Australian Government

Australian Transport Safety Bureau

ATSB TRANSPORT SAFETY INVESTIGATION REPORT
Rail Occurrence Investigation 2005/005
Final

Collision between Freight Train 5BS7 and Track Vehicle

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Published by: Australian Transport Safety Bureau
Postal address: PO Box 967, Civic Square ACT 2608
Office location: 15 Mort Street, Canberra City, Australian Capital Territory
Telephone: 1800 621 372; from overseas + 61 2 6274 6590
Accident and serious incident notification: 1800 011 034 (24 hours)
Facsimile: 02 6274 6474; from overseas + 61 2 6274 6474
E-mail: atsbinfo@atsb.gov.au
Internet: www.atsb.gov.au

ISBN and formal report title: see 'Document retrieval information' on page v.

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DOCUMENT RETRIEVAL INFORMATION

Report No.	Publication date	No. of pages	ISBN
2005/005	June 2006	49	1 921092 54 8

Publication title

Collision between Freight Train 5BS7 and Track Vehicle Greenbank, Queensland.

Author(s)

Australian Transport Safety Bureau

Prepared by

Australian Transport Safety Bureau
PO Box 967, Civic Square ACT 2608 Australia
www.atsb.gov.au

Abstract

Train 5BS7 was fifteen minutes into its Brisbane to Sydney journey when it collided with a stationary track vehicle at Greenbank staff station. Train 5BS7 and the track vehicle were both given authority to enter the Greenbank staff station yard limits.

A misunderstanding between the train controller and signaller in regard to the anticipated departure time of the south bound train in combination with workload and train route graph endorsement issues contributed to the erroneous granting of this authority. Longstanding inadequate safeworking practices then contributed to the lack of an effective block between these opposing movements.

AUSTRALIAN TRANSPORT SAFETY BUREAU

The Australian Transport Safety Bureau (ATSB) is an operationally independent multi-modal Bureau within the Australian Government Department of Transport and Regional Services. ATSB investigations are independent of regulatory, operator or other external bodies.

The ATSB is responsible for investigating accidents and other transport safety matters involving civil aviation, marine and rail operations in Australia that fall within Commonwealth jurisdiction, as well as participating in overseas investigations involving Australian registered aircraft and ships. A primary concern is the safety of commercial transport, with particular regard to fare-paying passenger operations. Accordingly, the ATSB also conducts investigations and studies of the transport system to identify underlying factors and trends that have the potential to adversely affect safety.

The ATSB performs its functions in accordance with the provisions of the *Transport Safety Investigation Act 2003* and Regulations and, where applicable, relevant international agreements. The object of a safety investigation is to determine the circumstances to prevent other similar events. The results of these determinations form the basis for safety action, including recommendations where necessary. As with equivalent overseas organisations, the ATSB has no power to implement its recommendations.

It is not the object of an investigation to determine blame or liability. However, it should be recognised that an investigation report must include factual material of sufficient weight to support the analysis and findings. That material will at times contain information reflecting on the performance of individuals and organisations, and how their actions may have contributed to the outcomes of the matter under investigation. 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.

Central to ATSB's investigation of transport safety matters is the early identification of safety issues in the transport environment. While the Bureau issues recommendations to regulatory authorities, industry, or other agencies in order to address safety issues, its preference is for organisations to make safety enhancements during the course of an investigation. The Bureau is pleased to report positive safety action in its final reports rather than make formal recommendations. Recommendations may be issued in conjunction with ATSB reports or independently. A safety issue may lead to a number of similar recommendations, each issued to a different agency.

The ATSB does not have the resources to carry out a full cost-benefit analysis of each safety recommendation. The cost of a recommendation must be balanced against its benefits to safety, and transport safety involves the whole community. Such analysis is a matter for the body to which the recommendation is addressed (for example, the relevant regulatory authority in aviation, marine or rail) in consultation with the industry.

The 24-hour clock is used in this report to describe the local time of day, Eastern Standard Time (EST), as particular events occurred.

EXECUTIVE SUMMARY

At about 0947 on 25 August 2005 a freight train travelling from Acacia Ridge[1] to Sydney, numbered as 5BS7, collided with a stationary track vehicle[2] at the take-off point[3] within the Greenbank[4] station yard limits. The impact speed was 21.9 km/h and the track vehicle was pushed back 25 metres. There were no injuries as a result of this accident and damage was limited to the front end of the track vehicle.

The track vehicle, with three track workers on board, had arrived on the main line at Greenbank moments before the arrival of the Sydney bound train and was going to the take-off point to be removed from the rail track for road operation. The approaching train was seen and heard by the track workers however they thought they would reach the take-off point and remove the track vehicle before the train arrived. When they realised that they could not, they escaped from the vehicle before the collision.

The two-man train crew of the Sydney bound train were travelling on a proceed signal and had made a routine brake application in preparedness for the mandatory stop at the Greenbank staff hut[5] . As the Greenbank staff station yard came into view they saw the track vehicle and made an emergency application of the train brakes 246 metres from the point of impact.

The train had departed Acacia Ridge under Rail Vehicle Detection authority to travel to Greenbank where the safeworking system changed to electric staff[6].

The track vehicle was travelling from Bromelton to Greenbank on a routine track inspection on the authority of a Track Occupancy Authority (TOA). This TOA consisted of an electric staff and implied verbal authority to proceed within the Greenbank staff station yard limits to the take-off point.

The potential for simultaneous arrival at Greenbank had not been detected by the QR south-west train controller when developing the train graph. Distractions attributed to teaching a trainee controller and ambiguous communication regarding the departure time of train 5BS7 contributed to this oversight. This ambiguous communication resulted in the train controller believing that the train would not depart before 0945. However, it was intended that 0945 would be the latest departure time.

1 Acacia Ridge – A southern suburb of Brisbane, site of a major rail freight terminal.

2 Track vehicle – A vehicle, usually self propelled, used mainly for inspecting and maintaining infrastructure. In this instance able to operate on rail or road.

3 Take-off point - Staging beside the track for removing track mounted maintenance vehicles or equipment clear of train movements.

4 Greenbank – 17 Kilometres ‘south’ of Acacia Ridge.

5 Staff hut – location where tokens are kept.

6 Electric staff – A metal rod of prescribed design used as a token to authorise train movements into or through a block in electric staff territory.

The investigation also found that longstanding inadequate safeworking practices between Acacia Ridge and Glenapp[7] allowed the train controller's oversight to result in this accident. These practices pertain to the operation of track vehicles that are not detected by track-circuitry[8]. The same system of safeworking exists between Glenapp and Casino[9] with two versions of rules and procedures.

Safety actions recommended as a result of this investigation pertain to QR, Interail and ARTC ensuring that blocking facilities are applied where necessary, rule and procedure conformity on the electric staff territory between Greenbank and Casino, trainee train controller training program structure and enforcement, verbal communication protocols, and locomotive data logger accessibility.

7 Glenapp – The electric staff station/crossing loop 12 kilometres on the Queensland side of the border.

8 Track-circuitry – An electrical current that uses the rails of a railway track as conductors such that a train electrically connects them by its axles. The absence or presence of this rail to rail connection indicate the absence or presence of a train or item of rollingstock.

9 Casino – A provincial city on the Brisbane to Sydney rail line, about 169 kilometres from Acacia Ridge. Casino is an interface between electric staff working and rail vehicle detection (RVD) safeworking systems.

1 INTRODUCTION

Following a collision between train 5BS7 and a stationary track vehicle[10] on the main line at Greenbank staff station at about 0947 on 25 August 2005, the ATSB initiated an investigation into the causal factors of this accident under the *Transport Safety Investigation Act 2003* (TSI Act).

The track vehicle had travelled in the Down[11] direction over the Bromelton to Greenbank section. Train 5BS7 had travelled in the opposite Up[12] direction from Acacia Ridge to Greenbank. Apart from being shaken by the accident, none of the three persons in the track vehicle or two crew members of train 5BS7 were injured. Both the track vehicle and train 5BS7 were given authority to occupy the main line at Greenbank at the time of the accident.

This investigation examined all factors that were causal or potentially causal to this accident, in particular the application of the safeworking procedures for track vehicles on this corridor. These factors include examination of relevant safety management systems, the actions of individuals and locomotive data logger information.

The ATSB acknowledges the cooperation of all who participated and assisted in this investigation.

10 Track Vehicle – A vehicle, usually self propelled, used mainly for inspecting and maintaining infrastructure. In this instance able to operate on rail or road.

11 Down direction – Travel 'northbound' towards Brisbane.

12 Up direction – Travel 'southbound' towards Sydney.

2 NARRATIVE

2.1 Overview

A collision between a track vehicle and a southbound freight train occurred at Greenbank at 0947 on 25 August 2005. The track vehicle was a Toyota twin cab Hi-Lux utility, registration SCV-212, that was being operated by the Infrastructure Services Group of Queensland Rail (QR). Three QR employees were aboard the track vehicle immediately before the collision. Train 5BS7 consisted of locomotives EL51 and EL55 hauling 32 'container flat' wagons of which 12 were loaded and 20 were empty. The train was 609.2 metres long, weighed 1150.5 tonnes and was operated by Interail Australia Pty Ltd. There were two Interail train crew employees aboard the lead locomotive at the time of the collision.

2.1.1 Location

Greenbank is an unattended crossing loop located on the main interstate Queensland/New South Wales rail line and part of the Defined Interstate Rail Network (DIRN), 17 kilometres from Acacia Ridge and 955.600 kilometres from Sydney. Acacia Ridge is on the southern outskirts of Brisbane and is the site of a major freight terminal. The station yard at Greenbank is defined as being within the Up and Down home signals. These signals are approach-cleared to oncoming trains and, if the relevant track-circuits[13] are unoccupied and proven, will display a yellow (proceed) aspect. Should the track-circuits be occupied or not proven, these signals will remain at red (stop). The Up home signal is located about one kilometre from the Greenbank staff hut on a rising 1:154 grade that eases to 1:264 on the immediate approach to Greenbank.

The loop at Greenbank is only able to accommodate trains of 411 metres and is rarely used for crossing purposes. From time to time though, it is used for stowing or crossing movements involving track vehicles. A staff hut is located adjacent to the main line and contains telephones, electric staff[14] instruments and relevant safeworking forms and equipment. It is the point at which authority to proceed in either the Up or Down direction is received from train control. The staff hut is about half way between the loop points and all trains and track vehicles stop to obtain this authority. In addition, there is a take-off area on the Acacia Ridge (or Down) side of the staff hut, which is the easiest point for track vehicles to transfer between rail and road at Greenbank.

Rail traffic through Greenbank varies according to the day of the week. One return Sydney-Brisbane-Sydney XPT passenger train operates daily. In terms of freight, about six trains operate in each direction daily. These trains can be up to 1500 metres long and weigh upwards of several thousand tonnes.

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13 Track-circuit – An electrical current that uses the rails of a railway track as conductors such that a train electrically connects them by its axles. The absence or presence of this rail-to-rail connection indicated the absence or presence of a train or item of rollingstock.

