Australian Government
Australian Transport Safety Bureau

Derailment of coal train 9869

8 km west of Oakey, Queensland | 21 July 2017

Investigation

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Addendum

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Safety summary

What happened

On 21 July 2017, a loaded coal train derailed at a level crossing on the Western Line between Oakey and Jondaryan, Queensland. The hauling locomotives and 18 wagons came off the track, destroying about 300 m of rail infrastructure.

It is very likely that the underframe of a low-clearance heavy road vehicle collided with the railway infrastructure as it traversed the level crossing soon before the coal train reached the crossing. The impact with railway infrastructure resulted in the lateral displacement of rail lines, which consequently derailed the coal train.

What the ATSB found

The rail infrastructure manager's monitoring and inspection process at the Dunkeld Access Road level crossing did not ensure the approach roads within the rail corridor and the crossing surface were maintained within safe operating limits throughout its lifecycle. As a result, the elevated gravel-based level crossing road and crossing surface deteriorated to a point where the underframe of a low-clearance heavy road vehicle collided with the exposed head of each rail as it traversed the crossing.

The driver of the heavy road vehicle did not report the collision with rail infrastructure to the asset owner (Queensland Rail) or the local police in accordance with the Queensland Government road transport guidelines. Therefore, the relevant authorities were not in a position to contact the driver of the train before reaching the level crossing.

At the time of the derailment, there was no interface agreement between the rail infrastructure manager and a responsible road authority.

What's been done as a result?

Following the derailment, Queensland Rail (QR) repaired the level crossing and installed a sealed asphalt surface on both sides of the crossing to mitigate the risk of erosion and deterioration. QR also advised that it had taken or was undertaking a series of actions to improve its inspection processes of level crossings to ensure that more focus is placed on inspecting the condition of the approach roads at the crossings. In addition, QR is reviewing its safety standards and relevant documentation in relation to identified defects at level crossings and how the defects are recorded and managed.

QR also advised it had a state-wide audit program in place to assess the current safety status of all private crossings, and upgrade them to the QR standard and/or seek to enter interface agreements.

Safety message

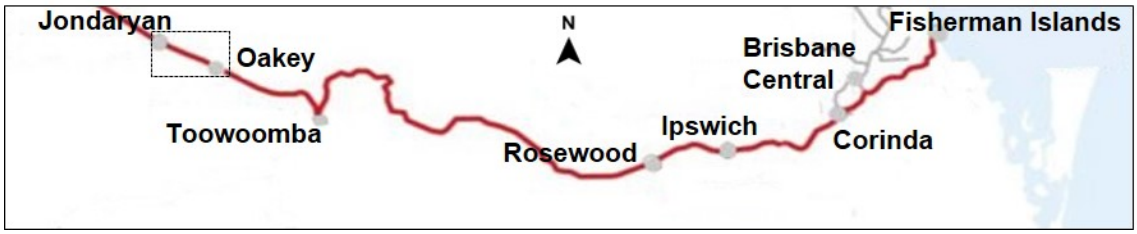
Rail infrastructure managers, who are responsible for the management of the rail corridor, need to ensure that approach roads and the crossing surface at level crossings are subject to regular and effective inspection and monitoring processes. This is particularly relevant for level crossings with gravel-based road surfaces and inclined approach roads.

If rail infrastructure is damaged due to a road accident, it is vitally important that the driver responsible report the matter to the local police or the asset owner as soon as possible.

The occurrence

At about 1550 Eastern Standard Time[1] on 21 July 2017, loaded Aurizon coal train 9869, operating on the Queensland Rail network, departed from the Jondaryan Coal Siding for Fisherman Islands, Queensland (Figure 1). The train was crewed by two drivers, and the consist included two locomotives and 41 wagons.

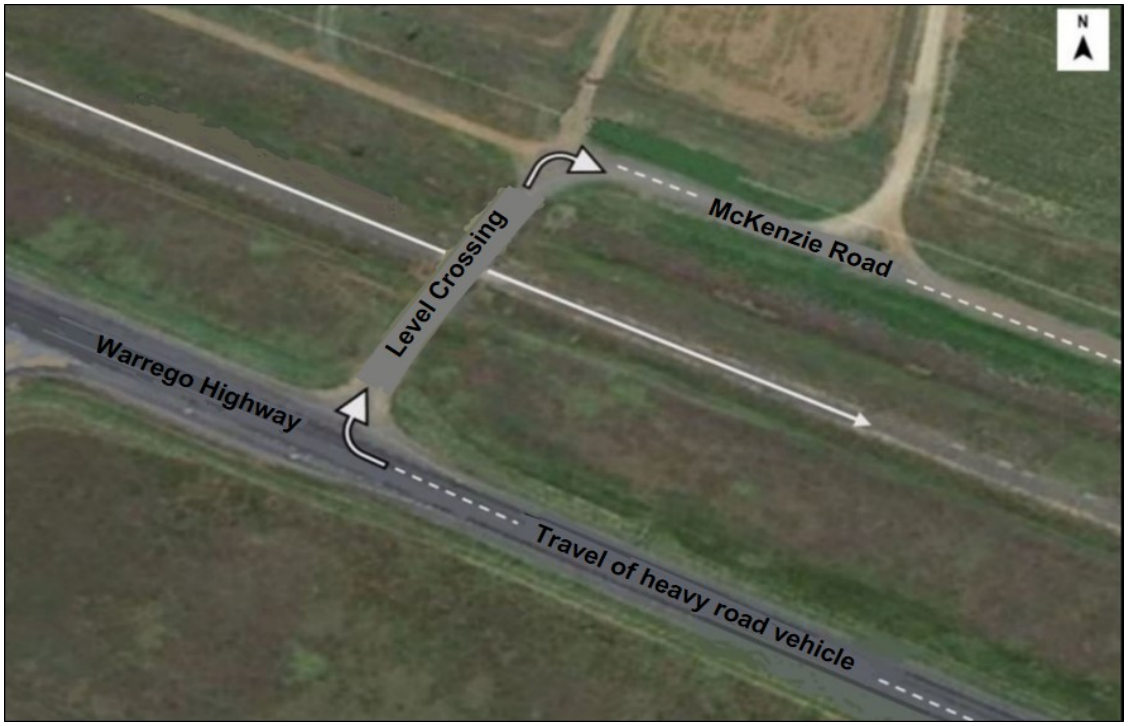
Figure 1: Jondaryan Coal Siding to Fisherman Islands rail route



