

Inquiry 11-106: Hi-rail vehicle nearly struck by passenger train,
Crown Road level crossing near Paerata,
North Island Main Trunk, 28 November 2011

The Transport Accident Investigation Commission is an independent Crown entity established to determine the circumstances and causes of accidents and incidents with a view to avoiding similar occurrences in the future. Accordingly it is inappropriate that reports should be used to assign fault or blame or determine liability, since neither the investigation nor the reporting process has been undertaken for that purpose.

The Commission may make recommendations to improve transport safety. The cost of implementing any recommendation must always be balanced against its benefits. Such analysis is a matter for the regulator and the industry.

These reports may be reprinted in whole or in part without charge, providing acknowledgement is made to the Transport Accident Investigation Commission.



Final Report

Rail inquiry 11-106
Hi-rail vehicle nearly struck by passenger train, Crown Road level
crossing near Paerata,
North Island Main Trunk, 28 November 2011

Approved for publication: October 2013

Transport Accident Investigation Commission

About the Transport Accident Investigation Commission

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

Commissioners

Chief Commissioner	John Marshall, QC
Deputy Chief Commissioner	Helen Cull, QC
Commissioner	Howard Broad, CNZM

Key Commission personnel

Chief Executive	Lois Hutchinson
Chief Investigator of Accidents	Captain Tim Burfoot
Investigator in Charge	Peter Miskell
General Counsel	Rama Rewi

Email	inquiries@taic.org.nz
Web	www.taic.org.nz
Telephone	+ 64 4 473 3112 (24 hours) or 0800 188 926
Fax	+ 64 4 499 1510
Address	Level 16, 80 The Terrace, PO Box 10 323, Wellington 6143, New Zealand

Important notes

Nature of the final report

This final report has not been prepared for the purpose of supporting any criminal, civil or regulatory action against any person or agency. The Transport Accident Investigation Commission Act 1990 makes this final report inadmissible as evidence in any proceedings with the exception of a Coroner's inquest.

Ownership of report

This report remains the intellectual property of the Transport Accident Investigation Commission.

This report may be reprinted in whole or in part without charge, provided that acknowledgement is made to the Transport Accident Investigation Commission.

Citations and referencing

Information derived from interviews during the Commission's inquiry into the occurrence is not cited in this final report. Documents that would normally be accessible to industry participants only and not discoverable under the Official Information Act 1980 have been referenced as footnotes only. Other documents referred to during the Commission's inquiry that are publicly available are cited.

Photographs, diagrams, pictures

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



Location of incident

Source: mapsof.net



The Crown Road level crossing
(located near Paerata)

Contents

- Abbreviations ii
- Glossary iii
- Data summary iv
- 1. Executive summary1
- 2. Conduct of the inquiry.....3
- 3. Factual information4
 - 3.1. Circumstances leading to the incident.....4
 - 3.2. Personnel information.....6
- 4. Analysis7
 - 4.1. Introduction.....7
 - 4.2. Assumptions about the locations of trains and other rail vehicles7
 - 4.3. Knowing where trains are on the rail network9
 - 4.4. Train controller wellbeing – nutrition and rest breaks 11
 - 4.5. Communication 13
- 5. Findings 15
- 6. Key lessons..... 16
- 7. Safety actions..... 17
 - General 17
 - Safety actions addressing safety issues identified during an inquiry 17
- 8. Recommendations 22
 - 8.1. General..... 22
 - New recommendations 22
 - 8.2. Recommendation 1: Assumptions about the locations of trains 22
 - 8.3. Recommendation 2: NZ Transport Agency 23
 - Previous recommendations 23
 - 8.4. Train controller wellbeing – nutrition and rest breaks 23
 - 8.5. Train visibility 24
- 9. References 25

Figure

Figure 1 Up Main line and Down Main line from Papakura to Pukekohe 10

Abbreviations

Commission	Transport Accident Investigation Commission
km	kilometre(s)

Glossary

blocking	a method of track protection that involves holding a signal at “stop” to prevent trains entering a section of track
controlled rail network	the rail network controlled by train control
dark territory	sections of the controlled rail network in which the train controller cannot electronically observe train movements
Down Main line	the rail track that trains and other rail vehicles use when travelling south from Papakura to Pukekohe
information bulletin	a KiwiRail bulletin with information about activities such as planned track work and changes to train services. Information bulletins are distributed to staff likely to be affected, including train controllers, signallers, train drivers and infrastructure maintenance personnel
mimic screen	an electronic display that each train controller has showing the locations of trains on sections of the controlled rail network
on-track	the process of transitioning a hi-rail vehicle from the road on to a rail track
person-in-charge	the person responsible for the safe operation of a hi-rail vehicle movement or a track occupation
signaller at Papakura	the person who directly controls signals within Papakura Station limits
track occupation authorisation	an authority from train control for infrastructure personnel to occupy a section of the controlled rail network to carry out track inspections, maintenance or other track activities
training shuttle	a non-revenue passenger train used for driver training. The train operation is supervised by a minder driver
train register	an electronic register that a signaller uses to record the arrival and departure times of trains
Up Main line	the rail track that trains and other rail vehicles use when travelling north from Pukekohe to Papakura

Data summary

Vehicle particulars

Train type and number:	suburban passenger train 3121
Classification:	diesel multiple unit powered by coach Australian diesel locomotive 806 leading, with unpowered coach Australian diesel coach 856 trailing. The train was 42.2 metres long and had a tare weight of 78.72 tonnes
Year of manufacture:	built by A. Goninian Limited, New South Wales, Australia in 1985
Operator:	Veolia Transport Auckland Limited
Date and time	28 November 2011 at 1040 ¹
Location	633.57 ² kilometres North Island Main Trunk, Crown Road level crossing
Persons involved	a driver, a train manager, a passenger operator and 7 passengers
Injuries	nil
Damage	nil

¹ Times in this report are New Zealand Daylight Times (universal co-ordinated time + 13 hours) and are expressed in the 24-hour mode.

² The distance was from a reference point at Wellington Station.

1. Executive summary

1.1. Summary of the incident

- 1.1.1. On 28 November 2011 a track maintenance gang arrived at the Crown Road level crossing near Paerata to relocate an 11-tonne hi-rail excavator from there to Pukekohe Station Yard about 5 kilometres (km) away.
- 1.1.2. A scheduled passenger train with 7 people on board was due to pass through the Crown Road level crossing on its way to Pukekohe. The train controller had authorised an unscheduled “training shuttle” train to proceed to Pukekohe several minutes ahead of the scheduled passenger train. The training shuttle looked just like the scheduled passenger train.
- 1.1.3. Several minutes after the training shuttle had passed over the Crown Road level crossing, the person-in-charge of the track maintenance gang radioed the train controller and told him that “a subby [which was meant to be a reference to the scheduled suburban passenger train] had just gone past” and he requested track time to take the hi-rail excavator to Paerata.
- 1.1.4. The train controller assumed that the person-in-charge was referring to the passenger train and, without checking, authorised him to place a hi-rail vehicle and the hi-rail excavator on the tracks in front of the approaching passenger train.
- 1.1.5. A short time later the train controller noticed the passenger train appear on his mimic screen and realised his error. He alerted the person-in-charge, who managed to get the hi-rail vehicle clear of the track just seconds before the passenger train passed, narrowly avoiding a collision.
- 1.1.6. The train controller’s mistake was failing to check the whereabouts of the passenger train. He did not make that check, because he made an assumption based on the person-in-charge of the worksite saying a “subby” had **just** passed his location.
- 1.1.7. The Transport Accident Investigation Commission (Commission) has identified 3 safety issues that contributed to the incident:
- the train controller acted on an assumption rather than following proper procedures before authorising the track occupation ahead of the passenger train
 - the passenger train was travelling through a section of track where it was not electronically visible to the train controller when he authorised the track occupation
 - the train controller had not consumed any food for about 15 hours before the incident and it could not be excluded that his performance was affected by his having a low blood glucose level.
- 1.1.8. The report also discusses another factor that contributed to the incident. The driver of the passenger train had reduced the volume on his train radio to a lower level, so he was not aware that the train controller had authorised the maintenance gang to occupy the section of track ahead of his train. This meant that the driver missed the opportunity to alert the train controller to the potential collision.

