions

The expressions listed in the following table are used in this report to describe the degree of probability (or likelihood) that an event happened or a condition existed in support of a hypothesis.

Terminology (Adopted from the Intergovernmental Panel on Climate Change)	Likelihood of the occurrence/outcome	Equivalent terms
Virtually certain	> 99% probability of occurrence	Almost certain
Very likely	> 90% probability	Highly likely, very probable
Likely	> 66% probability	Probable
About as likely as not	33% to 66% probability	More or less likely
Unlikely	< 33% probability	Improbable
Very unlikely	< 10% probability	Highly unlikely
Exceptionally unlikely	< 1% probability	

Source: mapsof.net

Location of accident

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Abbreviations

Britomart	Britomart Transport Centre
DTA	Defence Technology Agency
MPa	megapascal(s)
points	a set of points
Quest	Quest Integrity NZL Limited
RIC	rail incident controller
Transdev	Transdev Auckland Limited

Glossary

normal position	the straight road for a standard set of points
point of derailment	the precise point where the wheels of a rail vehicle have stopped being guided or supported by the rails
set of points	an assembly of switches and crossings that are designed to divert trains from one road to another
chatter mark	a defect on the surface of a material introduced during the machining process

Data summary

Vehicle particulars

Train type and number:	six-car, AM class electric multiple unit passenger Train 4250
Train length:	144 metres
Entered service:	2014
Operator:	Transdev Auckland Limited
Fleet owner:	Auckland Transport
Fleet maintainer:	Construcciones y Auxiliar de Ferrocarriles
Date and time	9 May 2018 at about 0937[1]
Location	Britomart Transport Centre, Auckland
Persons involved	train driver train manager about 130 passengers
Injuries	nil
Damage	moderate damage to the leading passenger car moderate damage to track

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[1] Times in this report are New Zealand Standard Times (universal co-ordinated time + 12 hours) and are expressed in the 24-hour mode.

1. Executive summary

1.1. At about 0935 on 9 May 2018, an Auckland metropolitan passenger train was approaching Britomart Station with about 130 passengers on board. The train was travelling at 24.7 kilometres per hour, which was below the maximum authorised line speed of 25 kilometres per hour, as it passed through a set of rail points that was supposed to divert the train to berth at platform 1. However, a section of rail within the set of points had fractured, which caused the leading passenger car to derail.

1.2. The train came to rest upright, but only centimetres from a concrete wall dividing the station platforms. Nobody was injured, but there was moderate damage to the train and the track.

1.3. The Transport Accident Investigation Commission (Commission) found that the first response to rescue passengers and crew from the derailed train was conducted appropriately and in accordance with the operator's procedures.

1.4. The Commission found that the rail from which the rail points had been manufactured met the required specifications. The fracture had initiated at a machining defect on the foot of the rail, which was introduced during the procedure for manufacturing the set of points. The defect likely resulted in a significant to severe reduction in the fatigue and fracture resistance of the rail.

1.5. The Commission found no evidence that the manufacturing defect was representative of a wider quality issue.

1.6. The Commission did not identify any safety issues or key lessons, and therefore made no new recommendations.

2. Conduct of the inquiry

2.1. The NZ Transport Agency notified the Transport Accident Investigation Commission soon after the occurrence on 9 May 2018. The Commission opened an inquiry under section 13(1) of the Transport Accident Investigation Commission Act 1990, and appointed an investigator in charge.

2.2. Commission investigators travelled to Auckland to conduct the site investigation on 9 May 2018.

2.3. Following the recovery of the derailed passenger train on 12 May 2018, sections of rail were cut from both sides of a fractured rail and taken to the Defence Technology Agency (DTA) for:

- an optical non-destructive examination of the fracture surface to determine the fracture initiation point
- a dimensional analysis of the rail section
- a metallurgical evaluation of the rail section
- hardness testing.

2.4. The Commission investigators interviewed the train driver, the train manager, the person who managed the passenger evacuation, personnel responsible for the maintenance of the passenger train, the rail infrastructure asset manager, the rail infrastructure field engineer, two track inspectors and the manager responsible for the non-destructive testing of railway lines.

2.5. On 22 January 2019 the sections of rail cut from both sides of the rail fracture surface were delivered to Quest Integrity NZL Limited (Quest) to perform the following tasks:

- examine the origin of the fracture using a scanning electron microscope
- determine the residual stress on the foot of the rail
- conduct tensile tests on samples cut from both the foot and the head of the rail within 500 millimetres of the fracture face
- determine the material composition of the rail section.

2.6. The Commission obtained the following records and documents for analysis:

- the data downloaded from the train's event recorder
- the train control diagram
- the train controller's voice recordings
- the train driver's training records and timesheets
- the train manager's training records and timesheets
- the Interfleet Technology 'Axle Counter Risk Analysis' for the Auckland commuter network
- a data summary of the ultrasonic rail flaw detection reports covering the previous 10 years
- the technical specifications for the supply of steel rail
- the metallurgy report from the DTA
- the metallurgy report from Quest.

2.7. On 26 June 2019 the Commission approved the draft report to be sent to interested persons for consultation.

2.8. Five written submissions were received. The Commission considered the submissions, and changes as a result of those submissions have been included in the final report.

2.9. On 28 August 2019 the Commission approved the final report for publication.

3. Factual information

3.1. Narrative

3.1.1. Britomart Station (Britomart) is the northern terminus of the North Island Main Trunk railway line. The underground station has five dead-end platform roads and is constrained by a 426-metre-long, double-track entrance tunnel. Britomart was opened to passengers in July 2003. The platform tracks were subsequently electrified in March 2014 as part of a major upgrade of Auckland's commuter rail network. All commuter trains serving Britomart since July 2015 have been AM-class electric multiple units.

3.1.2. On 9 May 2018 at about 0935, a six-car electric multiple unit passenger train approached Britomart with about 130 passengers on board. The train, operated by Transdev Auckland Limited (Transdev), was crewed by a train driver and a train manager. The train consisted of two sets of three cars coupled together. The train manager was travelling in the front portion of the train. There was no internal access between the two sets.

3.1.3. The train was travelling at 24.7 kilometres per hour when it passed the signal informing the driver that the train had been routed to berth on platform 1 (see Figure 1). The maximum authorised line speed to pass the signal was 25 kilometres per hour.