14 Electric staff – A metal rod of prescribed design used as a token to authorise train movements into or through a block in electric staff territory.

Figure 1: Acacia Ridge to Casino

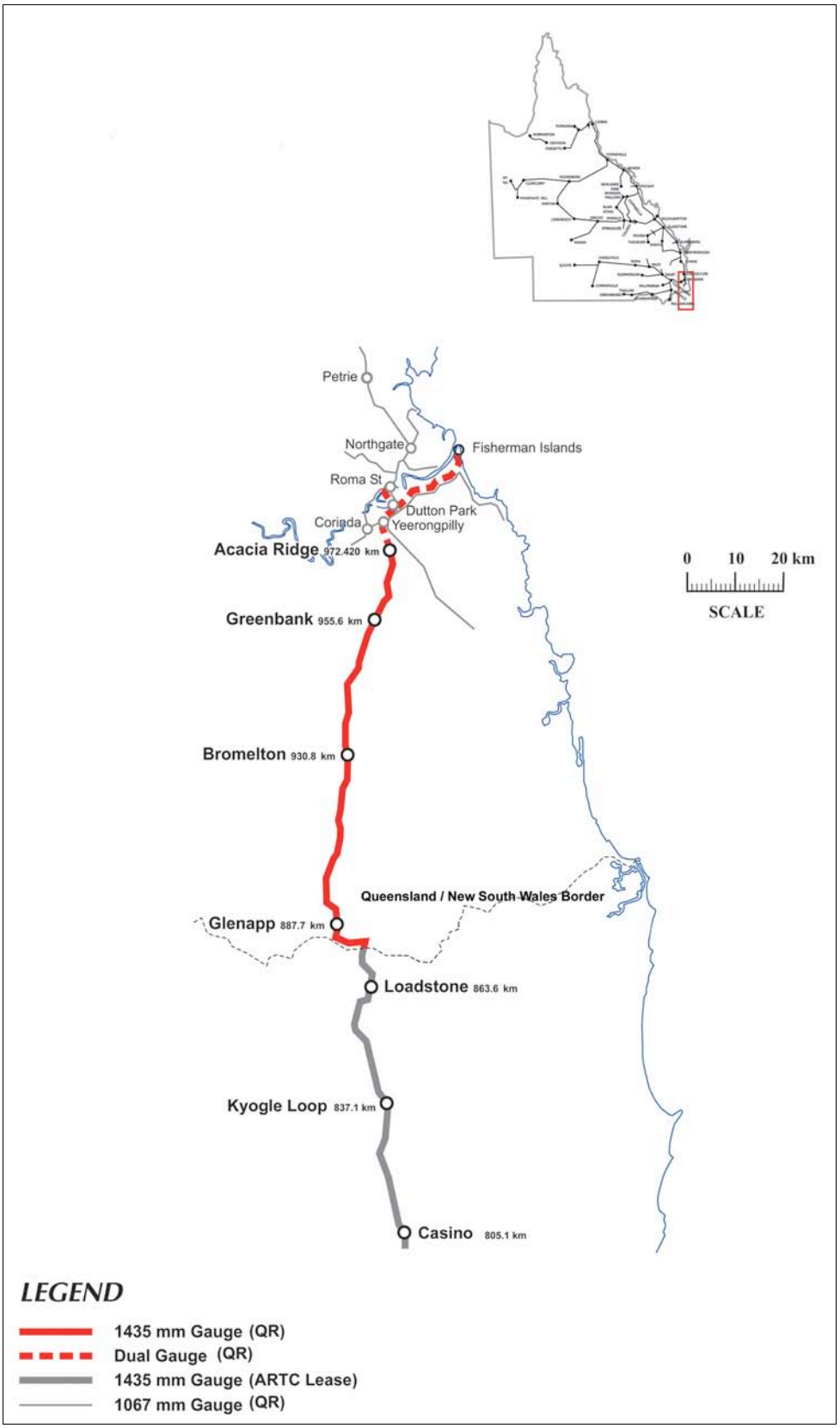


Figure 2: Greenbank staff hut

2.1.2 The accident

The (active) event sequence leading to this accident started at about 0900 at Bromelton, which is a crossing loop located 24.8 kilometres 'south' of Greenbank. At this locality, two gangs of track workers were seeking access to the section of track from Bromelton to Greenbank, one with track vehicles for the purpose of tamping and re-sleepering and one for a routine track inspection in a track vehicle.

A plan for these gangs to access the track earlier was abandoned when the south-west train controller (the controller) told them that the train running advice given earlier in the morning had omitted a late-running train: - train 5BS7. This train and its anticipated departure from Acacia Ridge meant that initially, only 30 minutes track access could be granted. The protection officer[15] of the tamping and re-sleepering gang told the controller that this would not be enough time to complete their task. The controller rang back shortly after and told the protection officer that the anticipated departure from Acacia Ridge of 5BS7 was a 'worst case scenario' of 0945 and that he could now authorise access on the Bromelton to Greenbank section for 45 minutes. Although this time span was still not sufficient for the tamping and re-sleepering gang, it would allow the track vehicle to complete the routine track inspection from Bromelton to Greenbank.

The protection officer of the track vehicle was then given permission just before 0915 to take a Bromelton to Greenbank electric staff with verbal instructions from the controller saying that they had to be off and clear of the track at Greenbank by no later than 1000. The point of removal from the track was tacitly understood to be

15 Protection officer – The qualified worker responsible for protection. In this instance those in charge of the tamping and re-sleepering gang and the track vehicle.

the take- off point just north of the Greenbank staff hut. The track vehicle departed for Greenbank shortly after.

Figure 3: Electric staff instrument

Meanwhile, at Acacia Ridge, train 5BS7 had completed the pre-departure tests and pulled forward to the starting signal (AR14) at about 0930. Shortly after at 0933, AR14 cleared to proceed and train 5BS7 departed for Greenbank.

The track vehicle arrived on the main line at Greenbank at about 0945 and was approaching the take-off point, which is about 52 metres past the staff hut, when a locomotive headlight was seen and the whistle heard. As they were only about 20 metres from the take-off point, they continued and seconds later at the take-off point started raising the rail wheels. The front set of wheels were in the process of being raised when they realised that the approaching train would not stop in time and the track vehicle was vacated. The train collided with the track vehicle and pushed it back 25 metres towards the staff hut.

The train crew of 5BS7 reported that the Up home signal at Greenbank cleared from red to yellow as usual and that the train brakes were applied for the stop at the staff hut. As the train encountered a left-hand curve and passed under a road-over-rail bridge with an associated embankment, the Greenbank yard came into view. The train crew saw the track vehicle and momentarily thought it was in the loop. In the following seconds, it was realised that the vehicle was in fact on the main line. The

train brake was then moved from the service zone to the emergency position and the locomotive whistle sounded. The train crew reported that two persons left the track vehicle moments after and the third person, who was in the driver's seat, remained in the vehicle a little longer before he too got out. All three were said to be well clear before impact.

Figure 4: Time line

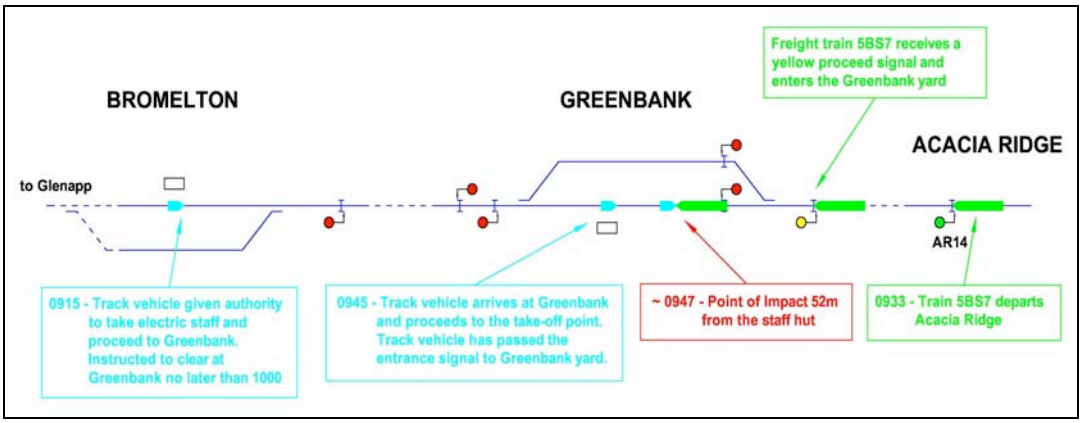
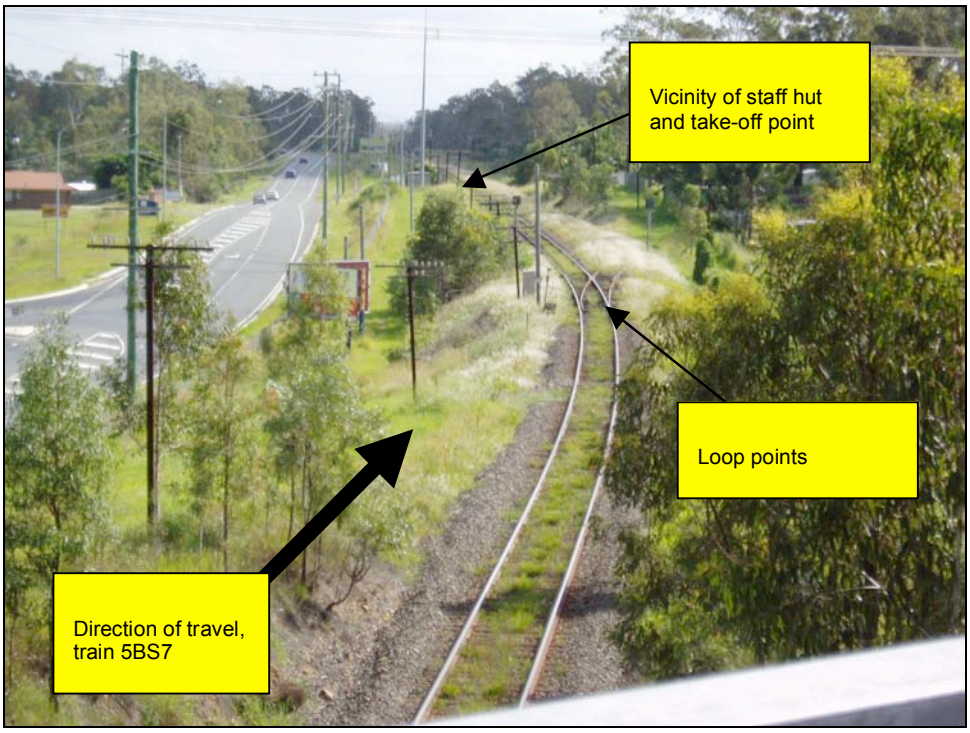


Figure 5: Approach to Greenbank yard, taken from road overbridge



2.1.3 Post accident

Immediately after the accident the protection officer in charge of the track vehicle rang the controller from the Greenbank staff hut and told him what had happened and that there were no injuries. Also, a resident of a house immediately adjacent to the accident site contacted the emergency services. Shortly after the police, fire brigade and ambulance (in that order) arrived. The train crew were breath tested by the police and returned negative blood alcohol content results.