The image shows the projected journey of train 9869 from Jondaryan Coal Siding to Fisherman Islands.
Source: Queensland Rail (QR)

At about 1534, prior to the departure of the train, a low-clearance heavy road vehicle (prime mover and low-loader) was travelling west along the Warrego Highway between Oakey and Jondaryan. The driver of the heavy road vehicle made a right turn off the highway on to Dunkeld Access Road and passed over level crossing ID 2309, which provided a connection from the highway to McKenzie Road (Figure 2). The level crossing was located at the 38.620 km[2] mark on the Western Line.

Figure 2: Travel direction of the heavy road vehicle over level crossing ID 2309



The image depicts the movement of the heavy road vehicle (white arrows) and the passageway of train 9869 (white solid line) in relation to the level crossing.
Source: Google Earth - annotated by Australian Transport Safety Bureau (ATSB)

1 Eastern Standard Time (EST): Coordinated Universal Time (UTC) + 10 hours.
2 Kilometres west of Toowoomba.

A member of the public saw the heavy road vehicle come to a sudden stop as it passed over the level crossing. According to the witness, the driver left the driving cab of the prime mover and inspected under the low-loader while it was stopped on the level crossing. The heavy road vehicle then continued on its journey, proceeding east along McKenzie Road.

At about 1557, as train 9869 approached level crossing ID 2309, the driver operating the train detected something on the track ahead. Initially, he thought a bird or small animal on the rails had distorted the appearance of the track, which is a common sight in this region. However, as the train neared the level crossing, the driver noticed a 'kink' in both rails. At that point, the speed of the train was 55 km/h, which was within the relevant limit for that section of track.

The driver reported that, as soon as he noticed the kink in the rails, he attempted to stop the train. At about 1558, the data logger on the locomotive recorded a full service brake application, which was initiated by the train driver to control the train to stop. The driver stated that the lead locomotive shuddered as it passed through the level crossing, and through the side mirrors he observed a number of wagons derail as the train slowed.

There were no injuries to the train crew or members of the public. A visual inspection of the train identified both locomotives and 18 coal wagons had derailed. There was also damage to about 300 m of rail infrastructure (Figure 3).

Figure 3: Derailed coal wagons of train 9869

The image shows derailed coal wagons of train 9869 – all wagons in the scene were in a derailed state.
Source: ATSB

Context

Level crossing information

History and location of level crossing ID 2309

In 1948, the Commissioner for Railways in Queensland, at the request of a local property owner, closed the occupation level crossing at the 124 miles 52 chains Western Line and relocated it to the 124 miles 70 chains, opposite the property owner's farm. The relocation of the crossing provided the property owner with ready access to the Warrego Highway. Over time, the property was subdivided into smaller farms, which border the northern side of McKenzie Road and the Western Line.

Level crossing ID 2309 is currently located midway between Oakey and Jondaryan on the Western Line. Although the location of the level crossing has not changed in 70 years, under the metric system, its position is at the 38.620 km mark Western Line. It was categorised as a private (occupation) level crossing.[3] At the time of the derailment, the crossing was used by the general public, including heavy road vehicles.

Queensland Rail (QR) has been the sole contributor to maintenance for both the level crossing and the approach roads within the rail corridor[4] since the relocation in 1948.

Maintenance requirements for private level crossings

QR's *Level Crossing Safety Standard* MD-10-115 stated that QR was responsible for audits, inspections, maintenance and testing at private level crossings. The maintenance responsibilities included (in part):

- erecting and maintaining all signs immediately adjacent to the tracks as set out in the level crossing agreement, deed or license (if applicable);
- maintaining the road surface within the rail corridor…

In the case of level crossing ID 2309, QR had no interface agreement with the road manager(s) and therefore it was responsible for the maintenance of the approach roads within the rail corridor (also see *Level crossing interface agreements*).

Maintenance of level crossing ID 2309

QR records showed that in October 2011, repair work was undertaken to eliminate longstanding drainage issues at level crossing ID 2309. In addition, the approach roads to the level crossing were upgraded (Figure 4).

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[3] A private (occupation) level crossing is used to provide access to private land either from one part of the property to another or to access the property from a dedicated road for use by the responsible road manager (property owner) and their invitees only.

[4] The land on which a railway is built; comprising all property between property fences, or, where there are no fences, 10 m from the outside rail of the outside track.

Figure 4: Dunkeld Access Road / level crossing ID 2309 upgrade in October 2011

The images show the condition of the approach road surface on the day of the upgrade (October 2011).
Source: QR

In July 2012, an assessment of the level crossing identified problems with the condition of the crossing surface. In the July 2012 assessment report, there was an 'Observations' section and a 'Proposals' section. A comment in the 'Observations' section stated:

> Crossing gravel surface is breaking up. Track is "pumping"[5] and contributing to surface deterioration… [Figure 5]

Figure 5: An image taken by the assessor during the July 2012 assessment of level crossing ID 2309

The assessors report recorded that the crossing gravel surface is breaking up and the track is 'pumping' and contributing to surface deterioration.
Source: QR

[5] Pumping refers to the vertical movement of the track under the movement of rail vehicles.

