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Australian Transport Safety Bureau

Safeworking irregularity involving train 9261

Sellheim Station, Mount Isa Line, Queensland, on 28 July 2020

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Addendum

Page	Change	Date

Safety summary

What happened

On 28 July 2020, the driver of Aurizon train 9261 told the Queensland Rail (QR) network control officer (NCO) the train was approaching its limit of authority at Sellheim Station, where it would stop to cross road-rail vehicle ZH42 travelling in the opposite direction. As 9261 entered the station, the driver triggered a counter in the locomotive cab to measure the distance travelled. The driver then stopped 9261 next to a trackside information sign that displayed the text 'Stop at this point unless holding DTC (direct traffic control) Authority to Mingela'. The driver determined the train to be complete and in-clear of the track section to the rear and supplied a release code to the NCO.

The NCO confirmed the location of train 9261 and issued an authority for ZH42 to continue onto the track section that 9261 had reportedly vacated. Shortly after, the driver of ZH42 advised the NCO that the rear wagons of train 9621 were not in-clear and estimated that two and a half wagon lengths were occupying the track section ahead.

What the ATSB found

QR had installed the information signs at Sellheim Station in 2015 as a measure to address noise complaints from members of the public living near the station. The signs were located 940 m past the block limit boards (BLBs), whereas the maximum train length permitted was 1,009 m, and drivers were not advised of the distance from the signs to the BLBs. When installing the information signs, QR personnel did not complete a formal infrastructure change approval process or risk assessment to consider the potential operational implications of the signs.

The driver of 9261 used the information sign location as a reference point for stopping rather than cross-checking the in-cab counter readout against the train comparison length. Subsequently, the driver erroneously provided the NCO with a release code for the Charters Towers to Sellheim section block.

QR's DTC system provided limited functionality for an NCO to verify the physical availability of a released section block prior to issuing an authority to the opposing rail traffic. This placed increased reliance on a second (opposing) train crew checking the other train to detect the occupied section block in sufficient time to avoid a collision.

What has been done as a result

Queensland Rail (QR) undertook a risk assessment of the information signs at Sellheim Station and subsequently moved the signs to the 110.109 km point, approximately 134 m east of the first location. The revised location provided about 1,060 m between BLBs and the associated information signs. QR also started a program of works to find locations on the Mount Isa Line and other lines where inconsistencies existed between the trackside infrastructure and the information contained in route maps, signalling arrangement diagrams and the DTC software.

Safety message

Given the limitations of DTC, rail traffic crew of the first traffic to stop at a directional travel station to undertake a cross or pass with other rail traffic must ensure their traffic is complete and in-clear before releasing the section block to the NCO.

In addition, rail infrastructure managers should carefully consider the potential for information signs to be misinterpreted by rail traffic crew, particularly if such signs contain the word 'Stop'. This occurrence also highlights the importance of rail infrastructure managers conducting appropriate change management and risk assessment processes when introducing changes to their infrastructure.

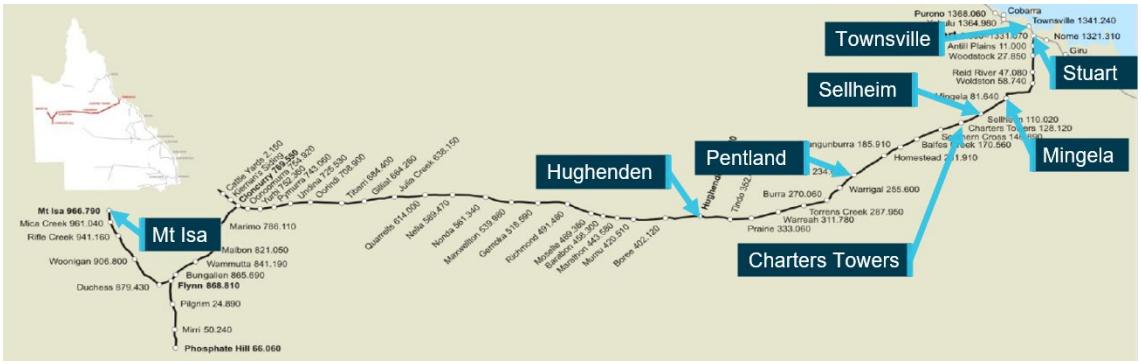
Contents

The occurrence

Prior to arriving at Sellheim

On 28 July 2020, an Aurizon rail traffic crew (driver and co-driver) took control of train 9261 at Hughenden on the Queensland Rail (QR) Mount Isa Line to travel toward Stuart (near Townsville) in Queensland (Figure 1). After leaving Hughenden at about 0354,[1] the crew travelled in an easterly direction toward Charters Towers under a series of direct traffic control (DTC) authorities issued by the QR network control officer (NCO).

Figure 1: Referenced locations on the Mount Isa Line



Source: Queensland Rail, annotated by the ATSB

At about 0900, as train 9261 approached Charters Towers, the rail traffic crew received their next authority from the NCO to leave Charters Towers and travel through to the block limit board (BLB) SM23 at Sellheim Station.

Shortly after, the driver of a road-rail vehicle ZH42, travelling in a westerly direction from Mingela toward Sellheim (Figure 1), contacted the NCO to advise of a driver change and to confirm the current authority to travel to BLB SM16 at Sellheim Station, where ZH42 would stop for the cross with train 9261. The NCO confirmed the authority and informed the driver of ZH42 that 9261 would likely be the first to arrive at Sellheim.

At about 0930, the driver of 9261 told the NCO they were approaching the limit of authority at Sellheim. The NCO was aware there had been an earlier issue with the correct operation of the western end trailable points, so asked the driver to check the train's position on approach. Shortly after, the driver responded, confirming that the trailable facing points functioned correctly for the train movement.