The force of the collision had wedged the front 'bull-bar' of the track vehicle under the automatic coupler of locomotive EL51. At 1355 a crane arrived on site to extract the track vehicle and lift it clear of the track. This task was completed at 1415.

Figure 6: Track vehicle wedged under locomotive coupler

The two locomotives each carried a Fisher mark 1 data logger. At the accident site no key was available to remove the memory module from the data loggers and the whole data logger assembly had to be removed. Because, at the completion of the on site investigation, the locomotives had no data logger and the speedometer was inoperable, the track owner would not authorise the train to proceed. It was subsequently decided to send relief locomotives from Acacia Ridge to haul 5BS7 back to Acacia Ridge. However, at 1625 the relief locomotives collided with a trail bike on the Acacia Ridge to Greenbank section, thereby further delaying the opening of the rail corridor.

2.1.4 Damage

The track vehicle suffered considerable damage to the front end and was rendered inoperable as a result. The lead locomotive of train 5BS7 was not damaged to any significant extent.

Figure 7: Damage to track vehicle

2.1.5 Environmental factors

At 0947 on 25 August 2005, the weather was fine and clear and predominantly sunny. The sun was bearing at about 42 degrees true at an altitude of about 41 degrees. Heading in a southerly direction once past the left-hand curve, the orientation of the Greenbank yard is approximately south-south-west.

2.2 Context of the occurrence

2.2.1 Organisational context

The standard gauge[16] rail line from the Queensland/New South Wales border to South Brisbane was opened in 1930. This route afforded a more direct link between Sydney and Brisbane than the original route by Wallangarra and did not involve a change of gauge at the State border. This rail line has been owned by the former Queensland Government Railways and now QR since 1930. Notwithstanding this ownership, until 2004 this rail line was operated and maintained by the Rail Infrastructure Corporation (RIC) and its predecessors, under an agreement with QR. This encompassed train control, track maintenance and operating rules.

In recent times there has been significant organisational change on this corridor, beginning with the advent of third party train operators in 1994 and the gradual phasing out of regular State Rail Authority (SRA) freight train operations by 1996.

16 Standard gauge – 1435mm between the inside rail faces.

In September 2004 the function of train control from Acacia Ridge to Glenapp[17] was transferred from the Broadmeadow train control centre[18] in New South Wales to QR train control Brisbane. At the same time, the responsibility for track maintenance was transferred from RIC to QR. This arrangement extended 12 kilometres beyond Glenapp to the state border. Operating rules and procedures, although managed by QR, remain those of RIC.

At the time of the accident all track access and maintenance issues were managed by the Network Access Group of QR. All train operators were required to have an access agreement with this group and hold accreditation with the Queensland Regulator, Queensland Transport, under the Transport Infrastructure Act 1994 (Qld).

Interail Australia, the operator of train 5BS7, is wholly owned by QR and is based in the northern New South Wales town of Casino.

2.2.2 Description of route and safeworking

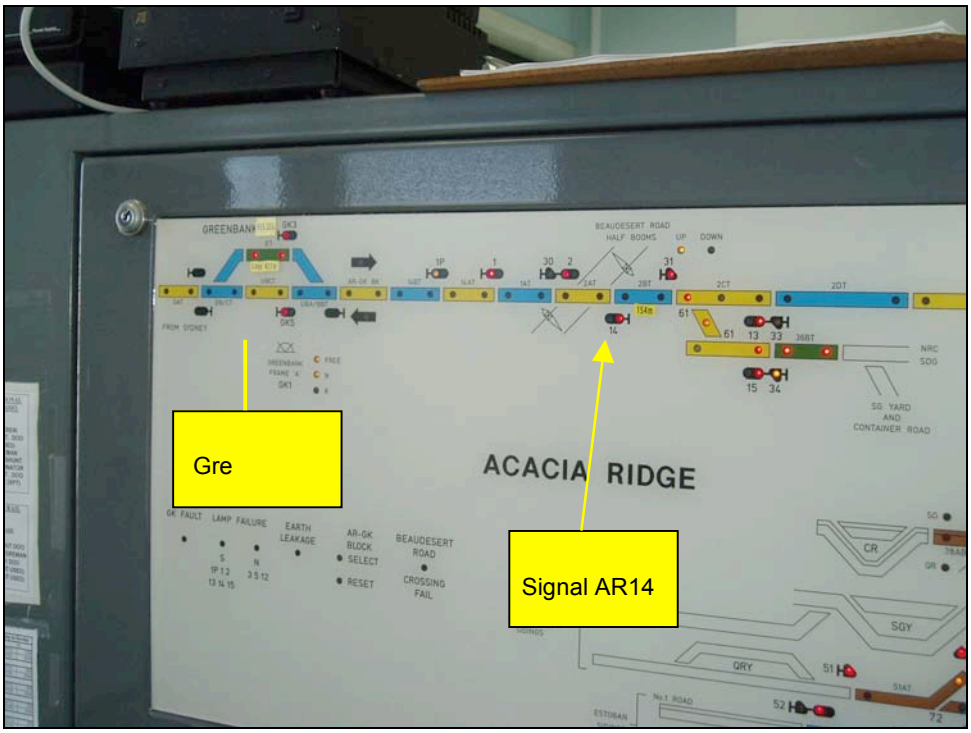
The Acacia Ridge signal cabin is the interface between Brisbane suburban train control and operations personnel at the Acacia Ridge shunt yard and freight terminal. QR rules and the procedures of the various rail operators govern the safe working systems at Acacia Ridge. The southern end of Acacia Ridge, immediately beyond the Up starting signal AR14, is the interface point for the change from QR rules to the QR derived RIC network rules and procedures. Departure of trains are authorised by the QR south-west controller. This authorisation is then passed to the Acacia Ridge signaller who clears the appropriate signals and tells the train crew that they have permission to depart. Once clear of starting signal AR14 the path of the train is overseen by the south-west controller.

The standard gauge railway between Acacia Ridge and the border is 100 kilometres long and consists of single bi-directional track with 53/60 kg/m rail laid on timber or concrete sleepers. The maximum axle load permitted is 23 tonnes and maximum speed (at 19.5 tonne axle load) is 115km/h. The XPT passenger train is authorised a maximum speed of 130km/h.

17 Glenapp – The electric staff station/crossing loop 12 kilometres on the Queensland side of the border.

18 Broadmeadow train control centre – Located in Newcastle. The 'B' board train controller controls the corridor from Kempsey to Glenapp.

Figure 8: Acacia Ridge signal cabin panel



There are unattended staff stations at Greenbank, Bromelton and Glenapp. The crossing loops at Bromelton and Glenapp can accommodate trains of 1618 metres and 1535 metres respectively.

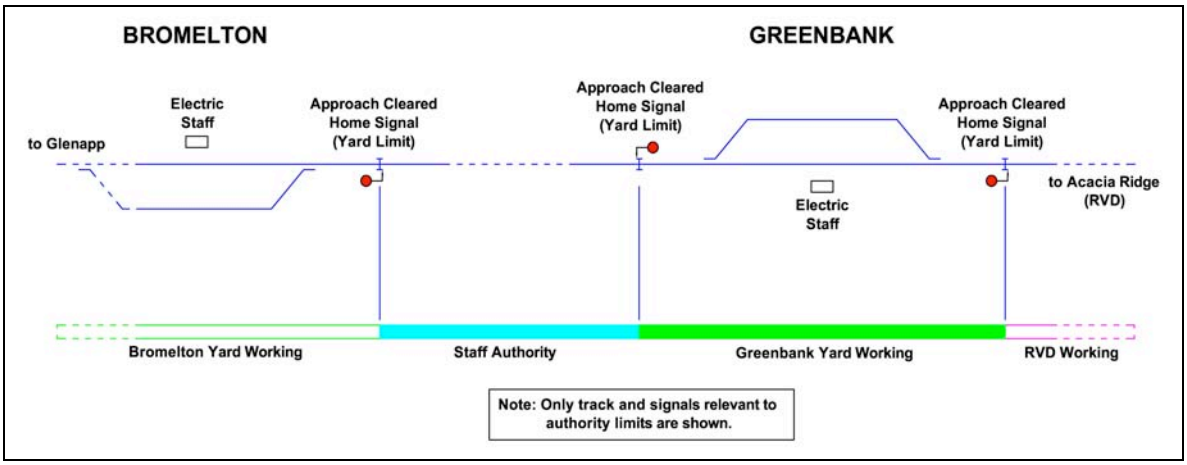
There are home signals situated on the approach to each of these staff stations that define the station yard limits and mark the boundary of the safeworking authority. These signals are approach-cleared to oncoming trains meaning that, if the main line in the station yard is unoccupied, the signal will clear to a proceed (yellow) aspect. Conversely, should the main line be occupied or the route not 'proven' then the home signal will remain at red (stop). Access to the crossing loops at Bromelton and Glenapp is obtained by the train stopping at the home signal and a crew member manually cancelling the main line route (returning the signal to red in the process) and setting the route for the loop. This is done by operating equipment located on the home signal post. Access to the crossing loop at Greenbank (although rarely used by trains) is by a key locked manually operated ground frame[19].

The RIC network rules and network procedures apply between Acacia Ridge and Glenapp. The actual safeworking systems in place are Rail Vehicle Detection (RVD)[20] from Acacia Ridge to Greenbank and electric staff from Greenbank to Bromelton and from Bromelton to Glenapp. This means that signal indications regulate the passage of trains between Acacia Ridge and Greenbank and the possession of an electric staff regulates the passage of trains from Greenbank to Bromelton and from Bromelton to Glenapp. In all instances verbal permission to continue and instructions for the next station from the controller is also required.

19 Ground frame – Small trackside interlocking machine used for manual points or signal operation.

20 Rail Vehicle Detection – consisting of track-circuiting or axle counters.

Figure 9: Authority limits Bromelton to Greenbank



2.2.3 Personnel involved

The Beaudesert[21] acting track depot supervisor, who was the protection officer for the tamping and re-sleepering gang at Bromelton at the time of the accident, had 20 years experience in track maintenance, all of which were on the Acacia Ridge to the border section of track. For about 19 years he had been employed by the New South Wales RIC and its predecessors before transferring to QR.

The three track workers that were in the track vehicle were employees of the Infrastructure Services Group of QR and were also based at the Beaudesert Track Depot. The protection officer for this workgroup had 15 years experience in track maintenance, the last 12 years of which has been on the section of track from Acacia Ridge to the border. For about 11 years of his career he was an employee of the New South Wales RIC and its predecessors. When the task of track maintenance was transferred to QR, he too was employed by the Infrastructure Services Group of QR.