In the 'Proposals' section of the report, the assessor noted:

> Repair gravel surface in accordance with QR Standard Drawing No.2586. Carry out track maintenance works to address track 'pumping' issue.

Queensland Rail's Standard Drawing No.2586, as referred to by the assessor in the report, is a civil engineering standard for public level crossings. In part, it stated:

> Road pavement to be sealed with asphaltic cement or a similar material for a minimum distance of 10m on both sides of the railway.

An asphaltic cement prevents road surface deterioration, which is common with gravel-based road surfaces, particularly when the approach road is steeply inclined as it was at level crossing ID 2309. In addition, a sealed surface reduces the risk of low clearance vehicles striking the tracks as they cross. In the case of level crossing ID 2309, the assessor's proposal was not actioned and the road surface remained unsealed (see *Level crossing assessments*).

Between October 2011 and the derailment in July 2017, there were two track defects recorded near the crossing:

- a low priority defect recorded in November 2015, which went untreated until after the derailment
- a critical track alignment issue recorded on 28 August 2016, which was rectified the following day.

Although the critical track alignment was not directly connected to the deteriorated condition of the level crossing, it is possible that the maintenance rectification work included some type of repair to the crossing surface. However, the extent of the repair work at the level crossing between July 2012 and August 2016 could not be determined based on the available records.

Accident site examination

Examination of approach roads

On 22 July 2017, the day after the derailment, the ATSB examined the accident site, which included the level crossing and approach roads to the crossing.

The approach roads to the level crossing were unsealed and constructed from compressed gravel road base. The on-site examination identified noticeable wheel furrows cut into the road surface on the approach to the level crossing from both sides (Figure 6).

Figure 6: The condition of the gravel-based road surface at the crossing on 22 July 2017

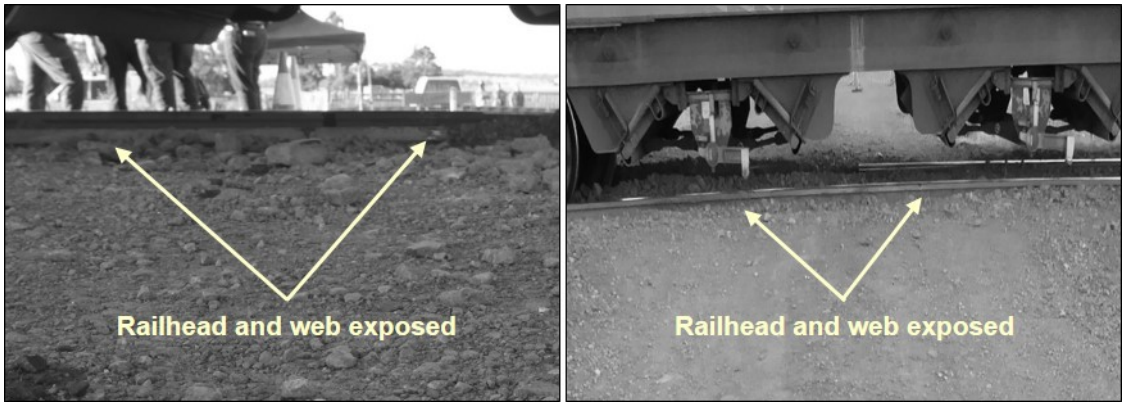
The images show the deteriorated state of the road surface and evidence of wheel furrow marks cut into the road surface.
Source ATSB

Australian Standard 7658:2012 *Railway Infrastructure: Railway Level Crossings* stated:

> The level crossing surface shall be flush with the top of rail, planar[6] between the two rails and flush with the approach roads.

When inspected by the ATSB following the derailment, the head of each running rail at the level crossing was standing noticeably proud above the crossing surface. In some areas, the web[7] of the rail was exposed (although see *Examination of rail track*). This was particularly noticeable where the wheel furrows in the road surface intersected with the rail lines (Figure 7).

Figure 7: The exposed railhead and rail web at level crossing ID 2309



The images show the deteriorated condition of the crossing surface with the railhead and some of the rail web exposed. The image on the left is the approach from the Warrego Highway and the image on the right is the approach from McKenzie Road.
Source: ATSB

There was evidence on both sides of the approach road of a pair of dual wheel tread marks, consistent with a large road vehicle having recently passed over the crossing. The tread marks followed the path of the wheel furrows. There was no evidence of gouge/score marks in the gravel-based road surface between the wheel furrows approaching the rail lines on either side of the crossing surface.

To provide guidance for underbody clearance for rolling stock and road vehicles at level crossings, QR developed civil engineering drawings. Level crossing civil drawing No.2587 defined road-grading limits at private level crossings. Where the approaches to a level crossing had a maximum incline of 6 per cent, the crossing surface design was to exhibit a level plane for 3,000 mm on either side of the track centre line.[8]

The rail track in the area near the level crossing was elevated above the surrounding terrain. Measurements using a laser scanner identified that the approach roads (Dunkeld Access Road) on either side of the level crossing were inclined at about 5 per cent. However, the crossing surface did not exhibit a level plane on either side of the track centre line in accordance with the civil engineering drawing No. 2587. That is, the 5 per cent incline in the approach roads extended all the way up to the edge of the sleepers.

Examination of rail track

The site examination identified lateral displacement to the rails and significant gauge variation at the level crossing. There were side impact marks to the head of each rail at the point of lateral displacement.

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6 A flat two-dimensional surface.

7 The web of the rail is the vertical section that supports the railhead.

8 A level crossing surface helps minimise the potential for the rail line to be damaged by low clearance vehicles passing over the rails. Civil engineering drawing No.2587 stated that the approach roads for private crossings could be made from compressed gravel. Civil engineering drawing No.2586, which applied to public level crossings, had the same requirements for incline and crossing surface, but it also required an asphalt or similar surface.