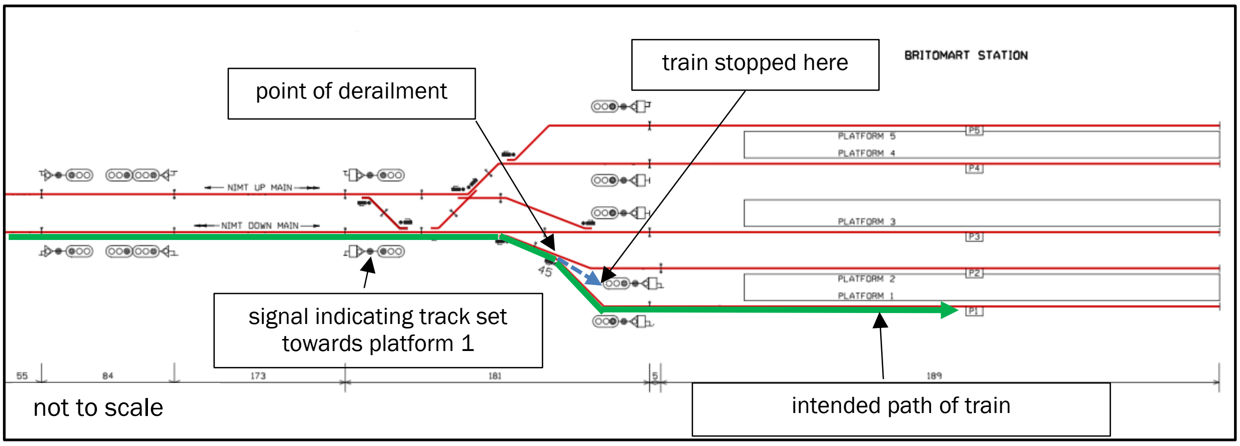

Figure 1
Britomart Station track layout

3.1.4. At about 0937 the leading wheels of the first passenger car derailed as it passed over a broken rail within a set of points[2] (the points) that routed the train from the platform 2 road towards platform 1. The first car of the train left the rails and travelled along the ballast between two tracks. The train driver applied the emergency brakes and stopped the train about 16 metres past the point of derailment[3]. The driving cab came to rest close to a vertical concrete wall (see Figure 2). There were no injuries to passengers or crew.

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[2] A set of points is an assembly of switches and crossings that are designed to divert trains from one road to another.

[3] The point of derailment is the location where the first wheel has stopped being guided by the rails.

Figure 2
Derailed train stopped short of vertical dividing wall

3.2. Recovery

3.2.1. At about 0938 the train driver informed the train controller by radio that the train had derailed on approach to platform 1, and requested an emergency overhead power isolation. The train controller acknowledged the request and instructed the driver to keep crew and passengers on the train until confirmation was given that the overhead power had been earthed and isolated.

3.2.2. The Transdev train crew manager was informed by telephone of a possible derailment by a colleague travelling on another train. The train crew manager was also a qualified rail incident controller (RIC) and was located at the Transdev offices, a short distance from the scene.

3.2.3. The train crew manager assumed duties as RIC and deployed to Britomart Station to manage the evacuation of what was then thought to be about 30 passengers.

3.2.4. The RIC received confirmation at 0959 that the overhead power had been isolated and earthed in preparation for the passenger evacuation. The RIC, assisted by two Auckland Transport station managers, started the evacuation process from the leading set of three passenger cars shortly after receiving this confirmation.

3.2.5. Passengers were assisted down a ladder placed against the middle car and were then assembled on a concreted area clear of the rail corridor. Similarly, passengers were then assisted from the middle car of the rear three-car set.

3.2.6. By 1047 about 130 passengers had been escorted safely to the platform. Train crew then conducted a final check before leaving the train. The RIC handed the accident site back to the network controller at 1102.

3.3. Key personnel

3.3.1. The train driver worked out of the drivers' depot at Wiri and had nearly four years' driving experience, which included in both diesel and electric multiple units. The driver's operating certification was current.

3.3.2. The train driver underwent a post-incident drug and alcohol test that returned a negative result for both.

3.3.3. The train manager had about 13 years' experience in the role and had been regularly trained in emergency scenarios, including tunnel evacuations training.

3.3.4. The RIC was an experienced train driver, and for the previous four years had been performing the role of train crew manager based in the headquarters of Transdev Auckland.

4. Analysis

4.1. Introduction

4.1.1. The derailment of a loaded passenger train can have serious consequences. In this case the train was travelling at low speed and came to rest upright only a short distance from a solid concrete wall.

4.1.2. The following analysis discusses the circumstances and factors contributing to the derailment.

4.2. The derailment

4.2.1. The point of derailment was within the left-hand switch rail of the points, about 3.4 metres past the point of switch in the direction of travel, at the exact point where the rail had broken (see Figure 3).

4.2.2. It was virtually certain that the train derailed because the left-hand switch rail that the train was traversing at the time was fractured and misaligned. Impact marks observed on the switch rail were indicative of the point of derailment (see Figure 4).