The driver of train 5BS7 had extensive experience in train operation, having started as a locomotive trainee with the New South Wales Government Railway in 1973. In 1989 he left the railway service for about 10 years before resuming as an electric suburban train driver in Sydney in 2000. He then obtained employment with Interail at Grafton[22] in December 2004, a position in which he has since regularly driven trains between Grafton and Acacia Ridge.

The locomotive assistant of 5BS7 started employment in the rail industry in September 2004 with Interail. Since this time and in this capacity he has worked numerous trains between Grafton and Acacia Ridge.

The signaller at Acacia Ridge has extensive experience in the rail industry, having started as a porter in 1977. He has worked as a signaller at Acacia Ridge for about 20 years, the first 10 years intermittently as a relief signaller and the last ten years

21 Beaudesert – About 50 kilometres by road from Acacia Ridge and about 12 kilometres by road from Bromelton staff station.

22 Grafton – A provincial city on the Brisbane to Sydney mail rail line, about 276 kilometres from Acacia Ridge.

full time in an appointed capacity. The signaller at Acacia Ridge controls the whole of the Acacia Ridge terminal and yard precinct; including both standard and narrow (1067mm) gauge operations. In this role the signaller is required to regularly liaise with management and operations personnel of above and below rail operators and maintenance providers as well as Mayne suburban control[23] and south-west train control. The signal cabin at Acacia Ridge is in continuous operation.

The train controller at the Brisbane train control centre had started work in the rail industry as a junior clerk in 1990. He held various clerical positions before becoming a trainee transportation officer in 2001. In June 2003 he was appointed as a network controller based in Brisbane. At the time of the accident he was working at the south-west control workstation.

All personnel involved in this accident were qualified and medically fit in accordance with the relevant standards.

2.2.4 Work environment, south-west train controller

Brisbane train control is located in the central business district of Brisbane. The south-west controller is responsible for four narrow gauge[24] corridors in Queensland and the standard gauge corridor between Acacia Ridge and Glenapp.

The controller workstation consists of five visual display units (VDU) and three train control graphs. The controller also applies two sets of rules (QR and RIC) and three safeworking systems including two applying to the section between Acacia Ridge and Glenapp.

The south-west controller workstation is situated in a room that contains several other train control workstations. Office partitions separate workstations and provide a degree of privacy while, at the same time, allowing for easy exchange between train controllers and supervisory personnel when necessary.

23 Mayne suburban control – Is the train control centre that controls train movements in the Brisbane suburban area. This control centre has control of train movements to and from the north of Acacia Ridge.

24 Narrow gauge – 1067mm between the inside rail faces.

Figure 10: Train control workstation

2.2.5 Train control diagrams

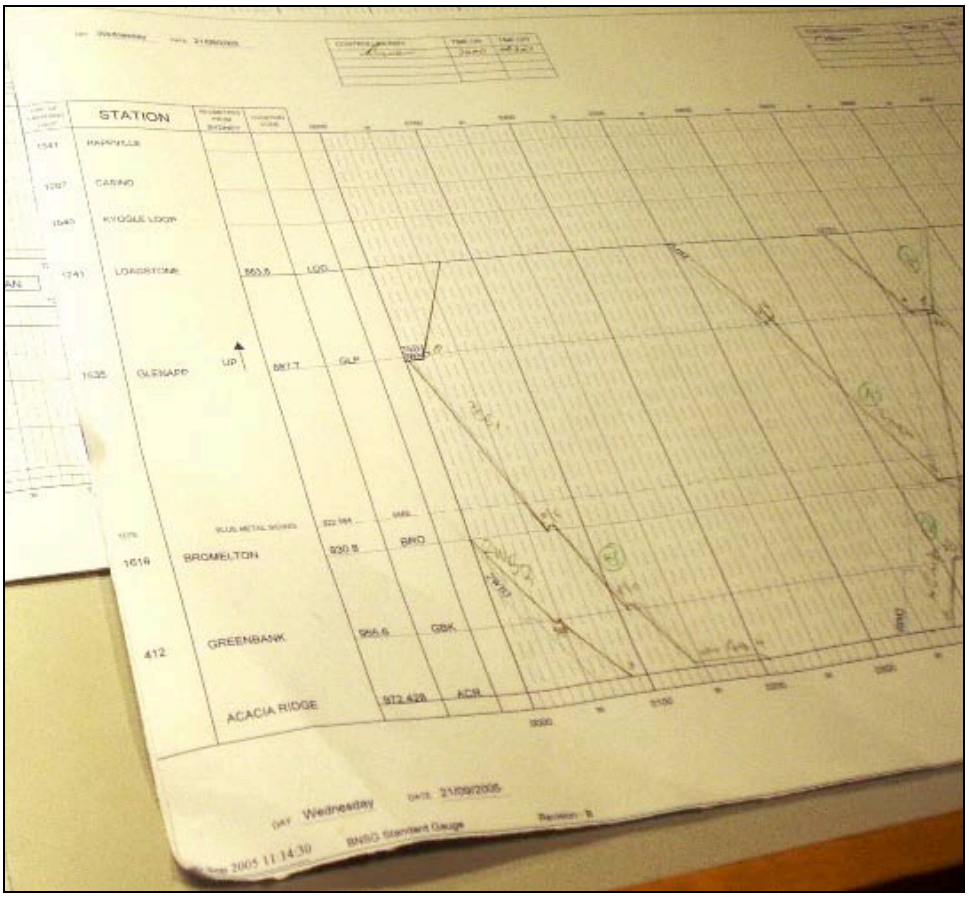
The train control diagram[25] is a key component of a train controller's task. It allows the controller to plan and amend train running while overseeing the safe separation of trains, track maintenance vehicles and track workers. A train control diagram is a distance/time graph with train running superimposed. Distance and locations are located on the y-axis, and time is located on the x-axis. Stations are shown as a continuous horizontal line, and intermittent sidings and locations are shown as broken horizontal lines across the diagram. Time is shown vertically in five minute, 15 minute and hourly increments although, depending on traffic density, time increments of as little as two minutes can be used. Five (or two) minute intervals are shown in broken line, 15 minute intervals in solid line and hourly intervals in solid line with a larger font.

The scheduled paths of trains are recorded in permanent form and the actual running of the train is recorded in unbroken pencil line by the train controller. Pencil is used because frequent variations to train running, both forecast and actual, make it necessary for the train controller to rub out and re-draw train running. The use of pencil for forecast and actual train movements is mandated by QR - STD/0029/SWK and is accepted practice in many rail systems. STD/0029/SWK also mandates that infrastructure movements be recorded in red and safeworking authorities, such as electric staff numbers etc, be recorded in green. An example portion of a train control diagram is at Figure 11.

25 Train control diagram (train control graph). A diagram showing operational information for a train control area.

If, as on 25 August, a train controller grants access to a maintenance team for a period of time then the section of track involved would be delineated against the 'y' axis and the start and finish time on the 'x' axis. A box is formed using red pen. Any line indicating a train path that crosses the borders of the box would be in conflict with an authority already issued.

Figure 11: Example portion of train control diagram



3 KEY ISSUES

The key issue is that the train and track vehicle were given authority to occupy the main line at Greenbank at the same time. Train 5BS7 had authority to proceed to the Greenbank staff hut as the home signal cleared to 'proceed' as the train approached. The track workers had tacit authority to occupy the same section of track, providing they were clear of the main line at the take-off point by 1000. Because the take-off point is about 52 metres on the Acacia Ridge side of the staff hut, the track vehicle was in the path of train 5BS7.

The authority for the track vehicle was based on the assumption that 5BS7 would leave Acacia Ridge no earlier than 0945. However, it left at 0933. Ambiguous communications regarding this departure time and train controller workload contributed to this mistaken assumption.

The safeworking practices on this rail corridor have the potential to authorise occupancy of the same section of track within station yard limits when movements involve vehicles that are not detected by track-circuitry. This potential has existed since 2001.

3.1 Actions and evidence of individuals

3.1.1 Train crew 5BS7

The train crew had signed on at 0350 on 25 August 2005 and had boarded 5BS7 at Clapham[26] shortly after. Because this train was several hours late and had missed its allotted path, the train did not leave Clapham until about 0825. It arrived at Acacia Ridge yard at about 0840 where wagons were attached. 5BS7 departed Acacia Ridge at 0933 after performing the standard train examination tests.

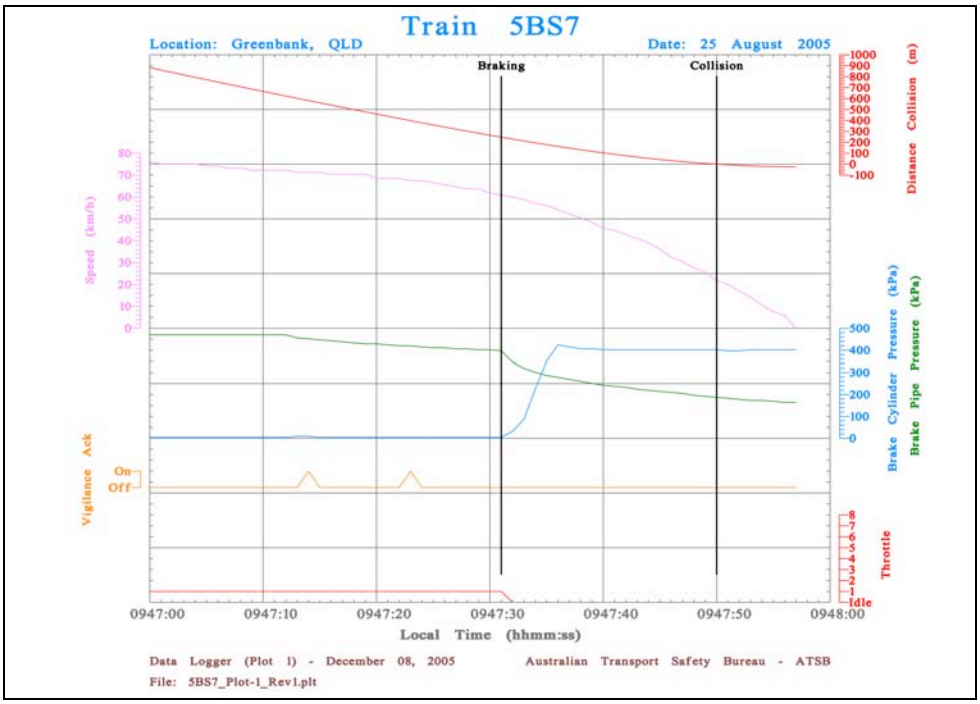
An analysis of the data from the data-logger of the lead locomotive (EL51) [27] shows that as the train approached Greenbank yard the driver initiated an application of the train brakes 602 metres from the point of collision. Over the following 17 seconds brake-pipe air pressure gradually reduced from 470 kPa to 402 kPa, throttle notch one (the lowest power setting) was selected and the locomotive brake remained released. This indicates a routine brake application. During this time the speed of the train reduced from 71.3 km/h to 61.8 km/h. When 246 metres from impact, the rate of brake-pipe pressure reduction rapidly increased, the throttle was placed in idle and within five seconds the locomotive brake was fully applied. The reduction in brake-pipe pressure continued until, at impact, 187 kPa remained. The speed of the train at the time of collision was 21.9 km/h and the deceleration rate was 0.56 metres per second squared (m/s^2). Train 5BS7 then continued for 25

26 Clapham Yard – Situated about five kilometres 'north' of Acacia Ridge.

27 The wheel size of locomotive EL51 was 966mm compared to 1016mm for a new wheel. 966mm is near the minimum diameter allowed. Fischer Mark One data loggers can be adjusted to take account of wheel wear, however in this case no adjustment had been entered. Therefore the speed and distance recorded were corrected by a factor of 0.9508 to reflect the actual wheel diameter.

metres before stopping. The operation of the locomotive whistle and headlight are not recorded.

