Inquiry 11-102: Track occupation irregularity
leading to near head-on collision
Staircase-Craigieburn
13 April 2011

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.

Final Report

Rail inquiry 11-102
Track occupation irregularity leading to near head-on collision
Staircase-Craigieburn
13 April 2011

Approved for publication: September 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.

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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.

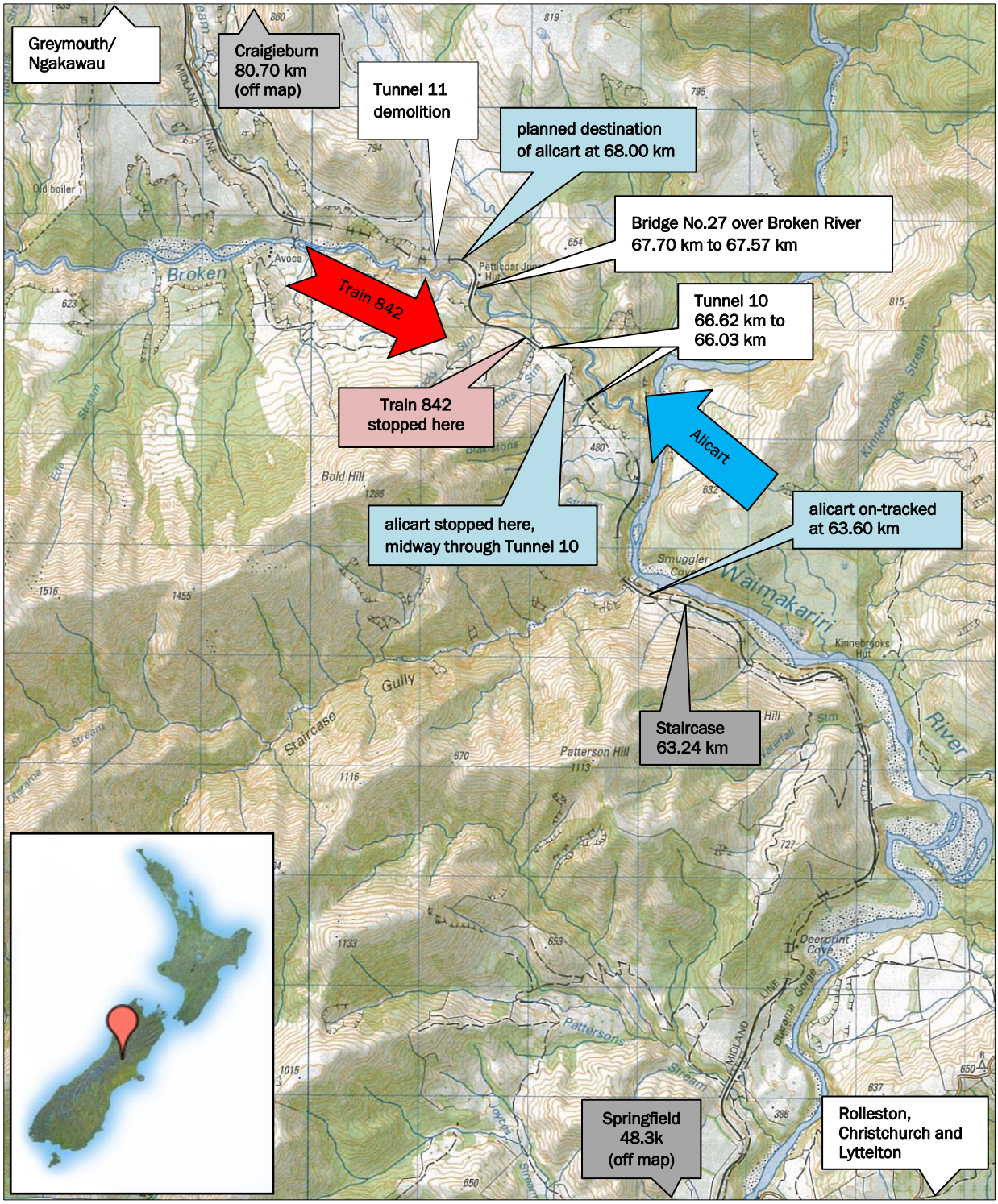
Ownership of report

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.



Source: mapsof.net

Journey of the loaded coal train and alicart

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Abbreviations

Commission	Transport Accident Investigation Commission
km	kilometre(s)

Glossary

alicart	a lightweight, self-propelled, 2-seater rail vehicle designed primarily to transport infrastructure staff to remote locations or to perform detailed engineering inspections 
infrastructure personnel	include track inspectors and maintenance personnel
Manager Network Operations	the most senior person within train control who is responsible for managing and co-ordinating the day-to-day operations of the national train control centre
Network Control Manager	one of 4 network control managers who report to the Manager Network Operations with responsibility for managing train controllers
on-track	the process of placing an alicart on to a rail track
Otira/Rolleston section	the rail line from Otira to Rolleston, which forms part of the Midland Line (effectively half a train control area)
roster co-ordinator	the senior train controller who managed the resourcing of the train control roster for the day of the incident
single-line automatic signalling	as described in section 4.8
structures inspector	overheard the radio conversation between the train controller and the track engineer and realised that the loaded coal train and the alicart were travelling towards each other. He raised the alarm
track engineer	the driver of the alicart
track infrastructure activities	include track inspections, repairs and maintenance
track occupation authorisation	an authority from a train controller for infrastructure personnel to occupy a section of the controlled rail network to carry out routine track inspections and maintenance
train control	the national train control centre located in Wellington
train controller	worked the 0700 to 1200 shift on 13 April 2013, which involved controlling the Otira/Rolleston section and the West Coast area
West Coast area	all rail lines west of Otira, which included those lines from: • Otira to Greymouth • Greymouth to Hokitika • Stillwater to Ngakawau (effectively one train control area on a weekday)

Data summary

Train particulars

Type and number:	loaded coal train (Train 842)
Origin/destination:	Ngakawau-Lyttelton 393.50 kilometres (km)
Train weight:	2223 tonnes including locomotives
Train length:	466 metres including locomotives
Operator:	KiwiRail Limited
Maximum speed:	80 km per hour

Lightweight on-track vehicle

Colloquially known as:	alicart
Weight:	about 25 kilograms
Owner:	KiwiRail Infrastructure and Engineering
Operating speed:	about 25 km per hour

Date and time	13 April 2011 11:55
Location of incident	Tunnel 10 located between 66.03 km and 66.42 km, Staircase-Craigieburn, Otira/Rolleston section
Persons on train	2 (train driver and train driver recruit observing)
Persons on alicart	one
Injuries	nil
Damage	nil

1. Executive summary

1.1. On Wednesday 13 April 2011, a loaded coal train was travelling through the Craigieburn-Staircase area on the Midland Line, en route from Ngakawau to Lyttelton. The coal train was travelling more slowly than usual because of infrastructure worksites in the area and because it had a problem with its dynamic brake operation.

1.2. A KiwiRail track engineer called the train controller and asked for permission to "on-track" his alicart rail vehicle at Staircase and travel towards Craigieburn in order to reach a remote location not accessible by road. The train controller assumed without checking that the coal train had already passed Staircase going in the opposite direction, so she authorised the track occupation.