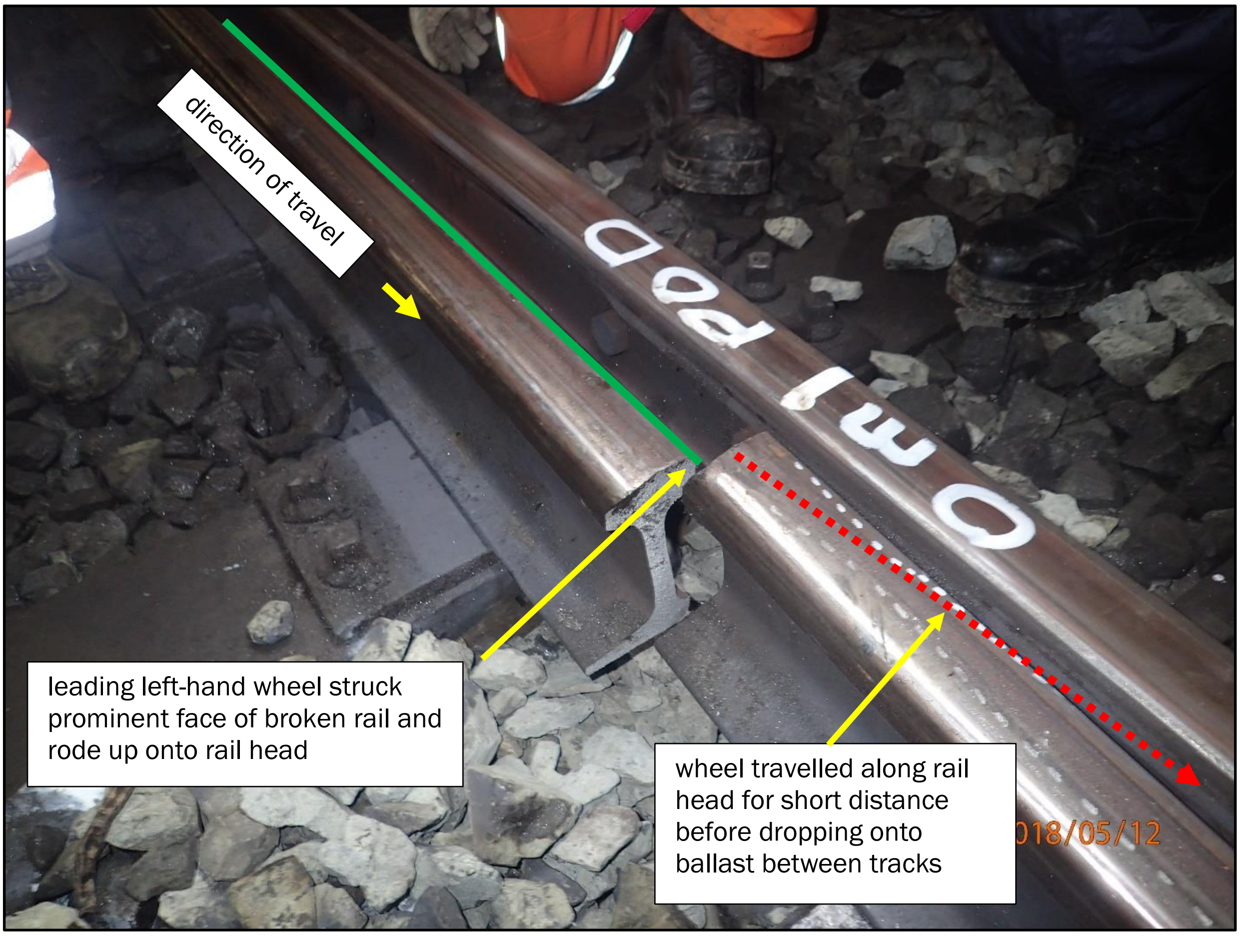


Figure 3
Photograph showing point of derailment

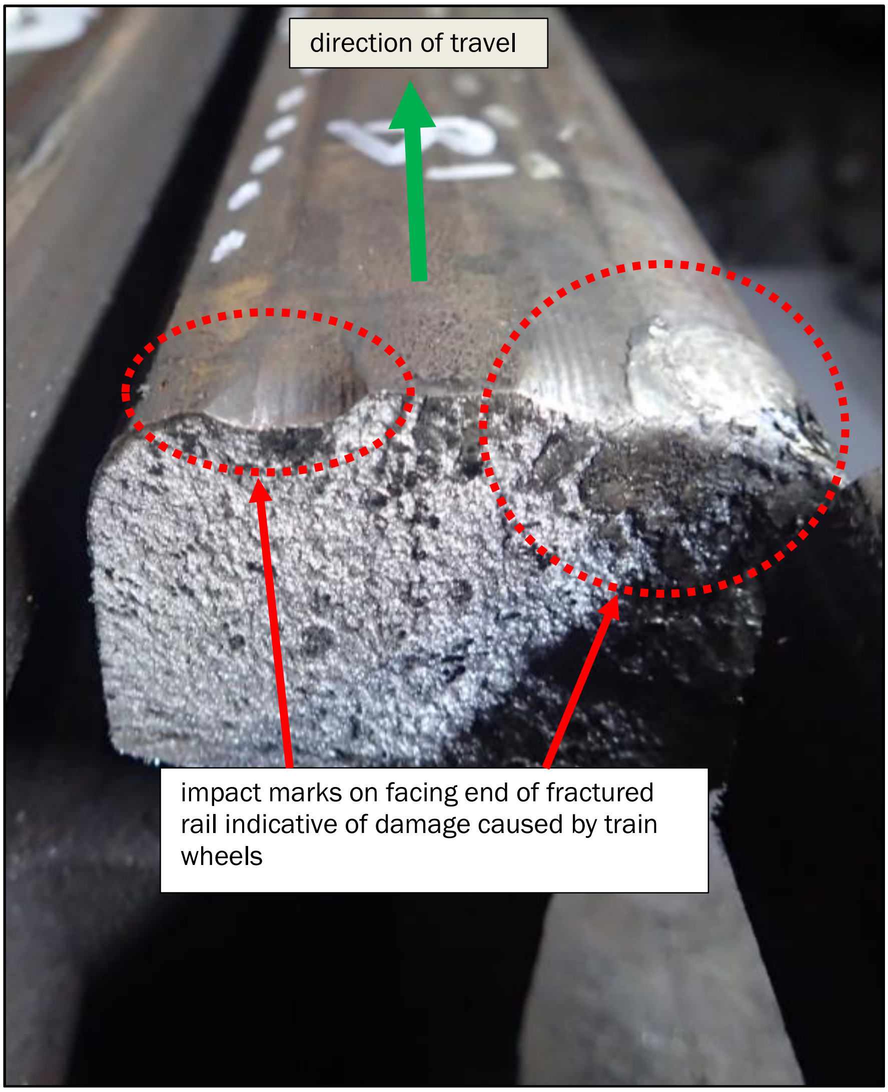


Figure 4
Damage to facing end of fractured rail

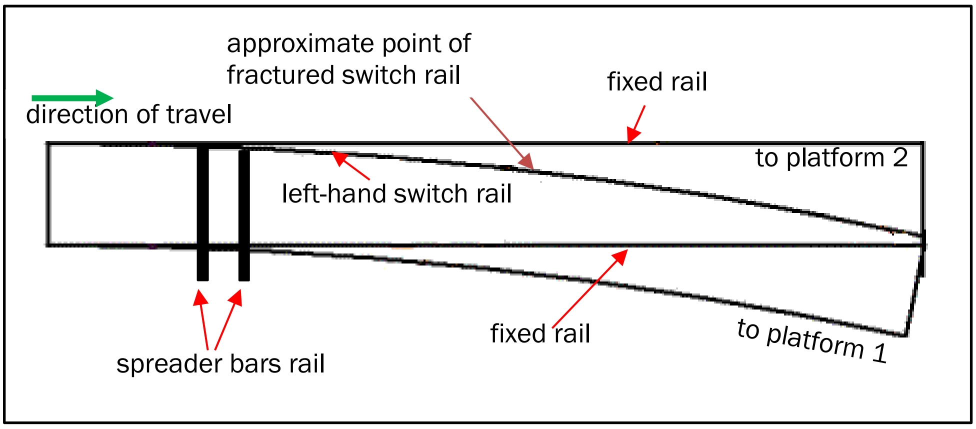
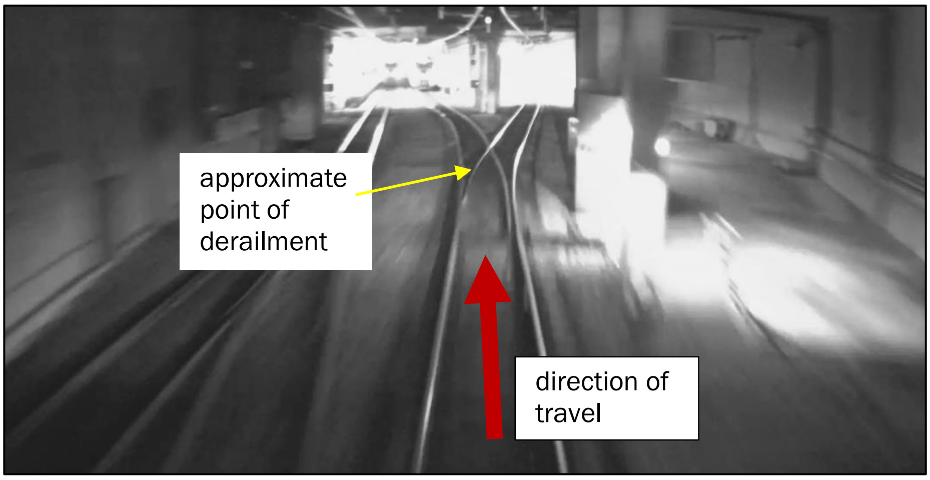


Figure 5
Simplified diagram of right-hand points

4.2.3. There was a complete lateral fracture in the left-hand switch rail, which likely occurred when it was placed into the 'normal'[4] position for an incoming and outgoing train movement on platform 2. Neither of these train movements traversed the broken switch rail and they were therefore not at risk of derailment (see Figures 5 and 6).



Source: Transdev Auckland

Figure 6
Still image taken from the on-board closed-circuit television of train approaching point of derailment

