

Serious Injury Collision, Draper Street, Cairns **15 June 2015**

Final report, rail incident investigation QT5128

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Serious Injury Collision, Draper Street, Cairns 15 June 2015 - Final Report

Serious Injury Collision, Draper Street, Cairns 15 June 2015

Major rail incident investigation

Final report, incident reference: QT5128

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Terms of reference

As Rail Safety Regulator pursuant to the *Transport (Rail Safety) Act 2010*, I hereby require a Rail Safety Officer to conduct an investigation in accordance with section 183(2) of the *Transport (Rail Safety) Act 2010* and report to me on the circumstances and causes of the incident where the Kuranda Scenic Railway train collided with a passenger bus at Draper Street Level crossing at Cairns on 15 June 2015.

Your investigation will:

- establish the factual circumstances of the incident
- conduct an analysis of the cause or causes of the incident
- assess human factors to identify any underlying matters, the interface and the actions of relevant parties which may have caused or contributed to the incident
- review the geography and infrastructure of the Draper Street level crossing
- if necessary make appropriate recommendations in order to prevent a recurrence of identified failures.

The investigation team will be comprised of members from the Rail Safety Regulator of the Department of Transport and Main Roads assisted by Queensland Rail Limited.

Director-General

Transport and Main Roads

Executive summary

On Monday 15 June 2015 at about 4.07pm, a Kuranda Scenic Railway (KSR) train was returning to the Queensland Rail Limited (Queensland Rail) Portsmith Rail Complex after undertaking a Cairns-Kuranda tourist revenue service. All passengers and Guest Services Attendants had disembarked at the Cairns Railway Station, with two rail traffic crew (RTC) remaining onboard for the trip to the Portsmith Rail Complex (a distance of 2.43km).

The KSR train was travelling in a general south-westerly direction approaching the Draper Street level crossing. The Draper Street level crossing is equipped with active protection, consisting of red flashing lights which are activated by an approaching train. Draper Street level crossing is not fitted with boom gates or an audible alarm.

The passenger bus (the bus) travelled in a north-westerly direction, stopping at the Draper Street level crossing stop line and red flashing light pedestal. The bus had stopped at the level crossing due to traffic queuing from the intersection of Comport and Draper Street, which is approximately 70m north-west of the level crossing and controlled by traffic signal lights.

The bus remained stationary for about 25 seconds, and as traffic began to clear on the departure side of the level crossing, the bus accelerated into the level crossing, and into the path of the approaching train. When the bus started to move into the level crossing the train was about 50–70m away, and travelling at about 30km/h.

The front of the train collided with the rear driver's side of the bus, causing the bus to rotate in a clockwise direction and pushed clear of the railway tracks. The bus came to stop north of the railway track against the level crossing signal box.

The bus driver when interviewed stated that he did not see or look for any approach train as he entered the level crossing, instead relying on the activation of level crossing protection, which he advised he did not see.

Witnesses advised that the level crossing flashing lights were in operation prior to the collision, and remained active until later disconnected by Queensland Rail. RTC and witnesses advised that the train whistle was used a number of times on approach to the level crossing.

As a result of the collision, a number of bus passengers and one RTC received injuries.

The investigation established that the bus entered the level crossing into the path of the approaching KSR train, resulting in the collision. Contributing factors to the incident included the incorrect positioning of the level crossing stop line and associated road markings.

The report makes safety recommendations to Queensland Rail and Cairns Regional Council. The recommendations include:

- Cairns Regional Council as the road manager and Queensland Rail as the rail infrastructure manager are to ensure audit and inspection assessments are available to both parties
- Cairns Regional Council as the road manager to ensure audits and inspections of the level crossing include the requirement to comply with the Manual of Uniform Traffic Control Devices (MUTCD)¹
- Cairns Regional Council as the road manager and Queensland Rail as the rail infrastructure manager to liaise with Transport and Main Roads to ascertain whether the traffic signals at the intersection of Comport and Draper Street should be synchronised with the Draper Street level crossing
- Cairns Regional Council as the road manager to liaise with Queensland Rail as the rail infrastructure manager to ascertain whether the level crossing protection should be upgraded to include boom gates and an audible alarm
- Queensland Rail to ensure level crossing activation timeframes align with the signposted track speed.

¹ www.tmr.qld.gov.au

1 Introduction

Rail safety in Queensland is regulated by Rail Regulation, the Department of Transport and Main Roads (Transport and Main Roads). All rail infrastructure managers and/or rolling stock operators within Queensland are required to be accredited in accordance with the *Transport (Rail Safety) Act 2010* (the Act). Rail Regulation accredits rail infrastructure managers and rolling stock operators and monitors compliance with the Act.

The accreditation process is to ensure the safe carrying out of railway operations and the management of associated risks. Rail Regulation is responsible for investigating incidents and other transport safety matters involving railway operations.

The level crossing incident was a notifiable occurrence as defined in Schedule 3 of the Act. The reason that it is considered a notifiable occurrence is:

- it involved the operation or movement of rolling stock on a railway which is defined in section 9 of the Act
- rolling stock as defined in Schedule 3 of the Act was involved in this incident
- the incident occurred on a railway as defined in Schedule 3 of the Act
- the incident caused serious injury
- the operator of the rolling stock was accredited under the Act at the time of the incident.

The incident was an occurrence that was required to be reported by the rail transport operator under the conditions of accreditation.

2 Investigation methodology

This report was prepared by Rail Regulation and assisted by Queensland Rail, in accordance with the terms of reference and the legal framework as defined in the Act.

The investigation analysed information obtained from a number of sources including:

- Queensland Rail Limited
- Queensland Police Service
- The Department of Transport and Main Roads
- Cairns Regional Council
- Loves Bus Service Qld
- bus driver
- interviews with involved parties
- attendance at the scene of the incident
- Origin Energy
- The Australian Level Crossing Assessment Model (ALCAM)
- Endeavour Foundation.