1.2. Other incidents involving train control

- 1.2.1. This is the second time within recent months that the Commission has looked closely at train control. In September 2013 the Commission completed an inquiry into a near-collision incident between Staircase and Craigieburn involving a loaded coal train with 2 people on board and an alicart driven by a track engineer. The Staircase/Craigieburn incident occurred about 7 months before this one. It involved a train controller failing to check the location of the loaded coal train before authorising the track engineer to “on-track” his alicart and travel towards the loaded coal train on the same section of track. The collision was avoided after a

structures inspector in the general area overheard the radio conversation between the train controller and the track engineer and raised the alarm.

1.2.2. As a result of its inquiry into the Staircase/Craigieburn incident, the Commission became concerned about a number of wider systemic issues that it had found within train control, including:

- the lack of a proper risk assessment of the merger of 2 train control desks
- poor supervision of and support for the train controller in that case, who had become increasingly stressed and mentally fatigued during her shift
- the standard protocol of not allowing scheduled breaks for train controllers.

1.2.3. Although the safety issues identified in the Staircase/Craigieburn incident are not precisely the same as those in this incident, both incidents raised concern with the performance of train control.

1.2.4. The Commission has made one new recommendation to the Chief Executive of KiwiRail and referenced 2 existing open recommendations from the earlier Staircase/Craigieburn report to address the safety issues identified in this report. It has also made one new recommendation to the Chief Executive of the NZ Transport Agency to ensure that KiwiRail address the safety issues.

1.2.5. The **key lessons** learnt from the inquiry into this occurrence were:

- train controllers need to verify all information before authorising a track occupations. If they cannot see trains by some electronic means, they must make radio contact with the drivers to verify the trains' locations in order to give authorisations
- the risk of train controllers making assumptions must be managed on an on-going basis
- train controllers who are significantly fatigued (mentally) during their shifts can be a risk to public transport safety. Having a proper diet and nutrition, and taking rest breaks during shifts are crucial for minimising this risk
- food must be easily accessible by train controllers, and train controllers must be given adequate breaks during their shifts to enable them to eat and to rest.

2. Conduct of the inquiry

- 2.1. The NZ Transport Agency notified the Commission of the near collision on the day it occurred. After making preliminary enquiries, the Commission opened an inquiry under section 13(1) of the Transport Accident Investigation Commission Act 1990 to determine the circumstances and causes of the incident. An investigator in charge was assigned to investigate the incident.
- 2.2. On 30 November 2011 the investigator in charge travelled to the Crown Road level crossing and examined the incident site. He subsequently interviewed the:
 - train controller
 - driver of the passenger train
 - 2 minder drivers and 4 trainee drivers from the training shuttle
 - person in charge
 - driver of the hi-rail vehicle.
- 2.3. The Commission's investigator also obtained and reviewed a number of records and documents from KiwiRail, including:
 - the train controller's training and personal records, including the results of his previous performance assessments
 - KiwiRail's operating rules and procedures for train control
 - various incident reports and signalling records.
- 2.4. On 26 August 2013 the Commissioners finalised a draft final report regarding the incident and approved it for distribution to interested persons for comment.
- 2.5. Written submissions were received from the NZ Transport Agency, KiwiRail and the train controller. These submissions were considered and changes made to the report.
- 2.6. On 24 October 2013 the Commission approved the final report for publication.

3. Factual information

3.1. Circumstances leading to the incident

3.1.1. On Sunday 27 November 2011, a track maintenance gang carried out maintenance work on the Up Main line of the North Island Main Trunk, near Paerata. After completing this work they left an 11-tonne hi-rail excavator near the Crown Road level crossing overnight.

3.1.2. The next day the maintenance gang, including the person-in-charge, returned to the Crown Road level crossing to relocate the hi-rail excavator. The maintenance gang timed its arrival to coincide with the off-peak suburban passenger train timetable, which would normally have provided a work-window of about 75 minutes between scheduled southbound trains. The person-in-charge intended to on-track the hi-rail excavator and a hi-rail vehicle on to the Down Main line at the Crown Road level crossing, then travel south to Pukekohe Station Yard about 5 km away.

3.1.3. Between 0900 and 1500 that day, however, driver training operations were scheduled to take place between Waitakere and Pukekohe. Part of this training programme would involve a non-revenue passenger train (training shuttle) making 2 return trips between Papakura and Pukekohe. These training operations were noted in the information bulletin for that day, which stated in part:

Veolia, Driver Training, Waitakere – Pukekohe:

Veolia driver training, (VT1), may operate between Waitakere and Pukekohe all lines, in accordance with KiwiRail ROC Section L1 Instruction 1.1, as directed by Train Control and as required by the Training Supervisor for training purposes. Hours: 0900 to 1500.

3.1.4. The person-in-charge of the track occupation said that although he had read the information bulletin that morning, he had not considered that his plan to relocate the hi-rail excavator would be affected by the driver training operations.

3.1.5. At about 1012 the signaller at Papakura contacted the train controller and told him that the training shuttle (otherwise known as VT1) had arrived at Papakura, and that its driver wished to return to Pukekohe. The Papakura signaller added that as there were no further rail movements at that time, the training shuttle could travel ahead of Train 3121 (the passenger train) on the Down Main line.

3.1.6. At about 1019 the training shuttle departed from Papakura. The train controller agreed and authorised the movement. About 9 minutes later the passenger train departed from Papakura on the Down Main line, and started travelling behind the training shuttle.

3.1.7. At about 1020 the maintenance gang, including the person-in-charge, arrived at the Crown Road level crossing. They were not aware that the training shuttle was travelling on the Down Main line towards the Crown Road level crossing at that time.

3.1.8. At about 1029 the training shuttle crossed the Crown Road level crossing on the Down Main line. The person-in-charge, who was near the crossing, saw it, but assumed that it was a scheduled passenger train rather than a training shuttle because:

- he was not aware that the training shuttle was in the area
- the training shuttle looked like a passenger train
- the training shuttle crossed the level crossing close to the time that the passenger train was expected to cross.

3.1.9. About 1036 (i.e. about 7 minutes after seeing the training shuttle pass the Crown Road level crossing) the person-in-charge radioed train control and said:

46293 [his call number]. I'm sitting at 663 and a half. A subby has just gone past on the Down Main and I want 30 minutes to go to 8L [Signal D in paragraph 4.3.4, the boundary between Auckland and Waikato train control desks]...