4.2.4. Although the left-hand switch rail had broken into two sections, the design of the switching equipment meant that the first portion of the switch rail was moved into the correct 'reverse' position by the spreader bars (see Figure 7). In doing so, the electrical circuit was complete and this allowed the signalling system to provide a proceed signal into the damaged section. However, the switch rail at the platform end of the fracture remained in the normal position as set for the previous movement.

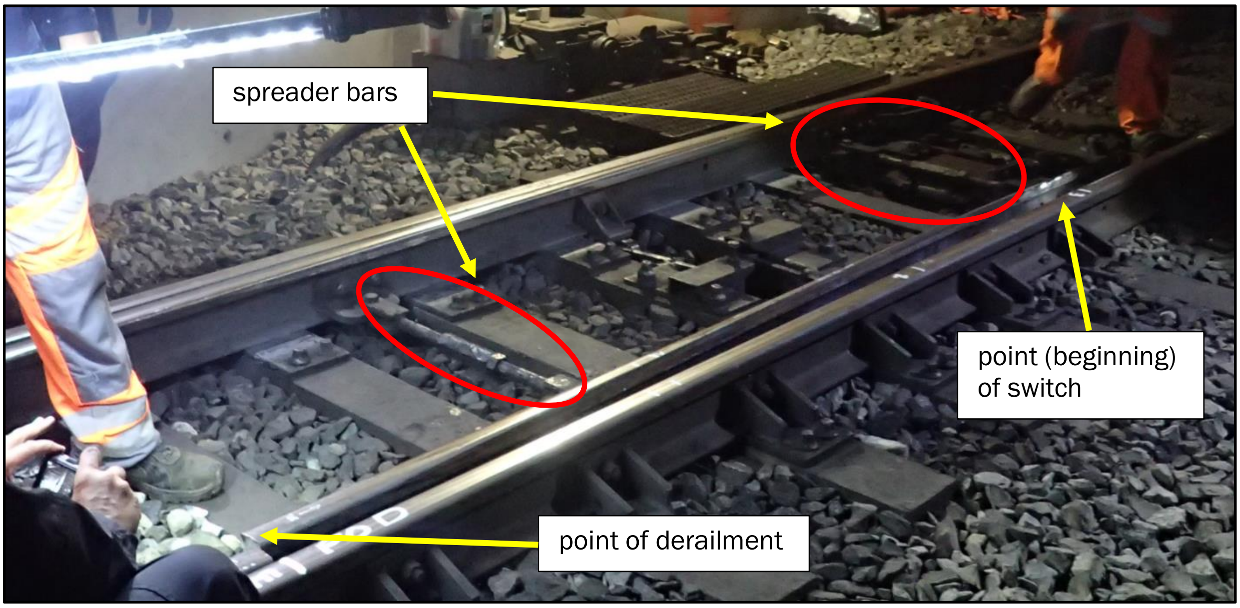


Figure 7
Spreader bars controlling movement of the switch rail at the tunnel end

4.2.5. As the train passed over the fractured switch rail, the leading left-hand wheel struck the prominent face of the platform end section, which acted as a ramp, causing the wheel to ride up over the head of the rail and lose guidance.