Figure 12: Data logger reproduction



3.1.2 Signaller Acacia Ridge

The signaller at Acacia Ridge had signed on at 0555 on the morning of 25 August. At 0913:40 the signaller received a call from the controller asking for an updated estimation of the departure time for 5BS7. The signaller replied that the train was on a brake test and that it should be ready to go at 0945 at the latest.

About 18 minutes later the train crew advised that the brake test and paper work had been completed. The Acacia Ridge signaller then contacted the controller and told him that 5BS7 was ready for departure. The controller immediately gave permission for the train to depart. The Acacia Ridge signaller cleared the starting signal and told the train crew that departure had been authorised. Train 5BS7 departed at 0933.

Somewhere between 0947 and 0950, the Acacia Ridge signaller said he received a call from a Mayne suburban train controller asking him whether he knew that a train had hit a car at Greenbank. This caller also said the emergency services had been told and were on the way. The Acacia Ridge signaller then phoned the south-west controller and was told that train 5BS7 had hit the track vehicle at Greenbank. The south-west controller said he had not told the train crew of 5BS7 that the track vehicle was on its way from Bromelton to Greenbank.

3.1.3 Track workers

The protection officer travelling in the track-vehicle confirmed the authority to occupy the Bromelton to Greenbank section from 0915 and to be clear of the track

at Greenbank by 1000. Advice that he was in possession of the Bromelton to Greenbank staff, number two, was given to the controller at this time. The controller confirmed to the protection officer that he would 'talk to you at Greenbank'. No further instructions were received.

The protection officer and track workers described seeing the headlight of the approaching train and hearing the whistle at Greenbank. Although initially thinking that they had time to reach the take-off point and clear the track it soon was obvious that they had not. They did manage, however, to be well clear of the track vehicle when the collision occurred.

3.1.4 Train controller

The controller started duty at 0600 on 25 August 2005, 24 hours after having completed his previous shift at 0600 on 24 August 2005. He said that between starting duty and the accident at Greenbank that he had been liaising with the Acacia Ridge signaller, Broadmeadow train controllers, QR National personnel and the track workers regarding the late departure and intended passage of train 5BS7. In addition to this, there was the normal rail traffic on the QR corridors that are under his authority. He described the shift thus far as busy, but routine.

The train controller was told by the signaller at Acacia Ridge at 0913:40 that 5BS7 was conducting brake testing and would be ready to leave 'in the worst case scenario' no later than 0945. In granting authority for access by the track workers the train controller had stressed that he would not delay the train as it was already late.

At about 0930 the controller overheard transmissions on the radio between local personnel and the train crew at Acacia Ridge that indicated train 5BS7 would soon be ready to depart. At this time, the controller was supervising a trainee who was issuing an authority for a QR track vehicle[28] to run from Talwood to Goondiwindi in south-west Queensland. The controller said that had this authority not been issued in a timely manner then this track vehicle would have been delayed considerably because of an approaching grain train. At 0932:33 the Acacia Ridge signaller confirmed that train 5BS7 was ready for departure and the controller responded with the departure authorisation within seconds, saying "green lights out the southern end". This conversation finished at 0932:56. Immediately after, at 0932:58[29], the controller resumed overseeing the trainee who was issuing the authority for the track vehicle at Talwood.

About 15 minutes later at 0947 the controller received a phone call from the track vehicle protection officer at Greenbank and was told that a collision with a train had just occurred. He said he then realised that he should have told the train crew of 5BS7 to remain at the Up home signal at Greenbank until advice was received that the track vehicle was off and clear of the main line.

An examination of the train control diagram reveals that a red box had been drawn on the section between Bromelton and Greenbank from 0915 until 1000. This box was endorsed with the staff number (two), the protection officers name and

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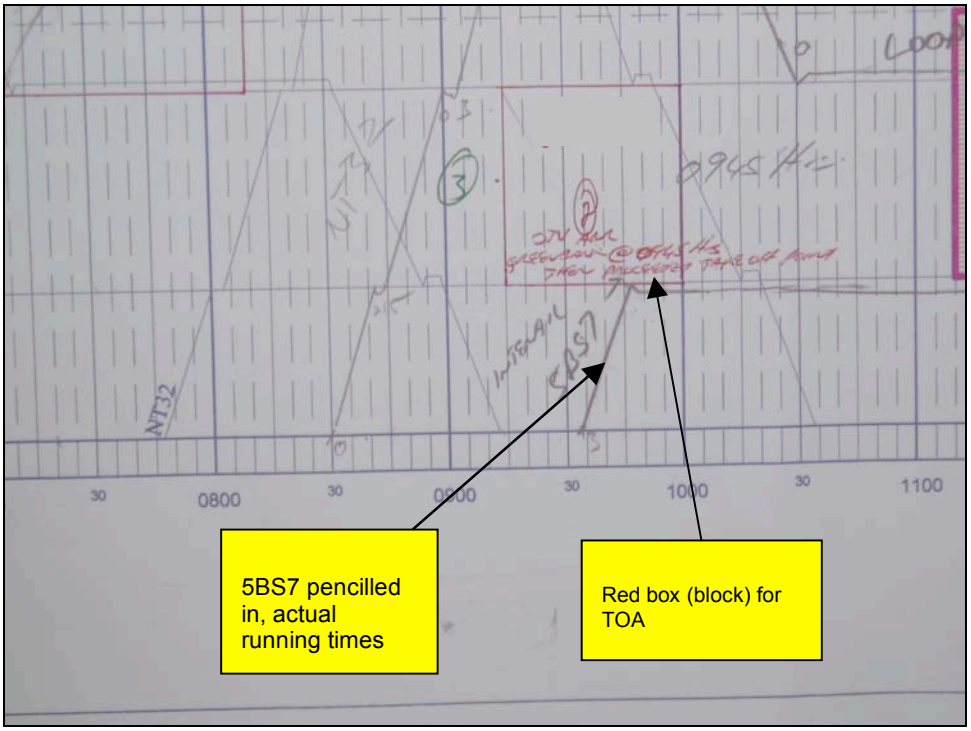
28 QR track vehicle – Known as on-track vehicles (OTV's) in QR.

29 0932:58 – Start time of radio transmission to track vehicle at Talwood.

comments 'on arr Greenbank @0945hrs[30] then proceed to take-off point'. Train 5BS7 is shown as having departed Acacia Ridge at 0933 and arriving at Greenbank at 0948. There is no line 'pencilled in' for this train beyond Greenbank.

Figure 13: Endorsement of train diagram



In issuing track authorities the controller was following a combination of RIC and QR rules. He stated that he experiences no problems working with the combination of rules and procedures. Also he enjoys teaching trainee controllers and likes to give them as much practical experience as possible. However, he did say that he had been under some pressure as a result of personal issues.

3.1.5 Trainee

The training program for a trainee train controller involves, in general terms, attendance at an induction course followed by 'board time'. At this stage the trainee observes the working of the control board by the controller. The trainee is not qualified to perform the task of train controller at this stage. The next training phase is practical classroom training and field trips followed by some more 'board time.' The trainee is then allotted a 'board mentor' and can perform some of the train control functions under supervision. The 'board mentor' is a senior train controller. After this phase the trainee sits for a examination and, if successful, is qualified as a train controller.

At the time of the accident at Greenbank, the trainee was at the first stage of the training program. He was not qualified to perform the task of train controller.

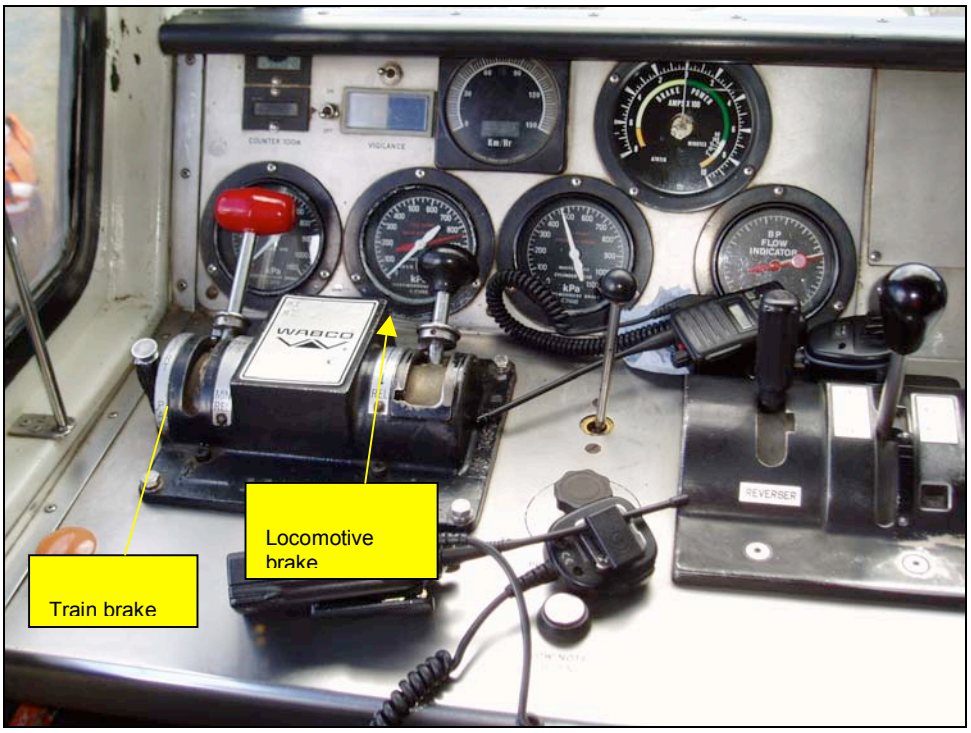
30 0945hrs - Although occupation was authorised until 1000hrs, 0945 hrs was the estimated time of arrival of the track vehicle at Greenbank.

3.1.6 Summary

The signaller at Acacia Ridge liaised with operational personnel and the controller in accordance with accepted practices and procedures and, when authorised, cleared the signals for the departure of train 5BS7 in a routine manner. The choice of words used when speaking to the controller in regard to the estimated departure of train 5BS7 is discussed later.