3 Factual information

3.1 Background information

At about 4.07pm on Monday 15 June 2015, a KSR tourist train travelling in a general south-westerly direction collided with a bus that had entered the level crossing at Draper Street, Cairns. The bus, which was travelling in a general north-westerly direction, entered the level crossing contrary to activated level crossing protection.

As a result of the collision, a number of bus passengers received serious injuries and were transported to hospital for treatment, one RTC received minor injuries.

3.2 Occurrence location

The Draper Street level crossing is situated south of the Cairns central business district in the Portsmith area, providing access to commercial, industrial and port areas.

The Draper Street level crossing (ID 4739) is at the 1679.5 railkilometrage point ², situated on the North Coast Line between the Cairns railway station and Queensland Rail’s Portsmith Rail Complex. The distance between the Cairns railway station and the Portsmith Rail Complex is 2.43km, with the Draper Street level crossing 1.36km from the Cairns railway station.

The area surrounding the level crossing is primarily industrial and commercial. The naval facility HMAS Cairns is located directly south-east of the level crossing.

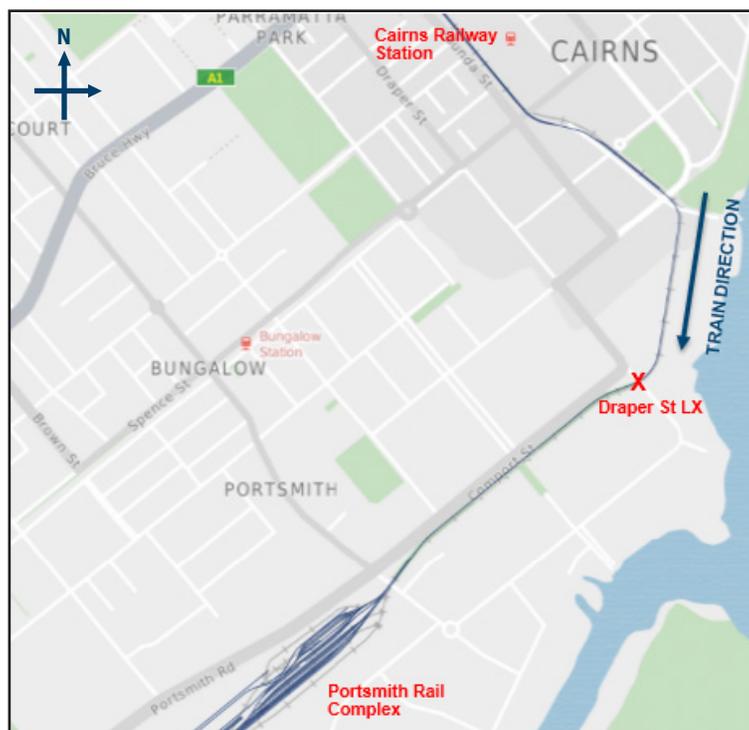


Figure 1: Location of Draper Street generally south of Cairns CBD

² Rail kilometres measured from the Roma Street Station Brisbane

3.2.1 Rail and road layout

Draper Street is a straight section of bitumen roadway, providing one lane of traffic in either direction. An unbroken separation line and painted median strip separates opposing traffic. The speed limit for vehicles at the level crossing is 60km/h. Draper Street is on the designated B-Double heavy vehicle route for Queensland³.

The rail infrastructure consists of single bi-directional⁴ non-electrified narrow gauge 41kg/m⁵ rail on steel insulated sleepers. The railway track through the level crossing is level with a slight curve, and trains travelling from Cairns encounter a right hand bend on approach. The maximum allowable speed for trains through the level crossing in both directions is 30km/h. The whistle and speed board on approach from Cairns railway station are correctly positioned⁶.

When stopped at the level crossing in the direction of the bus, the first vehicle has approximately 135m of vision to oncoming trains travelling from Cairns (direction of involved train).

Daily train volume over the level crossing averages eight train crossings per day, consisting of four KSR, two tilt trains and two freight train services.



Figure 2: Image showing layout of roadway and level crossing at the time of the incident

³ www.tmr.qld.gov.au

⁴ Track which allows trains to run in either direction

⁵ Kilogram per metre, used to determine rail mass

⁶ ALCAM assessment – Queensland Rail

3.3 Detail of rail operations

3.3.1 Accredited rail transport operator

KSR is a tourist operator, operating under Queensland Rail's accreditation as a rolling stock operator. Queensland Rail is accredited under the Act to operate rolling stock and manage rail infrastructure within Queensland.

KSR operates between Cairns and Kuranda on the Tablelands system in north Queensland. The service travels a distance of 33.24km each way, operating two services a day using two train consists.

3.3.2 Rolling stock

The KSR train consisted of two 1720 class diesel electric locomotives; DEL1774 (leading) and DEL1738, with 11 carriages. The train was approximately 215m long (comparison length) and weighed 392 tonnes.

KSR carriages are heritage rolling stock, constructed of timber and built from 1911 to the 1940s.

The front of leading locomotive (DEL1774) is painted blue and yellow.

The train underwent pre-departure examination at the Portsmouth Rail Complex, and was found to be operating and functioning correctly.

A review of rolling stock maintenance records did not identify any on-going maintenance issues. Queensland Rail undertook a post collision inspection of all rolling stock involved, no defects were identified that contributed to the collision. It was determined that the headlights, horn, speedometer and brake were working correctly. Rolling stock is not deemed to have contributed to the collision.

3.3.3 Train driver information

The lead locomotive was operated by two Queensland Rail RTC, both were route, traction and safe working competent in accordance with Queensland Rail standards.

RTC 1 was the driver at the time of the collision, having been employed by Queensland Rail since 1983, qualifying as a Locomotive Driver Class II in March 1998.

RTC 2 was the second driver at the time of the collision, having been employed by Queensland Rail since 1976, qualifying as a Locomotive Driver Class II in 1992.

In accordance with *The National Standard for Health Assessments of Rail Safety Workers* both drivers had undergone rail safety worker (category 1) assessments and both were current at the time of the collision.

Queensland Rail reviewed the Fatigue Audit InterDyne⁷ (FAID) analysis for both drivers, and the scores for RTC 1 was 62, and RTC 2 was 13. These scores were broadly within Queensland Rail's fatigue management procedure. Fatigue of the RTC is not considered to have contributed to the collision.