The rail on the Warrego Highway side of the level crossing, which took the initial impact, was broken at the impact mark. The matching impact mark to the head of the parallel rail showed distortion to the gauge face, resulting in a gauge disparity of 55 mm (Figure 8).

Figure 8: Damage to the rails at level crossing ID 2309

The image shows corresponding impact marks in the head of each rail, which distorted the gauge and compromised the track integrity.
Source: ATSB

The impact marks to each rail were located in the middle of the level crossing, between the wheel furrows made by road vehicles as they passed over the level crossing.

The impact marks covered the entire height of the head of each rail. Together with the absence of gouging/scoring in the road surface, this confirmed that the head of the rails were exposed at the point of impact.

As noted in *Examination of approach roads*, the site examination identified that the web of each rail was partially exposed at the level crossing and was clearly visible above the crossing surface. This was at least partly due to the low clearance vehicle colliding with the rails together with the derailment lifting the rails and displacing the gravel-based material previously surrounding the rails. Therefore, the extent to which the rail webs had been exposed, prior to the impact, was not able to be determined. However, it was noted that, where the wheel furrows intersected with the rails, the top of the rail webs had a distinctly different appearance to the lower sections of the webs, indicating that they had been exposed for some time.

Laboratory testing of a section of the damaged rail and the analysis of fracture propagation marks indicated that a factor external to the rail environment was involved in the lateral displacement of the rails. More specifically, the impact marks on each railhead indicated that the underframe of a low-clearance heavy road vehicle struck the track at some stage prior to the derailment. The impact marks confirmed that the road vehicle involved entered the level crossing from the Warrego Highway side.

Evidence relating to train activity on the day of the derailment confirmed that the condition of the track at the level crossing was free from damage at 1530. An empty coal train (9L16) passed through the level crossing at this time and did not encounter an issue with the track. Therefore, it is very likely that the underframe of a low-clearance heavy road vehicle collided with the rail infrastructure as it traversed the level crossing sometime between 1530 and 1557 on 21 July 2017.

Road vehicle information

Heavy road vehicle information

On the afternoon of 21 July 2018, the driver of a heavy road vehicle (prime mover and low-loader) was delivering a front-end loader to a worksite adjacent to the Devon Park Road level crossing

just west of Oakey. QR had engaged a transport company to deliver the front-end loader to the worksite for the purpose of planned track maintenance work.

The heavy road vehicle was operating under the provisions of *Guideline for Excess Dimension Vehicles Carrying Indivisible Articles in Queensland – Form Number 4 (Version 8) February 2013*. The gross load capacity of the low-loader (trailer) was 55,000 kg, and the weight of the end-loader was under 20,000 kg. Therefore, the low clearance heavy road vehicle was not overloaded when traversing the level crossing.

The driver of the vehicle stated that he had delivered heavy earthmoving machinery to this location on many occasions. He further stated that on all occasions the same prime mover and low-loader combination had been used to deliver the machinery.

The driver stated he normally turned off the Warrego Highway at Devon Park Road to reach the worksite, passing over the level crossing and unloading the machinery on the northern side of the rail corridor. He added that he would then continue along McKenzie Road, and turn left at level crossing ID 2309 to gain access to the Warrego Highway (Figure 9).

Figure 9: The preferred route after delivering heavy machinery to the worksite

The image shows the route normally taken by the driver of the heavy road vehicle after delivering earthmoving machinery for planned maintenance work during 2017.
Source: Google Earth, annotated by the ATSB

However, on this particular occasion, due to traffic build-up at the Devon Park Road level crossing, the driver of the heavy road vehicle chose to use an alternate route. He chose to continue along the Warrego Highway, turn off at the next level crossing (ID 2309) and proceed along McKenzie Road in order to reach his destination.

In this instance, by travelling the alternate route, the low-clearance heavy road vehicle was passing over level crossing ID 2309 in a loaded condition, rather than an unloaded condition as it normally would. It was also entering the level crossing from a different direction to normal (that is, it was entering from the Warrego Highway side).

The driver of the heavy road vehicle stated that he recalled passing over level crossing ID 2309, but insisted that the vehicle did not collide with the rail infrastructure at the crossing.

Additional evidence relating to the movement of the heavy road vehicle

At about 1534 on 21 July 2017, video footage recorded by a camera fitted to a private vehicle travelling east on the Warrego Highway showed a prime mover and low-loader combination travelling west on approach to level crossing ID 2309. The heavy road vehicle was transporting a yellow front-end loader (Figure 10).

Figure 10: Dash camera footage from a private vehicle

The image shows a prime mover and low-loader carrying a front-end loader as it approached level crossing ID 2309. The time stamped on the image is 1534:22 on Friday 21 July 2017. Source: private vehicle operator

A short time later, a member of the public, who provided information to the local police, stated that he observed a prime mover and low-loader combination, transporting a front-end loader, come to a sudden stop as it passed over level crossing ID 2309 from the Warrego Highway side.

The witness stated that the heavy road vehicle appeared to have 'bottomed-out' on the crossing. He also stated that the driver of the heavy road vehicle left the driving cab of the prime mover and checked the underframe of the low-loader while it was stopped on the level crossing.

Reporting damage or safety incidents at level crossings

There were 'incident reporting signs' in place at the level crossing on the day the railway infrastructure was damaged. The signs provided an emergency contact number for reporting faults or safety incidents at the level crossing (Figure 11).

The Queensland Department of Transport and Main Roads has provided guidelines for the operation of excess dimension vehicles in Queensland. It detailed the responsibilities of the driver if a vehicle causes damage at a level crossing. It stated:

> The driver of the vehicle must immediately report any damage caused to the asset owner and in the event that it presents a dangerous situation, to the local police.

On the day of the derailment, no advice of rail infrastructure damage at the level crossing was received by QR or the local police.