- 3.1.10. By this time the training shuttle had already reached Pukekohe and was now travelling back to Papakura on the Up Main line.
- 3.1.11. The train controller said that he had thought the person-in-charge's comment ("A subby has **just** gone past on the Down Main") meant that a suburban passenger train had just gone past **that second** rather than minutes earlier. He therefore assumed that the "subby" was the passenger train, and that the track between the Crown Road level crossing and Signal D at Paerata was now clear. He said that he had made this assumption because the person-in-charge's comment was made around the time that he expected the passenger train to be passing the Crown Road level crossing.
- 3.1.12. With this mind-set the train controller contacted the signaller at Papakura and instructed him to apply blocking to protect the person-in-charge's movement on the Down Main line. The Papakura signaller confirmed that the blocking had been applied.
- 3.1.13. The train controller then authorised the person-in-charge's track occupation, stating that:

1037 is the time, I understand a subby has just gone past you on the Down Main at 633 and a half. Yourself and [46]843 to proceed from there through to 8L Signal Paerata. Blocking applied at 44 Signal, Down Main line at Papakura. Clearance time at 1110, over.
- 3.1.14. Upon receiving this authorisation, the person-in-charge recorded the details on the required form (a pro-forma Mis 71, "Track Occupancy Cross Check" form). He then read back the details of the authorisation to the train controller. The train controller confirmed the person-in-charge's read-back then ended the radio communication. By now, the passenger train was only about 2 minutes away from the Crown Road level crossing.
- 3.1.15. The driver of the passenger train said that he had not heard the train controller authorising the person-in-charge to occupy the section of track ahead of his train, even though he was on the same radio frequency. He said that he had trained himself to focus only on those calls made to his call sign, and to ignore all other radio communications.
- 3.1.16. Upon receiving his authorisation, the person-in-charge radioed the operator of the hi-rail excavator to confirm the details of their track occupation authorisation. The plan was to move the hi-rail vehicle on to the track first, followed by the hi-rail excavator. The person-in-charge began doing this, instructing the driver to position the hi-rail vehicle on to the track. This put the hi-rail vehicle directly in the path of the approaching passenger train.
- 3.1.17. The train controller said that shortly after confirming the person-in-charge's track occupation, he had had a feeling that something was not right. His unease had been heightened when he looked at his mimic screen and saw that the passenger train (which had only just appeared on the screen) had not in fact passed the Crown Road level crossing, as he had assumed, but was instead approaching it. The train controller called the person-in-charge and asked him if the "subby" that had passed over the Crown Road level crossing had done so within the previous few seconds. The person-in-charge said no, that the subby had passed several minutes earlier. The train controller then informed the person-in-charge that the train that had passed earlier was in fact the training shuttle, and that another subby (the passenger train) was now approaching Paerata on the Down Main line.
- 3.1.18. A few seconds later (while the train controller and the person-in-charge were still speaking to each other), the warning bells at the Crown Road level crossing began ringing as the passenger train approached. The person-in-charge immediately signalled for the hi-rail vehicle to be driven from the Down Main line. This was done a few seconds before the passenger train passed, narrowly avoiding a collision.

3.2. Personnel information

Train controller

- 3.2.1. The train controller had started work with KiwiRail in a Wellington-based track maintenance gang on 1 August 2005. On 26 June 2008, after completing his train control training, including a period of on-the-job training, the train controller had been certified to perform train control duties on the Bay of Plenty desk. On 30 March 2009 he had been certified to perform train control duties on the Waikato desk, and on 21 May 2010 the Auckland desk. His train control certification for the Auckland desk was current at the time of the incident.
- 3.2.2. During the 10-day period before the incident, the train controller had worked the following roster:

Date – 2011	Posted roster hours	Train control desk
18 November	Annual leave	x
19 November	0650 to 1900 ³	Merged desks
20 November	Annual leave	x
21 November	Annual leave	x
22 November	2240 to 0650	Central and East Coast Main Trunk merged desks
23 November	2240 to 0650	Central and East Coast Main Trunk merged desks
24 November	2240 to 0650	Central and East Coast main trunk merged desks
25 November	Rostered day off	x
26 November	Rostered day off	x
27 November	Rostered day off	x
28 November (day of incident)	0640 to 1450	Auckland

- 3.2.3. The train controller had not been working excessive hours prior to this incident. He had been either on annual leave or rostered off duty for 6 of the 10 days before the incident. A post-incident urine specimen provided by the train controller was tested by the Institute of Environmental Science and Research as part of KiwiRail's standard protocols. The specimen tested negative for drugs and alcohol.

Person-in-charge

- 3.2.4. The person-in-charge had worked for KiwiRail's infrastructure maintenance provider since 23 March 2002. On 6 September 2004 he had become a track ganger for a track maintenance work group based at Pukekohe. His most recent biennial refresher training had been completed on 15 May 2009, and on 3 August 2010 he had undertaken further track safety training. On 31 March 2011 the person-in-charge had been trained in the Alternative Track Safety Rules and Pilot for Automatic Signalling Rules that were introduced within the Auckland suburban network from 8 May 2011.

Driver of the passenger train

- 3.2.5. The scheduled 2-car diesel multiple unit passenger train was crewed by a driver, one train manager and one passenger operator. The driver had 7 years' experience driving diesel multiple units on the Auckland suburban rail network. His certification was current.

³ The train control roster schedules a merged-desk, 12-hour shift on a Saturday when scheduled rail traffic and track maintenance activities are normally less frequent than at other times of the week.

4. Analysis

4.1. Introduction

4.1.1. The passenger train nearly collided with the hi-rail vehicle because the train controller mistakenly authorised the person-in-charge to place a hi-rail vehicle and hi-rail excavator on to the section of track on which the passenger train was travelling. The train controller made this mistake because he did not verify the location of the passenger train. He made an assumption based on what he was told by the person-in-charge of the worksite that a “subby”, which he assumed was the passenger train, had already and only just passed his location. The passenger train was in fact about 2 minutes away, approaching the Crown Road level crossing where the person-in-charge had begun to on-track his hi-rail vehicle.

4.1.2. This incident highlighted 3 safety issues, namely:

- [assumptions about the locations of the trains](#) – the train controller made an assumption about the location of the passenger train and did not verify this location before authorising the person-in-charge’s track occupation. Assumptions by train controllers about the locations of trains and other rail vehicles are a real and constant risk that must be continually and properly managed
- [knowing where trains are on the rail network](#) – the passenger train was not electronically visible to the train controller when he authorised the person-in-charge’s track occupation. A significant portion of the controlled rail network and therefore a large number of rail movements and track activities are not electronically visible to train control at any given time. Although mechanisms are available to help train controllers anticipate and verify these movements and track activities, these mechanisms require train controllers to interpret, analyse and understand information (or the absence of information), often in split-seconds and while under pressure. This makes their job complex and demanding. A high reliance on human input means that the system will always be at risk from human error. The Commission raised this issue in its Staircase/Craigieburn report⁴
- [nutrition and rest breaks](#) – the train controller had not eaten for about 15 hours before the incident. Train controllers who do not eat properly and regularly during their shifts and/or who do not take rest breaks during their shifts may become mentally fatigued, which can contribute to their making errors. The Commission also raised this issue in its Staircase/Craigieburn report. Although there is no objective evidence to support the train controller’s mental performance being affected by the lack of rest breaks or the lack of food before and during his shift, research has shown that insufficient nutrition can nevertheless affect human performance.

4.1.3. Each of these safety issues is discussed in the following sections.

4.2. Assumptions about the locations of trains and other rail vehicles

Safety issue: The train controller made an assumption about the location of the passenger train and did not confirm this location before authorising the person-in-charge’s track occupation. Assumptions made by train controllers about the locations of trains and other rail vehicles are a real and constant risk that must be continually and properly managed.

4.2.1. KiwiRail’s Track Safety Rules required train controllers to verify all train movements before granting track occupation authorisations. Rule 915(b) stated:

Train Control will ensure that the proposed movement will not conflict with rail vehicle movements (trains, hi-rail vehicles, etc).

The location of conflicting rail vehicle movements must be verified by Train Control prior to the movement being authorised⁵.

⁴ Commission report 11-102.

⁵ Rule 915(b), Rail Operating Rules: Section 9: Track Safety Rules. Ontrack. 25 November 2008.

4.2.2. Rule 915(b)(i) was specifically concerned with on-tracking. It stated:

When a train is in the vicinity where the on tracking is to take place:

Train control must verify that train's position to ensure that it has [passed] the on-tracking location, prior to authorising the Trolley /Hi-rail movement.