Both RTC were breath tested by the Queensland Police Service, returning a negative result.

⁷ Fatigue Assessment Tool by InterDynamics, used by Queensland Rail and other operators to gauge fatigue.

3.4 Details of passenger bus operations

3.4.1 Passenger bus

The bus was a 2013 BCI 'Classmaster 57' (model FBC6127BRZ1), white in colour, and at the time of collision was registered to travel on Queensland roads.

The bus is operated by Loves Bus Services Qld, which operate a Cairns school and charter service. BCI specify a 'Classmaster 57' bus as being 12.36m in length, 2.5m in width and 3.45m high.

At the time of the incident the bus was being operated on a charter service on behalf of the Endeavour Foundation.

The bus was travelling from Aumuller Street Portsmith to various locations in the Cairns area. At the time of the incident the bus had 17 passengers and the driver aboard.

The bus operator supplied the maintenance history of the bus, with no known defects identified.

On 18 June 2015, a member of the Queensland Police Service's Vehicle Inspection Unit undertook a detailed mechanical examination of the bus. The examination determined that the bus was in satisfactory mechanical condition, with no faults being identified that may have contributed to the collision.

3.4.2 Bus driver

The driver of the bus was a 51 year old male employed by the bus operator and was appropriately licenced to drive a passenger bus at the time of the incident. The driver has been driving buses for over three years in Queensland and Victoria. The driver tested negative to the presence of alcohol.

On 4 November 2015, Rail Safety Officers undertook an interview with the bus driver, where he provided his version regarding the circumstances surrounding the collision.

The bus driver has been employed by the bus operator for approximately 12 months; his twice weekly duties included picking up Endeavour Foundation employees from Aumuller Street, Portsmith and dropping them at locations in the Cairns area. The journey includes crossing the Draper Street level crossing, which is approximately 1.4km from the Aumuller Street address.

The bus driver advised that he is aware trains travel through the level crossing, and has been stopped at the level crossing on previous occasions for train crossings, however has never been stopped at the head of the queue. The driver usually follows vehicles through the intersection after the train has passed. The driver advised that he does not look left or right as he approaches the level crossing, relying on the activation of the level crossing red flashing lights to indicate an approaching train.

A review of the level crossing activation was undertaken and a sequence of events is shown at figure 19. The review revealed that the bus had stopped at the stop line for approximately 7.5 seconds prior to the activation of the red flashing lights.

At the time of finalising this report the matter was still pending before a Queensland Magistrates Court.

3.5 Local weather conditions

The Bureau of Meteorology⁸ recorded that on 15 June 2015, there was 6.4mm of rain recorded at Cairns Aero, with a minimum temperature of 21.4 degrees and maximum 27 degrees. Photographs taken shortly after the collision indicate a predominately dry roadway.

⁸ www.bom.gov.au

3.6 Injury and damage information

3.6.1 Injuries

A number of bus passengers received serious injuries as a result of the collision, and were transported and treated at Cairns Hospital. One of the RTC received minor injuries.

3.6.2 Damage to rolling stock

The lead locomotive sustained minor damage as a result of the collision.



Figure 3: Damage to front of locomotive DEL1774

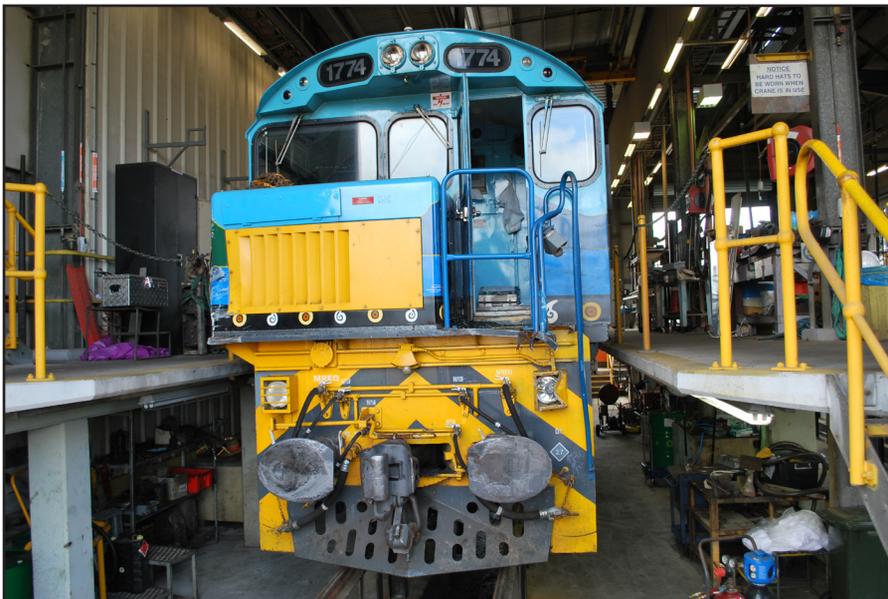


Figure 4: Lead locomotive DEL1774

3.6.3 Damage to rail infrastructure

The level crossing signal control box and a red flashing light situated to the north-west of the level crossing received significant damage as a result of the collision.

3.6.4 Damage to passenger bus

The bus received damage to the driver's side as a result of the collision with the train. A secondary impact to the passenger side occurred when the bus impacted with the level crossing signal control box north-west of the crossing.



Figure 5: Train and bus in situ



Figure 6: Train and bus in situ



Figure 7: Train and bus in situ



Figure 8: Train and bus in situ

4. Analysis

4.1 The incident

At about 7.50am on Monday 15 June 2015, the KSR train departed the Rail Portsmouth Rail Complex, travelling to Cairns railway station, a distance of 2.43km, arriving at 8.00am. Guest Service Attendants and passengers boarded the train for the journey to Kuranda. The return trip from Cairns to Kuranda was reported as being uneventful.

At about 4.00pm, the train departed Cairns railway station after Guest Service Attendants and passengers had disembarked the train, with the two RTC remaining onboard for the return trip to the Portsmouth Rail Complex.