Arrival at Sellheim

The driver recalled that, as the lead locomotive of 9261 passed BLB SM18 and entered the down track[2] at Sellheim, they triggered the counter in the cab to measure the distance the locomotive then travelled. The driver stopped 9261 at a point next to an information sign erected adjacent to the down track.

The driver later recalled being aware that the train was 997 m long and the in-cab counter was reading 940 m.[3] However, they stated that the significance of the counter's indication did not register with them at the time.

The co-driver later recalled observing the driver start the in-cab counter when they entered Sellheim and also observed the driver check the counter prior to providing the release code to the

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1 All time references in this report are in local time (Eastern Standard Time).

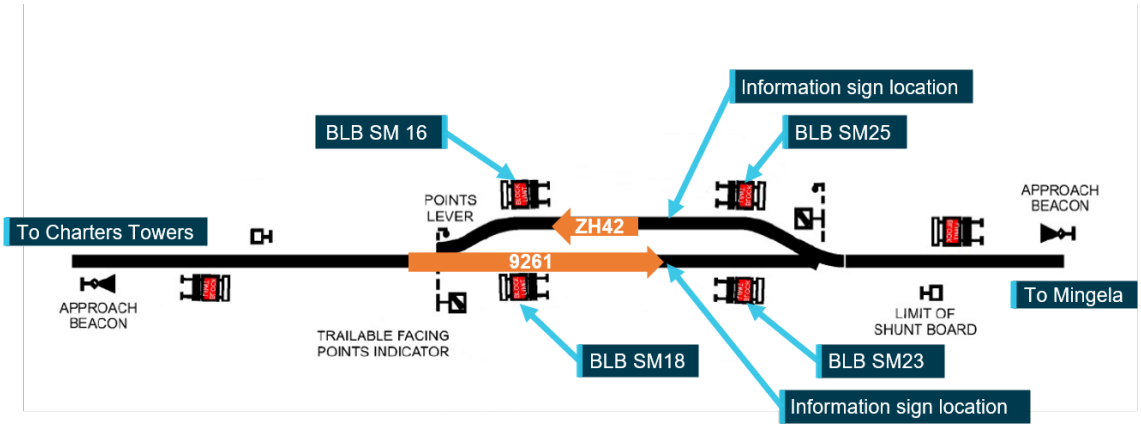
2 Rail traffic on the Mount Isa line travelling in the down direction are travelling towards Townsville.

3 The counter displayed 94. Distance travelled was measured as a multiple of 10 m.

NCO. However, the co-driver did not observe the counter as it was on the driver's side of the cab, and it was not normal practice for the driver to read out the value from the in-cab counter.

At about 0936, the driver of 9261 provided the NCO with a release code for the section block between Charters Towers and Sellheim Station (to the rear of 9261). After receiving the release code, the NCO responded by communicating an understanding that the train was intact and in-clear[4] at BLB SM18 in the down road at Sellheim (Figure 2). The driver of 9261 confirmed the NCO's understanding and inquired about how long it would be before the cross with ZH42 could occur.

Figure 2: Sellheim Station and location of 9261 and ZH42



Location of BLBs and signs is indicative only (not drawn to scale).
Source: Queensland Rail, annotated by the ATSB

At 0945, the NCO contacted the driver of ZH42 to determine the vehicle's location. The driver advised that ZH42 had passed the eastern end approach board to Sellheim Station and they would supply a release code to the NCO shortly. The NCO decided to issue an extension of the DTC authority for ZH42 that would allow the vehicle to travel through Sellheim Station without stopping and continue to Charters Towers.[5]

At about 0949, the crew of 9261 contacted the NCO asking when their next authority would be available. Shortly after, the NCO again contacted the driver of ZH42 to request a release code for the Mingela to Sellheim section. The driver of ZH42 advised the release code was available but that they were stationary at BLB SM16 as the rear of train 9261 was not in-clear. The driver of ZH42 estimated that two and a half wagon lengths (at the rear of 9261) were occupying the block section ahead (Figure 3).

[4] In-clear: occurs when rail traffic on a bidirectional single line, in other than remote controlled signalling territory, is brought to a stand at a station to allow other rail traffic to cross or pass.

[5] The speed of rail traffic departing from a turnout curve and trailing through the points was restricted to a maximum of 25 km/h until traffic had cleared the points.

Figure 3: Rear wagons of train 9261

Image taken after train 9621 moved approximately one wagon length. Rear wagons of 9261 were still foul of BLB SM18.
Source: Queensland Rail, annotated by the ATSB

At about 0950, the NCO radioed an instruction to the crew of 9261 to not move their train, but the NCO did not receive any acknowledgement of this instruction. At about this time, the driver of 9621, who had overheard the earlier communications between the driver of ZH42 and the NCO, had begun moving the train forward to clear the block section to the rear. Shortly after, the driver of 9261 contacted the NCO by mobile phone, advising they had moved forward to clear the block section and to further discuss the circumstances of the occurrence.

Following a discussion between the driver of 9261 and the NCO about moving the train forward,[6] the driver confirmed that the lead locomotive initially stopped at the information sign. The driver also advised that the length of the train was 997 m[7] and the in-cab counter had recorded 940 m. The driver indicated to network control a belief that the train should have bunched sufficiently during braking to clear the section block to the rear as the driver had recently undertaken a cross at Sellheim when driving a similar type of train of similar length with no issue.

The NCO then began addressing the DTC authorities, issuing a restraining authority[8] to the driver of ZH42 and seeking the release of the Mingela to Sellheim section block to recover from the occurrence and allow 9261 to proceed.

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6 Neither the driver or co-driver of 9261 recalled hearing the instruction from the NCO not to move the train.

7 The driver quoted the documented effective train length. Effective train length adds an allowance for train slack and a handling safety factor to the documented static train length.

8 Restraint authority: used when it is necessary to stop and hold rail traffic at a designated signal, BLB or location.

Context

Rail vehicle information

Train 9261

Aurizon train 9261 had a static length of 968.4 m that equated to a comparison[9] length of 997.1 m. The train included locomotives 2805 and 4049 and 66 freight wagons[10] for a gross mass of 3,705 t.