Apart from the active response in trying to stop train 5BS7 before colliding with the track vehicle at Greenbank, the actions of the train crew played no part in the collision as they had authority to occupy the section of track from Acacia Ridge and into Greenbank yard. The locomotive data download shows that at 246 metres from impact action was taken to stop that train as quickly as possible. Although the illumination of the headlight and whistle operation was not recorded by the data logger, the evidence of the track workers matches that of the train crew in that the headlight was illuminated and the whistle sounded.

Figure 14: Train brake in emergency, locomotive brake fully applied EL51



The actions of the track workers played little part in the lead up to this accident. They were given an authority to travel from Bromelton to Greenbank. This authority was a Track Occupancy Authority (TOA, see section 3.2.4) which consisted of an electric staff for the Bromelton to Greenbank section and implied verbal authority from the controller from the Down home signal at Greenbank to the take-off point. Their arrival at the take-off point was before the nominated time of 1000. An examination of the communication between the controller and the train protection officer reveals that clear verbal authority was not evident in regard to what was to be done within the Greenbank station yard limits. While the authority to proceed to the take-off point within the Greenbank staff station yard limits was no doubt implied, nowhere was it expressly stated. Adherance to the rules and procedures pertaining to TOA working is discussed at section 3.2 of this report.

In an active sense, the decision to continue to the take-off point once the oncoming train was sighted, even though they were only about 20 metres from the take-off point, was a contributing factor in the collision. Their initial assessment was that the track vehicle could reach the take-off point and be off the track by the time the train reached this point (or alternatively that the train would be able to stop before reaching this point). As the train would have to stop at the staff hut, hindsight would suggest that a better option would have been to stop and then reverse to allow the train to come to a stop.

The actions of the controller were a key factor in this accident. At interview he described the shift until the time of the accident as being busy, but routine. The controller had two primary terminals for communications, the south-west console and the south-west handset. Secondary communications in the form of radio channels at Acacia Ridge were monitored 'in the background'. From recordings of the communications it has been established that, in the 225 seconds between 0928:48 and the authorisation for departure of train 5BS7 at 0932:33, five radio console transmissions were recorded. In total, the duration of these transmissions was 117 seconds. This leaves 108 seconds free of communication tasks which, it appears, were largely devoted to the supervision of a trainee.

The initial request for access to the Bromelton to Greenbank section by the maintenance personnel at 0906:56 was refused. At 0913:40 the controller contacted the Acacia Ridge signaller to ascertain if the earlier advice of an anticipated 0945 departure for train 5BS7 had altered. This pertinent portion of the dialogue was:

> **Acacia Ridge signaller**: Just a minute // (talking to train crew of 5BS7) // yeah, he's probably, I reckon ready to go at 0945 at the latest.
>
> **Controller**: Oh…still looking at 0945, are we?
>
> **Acacia Ridge signaller**: Yeah, yep, well he's on test now so we might do a bit better but that's the worst case scenario.
>
> **Controller**: Okay.

The manner in which this transmission is interpreted by the controller is critical as are the words used.

The controller, seconds later, again contacted the track workers at Bromelton, the pertinent portion of the dialogue being:

> **Controller**: Hey (name)
>
> **Bromelton protection officer**: Yeah
>
> **Controller**: Hey 45 minutes wouldn't be enough for you fellows would it?
>
> **Bromelton protection officer**: Yeah I got (different name) here wants to run the road with the hi-rail.
>
> **Controller**: I could give you 45 minutes because they are still talking worst case scenario at 45.

A goods train such as 5BS7 is allowed 15 minutes to run from Acacia Ridge to Greenbank. In authorising the TOA until 1000 at Greenbank, there is the probability that the controller had interpreted the earlier advice (received at 0913:40) from the Acacia Ridge signaller that 0945 was the earliest that 5BS7 would depart Acacia Ridge. In fact, the Acacia Ridge signaller meant the opposite; that 0945 would be

the latest time that this train would depart Acacia Ridge. This probability was confirmed at a subsequent interview when the controller gave evidence that the Acacia Ridge signaller told him that 5BS7 would not be ready to go earlier than 0945.

The words used during the initial transmission (at 0913:40) warrant consideration. Any ambiguity in the initial response from the controller "Oh…still looking at 0945, are we?" was not corrected or clarified by the signaller who started his response with 'yeah, yep' (an affirmation) following with (in part) 'might do a bit better but that's the worst case scenario'. The word 'better' does not necessarily mean 'earlier' and the words 'worst case scenario' do not necessarily mean 'at the latest'. In short, the words used and the sentence structure were ambiguous and the interpretation of 'worst case' could depend on whether the individual wanted the train to leave as soon as, or as late as, possible.

In addition, the controller said that on the train control diagram he originally 'pencilled' train 5BS7 in as departing Acacia Ridge at 0945, with an anticipated path through to Glenapp. Although it is normal practice to 'pencil in' projected train running, the anticipated departure time of 0945 from Acacia Ridge could again indicate a mind-set that 0945 was the earliest that this train would depart. The controller subsequently rubbed this train path out and inserted the actual departure from Acacia Ridge at 0933 in lieu with a path to Greenbank only. He was unable to remember whether this alteration was made at or after the departure of this train from Acacia Ridge. Given that the path he drew encountered the block at 0947, (see figure 13) it would suggest, circumstantially at least, that the line was not drawn at or about 0933.

It is evident that some time before the accident the trainee controller was observing and then participating in the working of the south-west train control board. At 0928:48, during a transmission, a different train controller (the trainee) is heard. From this time until the accident the trainee engaged in transmissions to various personnel and the controller is, from time to time, heard in the background either providing guidance or actually participating in the transmission. The actual authority for the departure of train 5BS7 though, was given by the controller over the south-west console.

There is no doubt that the actions of the controller in authorising the occupancy of the Bromelton to Greenbank section of track by the track vehicle until 1000 hours and giving the trainee train controller practical time 'in the seat' were with the very best of intentions.

The sequence of events and voice transmissions indicate that at the time of granting authority for train 5BS7 to depart Acacia Ridge the controller's workload was high. The supervision of the trainee appears to have distracted the train controller from his primary task. This contention is supported by the transmission with the track worker at Talwood within two seconds of ceasing the transmission that authorized the departure of train 5BS7 from Acacia Ridge. The opening dialogue of this transmission is:

> **Controller**: Are you there (name)?
>
> **Talwood track worker**: Yes control.
>
> **Controller**: (Name), just hang on for a couple of seconds, I've just got a new fellow going here and I just want to explain something to him before we get back to you there.

Talwood track worker: Yeh, that'll be alright mate.

At this time the controller appears to have forgotten that the time allotted to the TOA for the Bromelton to Greenbank section of track (0915 to 1000) was based on a 0945 departure, in his mind presented as a 'worst case scenario' (being not before 0945), of train 5BS7's departure from Acacia Ridge.

The granting of this authority in this manner is an active failure that is only a part of wider systemic issues associated with the application of the safeworking systems on this corridor.

3.2 Ssfeworking and operations

3.2.1 Acacia Ridge to Glenapp before 1996

Before 1996, the Acacia Ridge to Glenapp corridor consisted of the following sections:

- Acacia Ridge to Greenbank
- Greenbank to Kagaru
- Kagaru to Tamrookum
- Tamrookum to Glenapp

The method of safeworking was RVD (known at that time as 'single line track block, with axle counter') Acacia Ridge to Greenbank and electric staff Greenbank to Kagaru, Kagaru to Tamrookum and Tamrookum to Glenapp. Each staff station was attended for the passage of the majority of trains. The home signals were either controlled signals that were operated from a signal cabin or non–controlled (known at that time as automatic signals), signals that operated according to the route set at a remote ground frame. Specifically, they were not approach-cleared to oncoming trains. Trains were worked through or crossed at these stations by station personnel or, if unattended, by train crew on the direction of the train controller. The length of these crossing loops meant that the majority of trains on this corridor were a maximum length of 374 metres.

In 1996 all station personnel were withdrawn and the staff stations at Kagaru and Tamrookum closed. The signalling and track-circuiting arrangements at Glenapp and the new staff station at Bromelton were altered to be approach-cleared uncontrolled signals. Greenbank remained unaltered. From this time train crew and track workers, on instruction from train control, performed the safeworking requirements in lieu of station personnel.

3.2.2 Safeworking amendments

Between 1996 and 2001 the procedures that prescribed the safeworking requirements were contained in five SRA manuals. In 2001 these procedures were replaced with two manuals; RIC network rules and RIC network procedures.

Between 1996 and 2001 track vehicles obtained possession of the track by a paper-based authority known as a T6400[31]. From 2001 until the time of the accident at Greenbank, track vehicles obtained possession of track by a TOA (see 3.2.4).

3.2.3 Personal accounts

To determine whether or not any changes in safeworking practice occurred in September 2004 when QR took over operational control of the Acacia Ridge to Glenapp corridor, evidence was obtained from past employees as well as those directly involved in the accident on 25 August 2005.

Their responses were similar in that since 2001 track vehicles have been worked between Acacia Ridge and Greenbank on a paper-based TOA and between Greenbank and Glenapp on a TOA that consists of the electric staff for the section and verbal authority. In the latter case, no TOA form is compiled. In all cases it was said that the train controller would draw a block (red box) on the train control diagram and record pertinent information within the box.

When trains and track vehicles were required to cross at Greenbank, Bromelton or Glenapp, the interviewees said that verbal instructions were given to the train crew or the protection officer, generally at the previous staff station.

The working of track vehicles and trains simultaneously towards an unattended staff station where a crossing is to take place was said to have been practice since 1996. However, when T6400 authorities applied the former safeworking procedures (SWU 945) mandated that the track vehicle, depending on the qualification of the track vehicle operator, had to:

- take off from the line at a suitable location before entering the yard limits of the unattended staff station or,
- be admitted within the yard limits of the unattended staff station in accordance with the former safeworking procedure (SWU 515). In essence, this procedure said (in part) that if entering the main line and the home signal had not cleared to proceed, an assurance had to be obtained from control that a train was not approaching from the opposite end of the staff station. In the case of a non track-circuited track vehicle, the home signal would not clear to proceed. If entering the loop the instructions were to stop at the home signal and to then set the points for the loop. The signal for the loop will not clear if another train is entering the station yard limits.

Of note was that, among those interviewed, there was a wide spread belief that possession of an electric staff authorised possession of the track within the station yard limits at either end of the section being traversed.

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31 T6400 – The procedure prescribed State Rail 900 series manual titled ‘Safeworking Procedures for Engineering Work.

3.2.4 Track Occupancy Authorities (TOA)

Trains are detected by track-circuits. Typically track vehicles, such as the one involved in the accident at Greenbank on 25 August 2005, are not[32].

A TOA authorises occupation of a section of track within specified limits for an agreed period and, where required, is used to facilitate the working of track vehicles. Such an occupation is exclusive except for joint occupancy by agreement with the holder of another TOA, Track Work Authority (TWA[33]) or to follow another train movement.