At about 4.07pm, the train was travelling in a general south-westerly direction, negotiating a right hand bend and approaching the level crossing. The Draper Street level crossing is located 1.365km from the Cairns railway station. Approximately 126m prior to the level crossing, a whistle board⁹ is located to the left of the track (direction of train). RTC₁ advised that they used the train whistle at this point to warn level crossing traffic of an approaching train, which was confirmed by witnesses to the collision. Queensland Rail standards indicate that upon approaching a level crossing at the whistle board, RTC are to use a long whistle, which is a whistle of approximately two seconds.

About 106m prior to the Draper Street level crossing, a 30km/h speed board is situated to the right hand side of the track, indicating the maximum allowable speed limit for the location. RTC₁ advised that they could see the red flashing lights operating as they approached the level crossing, and they could also see that traffic was queuing at the road traffic lights, with a stationary bus and three cars stopped at the level crossing. The driver observed that road traffic started to move from the traffic lights, and again used the train whistle. As the train approached the level crossing RTC₁ observed the bus start to move across the intersection. RTC₁ again sounded the whistle, however the bus continued to move through the intersection. RTC₁ applied full emergency braking and the train stopped approximately 45m after the collision.

The approximate sighting distance for this incident was 135m, for a train travelling at 30km/h, and it would have taken approximately 16 seconds from the first sighting until the train entered the level crossing.

The bus driver advised that as he approached the level crossing traffic had queued from the traffic control lights at the intersection of Comport and Draper Street. As a result of this queuing, the bus stopped at the white stop line prior to the level crossing. A review of the level crossing activation is detailed at figure 19, where it was estimated that the bus stopped at the level crossing approximately 7.5 seconds prior to the activation of level crossing protection. As the traffic started to move forward due to the green light at the traffic intersection, the bus entered the level crossing and into the path of the train. The bus driver advised that he did not look left or right for trains prior to entering the intersection, instead relying on level crossing activation. Due to the incorrect positioning of the stop line in relation to the RX-5 pedestal (red flashing light), the bus driver was unable to see the primary flashing lights, and although the secondary lights on the other side of the level crossing were facing the driver, he did not see them activate. As the bus accelerated across the level crossing, the bus driver's attention was brought to the approaching train by a passenger. When the driver looked to the right, the train was approximately 15m from the bus; the driver accelerated, but was unable to avoid a collision. The bus driver advised that he did not hear any train whistle before the collision.

Witnesses to the incident observed that red flashing lights did activate (including the secondary lights) as the train approached, and that the train whistle was used a number of times prior to the collision.

⁹ Whistle boards are placed next to the track to advise when RTC are to use the whistle to warn of an approaching train. Whistle boards are a black 'W' on a light coloured board and located in accordance to Queensland Rail's whistle board table.

4.2 Level crossing interface/protection

All level crossing infrastructure within the rail corridor is the responsibility of Queensland Rail to maintain as the rail infrastructure manager. This responsibility extends to 600mm from the outside rail. The road manager, being Cairns Regional Council, is responsible for the area outside the 600mm. An exception to this rule is that Queensland Rail also maintains active signage such as red flashing lights structures outside the 600mm.

Queensland Rail (rail infrastructure manager) is responsible for¹⁰:

1. Installing and maintaining flashing lights, boom gates, bells and associated equipment on the crossing
2. Erecting and maintaining all signs immediately adjacent to the tracks as set out in the interface agreement
3. Maintaining the road pavement between the rails and for a distance of 600mm outside the rails
4. Maintaining the sight distance free of obstructing vegetation within the rail corridor
5. Setting the maximum train speed through the crossing, in accordance with the agreement on control measures

Cairns Regional Council (road manager) is responsible for:

1. Erecting and maintaining all other signs and markings on the road associated with the public crossing
2. Maintaining the road pavement exclusive of that portion maintained by the rail infrastructure manager
3. Setting the maximum road vehicle speed through the crossing, in accordance with the agreement on control measures.

A rail interface agreement exists between Queensland Rail as the rail infrastructure manager and Cairns Regional Council as the road manager. Sections 71, 73 and 75 of the Act outline the requirement of rail transport operators and road managers to manage risk resulting from railway operations. The interface agreement was signed by both parties in 2011 and remains in force until 2017. The agreement outlines management, communication and consultative responsibilities of both parties regarding level crossings in the Cairns area. Sections 3 and 4 of the interface agreement outlines that both parties will apply a risk management process to identify and assess risks to safety, including the use of the Australian Level Crossing Assessment Model (ALCAM)¹¹ and Australian Standard (AS) 4360 Risk Management.

ALCAM is an assessment tool used to identify key potential risks at level crossings and to assist in the prioritisation of railway level crossings according to their comparative safety risk. It is used to support a rigorous defensible process for decision making for road and pedestrian level crossing as well as a method to help determine the most cost effective treatments¹².

In May 2003, the Australian Transport Council agreed to adopt the ALCAM method of risk assessment. Queensland Rail currently use tools including ALCAM to inform and support decision making processes regarding level crossing protection.

In 2002, prior to the introduction of ALCAM, Queensland Rail conducted a site survey and sighting distance assessment at the Draper Street level crossing. The survey indicated that the level crossing was fitted with flashing red lights and cross buck (RX-5, incorporating sign R6-25 – see figure 3). The survey proposed the installation of road cross hatching, advance warning signs and road markings. These works were completed by Cairns Regional Council in 2005.

Cairns Regional Council advised the following works were undertaken:

- original yellow cross hatching was added in 2005
- the roadway was resurfaced in November 2012
- the road markings in place at the time of the collision were added around August 2014.

On 22 May 2007, an ALCAM assessment was undertaken at the Draper Street level crossing by Queensland Rail, and the ALCAM likelihood factor was determined to fall within the low risk band. At this time the road marking at the level crossing appeared to align with MUTCD.