Train 9261 supplied a freight service between Phosphate Hill and Stuart (near Townsville). Although normally crewed by a single driver, in this case 9261 was crewed by two drivers, as the automatic train protection system on locomotive 2805 was unserviceable at that time.

Road rail vehicle ZH42

Queensland Rail (QR) maintenance road-rail vehicle ZH42 had a driver and two other persons on board. Vehicle ZH42 was on-tracked at Stuart for the purpose of undertaking a track inspection patrol between Stuart and Pentland (Figure 1) as well as the re-certification of category 3[11] driver qualifications for the driver and another rail safety worker on board at the time.

Train 9261 rail traffic crew information

The driver and co-driver on 9261 held current assessments as fit for duty per the requirements of the National standard of health assessment for rail safety workers. The crew also held current assessments for route accreditation for the Stuart to Hughenden section of track. Following the occurrence, Aurizon arranged screening tests for the presence of an illicit drug or alcohol, which returned a negative result for both the driver and co-driver.

Both drivers had over 25 years driving experience and they were both experienced in conducting driver-only operations and operating as a two-driver crew. Both drivers had many years' experience operating on the Mount Isa Line.

On this occasion, the driver operated the train for the first quarter of the trip, then the co-driver operated the train for the second quarter. The driver took over again at Mungunburra (119 km prior to Sellheim).

The driver and co-driver were based at Townsville. Table 1 shows the driver's hours of work for the week leading up to the occurrence. They stayed overnight at operator-provided accommodation at Hughenden and commenced duty at 0340 on the morning of the occurrence, following a 12.5-hour rest period.

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[9] Comparison length: for the purposes of comparison with the length of crossing loops, defined as static length plus 2 per cent of static length and 125 mm per vehicle coupler

[10] Comprising 40 VFMQ loaded fertiliser wagons and 26 OSZY unloaded acid tankers.

[11] Qualification applicable to a worker who is trained and accredited to drive either a section car, hi-rail rollingstock, or a track vehicle

Table 1: Actual duty times for the driver over previous week

Date	Work activity	Duty start	Duty end	Duty time	Time free (of duty)
21 Jul 2020	Off duty				
22 Jul 2020	Townsville–Cairns	2100	0630	9.5 hours	9.0 hours
23 Jul 2020	Cairns–Townville	1530	0130	10.0 hours	> 24 hours
24 Jul 2020	Off duty				
25 Jul 2020	Local	1504	2156	6.9 hours	> 24 hours
26 Jul 2020	Off duty				
27 Jul 2020	Townsville–Hughenden	0615	1510	8.9 hours	12.5 hours
28 Jul 2020	Hughenden–Townville (planned)	0340	1456	11.3 hours	

The driver recalled having a wake-up call at 0250 on 28 July. They also recalled going to bed at about 2030 the previous evening and obtaining about 5 hours sleep of reasonable or normal quality. The driver considered themself as being a night-time person and feeling 'a bit tired' due to the early start. They could not recall the amount of sleep they had the previous night but regarding it as being beneficial for achieving sufficient sleep. The driver estimated normally getting about 8 hours sleep a night when not working.

The co-driver worked the same shifts on 27–28 July, worked a short shift during the day on 26 July, and had the previous 2 days off duty. The co-driver recalled getting at least 6–7 hours sleep during the night prior to the occurrence and feeling fine at the time of the occurrence.

The drivers stated that the quality of the accommodation at Hughenden was suitable. The driver reported that there were no distractions present, either externally or in the locomotive cab, when they entered Sellheim.

Queensland Rail infrastructure information

Information signs

QR used signage to convey the following types of information to rail traffic crew:[12]

- information or advice
- safety critical instructions
- system of safeworking or area of control.

The background colour of a sign indicated the purpose of the sign to rail traffic crew, as follows:

- red, indicated 'Stop'
- yellow, conveyed 'Warning'
- white, conveyed information or advice.

To address noise complaints from residents (see *Infrastructure change management* processes), on 30 November 2015[13] QR installed information signs on the up and down track at the 110.243 km point, away from the limit of authority at block limit boards (BLBs) SM23 and SM25 (Figure 2). The signage displayed the text 'Stop at this point unless holding DTC Authority to Mingela' on a white background (Figure 4). The format of the sign (white background) conveyed to drivers that the text was for information or advice. Although the sign displayed the word 'stop', it was not meant to be interpreted by rail traffic crews as a stop board.

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12 *QR standard MD-12-189 (Queensland Network Rules and Procedures), QR6007 Signs – General.*

13 *Network Manager Townsville Network Control Centre Train Notice* TN15-09327, issued 27 November 2015.

Figure 4: Information sign at Sellheim Station

Train depicted ins not 9261.
Source: Queensland Rail, annotated by the ATSB

The actual track length available between the up and down starting BLBs[14] at Sellheim Station was 1,240 m. When rail traffic crew stopped the locomotive of their train at the nominated point, the track length between the information sign and BLB SM16 or SM18 to the rear reduced to approximately 940 m, effectively shortening the track length on which a train could be stopped and be clear of the section to the rear.

When the signs were installed, train notice TN15-09327 was issued. The notice advised of the kilometre mark where the signs were installed and the wording of the sign, and it also stated that the signage was '…erected to stop all trains at nominated point clear of local residence unless RTC have DTC authority to Mingela'. It did not specify the distance between the signs and the BLBs 16/18.

The information signs were not located on driver route maps, network maps or the location specific instructions in QR's general appendix (MD-14-36).

QR advised that information signs were used throughout its network. QR also advised that, as far as could be determined, no other information signs, similar to the ones at Sellheim providing advice to stop, had been installed at other locations on the Mount Isa Line.