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[4] The normal position for standard points is when the route is set for the straight road.

4.2.6. With the wheel flange no longer being guided by the rails, the train could travel in a direct line along the top of the left-hand fixed rail for a short distance, before departing the track and dropping onto the ballast between the two tracks.

4.2.7. The driver immediately realised that something was wrong and activated the train's emergency brake. The train's event recorder download data showed that the emergency brake application was made at 0936:42. The leading car of the six-car train stopped 16 metres from the point of derailment and came to rest approximately three centimetres short of a vertical concrete wall between platforms 1 and 2.

4.3. The rail fracture examination

4.3.1. Two sections of rail cut from both sides of the fracture were taken from the scene and transported to DTA, located at Devonport Naval Base.

4.3.2. DTA was asked to undertake three phases of work and provide a report containing the findings. The work included:

- an optical non-destructive examination of the fracture face and to verify the fracture initiation point
- a dimensional analysis of the rail section
- a metallurgical evaluation of the rail section
- hardness testing.

4.3.3. DTA determined that:

- the rail section dimensions were consistent with its specifications
- the initiation point of the fracture was at the foot of the rail
- the fracture was entirely consistent with a fatigue crack.

4.3.4. DTA also found evidence to suggest that the fracture occurred over a short period of time and resulted in a critical failure of the rail.

4.3.5. After receiving the DTA report the Commission decided that more in-depth testing and an examination of the rail were required to determine as far as possible the exact cause of the fracture.

4.3.6. The rail sections were then transported to Quest for further testing that included:

- tensile testing of a sample cut from the foot of the rail within 300-500 millimetres from the fracture face
- a residual stress test of the foot of the rail using strain gauges to measure the movement of the steel once it was cut from the main body of the rail from the opposite side of the fracture to the tensile test sample
- cutting the fracture surface from the end of the rail, cut in half through the stem of the rail, so the origin of the fracture at the foot can could be examined using a scanning electron microscope
- analysing the steel to confirm its composition using scanning electron microscope energy and dispersive X-ray spectroscopy.

4.3.7. Quest concluded in part:

The measured tensile residual stress of 210 Megapascals[5] (MPa) was below[6] the [maximum permissible] value of 250 MPa specified in the manufacturing standard.

Tensile testing of the rail section showed that the material met all requirements of the manufacturing standard, i.e. ultimate tensile strength of 1083 MPa and 1067 MPa for the two samples was greater than the minimum 980 MPa.

The ductility (elongation percentage) of 10.2% and 12.9% was greater than the minimum 9% specified.

Chemical analysis indicated that the material was compliant with KiwiRail's specification for U75V material.

The rail as manufactured met all standards and specifications required.

The fracture initiated from a chatter mark[7] at the foot of the switch rail introduced during the machining process in the region of a machined chamfer [see Figure 8]. The crack propagated, predominately by a high cycle fatigue mechanism, until a critical crack size was reached, and then the final brittle transverse fracture of the rail occurred [see Figures 8 and 9].

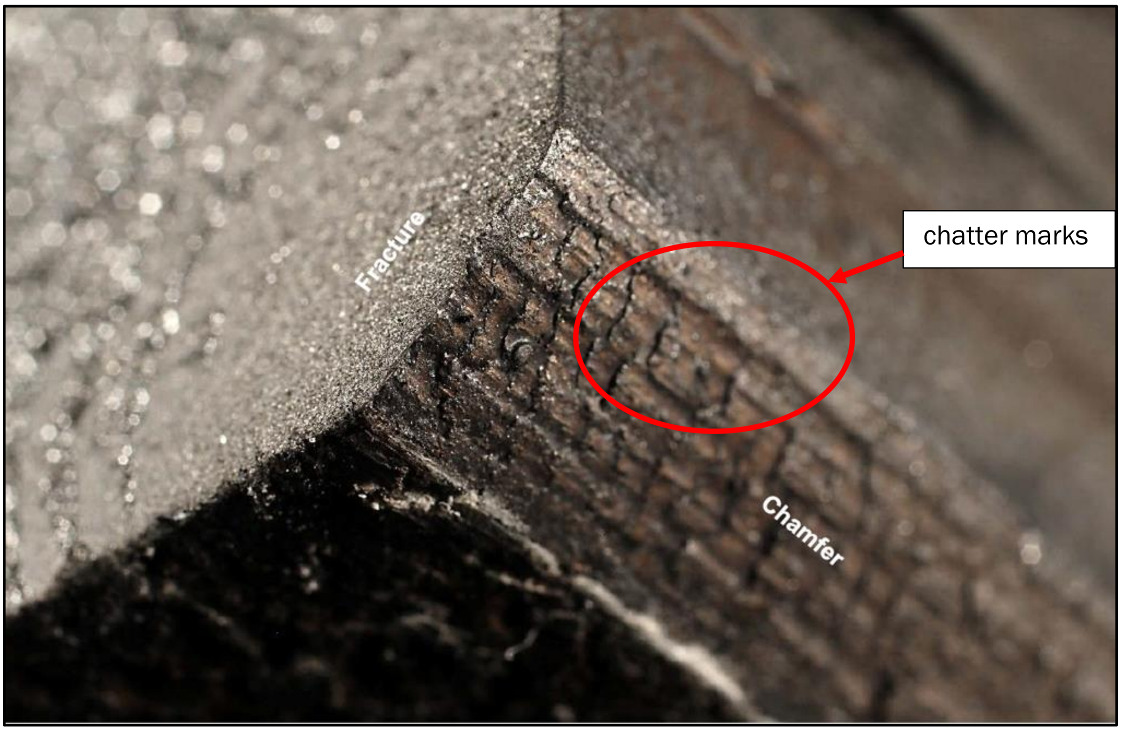

Figure 8
Origin of fracture at a chatter mark

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[5] One MPa is one million of the pascal units, which is the SI unit for pressure. One MPa is equivalent to 10 bar or 145 pounds per square inch. A tensile residual stress of less than 250 MPa was compliant with the manufacturing specifications.

[6] Complied with the standard.

[7] A chatter mark is a defect on the surface of a material introduced during the machining process..