1.3. The track engineer on-tracked the alicart and proceeded towards the oncoming coal train. A structures inspector working in the area at the time overheard the radio calls and recognised the potential for a near collision. He alerted the coal train driver, who then stopped his train, narrowly averting a head-on collision in a tunnel.

1.4. The near collision occurred because the train controller did not comply with KiwiRail rules and procedures, which required her to check where the loaded coal train was before authorising the track engineer to on-track his alicart. There were also a number of wider systemic issues beyond the train controller's control, which increased the risk of her making the error. These were:

- risk management of changes to train control – the plan to merge 2 train control areas partially into a single desk was not assessed and managed in a way that recognised its higher-than-usual level of risk
- stress and fatigue management in train control – the train controller had been working almost 5 hours without a break on a single desk that covered one and a half geographic areas of train control. The train controller was mentally fatigued and suffering from reduced blood glucose levels due to insufficient food intake at the time she made her error
- supervision of and support for train controllers – the train controller received no support and minimal supervision during her shift, even though she was performing a safety-critical function with a higher-than-usual level of risk
- rest breaks for train controllers during a shift – the train controller did not have a rest or get something to eat during her 5-hour shift due to her high workload
- the effects of planning and co-ordinating track infrastructure activity on train control workload – the train controller had an unrealistic workload for her to achieve a reasonable level of safety while operating the merged desk. The unrealistic workload was in part due to the train controller having to deal with too many ad-hoc requests by maintenance personnel for access to the track during periods of frequent train activity. This was in part caused by inadequate pre-planning of known maintenance activities across the rail network
- train invisibility – train controllers cannot see, at a glance, where all trains and all rail service vehicles are on the rail network at any time, despite the availability of technology to achieve this.

1.5. The Transport Accident Investigation Commission (Commission) made four recommendations to the Chief Executive of KiwiRail and one to the Chief Executive of the NZ Transport Agency to address these safety issues.

1.6. The key lessons from this inquiry were:

- an organisation that performs a safety-critical function must have effective risk management systems in place. The responsibilities of everyone involved in managing and implementing these systems must be clearly defined and well understood

- any changes to a safety-critical function that are likely to increase its risk profile must be properly risk assessed and managed
- persons who perform safety-critical functions must be properly supervised and supported
- an organisation that performs a safety-critical function should foster a workplace culture that encourages its people to ask for help and to support one another
- train controllers must be given adequate breaks during their shifts to eat and rest
- an organisation that performs a safety-critical function should have proper systems in place to detect and manage stress and fatigue in the workplace, including appropriate training and education
- persons who perform safety-critical functions must not be unduly burdened by routine activities or distracted by unplanned activities
- people who contact train control must conduct themselves in a way that does not distract train controllers. Their communication must be clear, concise and professional. They should not say more than is required.

2. Conduct of the inquiry

2.1. The NZ Transport Agency notified the Commission of the incident 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 its circumstances and causes. An investigator in charge was assigned to investigate the incident.

2.2. The next day the investigator in charge travelled to the incident site. In the next several days he interviewed the following KiwiRail personnel:

- the train controller
- the Manager Network Operations
- the Network Control Manager
- the structures inspector who had alerted train control and the driver of the loaded coal train of the pending collision with the alicart
- the persons in charge of 2 worksites between Staircase and Craigieburn
- the track engineer who had been driving the alicart
- the driver of the loaded coal train
- the driver-recruit who was with the driver of the loaded coal train at the time of the incident.

2.3. The Commission then engaged an industrial psychologist[1] to help the Commission to gain a better understanding of train control's organisational health at the time of the incident, from both human factors and organisational psychology perspectives. This industrial psychologist and the Commission's investigator in charge interviewed 2 randomly selected train controllers who had not been involved in the incident (one with 2 years' train control experience and the other with 8 years' experience). They then re-interviewed:

- the Manager Network Operations
- the Network Control Manager
- the train controller who had been involved in the incident.

2.4. The Commission's investigator also obtained a number of records and documents, including:

- the train controller's training records, her medical records (held by KiwiRail and her general medical practitioner), and her work records, including the results of her various performance assessments
- relevant KiwiRail policies and procedures.

2.5. On 12 February 2013 Commissioners finalised a draft final report regarding the incident and approved it for distribution to interested persons for comment. Submissions were received from KiwiRail, the NZ Transport Agency, the train controller and the driver of the loaded coal train. Commissioners considered these submissions at their April and May meetings.

2.6. On 23 May 2013 Commissioners visited train control.

2.7. On 22 and 23 May 2013 Commissioners considered another version of their draft report, and agreed that it should be redistributed to interested persons for further comment. KiwiRail responded with a detailed submission, the train controller provided general comments only and the NZ Transport Agency confirmed that it did not wish to make any comments.

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1 Keith McGregor is the Director of Personnel Psychology NZ Limited. His experience includes 12 years as an occupational psychologist in the Royal New Zealand Air Force and more than 15 years in private practice working with a wide range of private and public sector organisations in New Zealand and Australia.

2.8. On 24 July 2013 Commissioners considered the submissions from KiwiRail and the train controller.

2.9. On 21 August 2013, the Chief Executive of KiwiRail with the General Manager, Infrastructure and Engineering in attendance made further verbal submissions to the Commission. The Commission made changes to the report and sent an updated copy to the Chief Executive of KiwiRail.

2.10. On 4 September 2013, the Chief Executive of KiwiRail submitted a final submission. After making appropriate changes to this report to reflect this submission, the Commissioners approved this report for publication on 26 September 2013.

3. Factual information

3.1. Events before the incident

3.1.1. On 22 March 2011 KiwiRail's Manager Network Operations, who was responsible for managing the day-to-day operations of the national train control centre, asked that special roster arrangements be put in place for the period 8 April 2011 to 14 April 2011. All 11 train controllers on the South Island roster were required to attend a 3-hour training course to prepare for the planned relocation of the Invercargill signal box operation to train control.

3.1.2. On 5 April 2011 the South Island roster co-ordinator (a senior train controller) said in an email to the Manager Network Operations that it was going to be difficult to complete the training requirements because of existing staffing commitments. He suggested that the planned relocation of the Invercargill signal box and the training be deferred for 2 weeks. The Manager Network Operations responded by saying that this could not be done easily without incurring additional costs.

3.1.3. The roster co-ordinator reviewed the roster, and the next day he emailed the Manager Network Operations (and sent a copy to the network control managers and all train controllers) confirming the arrangements for co-ordinating the training programme around train control activities from 8 April 2011 to 14 April 2011. His email did not specifically say "The Otira/Rolleston section and the West Coast area will be merged and controlled by one train controller between 0700 and 1600 on 13 April 2011".

3.1.4. However, the effect of his last email and the roster (which the email said was posted on the roster board) was to merge these 2 areas, thereby creating one and a half train control areas. One train controller, therefore, was to control all trains and authorise all track occupations on all lines west of Rolleston. The first shift on the day of the incident was to run from 0700 to 1200, with the second shift running from 1200 until 1600.

3.1.5. The Manager Network Operations said that he did not realise from reading the email that the Otira/Rolleston section and the West Coast area would be merged on 13 April 2013. However, he also added that even if he had, he had not needed to approve this merger. Instead, he saw this decision resting with the roster co-ordinator, who he said was responsible for organising train controllers' workloads.