Figure 11: Incident reporting sign at level crossing ID 2309

The image shows the incident reporting sign and the emergency contact number, in place at level crossing ID 2309 on the day of the derailment.
Source: ATSB

Inspections and assessments of level crossing ID 2309

Scheduled inspections of rail corridor

Inspection is the process by which QR collects and records information on the condition of the track and its components. Inspection must commence when the track is new and continue through its operational life.

QR's *Civil Engineering Track Standard, Module 1 – Track Monitoring*, prescribed the regime to inspect the condition of the track[9] and track components in accordance with its standard. It lists three inspection types relevant to the inspection of track, each of which includes level crossings as an element for inspection. The three inspection types were:

- Scheduled patrol inspection (maximum interval between inspections is 96 hours). On the Western Line, these inspections were conducted by a single infrastructure worker driving an on-track vehicle through the rail corridor. The inspection was to detail all elements within the rail corridor including level crossings, stopping as required to inspect recorded defects. A scheduled patrol inspection occurred on 20 July 2017, 1 day prior to the derailment, with no defects identified at level crossing ID 2309.
- Scheduled general inspection (maximum interval between inspections is 4 months). On the Western Line, these inspections were typically conducted with two infrastructure workers, who travelled through the rail corridor using an on-track vehicle. The inspections detailed all elements within the rail corridor including level crossings, stopping as required to inspect recorded defects. The two scheduled general inspections undertaken prior to the derailment occurred on 16 January 2017 and 17 July 2017. Neither of the inspections identified issues at level crossing ID 2309.
- Scheduled detailed inspection (maximum intervals between inspections was 48 months). These inspections were typically conducted by walking the rail corridor. In addition to the requirements for general inspections, detailed inspections must be at a level of detail sufficient to record the condition of the track for specific purposes such as determining required repairs or remedial actions. The last scheduled detailed inspection occurred on 18 May 2016, with no defects at level crossing ID 2309.

[9] 'Track' meaning all the features on the right of way, excluding: bridges, culverts, signals, electrical infrastructure and buildings.

In accordance with QR's *Civil Engineering Track Standard*, the infrastructure workers conducting these inspections were required to keep a lookout for obvious unsafe conditions, changed conditions or evidence of high rates of deterioration, which indicated unacceptable risk to operations.

Workers who conducted these inspections informed the ATSB that they stopped at all level crossings to inspect the lights, boom gates and guardrails where applicable. They advised that they also inspected the road surface and crossing surface of level crossings to ensure the safe passage of trains and vehicles. Workers advised that they could not readily distinguish between public and private level crossings without referring to documentation. Additionally, the infrastructure workers were unable to determine the balance of responsibilities of the rail infrastructure manager and the road manager at a level crossing if an interface agreement existed.

Level crossing assessments

QR undertook 'assessments' of level crossings

> …to determine the appropriate level of control to reduce the risk of collision between a road vehicle/pedestrian and a train as far as is reasonably practicable.

QR's Level Crossing Safety Standard MD-10-115 stated:

> If a private crossing has substantial public use, the recognised level crossing risk assessment model (ALCAM) shall be used. For this purpose, public traffic is defined as vehicular traffic which is not owned or strictly controlled by the Responsible Road Manager…
>
> Private, maintenance and temporary construction level crossings will be reviewed by Queensland Rail at not more than five yearly intervals. These reviews shall be carried out to ensure compliance with the controls approved following the initial assessment for the crossing, and verify that the conditions applying at the time of the initial assessment are still current and the controls are still effective.

These level crossing assessments are separate from the scheduled inspections of the rail corridor discussed in the previous section.

Documentation provided by QR showed that the last assessment/review undertaken at level crossing ID 2309 was on 2 July 2012. The next review should have occurred prior to 2 July 2017. However, this did not occur and, at the time of the derailment on 21 July 2017, the review was overdue.

A notation recorded by the assessor within the July 2012 assessment report stated:

> Whilst at present this is a private (occupation) level crossing, it has been assessed as a public level crossing.[10]

The report was brief in nature, and there was no explanation within the report on the decision, for the purpose of the assessment, to upgrade the level crossing from private (occupation) to public. In accordance with the requirements for public level crossings in QR's Level Crossing Safety Standard MD-10-115, the assessor used the Australian Level Crossing Assessment Model[11] (ALCAM) to evaluate the level crossing.[12]

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[10] A public crossing is a level crossing provided to maintain continuity of a public vehicular thoroughfare across a railway at grade and available for use by the general public.

[11] ALCAM is an assessment tool used to identify key potential risks at level crossings and to assist in the prioritisation of crossings for upgrades. The risk model is used to support a decision making process for both the road and pedestrian level crossings and to help determine the most cost-efficient treatments.

[12] MD-10-115 stated that the assessment of private crossings was to be conducted using a 'Private & Queensland Rail Maintenance Level Crossing Assessment Report Form'. However, it also stated 'Private crossings that are substantially used by members of the public shall be assessed using ALCAM.'

QR's level crossing database contains information relating to individual level crossings. After an assessment/review or audit, the assessor updates the system by populating information into the values and fields sections relevant to the level crossing. The system has the capacity to produce a characteristics report. The report reflects on the condition and characteristics of the level crossing at the time of the last entry.

On 15 August 2017, at the request of the ATSB, QR provided the latest characteristics report relating to the level crossing. The last recorded entry date in the comments section of the level crossing database was on 2 July 2012 (following the assessment). In part, the characteristics report stated the crossing condition was 'bad'.

Based on the evidence supplied by QR, there was no record entered into QR's asset management database to indicate whether any action regarding the assessor's proposals in July 2012 to repair the approach road and crossing surface in accordance with QR Standard Drawing No.2586 (see *Maintenance of level crossing ID 2309*) was approved or actioned. Other proposals in the assessment report (such as installing advance warning signage and incident reporting signage) were actioned at some stage, but not recorded as being actioned in the asset management database.