4.2.3. These rules were further repeated in KiwiRail's Operating Instructions for Train Control⁶. Clause 14.1.2, for example, stated:

Pre Authorisation check and use of Train Control Diagram for Track Occupancy

Before track occupation is authorised the Train Controller must establish positively whether any conflict exists with either existing occupations, track maintenance machinery or trains within any part of the area requested.

All movements and work authorised must be plotted on the Train Control Diagram as prescribed in instruction 2.1 and 2.2 [plotting convention]

4.2.4. On 13 April 2011 (about 7 months before the incident) KiwiRail issued a safety briefing notice to train control personnel reminding them about the importance of verifying train movements before granting track occupation authorisations. This safety briefing notice was issued following potential conflicts, which had been created as a result of train controllers authorising track occupations. The safety briefing notice specifically alerted personnel to the danger of making assumptions about the locations of trains without verifying where they were. It concluded by saying:

In summary, be aware that you can make semi-conscious assumptions and believe that it is safe to authorise occupancy when it is not. The defence is to consistently apply checks fully with verification, and then verbalise what you understand and are authorising.

4.2.5. The train controller made 3 assumptions⁷ based on the comment from the person-in-charge that "A subby has just gone past on the Down Main".

- he assumed that the "subby" was in fact the passenger train when in fact it was the training shuttle
- he assumed that the passenger train (which was actually the training shuttle) had only just passed the Crown Road level crossing on the Down Main line, when in fact it had done so several minutes earlier
- he assumed that the Down Main line between the Crown Road level crossing and Signal D was now clear for a 30-minute track occupation for the person-in-charge to travel on, when it was not.

4.2.6. The train controller made these assumptions because he thought that the person-in-charge's comment, "A subby has **just** gone past on the Down Main", meant that the passenger train had just gone past **that second**, rather than a few minutes earlier. The request for the track occupation was made within a few minutes of the time the train controller expected the passenger train to be passing the Crown Road level crossing.

4.2.7. Despite KiwiRail's Track Safety Rules and the safety briefing notice, the train controller did not verify the location of the passenger train, but instead relied on his assumptions about what train was being referred to, and that it had just gone past. In his submission to the Commission, the train controller implied that relying on the practice of field staff providing additional information to train controllers was normal practice. He implied that in this case, relying on the information that the "subby had just gone past" was appropriate. However, train controllers must use all means available to verify the locations of trains before authorising track occupations.

⁶ Rail Operating Procedures: Section 10.1: Operating Instructions for Train Control. Ontrack. 23 November 2009.

⁷ The Concise Oxford English Dictionary (11th edition) defines an "assumption" as something that is accepted as true without proof.

- 4.2.8. The risk of human error will always be present whenever a process or a system requires a person to make a decision or to perform an act. This risk can be effectively managed and minimised if the right level of attention and commitment is given to it.
- 4.2.9. Train controllers must not make assumptions. They should only act on verified information. KiwiRail could ensure that train controllers do not make assumptions by the following means:
- repeatedly reminding train controllers (through regular safety briefing notices or announcements) to follow proper protocols when authorising track occupations, including verifying the locations of trains and other hi-rail vehicles rather than relying on assumptions
 - locating visual reminders throughout train control (e.g. on posters or messages in each train control room and in the common areas) reminding train controllers not to make assumptions
 - ensuring that train controllers' formal training (initial and ongoing training) covers the risks of making assumptions and includes strategies to help train controllers avoid making them.
- 4.2.10. Managing the risk of train controllers making assumptions should be a daily priority, not an occasional exercise.

Findings

1. The train controller authorised a track occupation on a section of track in front of an advancing passenger train because he did not first check the whereabouts of all other trains in the area as required by KiwiRail rules and procedures.
2. The train controller did not check the location of the passenger train because he made an assumption about its location, based on additional information given by the person-in-charge of the track maintenance group.
3. KiwiRail must take all available steps to ensure that train controllers do not make assumptions. Train controllers must authorise track occupations on verified information only.
4. The person-in-charge provided additional information when he said, "A subby has just gone past on the Down Main". This information confused the train controller.

4.3. Knowing where trains are on the rail network

Safety issue: The passenger train was not electronically visible to the train controller when he authorised the person-in-charge's track occupation. A significant portion of the controlled rail network, and therefore a large number of rail movements and track activities, is not electronically visible to train control at any given time.

- 4.3.1. In New Zealand, only about 40% of the entire controlled rail network is configured to display the locations of trains on train controllers' mimic screens. For areas under track warrant control this has become colloquially known as "dark territory". This term is used in this report to describe any area that is not visible on a mimic screen. In order to monitor rail movements and track activities on a section of track (particularly within dark territory), train controllers rely on a number of mechanisms, including their paper-based train control diagrams, information from the electronic train register, compulsory radio calls from train drivers confirming their locations, and the read-back.
- 4.3.2. Not all of these mechanisms, however, can provide a train controller with the exact locations of all rail vehicles throughout dark territory; usually only their most likely locations. Also, in order to determine this likely location, a train controller must interpret, analyse and understand not only information that they see or receive from these various mechanisms but also information that may not be obvious because, for example, it may not be displayed on a

mimic screen. Based on this information (or the absence of it), a train controller must then form a view about where a train or other rail vehicle is on the controlled rail network at any given time.

4.3.3. In this case, the train controller said that he had checked his mimic screen before issuing the track occupation authorisation, and saw the training shuttle travelling on the Up Main line. However, for some reason (which the train controller said he could not explain) he did not register the fact that the passenger train was **not** displayed on his mimic screen. The absence of the passenger train from the mimic screen was important. It was telling the train controller (albeit in a complicated way) that the passenger train was still travelling through dark territory between Signal A and Signal B. This meant that:

- the passenger train had not yet passed the Crown Road level crossing, as the train controller had assumed
- the section of track between the Crown Road level crossing and Signal D was not free for the person-in-charge to on-track his hi-rail vehicle and hi-rail excavator.

4.3.4. Figure 1 shows the Up Main line and the Down Main line between Papakura and Pukekohe, and the location of the Crown Road level crossing near Paerata. It also shows the 4 signals between Papakura and Paerata:

- the 44 signal (645.59 km) south of Papakura (**Signal A**)
- the 636.55 km intermediate signal (**Signal B**)
- the 634.71 km intermediate signal north of the Crown Road level crossing (**Signal C**)
- the 8L signal (632.97 km) south of the Crown Road level crossing near Paerata (**Signal D**). This signal identified the boundary between Auckland and Waikato train control.