Maximum train length

According to its Mount Isa System Information Pack, QR derived the maximum train length for operation on the Mount Isa Line from:

- infrastructure restrictions for crossing/passing other trains
- requirements for braking performance of the train
- capacity of the route
- draw gear capacity
- train handling
- requirements for road/pedestrian access across the track

[14] Starting BLBs are usually numbered 16 and 18 for the up direction and 23 and 25 for the down direction.

The maximum train length allowed on the Mount Isa Line was 1,009 m. This length only applied west of Stuart as other limitations/restrictions applied between Stuart and Townsville jetty. Reduced lengths also applied on other lines in the network, such as the North Coast Line.

Variations of train length (greater than the maximum train length allowed) for a particular train configuration were possible west of Stuart, however changes needed ratification as part of access agreement negotiations with QR. At Sellheim Station, the default maximum allowed train length (1,009 m) on the Mount Isa Line west of Stuart exceeded the agreed 940 m track length available between BLB SM18 or SM16 and the location of the respective information signs.

Infrastructure change management process

After receiving complaints from residents at Sellheim about noise from idling trains, in 2014 QR moved the siding at the station.

Following further complaints in July 2015, representatives of QR, Aurizon and another rolling stock operator agreed (during an onsite meeting) that trains waiting for an authority to proceed to Mingela may be stopped at a nominated location away from the limit of authority at BLBs SM23 or SM25, and that an information sign could be installed at that location.

QR personnel advised the ATSB that the distance of 940 m was selected in consultation with Aurizon and the other rolling stock operator because at that time Aurizon had a maximum train length of 925 m. The other operator was operating trains up to the maximum permitted train length.

Prior to installing the signs, QR advised the other parties that the proposed change would need to undertake an information change request process.

QR procedure MD-11-157 (*Infrastructure change management*) outlined QR's processes for requesting a change to track or structures infrastructure owned by QR or infrastructure or processes that interfaced with QR track or structures infrastructure. Infrastructure changes could be assessed using a standard process or a short process. A short process could be used if the proposed change did not require significant design, track modification, signalling modification or overhead line equipment modifications.

Conducting the short process required that a detailed risk assessment be conducted in accordance with QR standard MD-11-1338 (*Risk management*), the complexity be reviewed to determine if a safety management plan was required, and an infrastructure change approval form be completed.

The risk assessment component of the 'short' change process used the QR template 'Simple safety risk assessment tool' (MD-11-7056). The template was to be used in conjunction with the QR document *Risk assessment criteria* (MD-13-561), which detailed the consequence and likelihood matrix used in determining the anticipated risk exposure.

The tool and associated guidance material assisted attendees through the safety risk assessment process and enabled the recording of contextual information about the proposed change, the objective of the change, and a description of the identified risks associated with that change. For each identified risk the tool stepped attendees through processes to analyse the hazard and determine the organisation's exposure, establish appropriate treatments (controls) and record the expected residual risk following application of the treatments.

QR located documentation for an information change process relating to the movement of the siding in 2014, but could not locate any documentation to indicate that the information change request process or a detailed risk assessment was conducted for the installation of the information signs.

Subsequent changes and events

In 2016 Aurizon increased its train lengths, with the longest service having a comparison length of about 1,005 m (within the 1,009 m maximum train length allowed on the Mount Isa Line). When

this change occurred, the potential problem with the location of the information signs at Sellheim was not identified. QR personnel advised that this was an oversight, and related to the fact that the sign was not identified when considering that change (given the sign was not a signal or BLB and did not appear on any driver route maps or network maps).

On 1 November 2019, QR sent an email to Aurizon informing receipt of further public complaints about noise from trains stopped at the eastern end of Sellheim Station. QR summarised the work undertaken to mitigate the complaints, including the installation of the information signs. The email noted the signs' placement was to allow eastbound rail traffic to be in-clear at the western end and requested Aurizon reinforce this issue with its rail traffic crews.

Aurizon forwarded the QR email internally to team leaders and asked them to remind drivers to follow the 'direction' and stop at the information sign. Additionally, Aurizon asked team leaders to report any circumstances that did not allow its drivers to follow the instruction. There was no record of any issue raised in response.

There was no record of Aurizon raising an issue with QR in relation to rail traffic crew working a train exceeding 940 m responding to the information sign at Sellheim, and managing a cross with opposing rail traffic.

Safeworking requirements

Direct traffic control territory safeworking arrangements

The QR safeworking system of direct traffic control (DTC) used on the Mount Isa Line operated on the principle of absolute block working, which provided that only one rail traffic movement would be authorised on any one block (section of track) at any one time. The NCO issuing a DTC authority up to a nominated BLB effectively transferred ownership of the affected block(s) from the NCO to rail traffic crew. After exiting a block, the rail traffic crew could transfer ownership back to the NCO with the provision of a release code.

The transfer of block ownership was primarily through numerical codes communicated verbally between the NCO and rail traffic crew. In addition, the DTC system software supplied an oversight function when generating and validating the codes. It compared the GPS location of the locomotive against the selected block(s) to be released, and those that would remain in the authority when the release was finalised. This occurred through a combination of functionality in the DTC driver workstation equipment in the locomotive cab and the controller workstation equipment in the network control centre.

The driver workstation calculated whether the current locomotive GPS location was within the block(s) that would remain in the authority after the release and, if not, triggered an alarm requiring confirmation of the release. The driver workstation did not hold information on the train length, so it could not prove the location of the rear vehicle of the train when calculating the release.

On receipt of the release code from the rail traffic crew, the NCO selected the rail traffic and entered the code into the control workstation. The control workstation calculated whether the current GPS location was within the blocks that would remain in the authority after the release and, if not, displayed a prompt requiring confirmation of the release. The control workstation did hold information on the train length and used this information to confirm that the length of the train would fit within the blocks still in the authority.