¹⁰ Queensland Rail Limited Standard MD-10-115 Civil – Level Crossing Safety

¹¹ www.alcam.com.au

¹² ALCAM in Detail: www.transport.nsw.gov.au/sites/default/files/b2b/levelcrossings/ALCAM_In_Detail-NSW.pdf

On 8 July 2015 (post-collision), Queensland Rail undertook a further ALCAM assessment of the level crossing. As part of the assessment it was determined that the stop line, yellow hatching and advance warning sign did not meet the requirements of the MUTCD. It was identified that the stop line was not 3m from the RX-5 signal pedestal as required, the cross hatching was not correctly positioned in relation to the stop line and advance warning signs were not correctly located. The post-incident review included a sighting assessment. The ALCAM assessment produced a risk score which fell into the low risk band, which included identified deficiencies as detailed. A low risk band indicates that on-going monitoring is required.

As part of the post-collision review, Queensland Rail also undertook a review of the level crossing flashing lights, and although the secondary lights were slightly out of focus, both primary and secondary lights were clearly visible.

Part 7 'Railway Crossings' of the MUTCD sets out the various traffic controls to be used at a level crossing at grade, describing the assemblies, markings, use and location. The use of MUTCD is required pursuant to section 72A of the *Transport Operations (Road Use Management) Act 1995*, 'Way to install official traffic sign'.

At the time of the collision, the Draper Street level crossing had active protection, consisting of:

- RX-5 flashing lights pedestal and signage on both approach sides of the level crossing (figure 9). The level crossing was fitted with primary and secondary LED¹³ red flashing lights (figure 15)
- box marking sign (G9-67-2), located on the approaches to the level crossing, installed to reduce queuing across the level crossing (figure 10)
- box markings on the approach and departure of the level crossing (figure 11)
- advance warning sign (W7-4), used to give advance warning of a crossing controlled by flashing lights (figure 12)
- a stop line marked on the approach sides of the level crossing (figure 13).

Keep Tracks Clear (G9-67-2) signs are used where box markings have been placed on the crossing. Box markings are used to discourage traffic queuing on a crossing where an intersection or other traffic constriction is located downstream, but in the near vicinity of a railway crossing such that queuing of traffic across the crossing could occur.

Cairns Regional Council as the road manager advised that they do not undertake risk assessments using ALCAM; they undertake yearly maintenance and compliance inspections. The inspections relate to pavement condition, signage condition, signage visibility and line marking condition. Cairns Regional Council are aware that Queensland Rail undertake ALCAM assessments of level crossings.

¹³ light-emitting diode

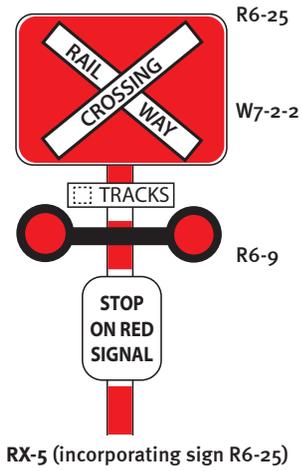


Figure 9: Red flashing light assembly



Figure 10: Keep Tracks Clear sign



Figure 11: Road cross hatching (box marking)



Figure 12: Advanced level crossing warning sign



Figure 13: Stop line and red flashing light structure showing crossing the approaching train path



Figure 14: Train path approaching Draper Street Level Crossing

4.2.1 Intersection of Comport and Draper Street

The intersection of Comport and Draper Street is approximately 70m north-west of the Draper Street level crossing and is controlled by traffic lights. The traffic lights are not synchronised with the Draper Street level crossing activations. The traffic lights are maintained by Transport and Main Roads who work with the Cairns Regional Council to assess traffic control needs.

The intersection of Comport and Draper Street is a major intersection, and is in direct line of sight for traffic stopped and approaching the Draper Street level crossing. The traffic light configuration shows four individual sets of traffic lights towards traffic at or approaching the Draper Street level crossing. Drivers approaching the level crossing may focus on the status of the traffic lights at the intersection instead of the level crossing protection and any approaching rail traffic.

4.2.2 Level crossing signal maintenance

Queensland Rail Procedure *MD-14-571 Signalling – Preventative Maintenance Check Sheets* outlines the minimum signalling preventative maintenance to be undertaken for each item of signalling equipment, ensuring that safety provided by the system is maintained. A review of signal maintenance documents provided by Queensland Rail revealed that Services A, D and E had been undertaken in line with the requirements of Queensland Rail's Enterprise Asset Management System (EAMS).

Queensland Rail advised that EAMS Work Order 6200083960 was due for completion on the date of the incident; this included preventative maintenance as required.

On the morning of the incident, a Queensland Rail signal electrician checked the Draper Street level crossing and verified that the crossing protection was operating correctly.

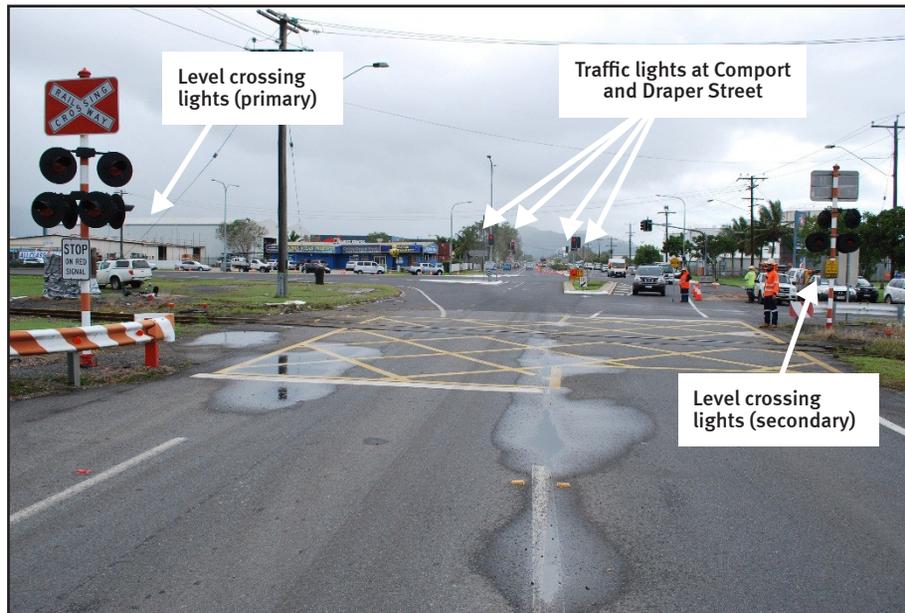


Figure 15: Draper Street level crossing, general north-westerly direction (direction of bus travel), also showing the vicinity of traffic control lights at the intersection of Comport and Draper Street.