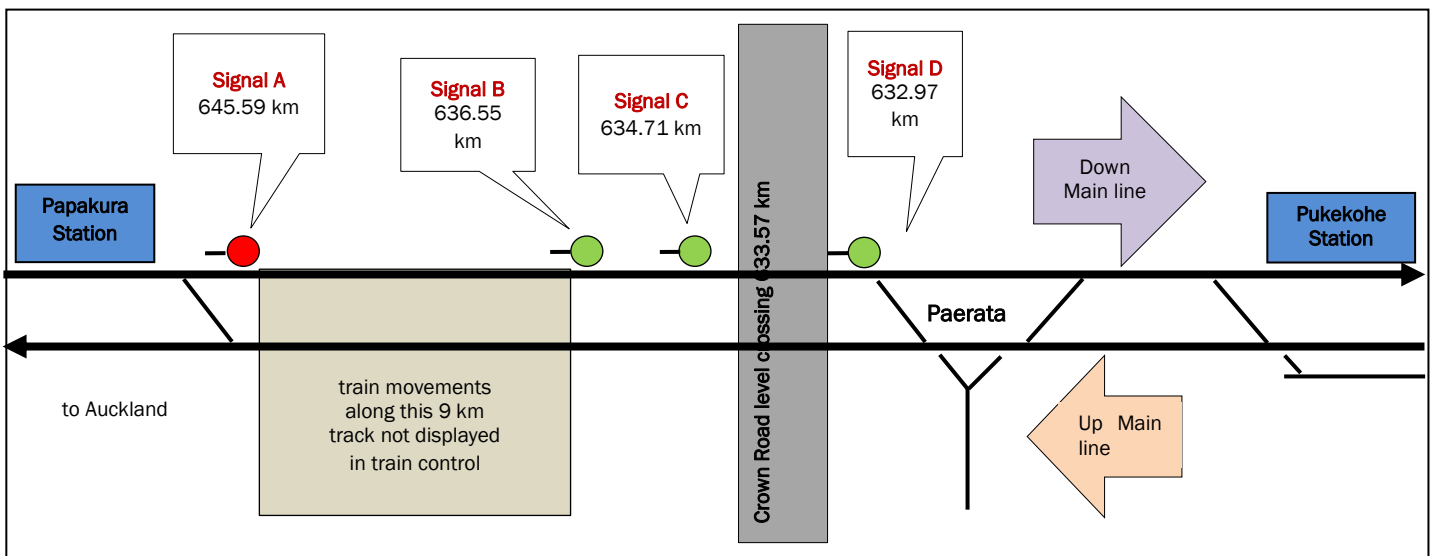


Figure 1
Up Main line and Down Main line from Papakura to Pukekohe

4.3.5. Trains travelling between Signal B and Pukekohe were continuously displayed on the mimic screen, enabling train controllers to see where they were. However, trains travelling between Signal A and Signal B were not, meaning that their movements on this section of track (approximately 9 km long) were not electronically visible to train control (dark territory). In these cases, train controllers had to anticipate train movements by plotting progress on their paper train control diagrams, with the help of other information such as information from the train register.

4.3.6. When the locations of trains are not electronically visible to train controllers, it can be difficult for them to interpret and understand the significance of information, particularly when they

are under pressure. The Commission is aware that global positioning technology is available within KiwiRail that will enable train controllers to see all train movements in real time. However, this technology has not been formally introduced as an aid to controlling trains across the entire rail network. If the train controller in this case could have seen in real time all train movements between Auckland and Pukekohe, and if he had looked at the screen before issuing the track occupation authority to the person-in-charge, he would have seen that the passenger train had not passed the Crown Road level crossing.

- 4.3.7. This does not mean that the mechanisms that train control uses to monitor rail movements and track activities on the controlled rail network are inadequate for tracking trains and other rail vehicles or for determining their locations. The fact that the majority of rail movements and track activities have operated on the network without incident supports this. However, these mechanisms do require more input from train controllers, who must interpret and analyse the information that these mechanisms provide or do not show.
- 4.3.8. A train controller's job would be easier, and public safety would be improved, if all trains and hi-rail vehicles on the controlled rail network were electronically visible to them at all times. That way they could see at a glance all rail movements and track activities on a particular section of track at any given time. Train visibility through global positioning technology will reduce the risk of collisions occurring.
- 4.3.9. Since this incident, KiwiRail has developed a system that shows train controllers the locations of all trains over 95% of its controlled network with a reasonable level of accuracy. The system, known as "GeVis", uses global positioning technology. A similar system using global positioning technology to identify the locations of all hi-rail vehicles is currently being designed.

Findings

- 5. The passenger train was not displayed on the train controller's mimic screen when he authorised the person-in-charge's track occupation. A visual representation of the passenger train's location would have reduced the risk of the train controller inadvertently creating a potential collision between the passenger train and the hi-rail vehicles.
- 6. Train controllers must determine where trains and other rail vehicles are on the controlled rail network at any given time, by interpreting, analysing and understanding not only information that they see but also information that is not obvious or displayed. A train controller's job would be made easier, and public safety would be improved, if all trains and hi-rail vehicles were electronically visible to train control at all times. If the train controller had had access to this technology at the time of the incident, he would have seen (at a glance) that it was not safe to authorise the person-in-charge's track occupation. This would have prevented the incident occurring.

4.4. Train controller wellbeing – nutrition and rest breaks

Safety issue: The train controller had not consumed any food for about 15 hours before the incident. Train controllers who do not eat properly and regularly during their shifts and/or who do not take rest breaks during their shifts may become mentally fatigued. In these circumstances, train controllers are more likely to make mistakes.

- 4.4.1. Train control is a mentally demanding and stressful role. Train controllers are required to make numerous quick decisions during their shifts and to get these right all the time. To do this train controllers must be in peak mental form throughout their shifts. A lapse of concentration could result in an accident, with consequent loss of life and/or significant damage to property and/or the environment.

- 4.4.2. To ensure that train controllers are mentally and physically fit to perform their duties, the Commission believes that there are 2 basic, but important, principles that train controllers must follow as a matter of standard practice, namely:
- train controllers must have sufficient nutrition before and regularly during their shifts
 - train controllers must take regular rest breaks.
- 4.4.3. Research shows that in order for the brain to sustain optimal performance, the body needs a specific level of glucose. Food is a key way to provide the body with this. A modest reduction in available glucose (through inadequate nutrition) can have a measurable effect on the speed with which the brain responds to, and processes, information (De Feo et al., 1988).
- 4.4.4. In this case, the train controller's most recent meal had been about 15 hours before the incident (i.e. his dinner the night before). When he awoke around 0445 on the day of the incident, he did not have breakfast. Nor could he recall eating anything at work before the incident. In both cases the train controller chose not to eat, at least intentionally in the first case because he preferred not to have breakfast so early, and in the second case because he had not yet got around to doing so.
- 4.4.5. The train controller said that about 40 minutes before the incident he had had a mild headache, although it was not severe enough for him to consider discontinuing his shift. He nevertheless had told the Network Control Manager about it, then returned to his desk to continue his work. Once the Network Control Manager was aware of the train controller's ailment, he had a responsibility to determine the extent of the ailment and put in place a process to monitor the train controller's wellbeing. In this case no such action was taken.
- 4.4.6. It is unclear if the train controller's headache was due to his lack of food intake or some other factor. It is also unclear if his headache affected his performance in any way (there was no evidence to enable the Commission to determine this). Given that the train controller had not consumed any food for about 15 hours before he made his error, low blood glucose levels could not be excluded as a factor contributing to his performance.
- 4.4.7. Train controllers have a responsibility to ensure that they are mentally fit to perform their duties. This means eating properly and regularly during shifts. This is not something that train controllers should treat casually or with indifference, because they are performing a safety-critical role that requires high mental and cognitive performance.
- 4.4.8. KiwiRail also has a responsibility to ensure that its train controllers are properly educated to treat diet and nutrition seriously. It also has a responsibility to ensure that they have opportunities to rest and take in nutrition. Safety briefings and safety notices reminding train controllers of the importance of proper nutrition are important.
- 4.4.9. Rest breaks were a matter that the Commission examined in its Staircase-Craigieburn rail inquiry⁸. In that case the train controller's significant workload meant that she felt she could not leave her room during her 5-hour shift to get something to eat or to have a break. The Commission found that it was likely that the train controller, in that case, was mentally fatigued immediately before, and at the time, she made an error.
- 4.4.10. Standard protocol within train control is not to provide train controllers with scheduled breaks within their shifts because of the need for them to be near their desks at all times to hear and respond to calls. Rather, the practice is for informal breaks and interactions, including meal, toilet and rest breaks, to be taken as and when opportunities arise, mainly during quiet periods. In most cases then, train controllers eat at their desks, and have rest and toilet breaks as and when their workloads allow them to.

⁸ Commission report 11-102.