3.1.6. On 11 April 2011 the roster co-ordinator verbally told the train controller that she was rostered to work the 0700 to 1200 shift on 13 April 2011. The train controller was aware that this would involve controlling the Otira/Rolleston section and the West Coast area. Although she admitted to feeling anxious about this, she did not tell the Manager Network Operations or the Network Control Manager because she understood the decision to be final. The train controller said that she psyched herself up during the next 2 days to do the shift, anticipating that it was going to be unusually busy.

3.2. Incident on 13 April 2011

3.2.1. The train controller rose at 0445 and had a light breakfast (a banana and yoghurt). This was the last food she consumed until after the incident, some 7 hours later. The train controller left home (from Te Horo) at 0530 and drove to work at Wellington railway station. The train controller started work at 0650. At the end of her shift (at 1200) she was scheduled to attend the training course for relocating the Invercargill signal box operation.

3.2.2. For the most part, the train controller's shift was busy but uneventful. However, the last hour of her shift (which is when the incident occurred) was the busiest, with the train controller having to deal with 61 calls compared with 39 calls in the first hour of her shift, 45 calls in the second hour, 40 calls in the third hour and 39 calls in the fourth hour (see Table 2 in paragraph 4.4.1). At no time during this shift did the train controller take a break or get something to eat, because she felt that she could not leave her room due to her high workload.

3.2.3. At 1014 a KiwiRail track engineer radioed the train controller from Christchurch, informing her of his intention to travel to a remote location between Springfield and Staircase on the Otira/Rolleston section. The train controller replied that a loaded coal train was about to leave Arthurs Pass. The track engineer decided instead to travel by road to Staircase where he would call the train controller for a track occupation authorisation. The train controller acknowledged that decision.

3.2.4. At 1019 the train controller issued the loaded coal train driver with a running authority to travel from Arthurs Pass to Rolleston, crossing an opposing passenger train at Cora Lynn and an opposing empty coal train at Springfield. Seven minutes later the loaded coal train driver informed the train controller that he was experiencing locomotive dynamic-brake problems and requested that locomotive control be informed.

3.2.5. At 1049 the loaded coal train driver informed the train controller of his departure from Cora Lynn after crossing the opposing passenger train.

3.2.6. At 1115 the loaded coal train driver informed the train controller of his progress through Craigieburn. Around this time the train control voice recorder system showed that the train controller was busy but composed while dealing with a large number of tasks.

3.2.7. Between 1119 and 1123 the loaded coal train stopped at a protected worksite at the 78.70 km point. Between 1145 and 1147 the loaded coal train stopped at a second protected worksite at the 70.50 km point.

3.2.8. Meanwhile the train controller was becoming increasingly overwhelmed by her growing workload. Between 1130 and 1150 the train control voice recorder system recorded episodes of the train controller swearing and sobbing (off air). The train controller later said that at about 1153 she became further upset following an unwelcomed comment from a track inspector, who was seeking a track occupation authorisation in another area that was congested with train activity.

3.2.9. Around 1150 the track engineer who had earlier advised the train controller of his intention to travel to a remote location between Springfield and Staircase arrived by motor vehicle at Staircase. He radioed the train controller asking for permission to travel on the track by alicart from Staircase towards Craigieburn. The train controller was now about 5 minutes from the end of her shift.

3.2.10. At 1155 the train controller authorised a 20-minute track occupation for the track engineer. She did this without checking if the loaded coal train had already passed through Staircase, instead assuming that it had. She said that she had made this assumption because:

- moments beforehand, a track maintenance worker had erroneously reported that the loaded coal train had passed his worksite at about 26 km east of Staircase. Although this was another train travelling in the opposite direction from the loaded coal train, and although the train controller had realised this error (and had corrected the maintenance worker), she said that the track maintenance worker's comments remained subconsciously in the forefront of her mind
- she had earlier estimated that the loaded coal train would pass through Staircase before 1155. However, this estimate was incorrect because the loaded coal train was travelling more slowly than expected because of brake problems.

3.2.11. If the train controller had stopped to check the signalling mimic screen, she would have seen that the loaded coal train had not yet passed through Staircase. Furthermore, she should have realised that the driver of the loaded coal train had not yet radioed her confirming that he had passed through Staircase. These calls to train control are compulsory and are a key way of monitoring trains' whereabouts and progress.

3.2.12. The loaded coal train driver did not hear the train controller issuing the track occupation authorisation to the track engineer as he was on another radio channel. Accordingly, he was not aware that his train and the alicart were now heading towards each other on the same track.

3.2.13. After obtaining the track occupation authorisation, the track engineer began travelling towards Craigieburn on his alicart. He began his journey about the same time that the loaded coal train was travelling through a worksite over Broken River (see map on page iv). The distance between the opposing movements was estimated to be about 5 km at that time.

3.2.14. In the meantime, a KiwiRail structures inspector working near Bridge No.27 had his vehicle radio tuned in to train control's radio frequency. This was his normal practice. He overheard the train controller authorising the track engineer's occupation towards a location near where he was working, and he realised that a conflict situation had been created because he did not hear the train controller refer to the loaded coal train.

3.2.15. The structures inspector radioed train control twice to alert the train controller about the conflict, but he did not receive a response. He then selected the radio channel that the loaded coal train was on, called the driver and suggested that the driver stop his train. The driver complied, stopping the loaded coal train at 1202 about 60 metres from the entrance to Tunnel 10 (see Figure 1).

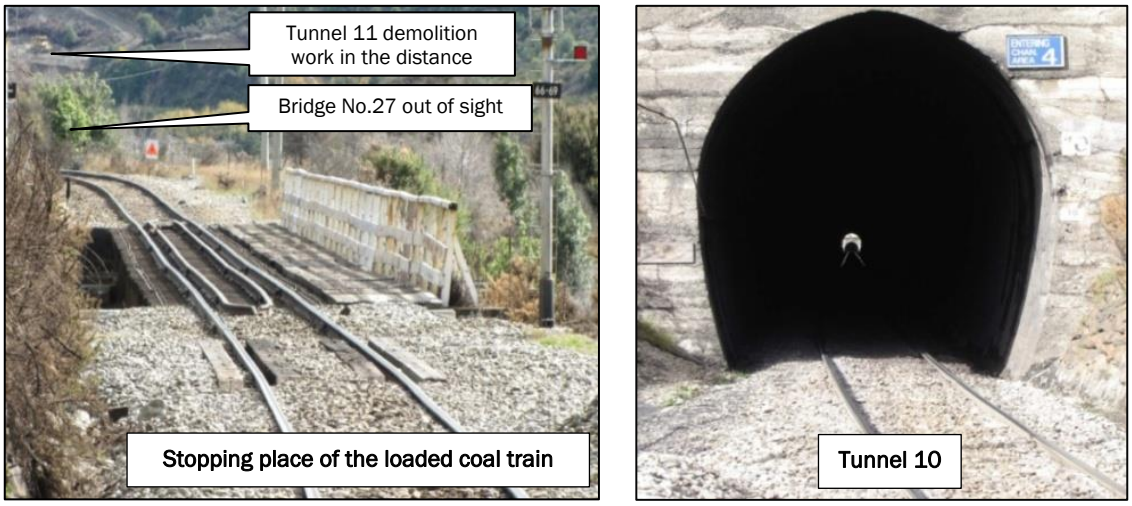

Figure 1
Near-collision site

3.2.16. At this time the track engineer was about midway through the tunnel, but he stopped his alicart after seeing the train's headlights and hearing a long blast on the whistle. Shortly afterwards the track engineer slowly made his way towards the loaded coal train after realising that it was not moving. The track engineer then removed his alicart from the track and discussed the incident with the train driver after exiting the tunnel. They alerted train control to the incident, where a different train controller had taken over the merged desk following a shift change.