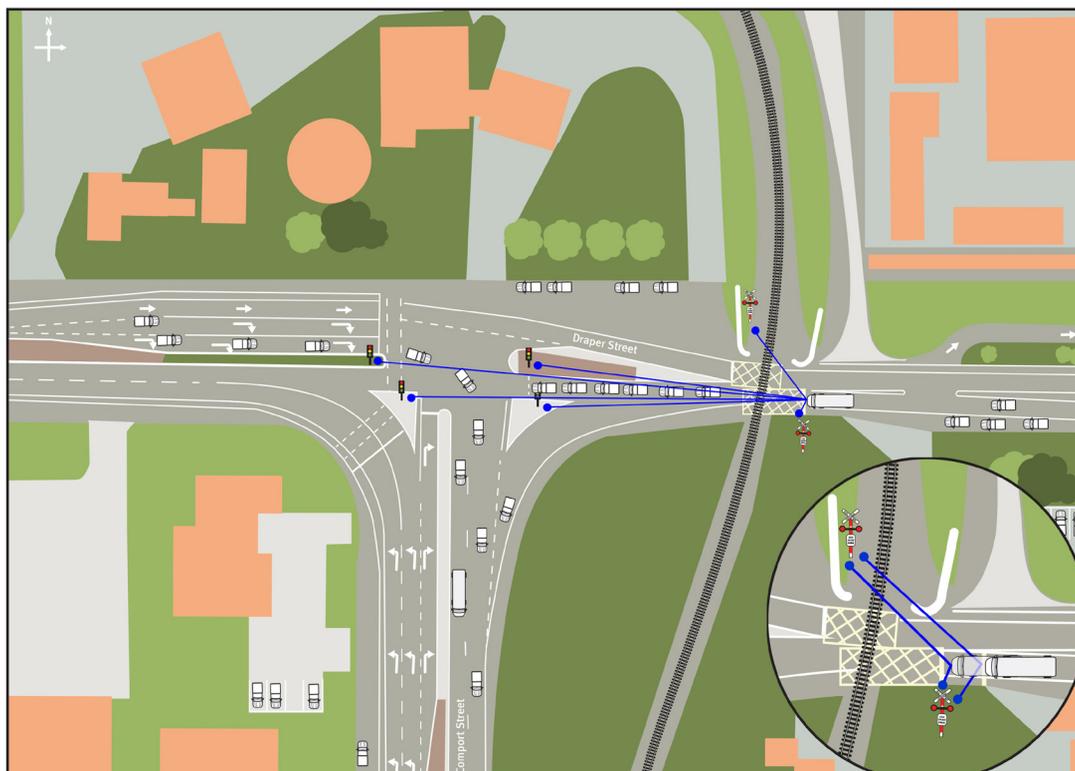


Figure 16: Drawing depicting the position of the bus with the stop line in place at the time of the incident and the acute angle of the primary lights, the inset shows the difference in angle had the stop line been positioned as required in the MUTCD.

4.3 Duties of vehicle drivers

As reflected in state legislation, the onus is with road traffic not to enter level crossings on the approach of rail traffic, however appropriate signage and controls need to be in place to warn road traffic of the existence of a level crossing.

Section 123 Transport Operations (Road Use Management – Road Rules) Regulation 2009 states:

‘Entering a level crossing when a train or tram is approaching etc. A driver must not enter a level crossing if –

- (a) warning lights (for example, twin red lights or rotating red lights) are operating or warning bells are ringing; or
- (b) a gate, boom or barrier at the crossing is closed or is opening or closing; or
- (c) a train or tram is on or entering the crossing; or
- (d) a train or tram approaching the crossing can be seen from the crossing, or is sounding a warning, and there would be a danger of a collision with the train or tram if the driver entered the crossing; or
- (e) the driver can not drive through the crossing because the crossing, or a road beyond the crossing, is blocked.’

4.4 Recorded train data

The second locomotive, DEL1738 was fitted with a ‘Wabetec Railway Electronics TrainTrax TDR9000’ event recorder. This is an event recording system that receives input (analogue, digital and speed) from locomotive subsystems. The event recorder does not store data in relation to the lead locomotive DEL1774. Lead locomotive DEL1774 was not fitted with an event recorder.

Analysis of locomotive DEL1738 event recorder indicated:

- at the time of brake pressure drop, that is when the emergency brake was applied, the train was travelling at a speed of 31km/h¹⁴. The analysis indicated that the emergency braking occurred about 12.3m prior to the level crossing
- the train travelled 57m over a period of 11 seconds before coming to a standstill after the application of emergency brakes¹⁵.

The event recorder, together with the Queensland Police Service measurements, the signalling report, level crossing assessment and related documents allowed Queensland Rail to determine the sequence of events as detailed in figures 17 and 18.

¹⁴ Speedometer in the locomotive cabin is in 2km/h increments.

¹⁵ Braking distance is well within required deceleration rate as detailed in Queensland Rail standards.