- 4.4.11. The Accident Investigation Board in Norway and Australian Rail Track Corporation Limited⁹ both confirmed similar arrangements in their respective countries, where train controller shifts are 8 hours without scheduled breaks.
- 4.4.12. Notwithstanding this, there are risks when people who perform safety-critical functions work long hours without scheduled breaks, particularly if the work required is complex and mentally demanding, such as train control. The fact that someone else may be doing the same thing is not a good reason for continuing with a high-risk procedure involving a safety-critical function.
- 4.4.13. There is a wealth of cases in which long and irregular working hours have contributed to people making errors or that have been associated with a range of physical and mental health and injury risks (International Labour Organisation, 2011). Eight hours without a scheduled break is a long time in which to expect a person to remain fully alert and in optimal mental form.
- 4.4.14. The Commission does not accept that KiwiRail's approach to train control, where its train controllers work their 8-hour shifts¹⁰ without scheduled breaks, is safe – certainly not without proper processes in place to manage and mitigate the risks of workplace fatigue and stress effectively. This is a significant safety issue that must be properly assessed from a risk perspective.
- 4.4.15. KiwiRail has since introduced a range of measures to improve the health and wellbeing of its train controllers. These are detailed in the “Safety actions” section of this report.

Findings

- 7. Given that the train controller had not consumed any food for about 15 hours before he made his error, low blood glucose levels could not be excluded as a factor contributing to the train controller's performance.
- 8. Train controllers must ensure that they eat properly and regularly during shifts. This cannot be treated casually or with indifference, when they are performing such a safety-critical role.
- 9. KiwiRail must ensure that train controllers treat diet and nutrition seriously, that food is easily accessible by train controllers during their shifts and that train controllers are given breaks to rest and have adequate nutrition.
- 10. KiwiRail's approach to train control, where its train controllers work 8-hour shifts without scheduled breaks, is not safe unless processes are in place to manage and mitigate the risks of fatigue and stress effectively.

4.5. Communication

- 4.5.1. This incident highlights the importance of clear communication and the need for train controllers, and those who communicate with train control, to check and clarify their understanding of communications.
- 4.5.2. The driver of the passenger train said that he had not heard the train controller authorising the person-in-charge to occupy the section of track ahead of his train, even though he had been on the same radio frequency. He said that he had reduced the volume on his train radio and had trained himself to focus only on those calls made to his call sign, and to ignore all other radio communications. Although there was no rule requiring the train driver to listen to all

⁹ Australian Rail Track Corporation Limited is responsible for the management of over 8500 route of standard-gauge interstate track in South Australia, Victoria, Western Australia, Queensland and New South Wales. It also manages the Hunter Valley coal rail network, and other regional rail links, in New South Wales.

¹⁰ Shifts are nominally 8 hours, but can be up to 12 hours during weekends.

radio communications, best practice and good crew resource management¹¹ dictated that he and other drivers do this. The fact that he did not “tune in” to the radio conversation between the train controller and the person-in-charge in this case meant that an opportunity was lost to alert train control to the potential conflict involving his own train.

- 4.5.3. The Commission made reference to the need for good communication and crew resource management in its report on a near-head-on collision near Papakura on 14 January 2011. In that report the Commission recommended that the Chief Executive of the NZ Transport Agency require the Executive of the National Rail System Standard to develop standards to ensure that all rail participants meet a consistently high level of crew resource management and communication that includes the use of standard rail phraseology.
- 4.5.4. On 16 April 2012 the Chief Executive of the NZ Transport Agency replied that he intended to work closely with the National Rail System Standard Executive with an aim of implementing and closing out this recommendation as soon as practicable. He also said that the NZ Transport Agency sat on the National Rail System Standard Executive as an observer and that he would also consider a strategy for rail operators outside the National Rail System Standard coverage.
- 4.5.5. The recommendation remains open pending suitable action on this safety issue.

Finding

- 11. The passenger train driver could have heard the train controller authorising a track occupation directly in the path of his train and intervened to prevent the conflict, but he lost that opportunity because he routinely turned down the volume on his train radio and only actively listened for radio traffic in which his train number was mentioned.

¹¹ Crew resource management can be defined as a management system that makes optimum use of all available resources (e.g. equipment, procedures and people) to promote safety and enhance the efficiency of operations. It encompasses a wide range of knowledge, skills and attitudes, including communications, situational awareness, problem-solving, decision-making and teamwork.

5. Findings

- 5.1. The train controller authorised a track occupation on a section of track in front of an advancing passenger train because he did not first check the whereabouts of all other trains in the area as required by KiwiRail rules and procedures.
- 5.2. The train controller did not check the location of the passenger train because he made an assumption about its location, based on additional information given by the person-in-charge of the track maintenance group.
- 5.3. KiwiRail must take all available steps to ensure that train controllers do not make assumptions. Train controllers must authorise track occupations on verified information only.
- 5.4. The person-in-charge provided additional information when he said, “A subby has just gone past on the Down Main”. This information confused the train controller.
- 5.5. The passenger train was not displayed on the train controller’s mimic screen when he authorised the person-in-charge’s track occupation. A visual representation of the passenger train’s location would have reduced the risk of the train controller inadvertently creating a potential collision between the passenger train and the hi-rail vehicles.
- 5.6. Train controllers must determine where trains and other rail vehicles are on the controlled rail network at any given time, by interpreting, analysing and understanding not only information that they see but also information that is not obvious or displayed. A train controller’s job would be made easier, and public safety would be improved, if all trains and hi-rail vehicles were electronically visible to train control at all times. If the train controller had had access to this technology at the time of the incident, he would have seen (at a glance) that it was not safe to authorise the person-in-charge’s track occupation. This would have prevented the incident occurring.
- 5.7. Given that the train controller had not consumed any food for about 15 hours before he made his error, low blood glucose levels could not be excluded as a factor contributing to the train controller’s performance.
- 5.8. Train controllers must ensure that they eat properly and regularly during shifts. This cannot be treated casually or with indifference, when they are performing such a safety-critical role.
- 5.9. KiwiRail must ensure that train controllers treat diet and nutrition seriously, that food is easily accessible by train controllers during their shifts and that train controllers are given breaks to rest and have adequate nutrition.
- 5.10. KiwiRail’s approach to train control, where its train controllers work 8-hour shifts without scheduled breaks, is not safe unless processes are in place to manage and mitigate the risks of fatigue and stress effectively.
- 5.11. The passenger train driver could have heard the train controller authorising a track occupation directly in the path of his train and intervened to prevent the conflict, but he lost that opportunity because he routinely turned down the volume on his train radio and only actively listened for radio traffic in which his train number was mentioned.

6. Key lessons

- 6.1. Train controllers need to verify all information before authorising track occupations. If they cannot see trains on their mimic screens, they must make radio contact with the drivers to verify the trains' locations in order to give authorisations.
- 6.2. The risk of train controllers making assumptions must be managed on an ongoing basis.
- 6.3. Train controllers who are significantly fatigued (mentally) during their shifts can be a risk to public transport safety. Having a proper diet and nutrition and taking rest breaks during shifts are crucial for minimising this risk.
- 6.4. Food must be easily accessible by train controllers, and train controllers must be given adequate breaks during their shifts to enable them to eat and to rest.

7. Safety actions

General

- 7.1. The Commission classifies safety actions by 2 types:
- (a) safety actions taken by the regulator or an operator to address safety issues identified by the Commission during an inquiry that would otherwise result in the Commission issuing a recommendation
 - (b) safety actions taken by the regulator or an operator to address other safety issues that would not normally result in the Commission issuing a recommendation.

Safety actions addressing safety issues identified during an inquiry

- 7.2. On 18 July 2013 KiwiRail advised that KiwiRail Network Operating Procedures, Train Control, Section 10.1, Instructions 14.1.2 and 14.1.3 will be amended by information bulletin effective from 1 August 2013. These amendments and covering letter stated:

18 July 2013

Train Controllers
National Train Control Centre
WELLINGTON

Dear Colleague,

New Track Occupancy Section Clear Procedure

The authorization and protection of track occupancy is the most safety critical task that you are required to perform. We rely on accurate procedural checks and clear communication.