There are two practical applications of a TOA; paper-based and verbal. A paper-based TOA consists of a form that is compiled by the controller and protection officer and is used in RVD territory (such as between Acacia Ridge and Greenbank), at designated worksites, when following a train or for movements wholly within an unattended location. Information is passed by phone or radio link and the train controller's directions and conditions are written by each individual on the form. A verbal TOA is used for movements wholly within an attended location (authorised by the controller, issued by a signaller) or when traversing a section in electric staff territory. No written form is used. A requirement of a verbal TOA in electric staff territory is that the staff for the section must be in the possession of the protection officer. In all situations the train controller is to draw a block on the train control diagram.

A 'section' is defined in the glossary of the RIC network rules as:

> The line between the departure-end yard limit of one location and the arrival-end yard limit of another location. A section consists of one or more blocks.

In regard to an electric staff constituting a TOA, the pertinent extract of the RIC Network Rules NWT 304 reads:

> If practicable during token (staff) working, or in areas where half pilot staffs are provided, the protection officer must arrange to take or safeguard, for the period of the authority:
>
> - the ordinary staff or electric staff for the section, or
> - the half pilot staffs at the limits of the authority.
>
> The signaller and/or train controller must record, in permanent form, that the staffs have been secured for work on track or taken for a track vehicle to travel on the network.
>
> A TOA form is not needed.

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32 Track vehicles are designed not to be detected by track-circuits primarily due to reliability in operating track –circuits (low vehicle mass) and unnecessary activation of signalling and level crossing equipment due to lengthy occupancy of track. Also, a whole section may not be traversed or reverse movements may occur.

33 TWA – An authorisation for the occupation of a defined portion of track between train movements. Does not give exclusive occupancy of track, is protected by hand-signallers and/or detonators and is a verbal authority.

NWT 304 sets the following limits of a TOA as being between:

- one yard limit and another yard limit, or
- defined clearance points wholly within one yard's limits, or
- one yard limit to a defined clearance point within another yard, or
- a defined clearance point within one yard's limits to a defined clearance point within another yard's limits.

NWT 304 sets the following conditions on the issue of a TOA:

Only a train controller can authorise a TOA. Before issuing a TOA, the train controller must make sure that:

- the track is unoccupied, and will remain unoccupied, except as specified in the TOA, and
- the protection officer knows about any existing obstructions, and
- the protection officer understands and agrees to the limits of the TOA, and
- blocking facilities have been applied to prevent the entry of rail traffic into the portion of track within the TOA limits.

Before authorising the occupancy, the train controller must record, in permanent form, the details of the TOA.

The rules and procedures make it clear that, in ordinary or electric staff territory, the preferred method of obtaining a TOA is to take possession of the staff for the section. The rules and procedures also allow various limits and conditions to be applied to a TOA. In this instance, the intent was that the limit of the track vehicle's TOA would be from 'a defined clearance point within one yard's limits to a defined clearance point within another yard's limits'. That is; from the staff hut at Bromelton to the take-off point at Greenbank.

Alternatively, although not the preferred method of working track vehicles between Acacia Ridge and Glenapp, the RIC network rules (NWT 316) allow track vehicles to be worked as a 'train'. The term 'train' in this instance means that safeworking rules and procedures applicable to a train are applicable to the track vehicle. The implications of this are discussed at the end of section 3.2.5.

3.2.5 Summary

In 1996 unattended electric staff stations were introduced on the Acacia Ridge to Glenapp corridor. Between 1996 and 2001 track vehicles were worked under T6400 authority. The provisions of this authority required removal from the track before entry into staff station yard limits or permitted entry within staff station yard limits under strict conditions if a crossing was to take place. In 2001 TOA working was introduced, the preferred manner for working track vehicles between stations being the retention of the relevant electric staff and (in practice) verbal authority to access station yard limits.

An electric staff gives authority to occupy the section of track between staff stations only. That is, between the departure end yard limit of one station to the arrival end yard limit of another station (refer figure 9). In accordance with NWT 304 a verbal TOA to access yard limits at an unattended station is not permitted. Under TOA

working access to unattended station yard limits is to be obtained by a paper-based TOA issued by the controller.

This means that if a TOA is to apply from a staff hut within an unattended station yard limit to a point within the next unattended station yard limit, paper-based TOAs should be issued in conjunction with the electric staff for that section. Paper-based TOAs would cover the track within the two unattended station yard limits (one for each yard) and the staff would constitute the TOA for the section between the station yard limits.

The requirement then arises to ensure that a block exists between trains and non-track-circuited track vehicles when a crossing is to take place.

RIC network rules, at NSG 614, state in part:

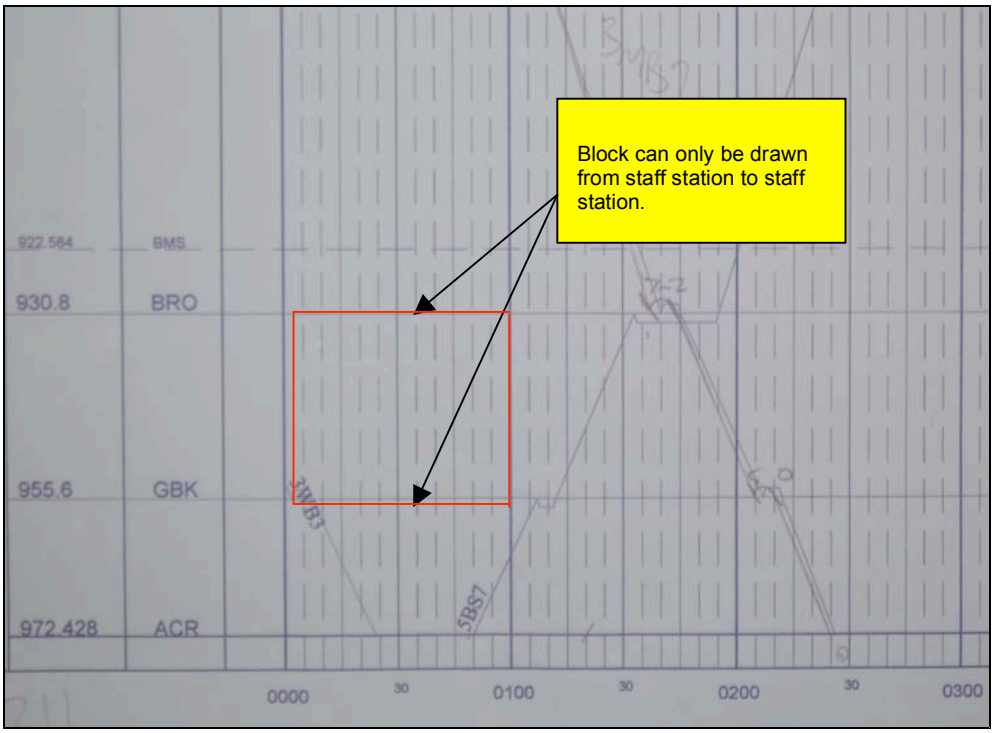
> Train controllers must not issue proceed authorities for sections that train control diagrams show as blocked out of use.

RIC network rules, at NWT 304 state in part:

> Before issuing a TOA, the train controller must make sure that . . . blocking facilities have been applied to prevent the entry of rail traffic into the portion of track within the TOA limits.

On the Acacia Ridge to Glenapp corridor, the home signals at the unattended staff stations are approach cleared uncontrolled signals and cannot be changed by the controller. The block, as drawn on the train control diagram, is from staff station to staff station and does not differentiate between station yard limits (home signals) and the section itself. An electric staff gives authority to the home signal and a proceed indication in the home signal gives authority to enter the staff station yard limits.

Figure 15: Example, block drawn on train graph



Therefore, to ensure a block between a non-track-circuited track vehicle and another movement (train or track vehicle) these opposing movements cannot be allowed to simultaneously enter the unattended station yard limits. This can be achieved by either holding the track vehicle at the home signal by not issuing the final paper-based TOA to enter the station yard limits, or by holding the train or the track vehicle at the previous staff station. In both examples this restraint would be until advice is received that the opposing movement has arrived within the unattended staff station yard limits.

The evidence is though, that an electric staff and accompanying verbal instructions have been regarded as giving track vehicles authority to leave or enter unattended station yard limits on this corridor since 2001. This is contrary to NWT 304 and is an exceedence of a TOA authority constituted by an electric staff. The evidence is that these practices have also been prevalent since 2001 between Glenapp and Casino, where the same safeworking system applies. The potential for dual occupancy of track within station yard limits results.

However, the strict application of the rules and procedures results in the issue of three TOAs for one section on this corridor; two paper-based and one verbal (section staff). Such working would raise questions in regard to train controller workload and overall practicality. Likewise, the holding of opposing movements at the previous staff station would restrict the opportunity for maintenance track vehicles to access the track.

Further, in accordance with NWT 316, a track vehicle can be worked as a 'train' on this corridor. Should this be so then the risk for dual occupancy of track within unattended staff stations is again evident, this time without any breach of the rules and procedures. This is because the home signals are 'permissive', and are thereby able to be passed at stop under certain circumstances. The non-track-circuited track vehicle is then able to enter the station yard limits without further authorisation even though it will not be detected by the track-circuitry.

Therefore, the rules that allow an electric staff to constitute a TOA and a non-track-circuited track vehicle to be worked as a 'train' on this corridor are questionable in regard to practicality and the prevention of conflicting movements.

The accident at Greenbank on 25 August 2005 was the end result of train 5BS7 having authority to occupy the main line within the yard limits of Greenbank when this section of track was occupied by the track vehicle. Given that the Up home signal was approach-cleared to arriving trains and that the track vehicle was not detected by track-circuits, blocking facilities, in this instance, should have been applied to the last controlled signal before Greenbank. This is starting signal AR14 at Acacia Ridge.

3.2.6 Organisational factors

3.2.7 Risk Assessment/Safety Case

In August 2004 an assessment was conducted into the risks involved in transferring the operation of the standard gauge line between Acacia Ridge and Glenapp and maintenance between Acacia Ridge and border by RIC, State Rail, QR and other stakeholders. This risk assessment dealt with process change, infrastructure operation, human resources, trackside communication, communication (to

stakeholders) and infrastructure (in general). In addition, other risk assessments covering many facets were conducted. Together they made up the broader Interface Risk Management Plan for the formal handover of all track and signalling assets and maintenance from RIC to QR. This plan and an associated Safety Case were presented to Queensland Transport for review under the accreditation process.

A compliance audit of the Interface Risk Management Plan was conducted by the Senior Safeworking Auditor, QR Network Access, between November 2004 and mid January 2005. The audit report was released on 16 March 2005. It said in part:

> The audit revealed an extremely high level of compliance with the successful addressing of action items. In fact all items were sufficiently addressed satisfactorily to permit smooth and successful changeover of activities from RIC to QR management. Only a small number of outstanding matters need addressing for which recommendations have been made.

There were five recommendations where outstanding matters needed addressing. One of these was:

> As there appears to be no formal documentation process for the procedures included in the safety management system, and there does not appear to be custodian or 'owner' of the procedures it is recommended that a further audit, independent to this audit, be carried out to assess compliance with the actual safeworking procedures, that the procedures are adequate and that training needs analysis has adequately identified all that need to be trained and to whom the training has been given.