QR standard MD-10-113 (*Direct traffic control manual*) summarised the limitations of the system. It stated that, although the DTC system design created and validated authorities for issue by the NCO, it could not:

- detect if blocks that were currently occupied, or to be occupied, were released by the rail traffic crew or by the NCO
- detect if a block that was available to the NCO was physically unavailable for traffic for any reason such as a track defect.

Procedure for crossing rail traffic at a DTC station

For a cross at a directional travel station,[15] such as Sellheim Station, the NCO relied on the rail traffic crew stopped at the location to confirm their train was complete and in-clear of the section block to the rear (that is, for train 9261, the Charters Towers to Sellheim section block).

Following receipt of confirmation and the release code from the rail traffic crew, the NCO could then issue the next electronic authority or extend an existing authority for the opposing rail traffic to proceed and occupy the vacated block (that is, for road-rail vehicle ZH42, the Sellheim to Charters Towers section block).

To facilitate this, the DTC manual required rail traffic crew of the first rail traffic arriving at the station to:

- check the points indicator is in the normal position
- if necessary, stop the rail traffic clear of the points and reset them to the correct position
- enter the station, on the road indicated on the DTC Authority, at a maximum speed 25 km/h
- stop the rail traffic within the clearance point boards[16]
- make sure the rail traffic is complete
- report to Network Control Officer the rail traffic is in clear and complete and release unoccupied blocks
- check the points, and if necessary, correctly set them for the opposing rail traffic

The opposing rail traffic crew arriving at the station were to:

- check the opposing rail traffic is clear and complete
- tell the opposing rail traffic crew their rail traffic is clear and complete, or otherwise
- obtain an Authority to proceed[17]
- proceed in accordance with the Authority
- release unoccupied blocks when clear and complete

The DTC manual also stated that, when approaching a station or when passing other rail traffic, a rail traffic crew should travel at controlled speed. The QR standard MD-10-107 (*General operational safety manual*) defined controlled speed as '…a speed that allows rail traffic to stop short of an obstruction within half the distance of clear line that is visible ahead'.

Procedure for checking in-clear and complete

MD-10-107 required that when rail traffic was stopped at a station in single line bidirectional territory (such as the Mount Isa Line) to cross other rail traffic, its crew must check the rail traffic was complete and in-clear by:

- verbal confirmation of another who can see the rear of train signals, or
- visually determining the correct rail vehicle is at the rear of the rail traffic, or
- the correct number of rail vehicles are on the rail traffic, or
- carrying out a brake pipe leakage test

Note: A rail traffic driver may assume the rail traffic is complete if the Brake Pipe Leakage Test is successful.

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15 Directional travel station: station at which the points are normally set to allow simultaneous entry and exit of trains through the up and down lines.

16 Clearance point boards were typically not provided at directional travel stations on the Mount Isa Line.

17 Following receipt of the required release code from the first rail traffic crew to arrive, the NCO may have already provided the opposing rail traffic crew with an extension to their authority to proceed.

- make sure the rail traffic is in clear by comparing the length of the rail traffic with the capacity of the main line or loop
- if rail traffic is not in clear, tell Network Control Officer and rail traffic crew of opposing rail traffic
- protect the rail traffic, if necessary

For an unattended station such as Sellheim, the crew of the first rail traffic to arrive could satisfy the requirements by conducting a brake pipe leakage test and comparing the train length to the available track length in the station (if stopping at the limit of authority) or the distance travelled by the locomotive after entering the station. The crew of the second rail traffic to arrive could satisfy the requirement for checking in-clear and complete through receipt of verbal confirmation from the crew of the first rail traffic that they had sighted the rear of train signals on the second rail traffic after it had entered the station.

If the crew of the second rail traffic to arrive found the first rail traffic not to be in-clear of the track ahead, the crew were to:

- stop clear of other rail traffic
- tell rail traffic crew of other rail traffic their rail traffic is not in clear

The crew of the first rail traffic to arrive were then to pull in-clear of the opposing track, if possible.

If the second crew found the first rail traffic to arrive was not complete, they were to tell the other crew and notify the NCO. The second crew were not to proceed until authorised by the NCO.

Aurizon rolling stock operator information

Aurizon rail traffic crew working the Mount Isa Line were required to follow the applicable safeworking rules published by QR for DTC working, as well as other instructions implemented by Aurizon. To manage a cross with opposing rail traffic, the Aurizon crew of the first train to arrive were to undertake several tasks, including:

- stopping the rail traffic within the clearance point boards, or in the case of 9261 at Sellheim within the information sign and BLB (SM16/SM18)
- making sure the rail traffic was complete
- reporting to the NCO that the rail traffic was in-clear and complete.

Aurizon advised that no discrete procedures, or work/local operating instructions, were provided to drivers to explicitly address the unique requirement for stopping a down direction train at the Sellheim Station information signs.

Drivers stopping a train at a BLB for the limit of authority or, in the case of 9261 on 28 July 2020, the information sign, were essentially required to perform the same sequence of tasks. These involved:

- the correct operation of the locomotive in-cab counter
- the choice of static or comparison train length for use in conjunction with the in-cab counter
- deciding if the train was in-clear
- cross-checking the train was in-clear and complete before releasing a section block.

Aurizon advised that drivers received training in the above tasks as part of the traction competency, route knowledge and verification of competence training provided to rail traffic crew during the initial driver training and reaccreditation of competency processes.

Aurizon advised that Sellheim was infrequently used to perform crosses. It also stated that its trains on the Mount Isa Line varied in length from 620 m to 1,005 m.

The driver of train 9261 reported that they may have performed crosses at Sellheim on about 15 previous occasions, but could not recall how many they had done since the maximum train length had been extended. As noted in the occurrence, the driver indicated they had done a cross

recently at Sellheim and on that occasion they had encountered no problem when stopping at the information sign. The driver stated that they always stopped at the relevant stop boards and never had a problem doing so, so had assumed on this occasion that stopping at this sign would have meant their train was in-clear. The co-driver could not recall conducting a cross at Sellheim since the Aurizon maximum train length had been extended.