As these processes rely on you doing a series of manual checks and decisions, they are prone to mistakes being made – Miscommunication, one check or task not done etc. We mitigate these by cross-checking.

A critical review of the track occupancy procedures has identified that train controllers failing to correctly identify the last train clear of an on-tracking location is an error that is not able to be challenged or cross checked by the person who could be harmed. Field staff are not able to have any real/accurate situational awareness about train position. This is a single point of failure.

Recent incidents have made us look at this again at how we mitigate this risk.

When we apply the (Railways Act) test to “*take all practicable steps on its part to ensure that none of the rail activities for which it is responsible causes, or is likely to cause, the death of, or serious injury to, individuals*”, we must make change to reduce this hazard.

We have conducted two conference workshops with Area Managers and run a risk workshop with RMTU input to determine options for improvement. A recommendation was made to the executive management team who have decided to implement new procedures requiring on-tracking sections to be train-free before granting occupancy. This requirement will commence on 1 August 2013.

This change is the only appropriate choice (given the current technology) that passes the *all practicable steps* test. I’m confident future technology use will offer us more opportunity for safety change in coming years.

This new requirement will mean more waiting time by field staff. We are issuing tool box briefings to advise of this change with support from Regional and Area Managers and we want your feedback if field staff raise concerns about waiting. At a more strategic level, work is underway to implement weekly train free block-of-line type time periods for more intensive coordinated maintenance activity. Two such time periods are now operating on the Midland/SWL and ECMT and more will follow this financial year.

Provided with this letter is a Safety Briefing titled "Section Clear for Occupancy". Please read this in conjunction with this letter as it defines the detail and interpretation of this safety change. Briefing sessions will also be conducted by Network Control Managers where you will be asked to sign an acknowledgement of briefing and new Bulletin instructions.

Please maintain the utmost diligence in your track occupancy tasks recognising that safety defences come from the consistent and correct application of these procedures by both train control and field users.

Yours sincerely

Safety Briefing

For all Train Control Personnel



SECTION CLEAR FOR OCCUPANCY

A significant hazard exists of Train Control & track users not correctly establishing that a train in a section has passed a proposed on-tracking location. We have had near collisions caused by confusion of train numbers, colloquial phrases, and/or assumption.

Following review by the KiwiRail Group Executive Management team, a change is being introduced to require that track occupancy under Rules 908, 909, 915 or 918 must NOT be granted for any on-tracking location that has a train still occupying the same section.

In practice, in most CTC and ASR territory, this means that blocking would be fully applied (and not in “pending” state) to the on-tracking section before granting occupancy.

In dark territory, to verify a train is clear of a section, Train Control MUST make/ receive a verbal call to/from the relevant train/s **directly with the LE** about their current location which must be beyond the next station. Information from field staff about the passing of trains **must not** be relied upon.

Train Control Operating Instructions Section 10.1 Instructions 14.1.2 and 14.1.3 are being modified by Bulletin to require **from 1 August 2013**:

Where track safety rules require train control to verify the position of a train to ensure that it is passed the on-tracking location, this must be performed by:

- Observing all track circuits are clear within the on-tracking location when within station limits of an interlocked station, or
- Observing **all** track circuits are clear between adjacent stations for any continuously detected block section, or
- Obtaining verbal advice and confirmation of a train's position from the Locomotive Engineer that it is clear of the **next station** (incl Metro Platforms & Intermediate Boards) when the on-tracking location is in dark territory or non-continuously detected section (DLAS, TWC, SLAS, ASR)

Continued on Page 2 ...

SECTION CLEAR FOR OCCUPANCY

To provide practical examples of the application of this rule:

Request	Rule requirement before allowing authorisation
On-track on Up Main at 633.5km NIMT Crown Rd Paerata	Last train must have verbally confirmed arrived clear inside station limits Papakura
On-track on Down Main at 606.6km NIMT Oram Rd Mercer - Amokura	Last train must have arrived clear through Amokura by panel observation with blocking fully applied
On-track on Up Main at 621.6 Harrisville Rd between Pukekohe and Mercer	Last train must have verbally confirmed arrived clear at/through Pukekohe
On-track on the Up Main at 2.6km Wairarapa Line Kaiwharapura	Last train must have verbally confirmed clear of Ngauranga Station
On-track at 48.7km Midland Line Pocock Rd station limits Springfield	Last train must have cleared station limits Springfield by panel observation with blocking fully applied
On-track at 60.0km Midland Line between Springfield and Staircase	Last train must have verbally confirmed clear of Springfield or Staircase
On-track at main inside station limits Staircase	Last train must have verbally confirmed clear of station limits Staircase
On-track at 37.0km ECMT between Morrinsville and Kereone	Last train must have cleared the section through Kereone or Morrinsville by panel observation with blocking fully applied
HRV on loop waiting to follow train into section	Last train has cleared the points giving entry to follow
On-track at 346.0km MNL between 2R and 4R Picton	Last train must have cleared track between 2R and 4L by panel observation with blocking fully applied
On-track using foul time at 90.0km MNPL between Waitotara and Patea	Last train must have verbally confirmed arrived clear at/through Patea or Brewer Road IB

Note:

- Pending blocking is permitted for sections beyond the on-tracking section to follow a train.
- This new instruction does not affect or limit the use of after the departure/arrival Track Warrants.

Summarised locations that trains must be clear of are:

CTC/ASR Single Line blocks – Next Station

DLAS/ASR Multi-Line – Next interlocked station or passenger platform

Station Limits – any fixed controlled signal clear of the on-tracking track

TWC for Foul Time only - Next Station or Intermediate Board

7.3. On 15 October 2013 KiwiRail stated in part:

Following on from Commission’s investigation report 11-102, KiwiRail has introduced new initiatives recently including a ‘step away for 5’ initiative encouraging Train Controllers to take mini breaks. We now provide fresh fruit, nutritional bars and milk beverages in Train Control. [National Train Control Centre] NTCC records the data on breaks. In addition Network Control Managers regularly walk the centre to check on the wellbeing of staff. This is also recorded. KiwiRail has also introduced a wellness portal which provides employees information on health and wellbeing.

8. Recommendations

8.1. General

- 8.1.1. The Commission may issue, or give notice of, recommendations to any person or organisation that it considers the most appropriate to address the identified safety issues, depending on whether these safety issues are applicable to a single operator only or to the wider transport sector.
- 8.1.2. In this case the Commission makes 3 recommendations to the Chief Executive of KiwiRail. The Commission believes that KiwiRail is the appropriate organisation to address the safety issues reflected in these recommendations, as the issues arose from the operations of one of its business units (train control).
- 8.1.3. The final recommendation is made to the Chief Executive of the NZ Transport Agency. The NZ Transport Agency has various powers under the Railways Act 2005 to monitor and ensure rail participants' performance and compliance. The Commission, therefore, recommends that the NZ Transport Agency exercise all appropriate powers to ensure that KiwiRail is taking all appropriate steps to implement its recommendations.
- 8.1.4. In the interests of transport safety it is important that these recommendations are implemented without delay to help prevent similar accidents or incidents occurring in the future.

New recommendations

8.2. Recommendation 1: Assumptions about the locations of trains

- 8.2.1. The train controller in this case made an assumption that the passenger train had passed a particular location based on information from the person-in-charge. Rather than verifying the train's location, the train controller acted on his assumption and authorised the person-in-charge to occupy a section of track that the passenger train was approaching.

Train controllers must not make assumptions about the locations of trains without first verifying their locations. Unless KiwiRail and train controllers remain alert to this risk and take all appropriate steps to minimise the likelihood of train controllers making assumptions, further incidents could occur, perhaps with more serious consequences.