3.3. Train control

3.3.1. There are 10 train control areas in New Zealand, including the Otira/Rolleston section and the West Coast area. These areas are largely determined by historical boundaries, which take into account natural geographic characteristics, the locations of major network junctions, the Auckland/Wellington metro operations, and technical constraints within the established train control radio system and network connections.

3.3.2. KiwiRail practice is for one train controller to manage one train control area during the day shift. However, the configuration of these areas may change, and do change, daily to take into account the levels of rail activity on the lines and unexpected events, such as train controller sickness and leave, and seasonal and ad-hoc activities and events. According to KiwiRail, daytime mergers, while not as regular as night-time mergers, were also standard practice.

3.3.3. There is one train control centre based in Wellington, which oversees KiwiRail's entire rail network. It has about 50 personnel, including the Manager Network Operations, 4 network control managers and up to about 35 train controllers.

3.3.4. Train controllers generally work in separate rooms located side by side down a long corridor (see Figures 2 and 3). Each room has a door with a glass window. The wall in each room, which is adjacent to the corridor, has a large window, thereby enabling a person standing in the corridor directly outside a room to see a train controller at their desk. By comparison, train controllers controlling the Auckland metro area work in another room, which is open plan.

Figure 2
Photo of train control offices

3.3.5. The train controller in this case was working in the second-to-last room at the end of the corridor on the day of the incident (see Figure 3). Her door was closed during her shift. The Network Control Manager's office was located at the opposite end of the corridor, away from the train controller.

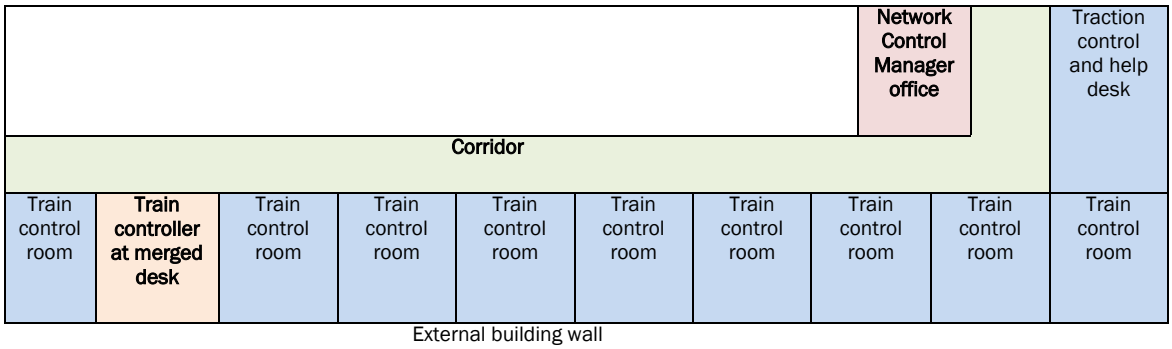

Figure 3
Floor plan for train control (not to scale)

3.4. Personnel information

Train controller

3.4.1. The prescribed duties of a train controller are reproduced in Appendix 1. All train controllers report to network control managers.

3.4.2. The train controller had been employed in 2007 after completing pre-employment tests. She then completed the formal train control training programme and a period of on-the-job training. Her training did not cover stress and fatigue management.

3.4.3. In 2007 and 2008, the train controller became certified to perform train control duties on the main North and the main South lines, and in August 2009 she became certified to perform train control duties for the West Coast area.

3.4.4. KiwiRail's records and the train controller's personal records showed that the train controller had not had any significant or reoccurring performance or behavioural issues. Between 31 August 2009 and 13 April 2011 she received formal letters for technical procedural errors, but otherwise the records from 8 train control desk assessments and voice-recorded activity assessments performed during 2010 showed that the train controller was consistently meeting task requirements.

3.4.5. During the 10-day period leading up to the incident, the train controller worked the following roster (her sleep patterns during the same period are also included):

Table 1: Roster and sleep patterns

Date 2011	Posted roster hours	Total weekly hours	Reported sleep patterns
3 April	1450 to 2300		Slept well
4 April	1450 to 2300		Slept well
5 April	1450 to 2300		Slept well
6 April	1450 to 2300		Slept well
7 April	1450 to 2300		Slept well
8 April	Off		Slept well
9 April	Off	40 hours 50 minutes	Slept well
10 April	Off		Slept well
11 April	0650 to 1500		Slept well over 6/7 hours
12 April	0730 to 1530		Slept well over 5/6 hours
13 April	0650* to 1630		

*Incident occurred at 1155.

3.4.6. There was nothing of concern with the train controller's roster or her sleep patterns before the day of the incident.

Train controller's health status

3.4.7. The train controller said that she had a long-term medical condition with both feet, for which she took pain relief from time to time, e.g. Panadeine (an over-the-counter pain-relief drug). About 20 years earlier, a growth known as a neuroma[2] had been surgically removed from the ball of one foot. Another neuroma had been subsequently removed from the ball of her other foot about 15 years later.

[2] A neuroma is a growth or tumour of nerve tissue. It can be either benign or malignant.

3.4.8. KiwiRail submitted that it had not been aware of this medical condition until after the incident, when it received the results of the train controller's post-incident drug test. On the day of the incident, the train controller had twice taken Panadeine to alleviate discomfort in her foot. Her post-incident drug test therefore revealed a positive result for codeine, an ingredient of Panadeine. However, the train controller's general practitioner advised that the dosage of Panadeine taken by the train controller on the morning of the incident would not have affected her performance. The Commission's medical advisor[3] agreed.

3.4.9. KiwiRail also submitted that the train controller's foot condition could have contributed to her fatigue and/or distracted her around the time she made her error. However, the train controller strongly refuted this. She said:

> Management has stated that they knew nothing about my sore feet and as to which I would like to reiterate that it had absolutely nothing to do with the incident. I have lived with sore feet for more than 20 years, coached gymnastics full time for most of these, played softball and lived a normal life except that if I was a bit sore I would take a pain reliever to help. Even now, I go on a hike with my neighbour 3-4 times a week for an hour and a half at a time. It has never stopped me from doing anything.

Manager Network Operations

3.4.10. The Manager Network Operations was a former train controller with extensive operations experience. He was the most senior person at train control, with responsibility for managing and co-ordinating the day-to-day train operations on the controlled network. His position description required him to perform the following responsibilities:

- ensure train control staff were appropriately trained and competent to perform their duties
- identify risks with train control function and mitigation strategies
- overview train control's safety performance.

Network Control Manager

3.4.11. The Network Control Manager was the train controller's immediate manager. He had a signaller background and lengthy operations experience. Although he had completed the requirements for train control, he had never practised as a train controller. He was the most senior Network Control Manager in train control, having worked in this role for about 10 years.