As of 25 August 2005 this recommendation had not been addressed.

3.2.8 Rules and Procedures

When operation and maintenance functions were transferred from RIC to QR the existing RIC rules and procedures were retained by QR on the Acacia Ridge to Glenapp corridor. At the same time, the responsibility for operation of track south of Glenapp and maintenance south of the border was transferred from RIC to the Australian Rail Track Corporation (ARTC). On the corridors within New South Wales that came under ARTC control, ARTC rules and procedures applied. The ARTC rules closely mirrored the RIC rules in all facets with the exception of some minor amendments and notations that reflect documentation ownership and control. For example, the rule applying to TOA working is identified as NWT 304 under the RIC rules and ANWT 304 under the ATRC rules. In this example, the rules applying to TOA working are identical.

The corridor between Greenbank and Casino is 150 kilometres long. The safeworking system in use is electric staff and, with the exception of Casino, all staff stations are unattended with approach-cleared home signals. Despite this corridor being worked under the same safeworking provisions, two versions of rules and procedures apply. That is, RIC rules Greenbank to Glenapp and ARTC rules between Glenapp and Casino.

3.2.9 Summary

The risk assessment conducted before the transfer of the train control function from RIC to QR on the Acacia Ridge to Glenapp corridor did not identify that safeworking practices did not comply with the RIC rules. However, it is noted that

this non-compliance has been evident since 2001 and the identification of the associated risks has therefore eluded the former manager of this corridor and not just QR.

A subsequent compliance audit of the interface management plan conducted by QR in March 2005 identified and recommended the need for a further audit to assess compliance with the existing safeworking procedures and that these procedures were indeed adequate. Therefore, this compliance audit had identified that the original risk assessments had not examined this issue. The recommendation for the further audit had not been carried out by the time of the accident.

The two sets of rules and procedures are not inconsistent. However, they add an unnecessary layer of complexity and there is a risk to continued safe operations that one set is amended and the other not. Also, because QR maintains the track to the border (in lieu of Glenapp) track maintenance workers have to be qualified in both sets of rules and procedures. Similarly, operators on this corridor will have to maintain train crew qualifications in both sets of rules and procedures.

Having two different sets of rules, for what is exactly the same safeworking system, between Acacia Ridge and Glenapp and between Glenapp and Casino can serve no purpose other than to exacerbate the existing interface requirements at Glenapp or, in the case of track maintenance workers, the border. The potential for adverse safety implications is clear.

4 CONCLUSIONS

4.1 Findings

1. The train crew of 5BS7 had authority to occupy the section of track where the collision occurred.

2. The driver of train 5BS7 made an emergency application of the train brakes and sounded the whistle 246 metres from impact. In addition, the headlight (at least one globe) was illuminated.

3. The track workers had vacated the track vehicle and were clear at the time of the collision.

4. The protection officer in charge of the track vehicle told the south-west train controller what had happened within minutes of the collision.

5. The response of the emergency services personnel was complete and timely in that the police, fire brigade and ambulance attended shortly after the collision.

6. The memory modules of the Fischer Mark One locomotive data loggers on the locomotives of 5BS7 could not be removed due to the non-availability of a key.

7. All personnel directly associated with the accident where appropriately qualified and medically fit for duty.

4.2 Contributing factors

1. In the minutes before and at the time of granting authority for train 5BS7 to depart Acacia Ridge, the workload of the south-west train controller was high.

2. The workload of the south-west train controller was increased by the supervision of a trainee train controller and the probability is that this served to distract him from his primary task.

3. The verbal transmissions between the Acacia Ridge signaller and the south-west train controller regarding the anticipated departure time of train 5BS7 were misinterpreted by the train controller.

4. The words used during the transmission between the Acacia Ridge signaller and the south-west train controller were ambiguous with respect to a clear understanding of the anticipated departure time of train 5BS7.

5. The south-west train controller based the issue of the Track Occupancy Authority to the protection officer at Bromelton on an anticipated departure time of 0945 of train 5BS7 from Acacia Ridge and an anticipated arrival of 1000 at Greenbank.

6. The path of train 5BS7 was not appropriately endorsed on the train graph by the south-west train controller.

7. The south-west train controller did not instruct the signaller at Acacia Ridge to place blocking facilities on starting signal AR14 in order to prevent train 5BS7 from departing Acacia Ridge.

8. The protection officer of the track vehicle was in possession of a Track Occupancy Authority that was constituted by an electric staff. There was tacit authority to proceed to the take-off point that was within the staff station yard limits at Greenbank rather than an additional paper-based Track Occupancy Authority.

9. The track vehicle involved in the accident was not designed to be detected by track-circuits. Therefore the signal authorising access for train 5BS7 to enter the Greenbank staff station yard limits cleared to proceed while the track vehicle was on the main line within the staff station yard limits.

10. A quickly calculated risk was taken by the track workers in the track vehicle who decided to continue towards the take-off point at Greenbank when the approaching train was sighted.

11. The majority of staff interviewed as a result of this investigation believed that possession of an electric staff authorises access within staff station yard limits.

The following contributing factors are associated with the existing safeworking system used between Greenbank and Glenapp and between Glenapp and Casino.

12. An electric staff authorises occupation of a section of track between staff station yard limits only. Movements within staff station yard limits are controlled by signal indications, relevant rules and procedures and instructions from train control. As such, a Track Occupancy Authority constituted by an electric staff cannot, of itself, authorise access within staff station yard limits.

13. It has been practice since 2001 to issue Verbal Track Occupancy Authorities for access within unattended station yard limits on the Acacia Ridge to Casino corridor. This practice contravenes RIC rule NWT 304.

14. The safeworking practices in use on this corridor since 2001 have meant that blocking facilities have not been applied between non-track -circuited track vehicles and trains when crossing at unattended staff stations.

15. The risk assessments conducted by QR as a component of the safety case presented to Queensland Transport for the transfer of operational and maintenance responsibility from RIC to QR did not identify the incorrect practices regarding the issuing of Track Occupancy Authorities on the Acacia Ridge to Glenapp corridor. Although not assessed, the same deficiencies are evident from Glenapp to Casino under ARTC management.

16. The existence of two sets of rules and procedures on the Acacia Ridge to Casino corridor and the potential impact on operational and safety aspects has not been considered in the risk assessments and associated safety case for the transfer of operational and maintenance responsibility from RIC to QR.

5 RECOMMENDED SAFETY ACTIONS

As a result of its investigation, the ATSB makes the following recommendations with the intention of improving railway operational safety. Rather then provide prescriptive solutions, these recommendations are designed to guide interested parties on the issues that need to be considered. Recommendations are directed to those agencies that should be best placed to action the safety enhancements intended by the recommendations, and are not necessarily reflective of deficiencies within those agencies.

5.1 Queensland Rail

RR20060019

The ATSB recommends that Queensland Rail structure and enforce the training curriculum for trainee train controllers to ensure that practical experience at a train control workstation is undertaken in an appropriate manner at the intended stage of training. Consideration to be given to train controller workload factors in conjunction with the stage of trainee development.

RR20060020

The ATSB recommends that Queensland Rail review verbal communication protocols to provide advice to employees on the use of unambiguous language.

RR20060021

The ATSB recommends that Queensland Rail ensure that appropriate blocking facilities are applied on the Acacia Ridge to Glenapp corridor to prevent conflicting movements between trains and non track-circuited track vehicles. Such measures to be progressed conjointly with the custodians of the rules and procedures that apply on the Glenapp to Casino corridor.

RR20060022

The ATSB recommends that Queensland Rail progress the issue of rule and procedure conformity to ensure that the rules and procedures on the Acacia Ridge to Glenapp corridor match those on the Glenapp to Casino corridor.

5.2 Queensland Transport

RR20060023

The ATSB recommends that Queensland Transport actively monitor the actions initiated by Queensland Rail in response to these recommendations.

5.3 Australian Rail Track Corporation

RR200600024

The ATSB recommends that the Australian Rail Track Corporation ensure that appropriate blocking facilities are applied on the Glenapp to Casino corridor to prevent conflicting movements between trains and non track-circuited track

vehicles. Such measures to be progressed conjointly with the custodians of the rules and procedures that apply on the Acacia Ridge to Glenapp corridor.

RR20060025

The ATSB recommends that the Australian Rail Track Corporation progress the issue of rule and procedure conformity to ensure that the rules and procedures on the Glenapp to Casino corridor match those on the Acacia Ridge to Glenapp corridor.

6 SUBMISSIONS

Section 26, Division 2, and Part 4 of the Transport Safety Investigation Act 2003, requires that the Executive Director may provide a draft report, on a confidential basis, to any person whom the Executive Director considers appropriate, for the purposes of:

a) Allowing the person to make submissions to the Executive Director about the draft: or

b) Giving the person advance notice of the likely form of the published report.

The final draft of this report was provided for comment to the following directly involved parties:

a) Queensland Transport

b) Queensland Rail

c) Interail Pty Ltd

d) Australian Rail Track Corporation

e) Rail Infrastructure Corporation

f) The train controller

g) The Acacia Ridge signaller

h) The protection officers of the track gangs

i) The train crew of 5BS7

Queensland Transport, Queensland Rail, the Australian Rail Track Corporation, the Rail Infrastructure Corporation and the Acacia Ridge Signaller made a number of comments and observations on the draft report issued to directly involved parties. Comments and observations have been incorporated into this report where they were supported by evidence and agreed by the investigation team.

7 MEDIA RELEASE

Rail Collision at Greenbank on August 2005

An ATSB investigation has found that train controller workload, a misunderstanding in regard to the departure time of a freight train and longstanding inadequate practices concerning track access for track vehicles used for maintenance purposes combined to cause a collision at Greenbank in August 2005.

The final report states that the collision occurred because the Sydney bound freight train and a track vehicle were both given authority to occupy the same section of track at the same time at Greenbank station in south eastern Queensland. The authority for the train was valid; the authority for the track vehicle was not. The track vehicle was stationary at the time of impact and the three track workers had exited moments before. There were no injuries and damage was limited to the front end of the track vehicle.

Issues identified include a misunderstanding between the train controller and a remote signaller regarding the anticipated departure time of the freight train, and teaching of a trainee train controller by the appointed train controller at a time of high workload. The ATSB also found that the words used in the transmission between the train controller and signaller were ambiguous.

Other issues identified were the application of the rules concerning track access for track vehicles between Acacia Ridge and Casino. In this instance, the track access authority for the track vehicle was implied to extend beyond its boundary. This exceedence, combined with signalling that clears to proceed for oncoming trains if the track is unoccupied, placed the track vehicle and train in conflict with one another. The ATSB found that the rules have not been applied correctly since 2001.

In the interest of future safety the ATSB has made recommendations regarding train controller training, verbal communication protocols, blocking facilities between trains and track vehicles and, rule and procedure conformity between Acacia Ridge and Casino.