Safety analysis

Introduction

Train 9621 and road-rail vehicle ZH42 were undertaking a cross in single line bidirectional territory at Sellheim Station. Train 9621 arrived first, and the driver stopped the train at the information sign advising drivers to stop, which was located 940 m passed the block limit board (BLB) 18 and 300 m prior to BLB 23. This resulted in the train, with a length of 997 m, still occupying the previous block.

The driver of 9261 released the previous block (rear of BLB 18) to the network control officer (NCO), who then extended the authority of ZH42 to enter that occupied block.

A rail vehicle receiving authority to enter an occupied block obviously increases the risk of a collision. In this case, the last line of defence was the requirement for the rail traffic crew of ZH42 to travel at controlled speed (that is, be able to stop within half the distance of the line of sight ahead). The crew complied with the requirement and stopped prior to reaching the rear of 9621.

Information sign location and design

The Queensland Rail (QR) train notice TN15-09327 identified the 110.243 km point as the nominated position of the information signs at Sellheim, but it did not specify the measurement of track length available for standing a train between each sign and its respective BLB (SM18 or SM16). Additionally, neither the signs nor other trackside monument displayed a measurement to inform rail traffic crew of the available track length from the signs to the BLBs. The published track length to stand a train at Sellheim Station was 1,240 m, however the positioning of the information sign left an available track length of around 940 m for a train stopped at that point.

The instruction to stop a train at the information sign was not safeworking related; rather it was intended to convey advice to rail traffic crew to avoid further noise complaints from the public. It was therefore not compulsory for rail traffic crew to stop at that point, meaning a driver could choose to pass the sign by a distance sufficient to ensure the rear of their train was in-clear, while still stopping short of the respective limit of authority at BLB SM23 or SM25.

Nevertheless, a driver choosing to travel past the information sign and closer to the limit of authority could have been exposed to criticism should receipt of further public noise complaints occur. In addition, the language in the train notice (‘stop all trains’) and a subsequent reminder email from Aurizon management to its train crews (referring to a ‘direction’ to stop) conveyed a stronger intent than purely advisory information.

With rolling stock operators working trains of varying length up to the maximum permitted train length on the Mount Isa Line of 1,009 m, rail traffic crew of some down direction trains would have had insufficient standing room to accommodate their entire train length if they stopped at the information sign. This would result in the section block to the rear remaining occupied, placing increased reliance on the rail traffic crew's implementation of procedural controls to identify whether the rear of the train was in-clear prior to providing the section block release to the NCO.

QR installed the information sign at Sellheim in 2015. This was the only location on the Mount Isa Line that displayed advice for rail traffic crew to stop short of the limit of authority. There was no earlier report where the incorrect provision of a release code at this location resulted in the crew of an opposing train finding a rail vehicle fouling the track section ahead. However, the ATSB notes that Aurizon had only been operating trains up to the maximum length at that location for 4 years.

Change management and risk assessment processes

To undertake an infrastructure change, such as installing the information signs at Sellheim, QR personnel were required to conduct an infrastructure change approval process. Given the nature

of the change, only a 'short' change process was required; nevertheless, this still required a risk assessment and other evaluations.

There was no evidence to indicate that the formal change management process or risk assessment was conducted prior to installing the sign. It is apparent that QR personnel consulted with rolling stock operators when making the change, and considered Aurizon's maximum train length at that time as part of that process. However, a formal risk assessment should have involved relevant personnel in a process to identify risks associated with the change, identify the causes and consequences of the risk, identify and evaluate the existing controls to minimise risk, and determine of any additional treatments were required to minimise risk.

It is difficult to conclude using hindsight whether a formal risk assessment would have identified the potential problems with the signs' design and/or location. It is possible that the relevant personnel may have considered that the Aurizon maximum train length at that time and the existing controls in place for managing DTC working would have been sufficient. However, it is also possible that a formal risk assessment would have considered the potential operational implications of the sign, noted that the other operator was using trains longer than 940 m, and concluded that the signs did not provide sufficient information regarding their location relative to the BLBs.

Aurizon changed its maximum train length after the signs were installed, which increased the opportunity for rail traffic crews to make errors and therefore the risk associated with the signs' design and placement. Unfortunately however, there was no obvious mechanism for this change to trigger a review of the location of the signs.

In summary, although there was consultation between QR personnel and rolling stock operators prior to the installation of the information signs at Sellheim, QR personnel did not complete a formal infrastructure change approval process or risk assessment to record their consideration of the potential operational implications of the signs. This resulted in a missed opportunity to identify the limitations with the location and design of the information signs.

Section block release

QR procedures required rail traffic crew undertaking a cross with opposing rail traffic to make sure their train was in clear by comparing the length of their train with the length of the main line or loop. As trains run on the Mount Isa line were generally less than the maximum train length,[18] a rail traffic crew stopping the locomotive at the limit of authority BLB would likely be in-clear.

However, a rail traffic crew of a down direction train using the information sign at Sellheim Station as the stopping point would need to check the train's length against the distance the locomotive travelled after passing the respective BLB (SM18 or SM16), to determine if the rear of the train was in-clear. If the distance travelled was insufficient for the train length, the rear vehicle(s) would still occupy the section block to the rear and the driver could therefore not supply a release code to the NCO. This would likely result in a delay in undertaking the cross, as the opposing rail traffic could not receive an extension to their authority and would need to stop at their limit of authority.

The static and comparison train lengths of 9261 were about 968 m and 997 m respectively. Depending on the extent of bunching/stretching of the train, its overall length could have been between 28 to 57 m longer than the standing distance available between BLB SM18 and the associated information sign. Although Aurizon did not publish any procedures or work instructions specifically addressing the use of the in-cab counter to determine a train was in-clear when stopping at the Sellheim Station information signs, the use of the tool for this type of application was common practice for the drivers operating trains on the Mount Isa Line.