3.4.12. His position description required him to perform the following responsibilities:

- supervise train controllers
- mentor and support staff to ensure safety compliance and quality performance
- notify rail operators of variances affecting their respective operations
- ensure that maintenance activity was planned to balance track quality and safety, and to meet rail operators' commercial objectives.

Driver of loaded coal train and structures inspector

3.4.13. The driver of the loaded coal train and the structures inspector both held current certifications for their positions.

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[3] Dr Rob Griffiths is the Director of the Occupational and Aviation Medicine Unit at the University of Otago, Wellington. His qualifications include MBChB (Hons), (Bristol, 1978), FAFPHM (RACP, Sydney, 1985), FFOM (RCP, London 1986), MACOEM (ACOEM, USA, 2009), MPP (VUW, 1994), DipAvMed (Univ London, 1983).

4. Analysis

4.1. Introduction

4.1.1. The Commission finds that the near-collision incident occurred because the train controller did not check the location of the coal train and mistakenly authorised the track engineer to on-track his alicart and travel towards it on the same section of track. This was contrary to standard protocol, which required train controllers to check all train movements before granting track occupation authorisations[4]. But for the train controller's action, the 2 rail vehicles would not have been put into conflict.

4.1.2. However, the train controller's error was not hers alone. Rather, a number of wider systemic factors beyond the train controller's control created an environment that increased the likelihood of her making this error, namely:

- a planned change to the train controller's workload was not assessed and managed in a way that recognised its higher-than-usual level of risk
- the train control's workplace culture at the time of the incident did not encourage train controllers to ask for help
- the train controller, who was performing a safety-critical function with a higher-than-usual level of risk, was able to become highly stressed and mentally fatigued during her shift without anyone being aware of, or anticipating, this
- minimal training and education about detecting and managing stress and fatigue was provided to the train controller (and other train controllers) before the incident, even though she was performing a safety-critical function. Further, poor systems existed within train control at the time of the incident to detect and manage stress and fatigue in the workplace
- the train controller received no support and minimal supervision during her shift even though she was performing a safety-critical function with a higher-than-usual level of risk
- train control protocols required train controllers to work their shifts without scheduled breaks
- poor planning and co-ordination of track infrastructure activity unnecessarily exacerbated the complexity of the train controller's work on the day of the incident. Train controllers were responsible for co-ordinating and managing high volumes of routine and unplanned track infrastructure activities. This increased the complexity of their role. In these situations, mistakes could occur
- a significant portion of the controlled rail network, and therefore a large number of trains and other rail vehicles, were not electronically visible to train control at any given time.

4.1.3. Each of these factors was a safety issue – a condition within train control that had the potential to create an unacceptable outcome, such as personal harm or loss and/or property and environment damage. All of these safety issues, collectively contributed to the train controller making the error.

4 Rule 915(e) of KiwiRail Rules and Operating Procedures – Track Occupancy Protection Rule.

4.2. Risk management approach to assessing and managing a safety-critical function

Safety issue: A planned change to the train controller's workload was not assessed and managed in a way that recognised its higher-than-usual level of risk.

4.2.1. The primary role of all train control personnel (particularly train controllers) is to prevent collisions, organise and expedite the safe movement of rail traffic, and provide information and other support to all rail track users. They perform a safety-critical function similar to air traffic controllers; that is, a function on which people depend for their wellbeing. Accordingly, if a train controller were to make a mistake, it could result in loss of life and/or significant damage to property and/or the environment.

4.2.2. If the normal procedure is to have one train controller working one area, any change to this arrangement (no matter how small) may create additional risks that KiwiRail must properly assess and manage.

4.2.3. In this case, the merged desk arrangement caused a higher-than-usual level of risk for train control because it required one train controller to manage one and a half train control areas during a weekday (i.e. when rail traffic was typically busy). This larger area included the Otira/Rolleston section (which formed part of the Midland Line). The Otira/Rolleston section typically had a high level of rail activity and it used a single-line automatic signalling system, which required train controllers to issue running authorities and to record manually the locations of trains with the aid of compulsory radio calls from drivers confirming their locations. This system relied heavily on train controllers' memories and a high degree of situational awareness (see paragraph 4.8 for more details).

4.2.4. Train control management should have managed the risk of the train controller making an error by:

- conducting a proper risk assessment of the merged desk arrangement. This should have involved their identifying and analysing the risks associated with this arrangement, then putting in place appropriate strategies to eliminate, minimise and/or manage these risks
- properly assessing whether the train controller was the right person, with the right skills and expertise, to carry out this activity
- regularly monitoring the effectiveness of their risk management strategies and the train controller's performance.

4.2.5. However, evidence reviewed by the Commission indicated that no-one within train control conducted a thorough analysis of the risks associated with merging the Otira/Rolleston section and the West Coast area during the day, including the potential impacts of this arrangement on the train controller's workload. Furthermore, no appropriate arrangements were put in place to manage these risks or to ensure that the train controller was coping with her increased responsibilities.

4.2.6. KiwiRail submitted that it did not consider a desk merger to be a significant change that warranted a specific risk assessment, but rather it was "standard practice". KiwiRail said:

> … the daytime merger of desks, while not as regular as it is at night, is not "unusual" at all as it is standard practice to accommodate events and other rostering requirements by combining desks and accepting that prioritisation by the train controller will limit their responsiveness to lower priority requests.

4.2.7. KiwiRail also said:

> … KiwiRail does not agree that there was "a lack of proper risk management approach" as the matter referred to was the decision to merge desks, which was made in accordance with a standard practice, which had not generated any lead indicators of concern…
>
> … The [Commission's] inference that a thorough risk analysis for the merging of the desks is required appears excessive…
>
> … we submit that the merging of an area was not considered a "significant change" to warrant specific risk assessment…

4.2.8. The Commission does not accept this view. A merged desk arrangement might be standard practice for periods of low workload (for example, at night for the Otira/Rolleston section). However, the usual arrangement during the day was to have one train controller manage one train control area. This was because of the heavy workload that train controllers were expected to manage on those sections during the day. Accordingly, train control management should only have merged these areas during the day after considering the increased risks for this safety-critical operation, and then only after putting in place appropriate measures to mitigate or control those risks. At the very least, the Network Control Manager (as the train controller's direct manager) should have:

- checked the train controller regularly
- stayed with the train controller long enough to get a good idea of her workload and her ability to cope with her additional responsibilities
- taken the lead and directly asked the train controller how she was coping rather than passively stood back waiting for the train controller to say something
- ensured that the train controller was able to, and did, take short breaks, i.e. at least long enough for her to stretch, get a drink and something to eat, and go to the toilet.

4.2.9. The Commission saw no evidence that the Network Control Manager had done any of these things. He was the most senior person within train control, and was therefore responsible for ensuring that the train control function was properly managed. This should have included ensuring that an appropriate risk management approach was applied whenever significant changes occurred to the train control function, and when such changes were likely to affect its risk profile, such as when a train control area was to be merged with another. If this responsibility had been delegated, the delegation should have been properly documented, with people's roles and responsibilities clearly defined, and the appropriate processes put in place to provide him with assurance that this delegation was being properly performed.

4.2.10. The Manager Network Operations said that he had not needed to approve the merger as he saw this decision resting with the roster co-ordinator, who he said was responsible for organising train controllers' workloads. However, the Manager Network Operations' position description expressly required him to identify risks within train control and appropriate mitigation strategies, and to maintain an overview of train control's safety performance. No documents were made available to the Commission showing that this responsibility had been delegated to the roster co-ordinator or to anyone else.