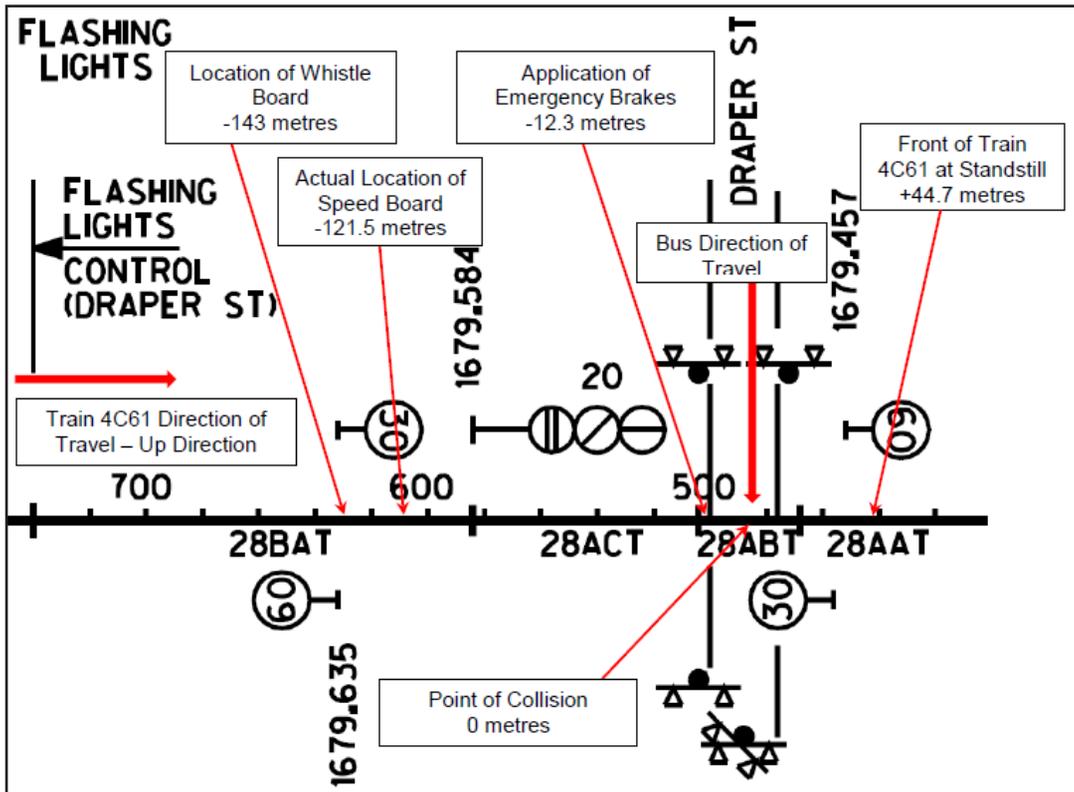


Figure 17: Diagram outlining the location of signage, brake application and stopping location of lead locomotive.

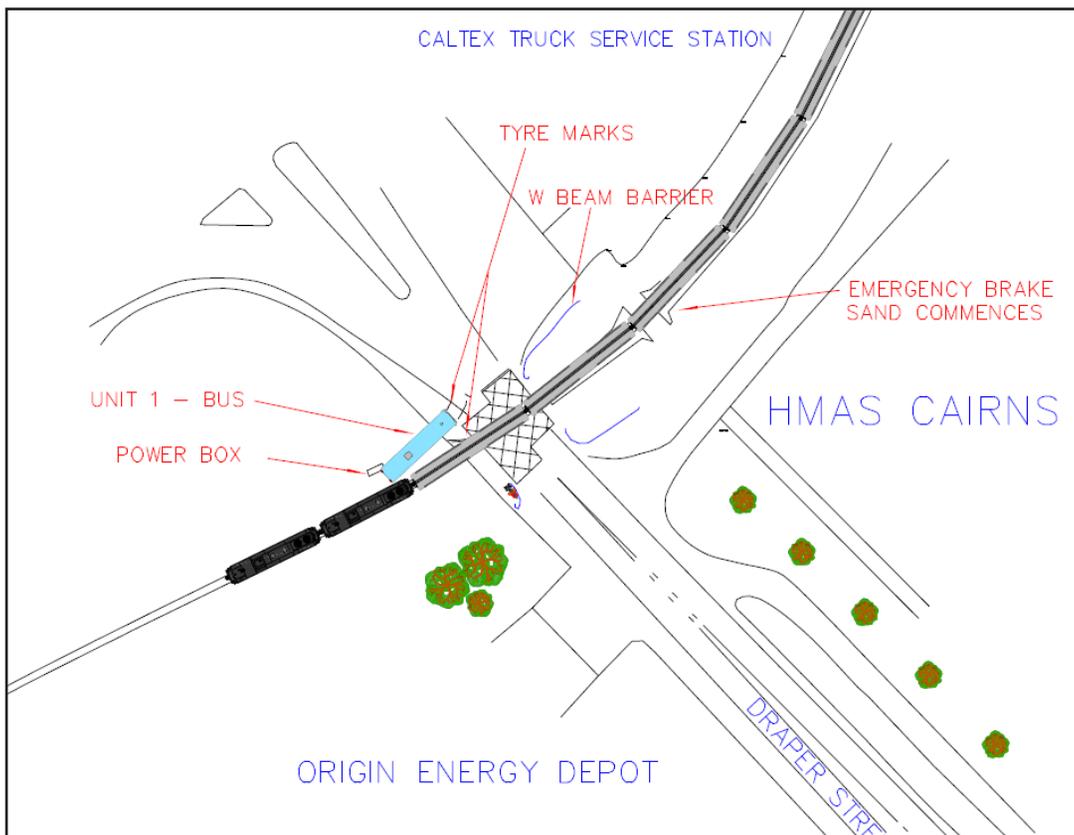


Figure 18: Queensland Rail diagram using the data download, scene examination and measurements taken by the Queensland Police Service and Queensland Rail.

4.5 Level crossing activation

A review of the available CCTV and level crossing warning times provided evidence for a sequence of events¹⁶.

Zero	Passenger bus approaches and stops at the level crossing stop sign. The bus stops due to traffic congestion on the northern side of the level crossing. There is no traffic queuing across level crossing.
Zero + 7.5 second	Level crossing protection (red flashing lights) are activated due to approaching train.
Zero + 25 seconds	Passenger bus moves off the stop line into the level crossing after traffic clears from the northern side of the level crossing.
Zero + 29 Seconds	Train impacts with the passenger bus at the level crossing.

Figure 19: Sequence of events



Figure 20: Still image of CCTV footage taken from a nearby business, indicates bus stopped at the Draper Street level crossing.