*The Commission recommends that the **Chief Executive of KiwiRail** ensure that appropriate mechanisms are in place, and are being applied, to minimise the likelihood of train controllers making assumptions about the locations of trains and other rail vehicles. (025/13)*

On 7 November 2013 the Chief Executive of KiwiRail replied in part:

Following on from the Commission's investigation report 11-102, KiwiRail has made significant changes in respect to mitigating the risk of Train Controllers making assumptions by introducing enhanced "Block to be clear" verification process, implemented on 1 August 2013 by Bulletin 449 [refer below].

Where track safety rules require train control to verify the position of a train to ensure that it is passed the on-tracking location, this must be performed by:

- *Observing all track circuits are clear within the on-tracking location when within station limits of an interlocked station, or*
- *Observing all track circuits are clear between adjacent stations for any continuously detected block section, or*
- *Obtaining verbal advice and confirmation of a train's position from the Locomotive Engineer that it is clear of the next station (incl Metro Platforms & Intermediate Boards) when the on-tracking*

location is in dark territory or non-continuously detected (DLAS, TWC, SLAS, ASR)

This new procedure has been reinforced by the Manager Network Operations by way of a Safety Briefing and a personal letter to all Train Control Personnel, outlining the change in procedure.

Compliance with the new process is monitored through our safety observation process.

8.3. Recommendation 2: NZ Transport Agency

- 8.3.1. It is important that KiwiRail addresses the above recommendation, which is aimed at addressing the safety issues examined in this report. The NZ Transport Agency has various powers under the Railways Act 2005 to monitor and ensure KiwiRail's performance and compliance.

*The Commission recommends that the **Chief Executive of the NZ Transport Agency** take all appropriate steps to ensure that KiwiRail addresses the above recommendation. (026/13)*

On 7 November 2013 the acting Manager Rail Safety at New Zealand Transport Agency replied:

Recommendation 025/13 that the Commission has direct to the Chief Executive of KiwiRail is noted. Recommendation 026/13 made to the Chief Executive of the NZ Transport Agency is accepted. Discussions on these recommendations will be initiated on the publication of the report. These discussions will include a projected timeframe for implementation. This will be advised to TAIC in due course.

Previous recommendations

8.4. Train controller wellbeing – nutrition and rest breaks

At the time that the train controller made his error, he had not eaten anything for about 15 hours. It is likely then that his glucose levels were low when he authorised the person-in-charge's track occupation. Train controllers have a responsibility to ensure that they are mentally fit to perform their duties. This means eating properly and regularly during their shifts. KiwiRail also has a responsibility to ensure that food is easily accessible by train controllers during their shifts and that train controllers are given breaks to enable them to eat this food and to rest.

This safety issue was identified in the Crown's Staircase/Craigieburn inquiry, where the train controller in that case worked a 5-hour shift without eating or having a break. In its Staircase/Craigieburn report, the Commission made the following recommendation:

*The Commission recommends that the **Chief Executive of KiwiRail** ensure that train control management has appropriate mechanisms in place to:*

- *detect and manage stress and fatigue, including appropriate training and education*
- *remind train controllers about the importance of eating properly and regularly during their shifts; and*
- *provide train controllers with certainty of reasonable breaks during their shifts. (014/13)*

The same recommendation and the safety issue it addresses apply to this report.

8.5. Train visibility

- 8.5.1. Only about 40% of the controlled rail network is configured to display the locations of trains on train control mimic screens. This makes it challenging for train controllers to determine the exact locations of rail movements and track activities on the network in all cases. The best they can do is to determine the most likely locations using a range of mechanisms, including train control diagrams, mimic screens, information from the electronic train register, compulsory radio calls and the read-back of communications. For the most part, these mechanisms work well.
- 8.5.2. However, rail vehicles not being visible will always present a challenge to train controllers who must interpret, analyse and understand information. This makes their job complex and demanding. A high reliance on human input means that there will always be a risk of human error.
- 8.5.3. Since this incident, global positioning technology has become available that would enable train controllers to monitor train movements in real time across 95% of the controlled network with a reasonable level of accuracy. KiwiRail intends to extend this technology to other rail vehicles operating on the controlled network.
- 8.5.4. Had the train controller in this case had access to this technology and been able to see, at a glance, all train movements between Auckland and Pukekohe in real time, and if he had glanced at the screen before issuing the track occupation authority to the person-in-charge, he would have seen that the passenger train had not yet passed the Crown Road level crossing.
- 8.5.5. This same safety issue was identified in the Commission's Staircase/Craigieburn inquiry. In that report the Commission made the following recommendation:

*The Commission recommends that the **Chief Executive of KiwiRail** take all appropriate steps to ensure that all rail vehicles travelling on the controlled rail network are electronically visible to train control. (O16/13)*
- 8.6. The same recommendation and the safety issue it addresses apply to this report.

9. References

De Feo et al., (1988) Modest decrements in plasma glucose concentration cause early impairment in cognitive function and later activation of glucose conterregulation in the absence of hypoglycaemic symptoms in normal man. *J Clin Invest*, 28: August, 436-444.

International Labour Organisation, (2011), The effects of working time on productivity and firm performance; a research synthesis paper. *Conditions of Work and Employment Series No.33*.

Ontrack, Rail Operating Procedures: Section 10.1: Operating Instructions for Train Control. Ontrack. 23 November 2009.

Ontrack, Rail Operating Rules and Procedures: Section 12: Radio Communication. Ontrack. 30 June 2008.

Ontrack, Rail Operating Rules: Section 9: Track Safety Rules. Ontrack. 25 November 2008.

Transport Accident Investigation Commission, Inquiry 11-102: Near collision between a loaded coal train and an alicart between Staircase and Craigieburn, 13 April 2011.

Transport Accident Investigation Commission, Rail occurrence report 07-108. Express freight train 720; track warrant overrun at Seddon, Main North Line. 12 May 2007



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

- 11-102 Track occupation irregularity, leading to near head-on collision, Staircase-Craigieburn, 13 April 2011
- RO-2013-104 Urgent Recommendations: Derailment of metro passenger Train 8219, Wellington, 20 May 2013
- 11-103 Track workers nearly struck by passenger train, near Paekakariki, North Island Main Trunk, 25 August 2011
- 10-101 wrong route setting, high-speed transit through turnout, near miss and SPAD (signal passed at danger), Tamaki, 13 August 2010
- 11-104 Freight Train 261 collision with bus, Beach Road level crossing, Paekakariki, 31 October 2011
- 10-102 collision between 2 metro passenger trains, after one struck a landslide and derailed between Plimmerton and Pukerua Bay, North Island Main Trunk, 30 September 2010
- 07-102 (incorporating inquiry 07-111) freight train mainline derailments, various locations on the national network, from 6 March 2007 to 1 October 2009
- 11-101 Wrong line running irregularity, leading to a potential head-on collision, Papakura - Wiri, 14 January 2011
- 08-102 Metro passenger train derailment, Sylvia Park, 14 April 2008 (incorporating inquiries 08-104 and 08-107) Diesel motor fires on board metro passenger trains, 3 June 2008 and 25 July 2008
- 08-111 Express freight Train 524, derailment, near Puketutu, North Island Main Trunk, 3 October 2008
- 08-112 Safe working irregularity resulting in a collision and derailment at Cass Station on the Midland line, 8 November 2008
- 09-102 Passenger fatality after falling between platform and passenger Train 8125, Newmarket West station, 1 July 2009
- 08-109 Passenger express Train 9113, platform overrun resulting in signal passed at danger, Fruitvale Road Station, North Auckland Line, 4 September 2008
- 07-114 Derailment caused by a wheel-bearing failure, Huntly, 19 October 2007, and 11 subsequent wheel-bearing failures at various locations during the following 12 month period

Price \$15.00

ISSN 1178-4164 (Print)
ISSN 1179-9102 (Online)