4.2.11. Indeed, KiwiRail confirmed that no position description existed for the roster co-ordinator at the time of the incident. Rather, the co-ordination of fortnightly rosters within many parts of KiwiRail (not just train control) was performed by nominated members of particular teams rather than a dedicated person. Medium- and short-term changes to the train controller rosters, for example, were undertaken by 3 senior train controllers at the time of the incident. KiwiRail said that this arrangement has since changed with the establishment of a new roster co-ordinator function. KiwiRail said that this role is now performed by a dedicated person rather than shared among senior train controllers, and that this safety action was taken partly in response to this incident.

4.2.12. KiwiRail also said that it was difficult for the roster co-ordinator to predict the train controller's workload on the day, largely because of the levels of unplanned track infrastructure activity that might arise. There was no evidence that the likely impacts of the merger on the train controller's workload had been properly assessed by management.

4.2.13. KiwiRail also said that the Manager Network Operations and the Network Control Manager had not been aware of the planned merger until the day of the incident and, therefore, they had been unable to judge the potential effects of this merger on the train controller's workload. However, the roster co-ordinator had emailed the Manager Network Operations (and sent a copy to the network control managers and train controllers) 6 days before the incident (i.e. on 6 April 2011), confirming the arrangements for co-ordinating the special training around train control activities for the period from 8 April to 14 April. Although the email did not specifically say, "The West Coast area and the Otira/Rolleston section will be merged on 13 April 2011", the arrangements explained in the email were in effect a merger of the 2 areas.

4.2.14. In its draft final report the Commission acknowledged that the Manager Network Operations and the Network Control Manager may not have realised from reading this email or the roster that the 2 train control desks would be merged. This prompted the Commission to ask the following questions, to which KiwiRail replied, as follows:

- were they [the Manager Network Operations and the Network Control Manager] concerned about the merger when they did learn about it on the day of the incident? [*KiwiRail reply: As previously discussed, they would not have been*]
- were they concerned that they had only just become aware of it on the day of the incident? [*KiwiRail reply: No*]
- did they make enquiries to find out why they did not learn about it until the day of the incident? [*KiwiRail reply: No as it was a regular procedure*]
- did they make enquiries to assess the level of risk associated with the merger upon becoming aware of it? [*KiwiRail reply*: *No, as per above*.]

4.2.15. KiwiRail's answers were consistent with its view that a merged desk arrangement was not a significant change but rather standard practice. However, this view overlooked one fundamental point; namely that train control is a safety-critical function. In this case, the additional risks should have been considered.

Findings

1. Train control is a safety-critical function on which people depend for their wellbeing. A mistake by a train controller could result in loss of life and/or significant damage to property and/or the environment.

2. Merging the Otira/Rolleston section and the West Coast area created a higher-than-usual level of risk for train control because it resulted in 2 normally busy lines having to be managed by one train controller.

3. KiwiRail did not properly assess the implications of merging the Otira/Rolleston section and the West Coast area during the daytime. Accordingly, it did not recognise the need for appropriate arrangements to be put in place to manage the risks associated with this merged desk arrangement.

4. A merged desk arrangement during daytime was a change to the normal roster that should have been assessed. Appropriate measures should also have been put in place to mitigate or control the risks arising from this change.

4.3. Organisational culture

Safety issue: Train control's workplace culture at the time of the incident did not encourage train controllers to ask for help.

4.3.1. The job description for network control managers contained little reference to supporting and mentoring train controllers, and none of the train control personnel interviewed said that they had received meaningful training or mentoring in how to manage workplace stress, nutrition and fatigue.

4.3.2. Comments from the train controller and other train control personnel questioned by the Commission, as well as from various organisation documents, suggested that a workplace culture existed within train control at the time of the incident that seemed to value those who operated independently and required minimal supervision and/or intervention. These comments also indicated an unspoken understanding among train control staff that train controllers were expected to sort out their own problems.

4.3.3. To some extent, this was reinforced by the Network Control Manager, who said that he could not recall a time when a train controller had asked for help or had asked to be relieved from their duties because of a high workload. It was also reinforced by the train controller, who said that she had received unhelpful responses in the past when seeking support from some network control managers. She believed that she was expected to get on with her job and just cope, no matter what. To a large extent, this explains why the train controller did not feel comfortable asking for help on the day of the incident.

4.3.4. Other indicators of the organisational culture within train control at the time of the incident can be seen from the following discussion about stress and mental fatigue, supervision and support and rest breaks.

4.4. Stress and mental fatigue

Safety issue: The train controller, who was performing a safety-critical function with a higher-than-usual level of risk, was able to become highly stressed and mentally fatigued during her shift without anyone being aware of, or anticipating, this.

4.4.1. The train controller's workload during her shift can be seen from data recorded on the train control voice recorder system (see Table 2). This data shows the number and types of radio calls to which the train controller responded (hour by hour) during her 5-hour shift. The 2 rows of sub-totals (in red) show the number of calls to which 2 train controllers would have responded if the Otira/Rolleston section and the West Coast area had **not** been merged.

Table 2: Calls handled by the train controller during her shift

Otira/Rolleston section	0700 to 0800	0800 to 0900	0900 to 1000	1000 to 1100	1100 to 1200		**5-hour total**
Operating instructions issued	0	2	0	1	1		4
Train authorities/progress	4	3	4	3	14		28
Track occupation authorisations	9	8	7	7	3		34
Subtotal#	**13**	**13**	**11**	**11**	**18**		**66**
West Coast area							
Operating instructions issued	2	2	0	0	2		6
Track warrants issued	6	3	6	6	9		30
Train authorities/progress	13	14	13	19	18		77
Track occupation authorisations	5	13	10	3	14		45
Sub total	**26**	**32**	**29**	**28**	**43**		**158**
Total calls per hour	**39**	**45**	**40**	**39**	**61**		**224**

#Note: Data for the Lyttelton-Studholme section is excluded from the Otira/Rolleston section because the merged desk arrangement did not include this section.

4.4.2. Table 2 shows that the train controller was consistently busy during her 5-hour shift. During her first 4 hours she received, on average, about 40 calls per hour as opposed to the about 30 calls per hour she would have received if she had been working on the West Coast area alone. However, during her fifth and last hour (i.e. 1100 to 1200) the number of calls increased to 61. It was during this time that the incident occurred (5 minutes before the end of her shift).

4.4.3. It was apparent from the train control voice recorder system that the train controller was stressed and distressed during the last hour of her shift. For example, between 1130 and 1150, the recording system recorded episodes of the train controller swearing and sobbing (off air). She could also be heard repeatedly sighing, and in one case she seemed to be begging for the work to "just stop".

4.4.4. At this time, the train controller was dealing with:

- a greater number of calls than she had been dealing with during each of the previous 4 hours of her shift
- a greater number of calls than she, and other train controllers, ordinarily had to deal with.