Queensland Rail performed tests on the level crossing equipment post incident which showed that the level crossing operated correctly on approach of a train. The testing included a train simulation through the level crossing, undertaken by pulling the track pins, which confirmed that the level crossing activated and operated as designed.

As part of the post-incident assessment of the level crossing, Queensland Rail reviewed the activation period for the level crossing protection. It was determined that the activation period did not strictly meet Queensland Rail signalling requirements.

The Draper Street level crossing activation point for trains travelling from Cairns to Portsmith occurs when trains enter track circuit 28BAT, which is 195.7m from the Draper Street level crossing circuit. At the point of activation the speed limit is 60km/h, with the 30km/h speed limit for trains starting at 105.8 meters before the crossing.

The total length of the approach track (and activation point) is 89.9m at 60km/h, and 105.8m at 30km/h.

The minimum approach time using these maximum speeds and distances is approximately 18.09 seconds.

The level crossing is controlled by a Processor Based Interlocking, and a two second delay period occurs between the train activating the circuit and the level crossing protection becoming operational, which makes the activation time 16.09 seconds (18.09 sec – 2 sec). Queensland Rail standards and MUTCD require a minimum 20 seconds activation period for a single track crossing.

¹⁶ Timings taken from CCTV footage.

A further review of Queensland Rail maps indicates that the track speed on departure from Cairns is 20km/h, with an increase permitted to 60km/h at the 1680.052 mark, which is approximately 550m prior to the Draper Street Level Crossing, and approximately 444m prior to the 30km/h speed board. The KSR train would not have been able to increase speed to the maximum allowable track speed of 60km/h within this distance. Information from RTC indicate that a maximum constant speed of 30km/h is maintained from Cairns to the Draper Street level crossing. However, in addition to KSR trains, empty tilt trains also use the tracks which have superior acceleration capability and may have been able to reach the signposted track speed.

Re-evaluating the activation time using a constant 30km/h approach speed provides a 21.48 second activation time, which is consistent with Queensland Rail standards and MUTCD¹⁷.

Activation timing of the level crossing was not considered a contributing factor in this incident.

4.6 Human factors

A review of the investigation material and the subsequent interview with the bus driver revealed that the driver's behaviour could be explained by the phenomenon known as inattentive blindness¹⁸. This occurs where a person does not notice an object which is fully visible because their attention is engaged in another task. This does not necessarily mean an individual was not paying attention. It means that their attentional resources were occupied on another task. This may mean that a person may fail to detect an object even though they were looking directly at it. Research into inattentive blindness has shown that when people focus their attention on a particular task, they tend not to notice unexpected objects, even if the object is conspicuous, potentially important, and right where they are looking¹⁹.

4.7 Previously reported incidents

There have been two near miss occurrences reported at the Draper Street level crossing since 2009, both in October 2011.

¹⁷ MUTCD Part 7, 'Railway Crossings', 4.3.1, 'Flashing lights shall commence activation a minimum of 20 seconds prior to the arrival of a train at a single track crossing'.

¹⁸ Schoppert and Hoyt, 1968 cited in National Transport Safety Board (199a). Safety at passive grade crossing. Volume 1: Analysis. Safety study NTSB/SS-98/02. Washington DC.

¹⁹ Chabris, C., and Simons, D., 2010, The Invisible Gorilla, Harper Collins Publishers.

5. Findings

5.1 Conclusion

Based on the evidence available, the bus driver entered the level crossing into the path of an on-coming train. If the bus driver had visually searched the rail track or noticed the activation of the secondary red flashing light, he would have been able to see or be aware of an approaching train and respond appropriately.

5.2 Contributing factors

- The incorrect placement of the stop line adjacent to the RX-5 structure (red flashing lights). The placement limits the view of a vehicle stopped at the stop line. This is exacerbated in a bus where the driver sits at the very front of the vehicle. Setting back the stop line the three metres in compliance with the MUTCD provides increased forward vision RX-5 pedestal (red flashing lights).
- The intersection of Comport and Draper Street is approximately 70m north-west of the level crossing. This intersection is controlled by traffic signals and causes traffic to queue back to the Draper Street level crossing and beyond.

5.3 Other safety factors

- Activation time of the level crossing protection, Queensland Rail are to ensure that activation timing conforms to Queensland Rail standards taking into account the maximum track speed.

5.4 Safety actions undertaken

5.4.1 Queensland Rail

- Queensland Rail undertook an ALCAM assessment of the level crossing on 15 June 2015 to ascertain compliance of level crossing controls and identify any improvements required, this assessment identified the non-compliance with the MUTCD.
- Queensland Rail has installed a level crossing monitor, which monitors the operation of the level crossing.

5.4.2 Cairns Regional Council

- Since the incident, Cairns Regional Council have re-marked the roadway to comply with the MUTCD.



Figure 21: Draper Street level crossing road markings at the date of the collision



Figure 22: Draper Street level crossing road markings complying with MUTCD.

5.5 Recommended safety actions

To prevent a recurrence of a similar incident, the following recommendations are made:

5.5.1 Queensland Rail

- Maintain regular contact with road managers to ensure audits or inspections of level crossings are available to both parties.
- Liaise with Cairns Regional Council and Transport and Main Roads to ascertain whether the traffic signals at the intersection of Comport and Draper Street should be synchronised with the Draper Street level crossing signals.
- Liaise with Cairns Regional Council to ascertain whether boom gates and an audible alarm should be installed at the level crossing.
- Ensure level crossing activation timeframes align with signposted track speed limits.

5.5.2 Cairns Regional Council

- Ensure audits and compliance inspections of level crossings include the requirement to comply with the MUTCD.
- Maintain regular contact with rail infrastructure managers to ensure results of audits or inspections of level crossings are available to both parties.
- Liaise with Queensland Rail and Transport and Main Roads to ascertain whether the traffic signals at the intersection of Comport and Draper Street should be synchronised with the Draper Street level crossing.
- Liaise with Queensland Rail to ascertain whether boom gates and an audible alarm should be installed at the level crossing.