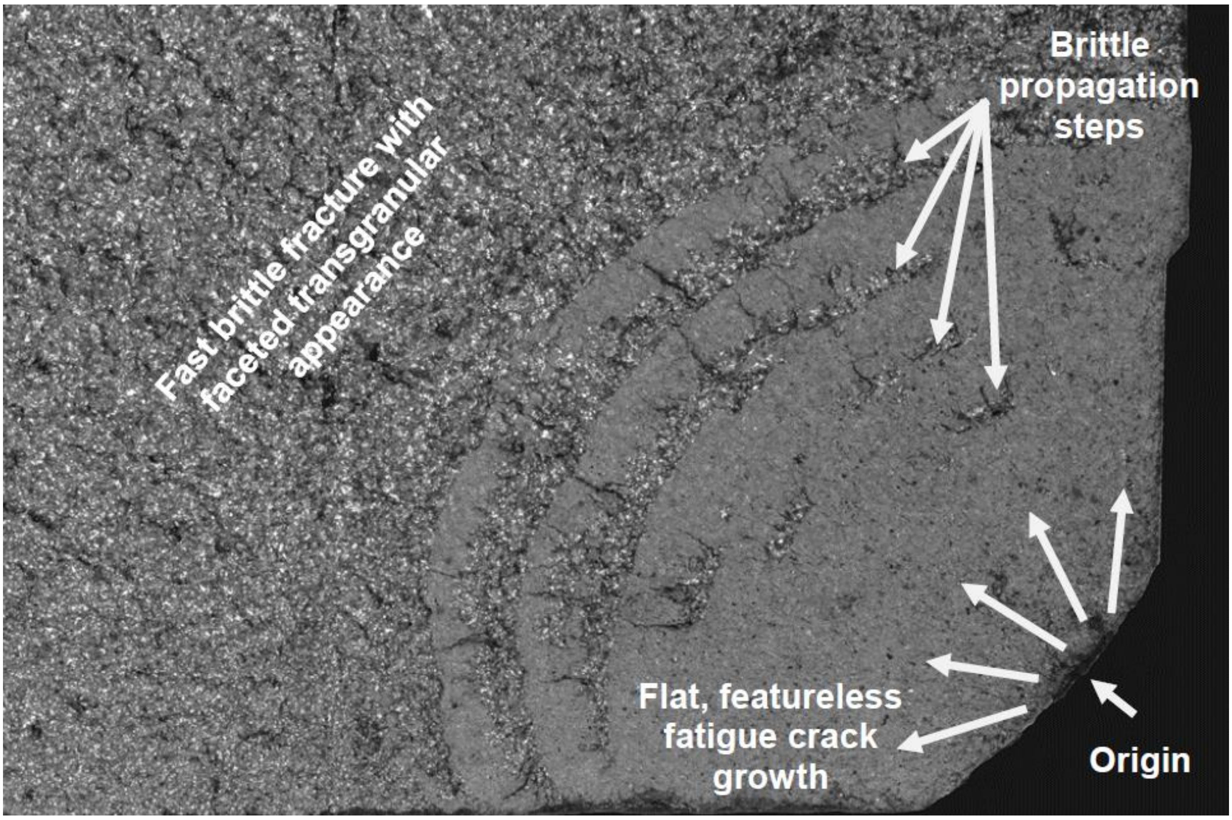

Figure 9
Fracture surface showing origin and initial growth followed by propagation

4.3.8. The Quest report also stated in part:

> The as-found condition of the machined chamfer in the rail samples supplied would likely result in a significant to severe reduction in the fatigue and fracture resistance of the rail, all other factors being equal.

4.3.9. The area of machining defect coincided at a location of maximum in-service rail loading, midway between two sleeper supports.

4.4. The rail

4.4.1. In June 2012 KiwiRail had placed an order for four sets of rail track points from its contracted supplier in China[8]. The supplier used a batch of rail that had been manufactured in 2009 to build the four sets of points. The rail had been manufactured by a different company in China[9]. That company had been supplying rail to the previous owner of the New Zealand rail infrastructure, ONTRACK[10], since 2006.

4.4.2. All four sets of points were later installed at Britomart during the Christmas closedown in 2012. The order included the switch rail that fractured.

4.4.3. The switch rail was mechanically profiled to ensure that it could fit flush against the fixed rail. It was very likely that chatter marks were unintentionally machined onto the foot of the switch rail during the profiling process. Chatter marks refer to rough flakes protruding from the main body of the rail (see Figure 8), which in this case acted as the point of the fracture initiation.

4.4.4. The supply agreement between ONTRACK and the China Railway Shanhaiguan Bridge Group Company did not specify a surface roughness standard for machined components. The

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[8] China Railway Shanhaiguan Bridge Group Company.

[9] Pangang Group Economic and Trading Company.

[10] ONTRACK was responsible for the maintenance and upgrade of the rail network before KiwiRail was established on 1 October 2008.

supplier, with agreement from ONTRACK, used Chinese standard TB/TT412, 'Technical rule for turnouts of standard gauge railway', which specified a surface roughness of Ra[11] 25µm. Surface roughness was only applicable to a normal machined surface, not to abnormal and undesirable machining defects such as chatter marks, which were irregular and usually assessed against presence and depth.

4.4.5. It was a requirement of the specifications that the supplier of the points provided a certificate of compliance for each order. KiwiRail was unable to provide the Commission with the certificate of compliance. Consequently it could not be established whether one had not been supplied or whether one had been supplied and not been retained in KiwiRail's recordkeeping system.

4.4.6. The supply agreement provided a one-year warranty period with the supply of each individual order. Although the set of points had been operating for more than five years, the fatigue fracture that resulted in the failure of the switch rail initiated from one of the chatter marks introduced during the machining process at the time of production.

4.4.7. KiwiRail had begun electronically recording rail failures in 1995. There had been no failures of a similar nature on the New Zealand network since electronic recordkeeping began.

4.4.8. Records showed that 329 sets of points had been supplied by the KiwiRail supplier and installed on the KiwiRail network between 2006 and 2017. A detailed examination using an industrial endoscope was carried out on the other three sets of points from the same batch installed at Britomart during the 2012 Christmas shutdown. No similar defects were found around the chamfered switchblade foot. A sample of mainline sets of points from the other 325 sets was also inspected. The additional inspection did not identify any chatter marks similar to those found on the failed switch rail.