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[18] Trains greater than the maximum train length may be operated on agreement with QR. In such cases other procedures applied when undertaking a cross or pass at a directional travel station.

For the cross between train 9261 and rail vehicle ZH42, the driver of 9261 used the information sign location as a reference for the locomotive stopping point rather than consciously cross-checking the in-cab counter readout against the train comparison length to determine if the locomotive had travelled sufficient distance for the rear of the train to be in-clear. Although the driver was aware of the train static and comparison lengths and the readout on the in-cab counter, these separate sources of information were not assimilated when undertaking the task of determining whether the train was in-clear. Subsequently, the driver erroneously provided the NCO with a release code for the Charters Towers to Sellheim section block.

The driver's decision to supply a release code was likely based on their recent experience working a similar train where no issue had arisen during a cross when stopped at the sign, and the driver's assumption that always stopping at the relevant stop board (or in this case an information stop sign) would ensure the train would be in-clear.

The ATSB also considered other potential reasons for the driver's error on this occasion. There was no evidence of any notable distraction during the task. It is possible that the driver was experiencing a level of fatigue associated with the early start (with a wake-up call at 0250) and only 5 hours sleep the previous night. However, given the length of time awake, the time of day of the occurrence, and the fact that the driver had only been operating the train for a short period (after a period acting as co-driver), there was insufficient evidence to conclude the existence of a significant level of fatigue at the time of the occurrence.

On this occasion, the driver was accompanied by a co-driver. However, the co-driver was not actively involved in cross-checking the train length with the information from the in-cab counter, nor did this appear to be normal practice when a train was crewed by two drivers. Although a second driver would not always be present for the operator's operations at Sellheim Station, it provided an opportunity on this occasion for ensuring safety-critical actions were monitored and checked. The ATSB has previously noted the important role that effective teamwork can play in transport operations.[19] Having the driver verbally call out relevant information during activities such as a cross, and having the co-driver confirm that information, would help reduce the risk associated with an individual driver's error.

DTC traffic control system

The procedures for direct traffic control (DTC) safeworking required the crew of the first rail traffic arriving at the station to enter at 25 km/h and, after stopping, make sure their rail traffic was complete and in-clear before providing a release code to the NCO. For the second rail traffic to arrive, the procedure typically required the crew to enter at 25 km/h, stop and check the opposing rail traffic was in-clear before obtaining the next authority from the NCO. As in this instance, an error by the first rail traffic crew in providing a release code when the rear of their rail traffic was not in-clear, would usually be identified by the second rail traffic crew prior to them obtaining their next authority from the NCO.

To facilitate traffic flow, the DTC safeworking system made provision for the NCO in receipt of the release code to extend the authority issued to the second crew, prior to their arrival at the station. This would allow the second rail vehicle to pass through the station without stopping, though the procedures still required the crew to check the opposing rail traffic was in-clear and complete before doing so.

It was noted that the DTC workstations did not have functionality to trigger an alarm for the NCO if the rear of the first rail traffic was not clear. This meant an error by one rail traffic crew in providing a release code when their rail vehicle was not in-clear increased reliance on the second

[19] For example, see ATSB investigation RO-2018-007, *Collision with floodwater involving freight train 6792, Little Banyan Creek, Queensland, on 7 March 2018*.

(opposing) rail traffic crew checking the other vehicle to detect the occupied section block in sufficient time to avoid a collision.

Although restricting the speed of the second rail vehicle to 25 km/h reduced the risk, it did not eliminate the risk. In situations arising from adverse environmental conditions or track alignment, the rail traffic crew might not sight the vehicle(s) of the opposing train in sufficient time to avoid a collision. For example, on 27 February 2018 at Oonoomurra on the Mount Isa Line, a westbound train collided with the wagons on the rear of the opposing train that were foul of the track.

In summary, the QR direct traffic control (DTC) system supplied limited functionality for the NCO to verify the physical availability of a released section block prior to issuing an authority to an opposing rail traffic crew. This limitation increased reliance on the crews of both rail vehicles correctly applying the procedure for crossing rail traffic at a DTC station. Accordingly, future technological developments to the DTC system (and similar systems) to ensure that NCOs are provided with information when trains are not in-clear would further reduce risk.

Findings

ATSB investigation report findings focus on safety factors (that is, events and conditions that increase risk). Safety factors include 'contributing factors' and 'other factors that increased risk' (that is, factors that did not meet the definition of a contributing factor for this occurrence but were still considered important to include in the report for the purpose of increasing awareness and enhancing safety). In addition 'other findings' may be included to provide important information about topics other than safety factors.

These findings should not be read as apportioning blame or liability to any particular organisation or individual.

From the evidence available, the following findings are made with respect to the safeworking irregularity (and subsequent rail vehicle receiving authority to enter an occupied block) involving train 9261 at Sellheim station, Mount Isa Line, Queensland, on 28 July 2020.

Contributing factors

- Queensland Rail installed information signs advising rail traffic crew to stop at a point 940 m past a block limit board (BLB) at Sellheim Station, a location where the maximum train length (for normal operations) was 1,009 m, without advising drivers of the distance from the sign to the BLB. This placed increased reliance on rail traffic crew of down direction trains stopping at the sign to effectively implement procedural controls to identify whether the rear of their train was in-clear.
- The driver of 9261 used the information sign location as a reference for the locomotive stopping point rather than cross-checking the in-cab counter readout against the train comparison length to determine if the locomotive had travelled sufficient distance for the rear of the train to be in-clear. Subsequently, the driver erroneously provided the network control officer with a release code for the Charters Towers to Sellheim section block when their train was not in-clear.
- The Queensland Rail direct traffic control system provided limited functionality for a network control officer to verify the physical availability of a released section block prior to issuing an authority. This placed increased reliance on a second (opposing) train crew checking the stationary train to detect the occupied section block in sufficient time to avoid a collision.