4.4.5. Other things were also happening to the train controller at this time, which may have exacerbated her stress and fatigue levels and affected her ability to remain composed and fully alert:

- it is likely that the train controller's glucose (energy) levels were significantly low immediately before, and at the time that, she made her error. During her 5-hour shift the train controller felt she was unable to leave her desk to get something to eat or drink, or to go to the toilet. By the time of the incident she had not eaten anything for about 7 hours (her most recent meal was a light breakfast at 0445). The train controller admitted to being hungry towards the end of her shift but said that the demands of working the merged desk meant that she could not leave her room. KiwiRail submitted that the train controller could have taken informal breaks in accordance with "normal practice", noting in particular that "… [train control] has a practice of regular informal breaks and interactions, including food breaks for which a kitchenette facility is provided". However, the fact that scheduled breaks were not included in train controllers' rosters meant that the train controller in this case could only take them as and when opportunities arose. No such opportunities arose during her 5-hour shift because of her high workload
- it is likely that the train controller was mentally fatigued immediately before, and at the time that, she made her error. By then the train controller had worked 5 hours without a break or food. During this time she had been managing a higher workload than usual, which had required her full concentration at all times, with the need to make split-second decisions, often while under pressure
- it is possible that the train controller was momentarily distracted by another incident at about 1153 (2 minutes before the incident). This other incident involved a track inspector repeatedly insisting on accessing a section of track that was congested with train activity. The train controller admitted to being unsettled by a comment from this track inspector (see the following section on planning and co-ordinating track infrastructure activity).

4.4.6. Despite the train controller's growing stress and fatigue during the last hour of her shift, no-one within train control seemed to be aware of this. Apart from 2 fleeting visits by the Network Control Manager at about 0800 and 0900, no-one else checked or monitored the train controller during her shift.

4.4.7. The Commission finds it alarming that a person performing a safety-critical function with a higher-than-usual level of risk was able to become highly stressed and mentally fatigued without anyone being aware of, or anticipating, this.

Training and education

Safety issue: Minimal training and education about detecting and managing stress and fatigue was provided to the train controller (and other train controllers) before the incident, even though she was performing a safety-critical function. Further, poor systems existed within train control at the time of the incident to detect and manage stress and fatigue in the workplace.

4.4.8. Train control personnel questioned by the Commission said that they had received little training and education to help them manage stress and fatigue effectively, or to help them identify others who might be experiencing these things. Although there appeared to be a strong focus on procedural accuracy within train control, and an active assessment programme to monitor train controllers' technical performance, there was little evidence of an equal emphasis on train controllers' physical and emotional wellbeing.

4.4.9. This is surprising given the mentally challenging nature of train control and the pressure that comes with performing a safety-critical function. Train controllers are expected to make numerous split-second decisions on a daily basis, and to get these decisions right at all times. A momentary lapse of concentration could result in loss of life. For most people, this type of responsibility would be hugely stressful.

4.4.10. It is difficult to say with certainty if and to what extent the train controller would have better managed her stress at the time of the incident if she had received proper training and education in these areas beforehand. The effects of stress and pressure on individuals and their performance vary widely depending on factors such as age, work experience, personality traits, physical and mental health and attitude. However, proper training and education about stress and fatigue for people performing safety-critical functions should be mandatory, and train control should have appropriate systems and protocols in place to monitor and manage train controllers' stress and fatigue levels.

Safety actions

4.4.11. On 22 March 2013 KiwiRail informed the Commission of 2 safety actions that it had implemented:

- an alertness management training programme for train controllers before starting on-the-job training, with "refresher training" provided biennially after that
- compulsory medical assessments for train controllers, including mental and physical checks.

4.4.12. On 2 July 2013 KiwiRail informed the Commission of a new managerial role (the train control manager), which had been created in July 2011 partly in response to the Commission's inquiry into this incident. The Commission understands that this new role is specifically responsible for developing:

- a staff support programme, which covers stress, fatigue management and staff wellbeing
- train controllers' supervisory competencies.

4.4.13. These steps are positive; however, it is still unclear to the Commission if appropriate systems have been established to detect and manage stress within train control. If not, these are gaps that should be addressed.

Findings

5. During the train controller's last hour of her shift she dealt with a greater number of calls than she had dealt with during each of the previous 4 hours of her shift, and she dealt with a greater number of calls than she, and other train controllers, ordinarily had to deal with.

6. The train controller was stressed, mentally fatigued and operating well below an optimal level when she made her error.

7. No-one within train control was aware of the train controller's growing stress and mental fatigue, even though she was performing a safety-critical function with a higher-than-usual level of risk.

8. Proper training about managing stress and fatigue was not available to train control personnel before or at the time of the incident.

9. No proper systems existed at the time of the incident to detect and manage stress and fatigue in the workplace.

10. KiwiRail has implemented a number of safety actions addressing some aspects of the safety issues relevant to poor stress and fatigue management.

4.5. Supervision and support

Safety issue: The train controller received insufficient support and supervision during her shift even though she was performing a safety-critical function with a higher-than-usual level of risk.

4.5.1. Despite the high demands of working a merged desk and the higher-than-usual level of risk associated with this arrangement, the train controller received insufficient support and supervision during her 5-hour shift.

4.5.2. The physical layout of train control meant that her manager, the Network Control Manager, could not see or hear the train controller from his desk. Accordingly, in order to monitor her, he needed to walk to the train controller's room at the end of a corridor. Further, in order to get an accurate idea of the level of activity with which the train controller was dealing at any particular time, the Network Control Manager needed to go into her room and view the train controller's computer screens and train control diagram, and listen to her radio calls. This could not be done from his desk or from anywhere else within train control (see the layout of train control in Figures 2 and 3, particularly the location of the Network Control Manager's desk in relation to the train controller's room).

4.5.3. The Network Control Manager said that his usual approach for supervising train controllers was to peer into each train controller's cubicle to get an idea of the level of activity that each person was managing and to ensure that trains were running smoothly and without incident. He said that sometimes his visits would be fleeting to avoid distracting the train controllers, whereas at other times he would spend longer with each train controller. In many cases, he said, his approach at the time would depend on what was happening with each train controller and his own work priorities.

4.5.4. The Network Control Manager said that on the day of the incident he put his head into the train controller's cubicle at about 0800 and 0900. Both visits were fleeting. The train control voice recorder system showed that the train controller was busy but composed at these times. Accordingly, there was nothing for the Network Control Manager to be concerned about at these times, in terms of both the train controller's performance and the level of activity with which she was dealing. The Network Control Manager did not check the train controller again during her shift.

4.5.5. The Network Control Manager said that during his 10 years in the role he had never closed a train control desk or arranged relief for a train controller. He also said that if he saw a train controller struggling with high work demands, his usual approach would be to suggest that they take a break. If this had occurred in this case, then at the very least the train controller would have had time to rest and get something to eat and drink. However, neither opportunity was available to her because the Network Control Manager largely left the train controller alone during her shift. Accordingly, he remained unaware of the train controller's needs and her increasingly stressed state during the last hour of her shift.

4.5.6. The Network Control Manager also said that he expected train controllers to tell him if there was a problem, and to ask for help. The Manager Network Operations also said this, saying that if the train controller had had concerns about her workload she should have said so either before or during her shift. The train controller, however, said that she did not feel comfortable doing this, partly because she believed that the roster was final and, therefore, not subject to discussion, and partly because she thought that her concerns might not be acted on. Accordingly, she remained silent.

4.5.7. The Commission accepts that people must take responsibility for their own wellbeing and that they cannot abdicate this responsibility entirely to their managers. Accordingly, the train controller could have told the Network Control Manager that she was anxious about her shift as soon as she became aware of it, and she could have asked for help during her shift when her workload was high. In both cases, however, she chose not to (at least deliberately in the first case and more likely without thinking in the second case because she was too busy).