4.4.9. There is therefore no evidence of a widespread quality issue with the supplier. Notwithstanding this, KiwiRail had changed its supplier to an ISO-certified company in 2016. At that time KiwiRail had adopted an improved layout design utilising Australian Standard AS 1085.21 along with its own Track Specification T-SP.21:2014 that required extensive quality assurance records from the manufacturer.

4.5. Inspection methods

4.5.1. Once the switch rail had been installed, the chatter marks located on the outer foot of the rail could no longer be observed by current inspection procedures.

4.5.2. There were three main methods of track inspection utilised within Britomart Station limits:

- visual inspection on foot
- inspection from the driving cab of a passenger train
- non-destructive testing using ultrasonic technology.

4.5.3. A visual inspection of the track within Britomart Station limits had most recently been conducted on 4 May 2018 (five days prior to the incident). No track defects had been reported. The visual inspections were conducted once a week. Visual inspections consisted of a person walking the track, usually between 2300 and 0500 when there was no rail traffic. The inspector conducted a prescribed series of checks on the rail, which included detailed procedures for checking points.

4.5.4. Track inspections from the driving cabs of passenger trains were conducted weekly to monitor the ride quality. Any unusual kicks or bumps observed during the inspections would be noted for follow-up action.

4.5.5. The detection of cracked rails is primarily done with a specialised hi-rail vehicle using ultrasonic testing equipment. The probes send sound waves into the rail and monitor the

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[11] Ra is the arithmetic mean roughness of a surface from the mean line.

echoes returned by the sound waves reflecting off internal and external surfaces. Defects within the rail create reflectors that return unique echo patterns depending on the type, location and size of the defect.

4.5.6. Ultrasonic testing has limitations. The detection of defects requires skilled operators and equipment that can detect a clear echo. The equipment is designed to detect cracks in the head and web of the rail but is unable to detect a defect from the foot of the rail unless such a defect propagated into the web (see Figure 10).

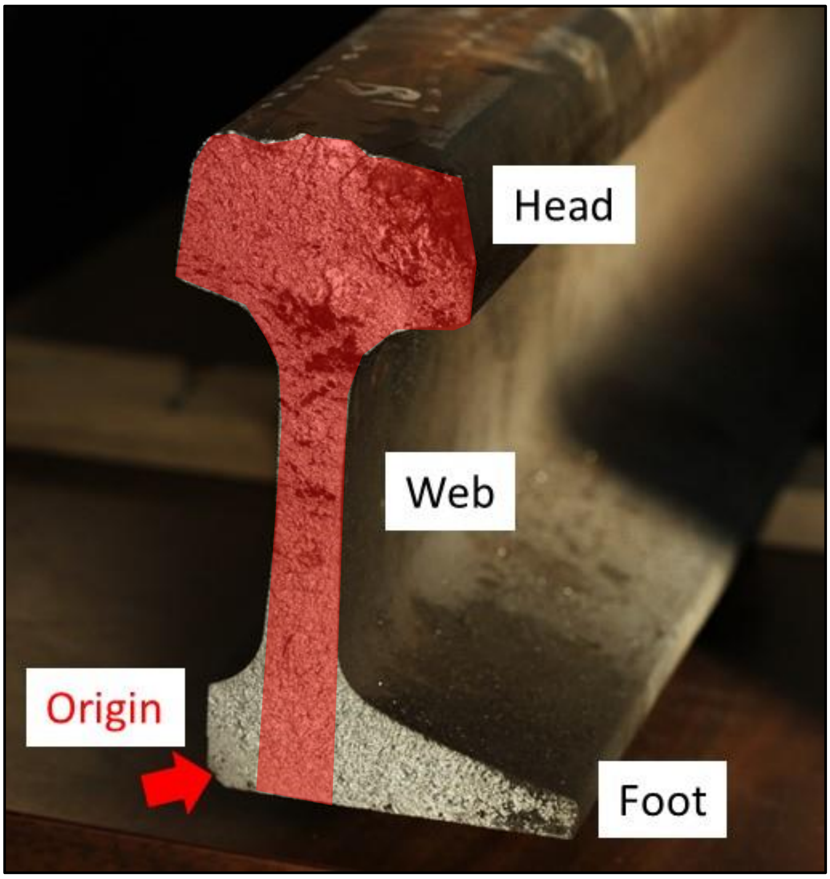

Figure 10
Cross-section of the rail at the fracture surface with the shaded red area representing where ultrasonic testing can detect defects

4.5.7. Ultrasonic testing is conducted every 12 weeks on the Auckland passenger network. The most recent inspection before the derailment had been carried out on 18 February 2018. No defects had been detected on the points.

4.6. Signalling system

4.6.1. Traditional signalling systems use track circuitry to detect if a section of track is occupied by a train. The weight of the train on the track breaks an electrical circuit, which then prevents the system signalling other trains to enter the occupied section.

4.6.2. A broken rail can sometimes have the same effect as a train occupying the section, because it can (but not always) cause the circuit to be broken.

4.6.3. However, track circuitry is not an entirely reliable method of detecting broken rails. It is estimated that it indicates an occupied track in no more than 60% of cases. This is dependent on the type and severity of the break. Rail operators must therefore still conduct regular inspections to check for broken and damaged rails.

4.6.4. The signalling system used in the Auckland metropolitan area, including Britomart, is different from those of most other areas in New Zealand in that rail movements are separated by an axle-counter system.

4.6.5. An axle-counter system does not require the track to be circuited. Rail traffic is detected by equipment on the side of the track that recognises when a train has entered and departed a particular rail section.

4.6.6. This allows for the track to be divided into smaller sections, which in turn provides the ability to run rail traffic more frequently and closer together than traditional track-circuited systems.

4.6.7. The axle-counter system is becoming the standard world-wide for managing traffic on large passenger networks due to its flexibility and efficiency. It also requires much less maintenance than traditional track-circuited networks as there is less rail-side equipment.

4.6.8. KiwiRail increased the frequency of track inspections in the axle-counter-controlled areas to mitigate any increased risk posed by the lack of possible broken rail detection.