Other level crossings

The ATSB did not conduct a detailed review of other level crossings in the area. However, it did examine level crossing ID 2310, located 1.5 km west of level crossing ID 2309. This was a private level crossing, and only supported traffic to and from a private property. There were noticeable wheel furrows on the approach roads. In addition, a significant portion of the railhead and web were exposed.

Level crossing interface agreements

An interface agreement is a written agreement between the rail infrastructure manager and road manager and sets out the responsibilities, mutual understanding and arrangement for the management of risks to safety at the shared level crossing interface.

Legislation, introduced in 2010 and current at the time of the derailment, stated the rail infrastructure manager (in this case QR) must identify, so far as is reasonably practicable, risks to the safety of persons arising or potentially arising from railway operations for a private road.

If the rail infrastructure manager forms the opinion that it is necessary to manage the identified risk in conjunction with the responsible road manager, the rail infrastructure manager should reasonably seek to enter into an interface agreement with that responsible road manager.

Alternatively, if the rail infrastructure manager forms the opinion that it is not necessary to manage the identified risks in conjunction with the responsible road manager, then the rail infrastructure manager for the road should keep a written record of the reasons for forming that opinion. The legislation stated that a responsible road manager for a private road meant the owner of the road.[13]

The Dunkeld Access Road was a private (occupation) road passing over a railway. It joined two public roads, the Warrego Highway and the nearby McKenzie Road (Figure 2). In effect, QR was the road owner within the rail corridor and was responsible for the inspection and maintenance of the level crossing. In addition, there is evidence that QR was maintaining the Dunkeld Access Road outside the boundary of the rail corridor.

At the request of the ATSB, QR provided correspondence stating that there was no interface agreement with a responsible road manager for level crossing ID 2309. There was also no

[13] The legislation had similar requirements for public roads, but stated that the rail infrastructure manager must reasonably seek to enter into an interface agreement with the responsible road manager. The legislation stated that a responsible road manager for a public road could be the local government or state government.

evidence provided to indicate that QR had attempted to enter into an interface agreement with either the owner of the nearby property or a road authority. Nor was there a written record regarding the reason QR chose not to manage the risks in conjunction with a responsible road manager.

Safety analysis

Introduction

The loaded coal train derailed at level crossing ID 2309 due to the misalignment of the rail track. No factors associated with the operation of the train or the rolling stock contributed to the derailment.

This analysis will discuss the factors associated with the rail track misalignment. These include the condition of the level crossing, the collision of a heavy road vehicle with the rail infrastructure, the absence of reporting the collision and the processes used to ensure the condition of the level crossing.

Condition of level crossing ID 2309

The railway track at the level crossing was elevated above the surrounding terrain. The approach roads on either side of the level crossing were inclined at about 5 per cent, which was within but close to the maximum allowed incline of 6 per cent. This incline, and the fact that the road and crossing surface were constructed of compacted gravel-based material, meant the crossing was vulnerable to erosion and deterioration.

The available evidence suggests that local traffic and heavy road vehicles used the crossing, and the condition of the level crossing deteriorated over a period of time. The assessment of the level crossing in July 2012, 8 months after a comprehensive upgrade in October 2011, noted that the crossing surface was breaking up and deteriorating. The report included a proposal to replace the gravel-based road surface with asphalt or a similar sealed surface, but this was not done. It is possible some repair of the gravel-based road surface was done at this time, or after this time, such as when a critical track irregularity was identified and repaired in August 2016. However, the extent of any repair work could not be determined based on the available records.

An examination of the level crossing on 22 July 2017, the day after the derailment, identified that the approach roads to the level crossing were in a deteriorated state. There were significant wheel furrows in the gravel-based approach roads, which lowered the underframe of vehicles relative to the road surface, if they followed the furrows. In addition, there was not a level plane over the crossing surface, with the 5 per cent incline in the approach roads extending up close to the rails. The available evidence also indicated that the head and probably some of the web of each rail was exposed above the crossing surface, although the extent the webs were exposed could not be determined. Collectively, these factors, in the period leading up to the derailment, presented a significant risk associated with low-clearance road vehicles and agricultural machinery passing over the level crossing and damaging the rail infrastructure.

Collision with rail infrastructure at level crossing ID 2309

An examination of the accident site identified identical impact marks to the head of each rail at the level crossing. The lateral impact distorted both rails resulting in misalignment of the rail track. Analysis of the marks indicated that they were the result of impact from a low-clearance road vehicle that turned off the Warrego Highway and passed over the level crossing from that direction. The available evidence also indicated that the collision occurred between 1530 and 1557 (just prior to the train reaching the crossing).

It is very likely that the vehicle involved in the collision was the low-clearance heavy road vehicle (prime mover and low-loader combination) delivering the front-end loader to a worksite on the northern side of the rail corridor. It was observed approaching the level crossing at 1534, and a witness saw the low-clearance road vehicle come to a sudden stop at the level crossing shortly after.

It is possible that another low-clearance heavy road vehicle was involved in the collision. However, no other vehicles were sighted passing over the level crossing in the relevant period. In addition, although the same low-clearance heavy road vehicle had crossed the level crossing on previous occasions without incident, it is notable that on those occasions it had crossed without a load and crossed from the other direction.

Collision with rail infrastructure not reported

The heavy impact marks to the head of each rail and the resulting rail infrastructure damage suggests that the collision was significant. Therefore, it is highly likely that the driver of the low-clearance heavy road vehicle that caused the damage would have been aware that the vehicle struck the rail track.

Any damage to rail infrastructure such as rail track misalignment can have very adverse consequences. Accordingly, it is vitally important that any suspected damage is reported as soon as possible. The requirements for reporting such damage have been promulgated, and were also posted at the level crossing. In this case, had the damage been promptly reported, it is likely that advice of the potential problem could have been provided to the train crew prior to the train reaching the level crossing.