Other factors that increased risk

- When installing the information signs at Sellheim, Queensland Rail personnel did not complete a formal infrastructure change approval process or risk assessment to consider the potential operational implications of the signs.

Safety actions

Safety action not associated with an identified safety issue

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.

Additional safety action by Queensland Rail

Following the occurrence involving train 9261, Queensland Rail (QR) reviewed the nominated location of the information signs. QR undertook a risk assessment in conjunction with its infrastructure change management procedure, subsequently moving the signs to the 110.109 km point, approximately 134 m east of the first location. The revised location provided about 1,060 m between BLB SM18 or SM16 and the associated information sign. QR notified rolling stock operators of the changed location via train notice TN20-09749.

Additionally, QR started a program of works to find locations on the Mount Isa Line and other lines where inconsistencies existed between the trackside infrastructure and the information contained in route maps, signalling arrangement diagrams and the DTC software.

Additional safety action by Aurizon

Following the occurrence involving train 9261, Aurizon created a ‘safety share’ surrounding the incident as part of toolbox meetings with its Stuart operations staff to emphasise actions to prevent a recurrence. Actions nominated included checking the counter reading. In July 2021, Aurizon advised that it was continuing to deliver train handling coaching (including the use of counters) to its train crew through toolbox talks.

Aurizon also commenced a review to identify other instruction boards and practices on loops and sidings which may cause full length trains to be foul of the previous section when stopped. In addition Aurizon, advised it would investigate a potential requirement for rail traffic crew and/or ground staff to cross call counter distances and train wire length to mitigate the risk of remaining foul of rear signals/authorities and the prevention of roll back SPADs when performing crosses or stopping in loops.

General details

Occurrence details

Date and time:	28 July 2020 – 0930 EST	
Occurrence category:	Incident	
Primary occurrence type:	Safeworking irregularity	
Location:	Sellheim Station, 18 km east of Charters Towers, Mount Isa Line, Queensland	
	Latitude: 20º 0.836' S	Longitude: 146º 24.344' E

Train details

Track operator:	Queensland Rail	
Train operator:	Aurizon	
Train number:	9261	
Type of operation:	Freight	
Departure:	Phosphate Hill	
Destination:	Townsville	
Persons on board:	Crew – 2	Passengers – 0
Injuries:	Crew – 0	Passengers – 0
Damage:	None	

Train details

Track operator:	Queensland Rail	
Train operator:	Queensland Rail	
Train number:	ZH42	
Type of operation:	Maintenance	
Departure:	Stuart	
Destination:	Pentland	
Persons on board:	Crew – 2	Passengers – 1
Injuries:	Crew – 0	Passengers – 0
Damage:	None	

Glossary

BLB	Block limit board. Sign used in direct traffic control (DTC) territory to define the limit of a particular block section.
DTC	Direct traffic control. DTC is an absolute block safeworking system used to control the movement of trains in non-signalled territory.
NCO	Network control officer
ONRSR	The Office of the National Rail Safety Regulator
QR	Queensland Rail

Sources and submissions

Sources of information

The sources of information during the investigation included the:

- Aurizon
- Queensland Rail
- the network control officer
- the rail traffic crew of train 9261 and road-rail vehicle ZH42
- recorded data from the Townsville network control centre and train 9261's event recorder.

References

National Standard health assessment for rail safety workers 2017, National Transport Commission.

Queensland Rail Rules and Procedures, MD-12-189, QR 6007 Signs-General, V6.0, 26 August 2019.

Queensland Rail Observance of Signals Manual, MD-10-109, v3.0, s2.7, v5.1, 10 August 2020.

Queensland Rail Mount Isa system information pack, v3.1, 20 February 2017.

Queensland Rail Infrastructure Change Management Procedure, MD-11-1157, v3.0, 30 July 2020

Queensland Rail SEMS Standard, Direct Traffic Control Manual, v3.1, 28 October 2019, Module DT-1 General, s1.6 Computer operations.

Queensland Rail SEMS Standard, General operational safety manual, MD-10-107, v5.0, 10 May 2019, Module GS-2, s2.9 Rail traffic in clear and complete.

Queensland Rail Train notice TN15-09327, 27 November 2015, General information: Signalling arrangements – Sellheim Yard, 30 November 2015.

Queensland Rail Simple Safety Risk Assessment Tool, MD-11-7056, v3.0.

Submissions

Under section 26 of the *Transport Safety Investigation Act 2003*, the ATSB may provide a draft report, on a confidential basis, to any person whom the ATSB considers appropriate. That section allows a person receiving a draft report to make submissions to the ATSB about the draft report.

A draft of this report was provided to the following directly involved parties:

- Aurizon
- Queensland Rail
- the rail traffic crew of rail vehicle 9261
- the Office of the National Rail Safety Regulator.

Submissions were received from:

- Aurizon
- Queensland Rail
- The Office of the National Rail Safety Regulator

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

Australian Transport Safety Bureau

About the ATSB

The ATSB is an independent Commonwealth Government statutory agency. It is governed by a Commission and is entirely separate from transport regulators, policy makers and service providers.

The ATSB's purpose is to improve the safety of, and public confidence in, aviation, rail and marine transport through:

- 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, as well as participating in overseas investigations involving Australian-registered aircraft and ships. It prioritises investigations that have the potential to deliver the greatest public benefit through improvements to transport safety.

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

Purpose of safety investigations

The objective of a safety investigation is to enhance transport safety. This is done through:

- identifying safety issues and facilitating safety action to address those issues
- providing information about occurrences and their associated safety factors to facilitate learning within the transport industry.

It is not a function of the ATSB to apportion blame or provide a means for determining 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. The ATSB does not investigate for the purpose of taking administrative, regulatory or criminal action.

Terminology

An explanation of terminology used in ATSB investigation reports is available on the ATSB website. This includes terms such as occurrence, contributing factor, other factor that increased risk, and safety issue.