4.6.9. In this case the fracture was located on part of a switch rail that would never have been detected by a traditional track-circuited network. The design of the circuitry by necessity does not include the moving parts of points, and therefore a track occupation by way of a broken rail would not have been detected before the derailment occurred.

4.6.10. Therefore, the use of axle counters instead of track circuitry to maintain separation between trains has not appreciably increased the risk that broken rails pose to the Auckland rail system.

4.7. Other potential factors considered

4.7.1. Once the derailed train came to a stop the driver made a conscious decision, because of the unknown status of the overhead line, to use the radio system to make an emergency call to train control, rather than activate the emergency red button, commonly called the 'emergency mushroom'.

4.7.2. Had the emergency mushroom been activated when the driver realised that the train had derailed, the following actions would have occurred almost simultaneously:

- the emergency brake is applied
- the pantograph[12] is lowered
- an emergency radio call to train control is initiated.

4.7.3. In this case the train was approaching the platform at about 25 kilometres per hour and stopped five seconds after it derailed. Had the driver activated the emergency mushroom to stop the train, train control would have been alerted to the incident approximately five seconds earlier irrespective of the driver's condition after a potential impact. The response to this rare and unusual circumstance was likely to have been appropriate on this occasion because the additional time that would have been required to activate the emergency mushroom may have resulted in the driving cab striking the end of the concrete wall.

4.7.4. Notwithstanding this occurrence, the operator has instructed all its drivers that in the event of a train derailment, the first actions are to: depress the emergency mushroom, respond to train control, inform the train manager and passengers, keep crew and passengers on the train until confirmation is received that the overhead line has been earthed and isolated, and wait for assistance.

4.7.5. The Commission considered the effectiveness and safety of the train evacuation and found that it was carried out safely and in accordance with Transdev's evacuation procedures. Passengers were kept informed by the train crew as to what to expect and when. The Commission found no safety issues with the first response to the accident.

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[12] A pantograph is a device fitted to the roof of an electric multiple unit that allows the traction unit to draw current from the contact wire of the overhead line.

5. Findings

5.1. It is virtually certain that the train derailed because the left-hand-side switch rail that the train was traversing at the time was fractured and had become misaligned.

5.2. The chemical composition and material properties of the rail section complied with the rail specifications, and were not factors contributing to the fractured rail.

5.3. The fracture initiated at a manufacturing defect where a chamfer had been machined on the foot of a switch rail which likely resulted in a significant to severe reduction in the fatigue and fracture resistance of the rail.

5.4. The fracture initiation point was in a location of maximum in-service rail loading, midway between two sleeper supports.

5.5. There was no evidence that the manufacturing defect was representative of a wider quality issue.

5.6. The first response to rescue passengers and crew from the derailed train was conducted appropriately and in accordance with the operator's procedures.

6. Safety issues

6.1. No new safety issues identified.

7. Safety actions

7.1. General

7.1.1. The Commission classifies safety actions by two types:

(a) safety actions taken by the regulator or an operator to address safety issues identified by the Commission during an inquiry that would otherwise result in the Commission issuing a recommendation

(b) safety actions taken by the regulator or an operator to address other safety issues that would not normally result in the Commission issuing a recommendation.

7.2. Safety actions addressing safety issues identified during an inquiry

7.2.1. No safety issues identified.

7.3. Safety actions addressing other safety issues

7.3.1. The KiwiRail track inspection regime has moved from a reactive inspection to predictive assurance in accordance with Track Standard T–ST–IN– 5109.

7.3.2. An independent wheel/rail interface working group has been established to resolve any potential rail wear issues within the Auckland passenger network.

8. Recommendations

8.1. General

8.1.1. The Commission may issue, or give notice of, recommendations to any person or organisation that it considers the most appropriate to address the identified safety issues, depending on whether these safety issues are applicable to a single operator only or to the wider transport sector.

8.1.2. In the interests of transport safety it is important that these recommendations are implemented without delay to help prevent similar accidents or incidents occurring in the future.

8.2. Recommendations

8.2.1. No new recommendations issued.

9. Key lessons

9.1. No new lessons identified.

10. Citations

Quest Integrity NZL Limited. (2019). *Britomart Rail Failure: Ambient Charpy Impact Tests and Assessment of Surface Condition.* Wellington: Quest Integrity NZL Limited.

Recent railway occurrence reports published by the Transport Accident Investigation Commission (most recent at top of list)

RO-2017-106	Mainline locomotives, Wrong-routing and collision with work vehicle, Invercargill, 16 November 2017
RO-2017-105	Collision between freight Train 353 and heavy motor vehicle, Lambert Road, level crossing, near Kawerau, 6 October 2017
RO-2017-104	Unauthorised immobilisation of passenger train, at Baldwin Avenue Station, Avondale, 17 September 2017
RO-2017-101	Signal Passed at Danger 'A' at compulsory stop boards protected worksite, Pongakawa, Bay of Plenty, 7 February 2017
RO-2017-103	Potential collision between passenger trains, Wellington Railway Station, 15 May 2017
RO-2017-102	Signalling irregularity, Wellington Railway Station, 3 April 2017
RO-2016-101	Signal passed at danger leading to near collision, Wellington Railway Station, 28 May 2016
RO-2016-102	Train 140 passed Signal 10R at 'Stop', Mission Bush Branch line, Paerata, 25 October 2016
RO-2015-103	Track occupation irregularity, leading to near collision, between Manunui and Taumarunui, 15 December 2015
RO-2014-105	Near collision between train and hi-rail excavator, Wairarapa Line near Featherston, 11 August 2014
RO-2013-101	Derailment of freight Train 345, Mission Bush Branch line, 9 January 2013
RO-2015-102	Electric locomotive fire at Palmerston North Terminal, 24 November 2015
RO-2014-104	Express freight train striking hi-rail excavator, within a protected work area, Raurimu Spiral, North Island Main Trunk line, 17 June 2014
RO-2013-103 and RO-2014-103	Passenger train collisions with Melling Station stop block, 15 April 2013 and 27 May 2014
RO-2015-101	Pedestrian fatality, Morningside Drive pedestrian level crossing, West Auckland, 29 January 2015

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