Scheduled inspections relating to level crossing ID 2309

The fact that the level crossing had deteriorated outside safe operating parameters suggests it was not being appropriately maintained. It is possible that the condition of the level crossing had only recently deteriorated. However, the level of deterioration that occurred between the upgrade in October 2011 and the assessment in July 2012 suggests that the crossing had a significant potential to degrade over time. The available information suggests that road vehicles, including heavy road vehicles, regularly used the level crossing. Together with factors such as the relatively steep incline and the gravel-based surface, this created the potential for degradation of the crossing surface and the approach roads.

In order for the level crossing to be maintained, the deterioration had to be detected through an assessment or review or scheduled inspections. The last assessment was conducted just over 5 years before the derailment. If an assessment had been done on or just prior to the scheduled date, it is likely that it would have detected the deterioration. Nevertheless, a slight extension to the 5-year timeframe would not be unreasonable in most circumstances (if requested). In addition, there was the significant potential for the problem with the access roads to have developed within 5 years. Therefore, the scheduled inspection processes played an important role in detecting problems before they reached a significant level of deterioration.

According to QR's documented procedures, level crossing ID 2309 should have undergone a series of scheduled inspections at 96-hour, 4-month and 48-month intervals. The level of detail required in each inspection varied, but they all required aspects of the level crossing, including the road surface within the rail corridor, to be examined.

Overall, there should have been more than 540 combined inspections undertaken at the level crossing between the upgrade in October 2011 and the derailment in July 2017. A number of different personnel would have undertaken these inspections. However, none of these inspections identified the deterioration of the level crossing, which strongly indicates that the inspection process for detecting deficiencies associated with the approach roads and level crossing surface was inadequate. The ATSB also notes that the condition of the approach roads of another private level crossing, located near ID 2309, also had deteriorated to the extent that a significant portion of the railhead and rail web was exposed.

The benefit of an interface agreement

Other than an indemnity agreement between a local property owner and the Commissioner for Railways in 1947, there is no record of an interface agreement involving QR and a road manager(s) at level crossing ID 2309. In the absence of an interface agreement with the road manager(s), QR's responsibility within the rail corridor was to monitor, inspect and maintain the condition of the road and level crossing throughout their operational life.

Alternatively, QR could have entered into an agreement with another entity to manage the road at the level crossing. As the level crossing forms a connection between a local council road and national highway, the responsible road manager could be either the local road authority, state government or both.

Although level crossing ID 2309 was classified as a private (occupation) level crossing, its unrestricted access as a thoroughfare between two public roads likely presented a level of risk similar to that of a public road crossing. The available evidence also indicates it was frequently used as a public road. In addition, the person who undertook the assessment of the level crossing in July 2012 conducted the assessment as if it was a public crossing. This presented an opportunity for QR to reconsider its classification of the crossing, and/or consider entering into an interface agreement with a responsible road authority.

The benefit of an interface agreement is that both QR and the road manager(s) would have shared the identified risks through a controlled process. Accordingly, if responsibilities for inspecting the condition of the road surface by a road manager at regular intervals was appropriately documented and controlled, this could have increased the potential to identify the developing problem.

However, without knowing exactly how the responsibilities within the rail corridor would have been documented and controlled, it is difficult to determine whether an interface agreement by itself would have led to the identification of the deterioration in the approach road and crossing surface on Dunkeld Access Road prior to the collision with rail infrastructure and subsequent derailment. Ultimately, QR was still responsible for inspecting the approach roads within the rail corridor, and had not identified the deterioration.

It should be noted that the QR network has more than 1,000 private level crossings. A substantial number of these do not have an interface agreement. Consequently, QR's inspection processes need to be adequate when inspecting approach roads and crossing surfaces at such locations.

Findings

From the evidence available, the following findings are made with respect to the derailment of train 9869 at level crossing ID 2309, near Oakey, Queensland on 21 July 2017. These findings should not be read as apportioning blame or liability to any particular organisation or individual.

Safety issues, or system problems, are highlighted in bold to emphasise their importance. A safety issue is an event or condition that increases safety risk and (a) can reasonably be regarded as having the potential to adversely affect the safety of future operations, and (b) is a characteristic of an organisation or a system, rather than a characteristic of a specific individual, or characteristic of an operating environment at a specific point in time.

Contributing factors

- The condition of level crossing ID 2309 was degraded, with significant wheel furrows in the approach roads, the absence of a level plane over the crossing surface, and the head of both rails was exposed. Some of the web of the rails was also probably exposed.
- It is very likely that the underframe of a low-clearance heavy road vehicle collided with the exposed head of the rails as the vehicle traversed level crossing ID 2309.
- As a result of the collision by a low-clearance heavy road vehicle, the rail lines at level crossing ID 2309 were laterally displaced, creating the potential for a derailment.
- The driver of the low-clearance heavy road vehicle that collided with and damaged the rail infrastructure at level crossing ID 2309 did not report the occurrence to the relevant authorities.
- **Queensland Rail's track monitoring and inspection processes were not effective in identifying significant deterioration in the condition of level crossing ID 2309 and its approach roads to ensure the safe operating limits of the level crossing throughout its lifecycle.** [Safety issue]

Other factors that increased risk

- Queensland Rail had not entered into an interface agreement with a responsible road authority at level crossing ID 2309, even though Dunkeld Access Road and the level crossing were in effect being used as a public thoroughfare. It is likely that an interface agreement would have resulted in a co-ordinated approach to managing the shared risks at the level crossing.

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 rail 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.

QR's track monitoring and inspection processes

Safety issue number:	RO-2017-007-SI-01
Safety issue owner:	Queensland Rail
Operation affected:	Rail: Infrastructure
Who it affects:	Rail Infrastructure Managers, Rail Operators and Road Authorities/Managers

Safety issue description:

Queensland Rail's track monitoring and inspection processes were not effective in identifying significant deterioration in the condition of level crossing ID 2309 and its approach roads to ensure the safe operating limits of the level crossing throughout its lifecycle.

Status of the safety issue

Issue status: Adequately addressed

Justification: The ATSB is satisfied that the action taken and proposed to be taken by Queensland Rail will reduce the risk associated with this safety issue.

Proactive safety action

Action taken by:	Proactive safety action taken Queensland Rail
Action number:	R0-2017-007-NSA-08
Action date:	29 April 2019
Action type:	Proactive safety action
Action status:	Released

In April 2019, Queensland Rail advised that it had taken the following safety action:

1. MD-10-575 CETS [Civil Engineering Track Standard] was reviewed recently (2018) and the requirement for a Level Crossing was explicitly included in Appendix 1A schedule of inspections.

2. MD-10-575 CETS, Module 5 is currently subject to an interim review and changes are being made to provide more detail on the priority for defects at level crossings including roadways and flangeways.
3. MD-10-115 Level Crossing Safety Standard is currently under routine review. Key findings from the report will be incorporated in the review, ie:

    a. Defects identified shall be entered in the Asset Manager's defect management system (EAMS)

    b. Acknowledgment of AS7658 requirement for the road surface requirements, which differ slightly from AS1742.7 (Most likely to be captured in standard drawing review)

    c. Clarifying the in-field identification and requirements for occupational crossings and public level crossings

    d. Identifying that Interface Agreements are a control and the absence of an Interface agreement may require additional controls from QR

    e. Clarifying the intent and expectation for the various inspections across a level crossing.
4. MD-16-645 Level Crossing Check Sheet has been reformatted to assist with the clarifying the requirements for an inspection of level crossing infrastructure to support changes in MD-10-575 CETS. This will be issued concurrently with MD-10-115.
5. Review of standard drawings associated with Level Crossings to improve clarity for expectations of design of Level Crossings. This will be issued following release of MD-10-115.

Additional safety action

Whether or not the ATSB identifies safety issues in the course of an investigation, relevant organisations may proactively initiate safety action in order to reduce their safety risk. The ATSB has been advised of the following proactive safety action in response to this occurrence.

Queensland Rail

Following the derailment, Queensland Rail (QR) repaired the level crossing. During this repair, a sealed asphalt road was installed, covering both sides of the crossing surface.

In its response to the draft investigation report in April 2019, QR advised that since the derailment it had attempted to enter into an interface agreement with a local land owner (who did not want the crossing closed) and the local council (who did not want to make the crossing public).

In April 2019, QR also advised the following in relation to interface agreements:

> QR has an audit programme in place to assess all private crossings, upgrade them to the QR standard as necessary, and seek to enter into interface agreements.
>
> QR have requested that the land owner for this crossing enter into an interface agreement with Queensland Rail for the safe operation and use of this level crossing.
>
> An Interface Agreement for Occupational Crossing ID 2309 (Dunkeld Access Road, Oakey (38.62km Western Line) was sent to the private land owner on 9 April 2019. Receipt of the letter was acknowledged on 15 April 2019.
>
> In relation to the ongoing audit programme, audits so far have been completed within the North, Central, North Coast/ Wide Bay/ Burnett regions of Queensland. To date, the audits have identified 72 crossings for closure (as they are no longer required by any party), 28 crossings will be changed from private to public status crossings (as they appear to be used by the general public), 7 crossings will be changed from private to maintenance status crossings and 3 crossings have been identified as requiring relocation. Also to date, licence/interface agreements for 411 have been sent to relevant parties in the regions noted above and 174 licence/interface agreements have been formalised.

General details

Occurrence details

Date and time:	21 July 2017 - 1558 EST	
Occurrence category:	Accident	
Primary occurrence type:	Train derailment	
Location:	At the 38.620 km mark between Jondaryan and Oakey on the West Moreton rail corridor, Queensland	
	Latitude: 27° 23.958’ S	Longitude: 151° 38.774’ E
Rail Infrastructure Manager	Queensland Rail	

Train details

Train operator:	Aurizon	
Train number:	9869	
Type of operation:	Bulk coal	
Persons on board:	Crew – two	Passengers – Nil
Injuries:	Crew – Nil	Passengers – Nil
Damage:	Substantial	

Sources and submissions

Sources of information

The sources of information during the investigation included:

- Aurizon (train operator)
- Queensland Police Service
- Queensland Department of Transport and Main Roads
- Queensland Rail (track owner)
- rail traffic crew of train 9869.

Submissions

Under Part 4, Division 2 (Investigation Reports), Section 26 of the *Transport Safety Investigation Act 2003* (the Act), the Australian Transport Safety Bureau (ATSB) may provide a draft report, on a confidential basis, to any person whom the ATSB considers appropriate. Section 26 (1) (a) of the Act allows a person receiving a draft report to make submissions to the ATSB about the draft report.

A draft of this report was provided to Queensland Rail, the driver of the heavy road vehicle, the operator of train 9869 (Aurizon), the crew of train 9869 and the Office of National Rail Safety Regulator (ONRSR).

A submission was received from Queensland Rail. The submission was reviewed and, where considered appropriate, the text of the report was amended accordingly.

Australian Transport Safety Bureau

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

The ATSB is responsible for investigating accidents and other transport safety matters involving civil aviation, marine and rail operations in Australia that fall within 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 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.

Australian Transport Safety Bureau

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Investigation

ATSB Transport Safety Report
Rail Occurrence Investigation

Derailment of coal train 9869, 8 km west of Oakey, Queensland, on 21 July 2017

RO-2017-007
Final – 26 June 2019