4.5.8. However, an employer has a responsibility to foster a workplace culture that enables its employees to feel comfortable about speaking up and asking for help without fear of ridicule or reprimand, particularly if that employer is in the business of performing a safety-critical function. Comments from the train controller and other train control personnel whom the Commission questioned suggested that there may have been an unspoken understanding within train control at the time of the incident that train control personnel were expected to get on with their jobs and sort out their own problems.

Findings

11. The train controller received no support and minimal supervision during her 5-hour shift, despite the high demands of working a merged desk and the higher-than-usual level of risk associated with this arrangement.

12. The lack of proper supervision meant that no-one within train control was aware of the train controller's workload and her increasingly stressed state in the last hour of her shift.

4.6. Rest breaks

Safety issue: Train control protocols required train controllers to work their shifts without any certainty of reasonable breaks.

4.6.1. Previous discussions in this report have talked about how the train controller's high workload meant that she was unable to have a break, get something to eat and drink and go to the toilet during her 5-hour shift. This discussion needs to be placed in context.

4.6.2. KiwiRail told the Commission that a standard train controller shift was 8 hours Monday to Friday, although in this case the train controller was required to work a 5-hour shift so that she could attend a training session at the end of her shift. Some weekend shifts were rostered for 12 hours. KiwiRail also told the Commission that standard protocol within train control was 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. In particular KiwiRail said:

> Train control required train controllers to work their shift without scheduled breaks: but has a practice of regular informal breaks and interactions including food breaks for which a kitchenette is provided.

4.6.3. This meant that meal, toilet and rest breaks were to be taken as and when opportunities arose, essentially during quiet periods. In many cases then, train controllers would eat at their desks and have rest and toilet breaks as and when their workloads allowed them to.

4.6.4. KiwiRail also told the Commission that train controllers preferred this approach, which had been confirmed through their collective employment bargaining negotiations. Indeed, at least 2 train controllers with whom the Commission spoke said that they did not mind working their shifts without scheduled breaks. In addition, the Commission made enquiries of the Accident Investigation Board in Norway and Australian Rail Track Corporation Limited[5]. Both organisations confirmed a similar arrangement where train controller shifts were 8 hours, without scheduled breaks.

4.6.5. Notwithstanding this, there are obvious risks with people who perform safety-critical functions working long hours without any certainly of reasonable 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 or that employees and their union may like what is being done is not a good reason for continuing an arrangement involving a safety-critical function that may give rise to significant risks, particularly if these risks are not properly identified and managed. There is a wealth of cases in which long and irregular working hours have contributed to people making errors and that have been associated with a range of physical and mental health and injury risks (International Labour Organisation, 2011). Five hours (and certainly 8 or 12 hours) without any certainty of a reasonable break is a long time to expect a person to remain fully alert and in peak mental form.

4.6.6. Further, KiwiRail's policy that rest breaks should be taken as and when opportunities arise fails to take account of the "overworked or extremely busy train controller"; that is, the train controller whose workload is so high that they are unable to leave their desk. This was the case here. The fact that the train controller could not leave her room to get something to eat and drink or to go to the toilet during her 5-hour shift because of her workload was unacceptable. Not only was this unsafe for the train controller because of the potential effects on her mental and physical wellbeing, it was also potentially unsafe for those relying on her to perform her safety-critical function without error.

4.6.7. As a rough comparison, the Commission asked Airways New Zealand to confirm the breaks provided to air traffic controllers. Air traffic controllers with radar duties had breaks every 2 hours, air traffic control planners every 2.5 hours and international air traffic controllers every 3 hours. The general rationale for these breaks was largely to minimise the effects of fatigue (e.g. mental fatigue and eye fatigue for those looking at radar screens for long periods of time).

4.6.8. The Commission does not accept that KiwiRail's approach to rest breaks, where its train controllers work 8- or 12-hour shifts without certainty of reasonable breaks, is safe – certainly not without proper processes in place to manage and mitigate properly the risks of this approach, such as fatigue and stress. This is a significant safety issue that must be properly assessed and managed.

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5 Australian Rail Track Corporation Limited is responsible for the management of more than 8500 route kilometres 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.

Findings

13. Train control protocols required train controllers to work their shifts without scheduled breaks. Meal, toilet and rest breaks were to be taken as and when workloads permitted.

14. The train controller believed that she could not leave her room during her 5-hour shift because of her high workload. Accordingly, she did not have a rest, get something to eat or drink or go to the toilet during her shift. Not only was this unsafe for the train controller because of the potential effects on her mental and physical wellbeing, it was also unsafe for those relying on her judgement.

15. KiwiRail's approach to rest breaks, where its train controllers work 8-hour shifts without any certainty of breaks, is not safe – certainly not without proper processes in place to manage and mitigate properly the risks of this approach such as fatigue and stress. This is a significant safety issue that must be properly assessed and managed.

4.7. Planning and co-ordination of track infrastructure activity

Safety issues: Poor planning and co-ordination of track infrastructure activities unnecessarily exacerbated the complexity of the train controller's work on the day of the incident. Train controllers are responsible for co-ordinating and managing high volumes of routine and unplanned track infrastructure activities. This increases the complexity of their role. In these situations, mistakes can occur.

4.7.1. Train control personnel questioned by the Commission said that about 50% to 80% of their calls on a typical weekday could involve routine repair, maintenance and inspection activities. Most of these, they said, could also be unplanned; that is, infrastructure personnel calling train control "out of the blue" asking to occupy sections of rail track at any given time. Often, they said, track staff could be insistent, thereby putting pressure on train controllers to issue them with track occupation authorisations.

4.7.2. On the day of the incident the train control voice recording showed that the train controller handled 79 calls from infrastructure personnel requesting track occupations for routine track maintenance and inspection tasks in the Otira/Rolleston section and the West Coast area. None of these requests had been pre-planned with train control except for the trip involving the track engineer. In addition, the train controller handled 6 calls from the West Coast area for routine on-track maintenance and inspection activities. That made 85 calls for routine work (out of a total of 224 calls), which were for unplanned work.

4.7.3. Rather than declining those calls, thereby taking some pressure off herself, the train controller dealt with all of them as and when they came in. This was standard practice within train control. The train controller believed that this was expected of her and other train controllers.

4.7.4. By extrapolating the figure of 85 calls (taking into account a shortened 5-hour shift instead of the usual 8-hour shift), the Commission roughly estimates that in excess of 500 calls for routine and unplanned track occupations could be made across all 10 train control desks on any given weekday. If even remotely accurate, this number is significant.

4.7.5. KiwiRail submitted that train controllers could decline track occupation authorisations during busy work periods. However, it was unclear to the Commission how a train controller was expected to exercise this authority. Train controllers are not fully trained in scheduling and prioritising infrastructure repairs and maintenance. They are not privy to decisions and information about which repair and maintenance tasks are high priorities and which are not. Accordingly, even though they may have the authority to decline track occupations, train controllers are unlikely to know if their decisions will affect the safety and efficiency of the railway infrastructure that is to be inspected, repaired and maintained.

4.7.6. KiwiRail also submitted that a core requirement of any train controller was to prioritise their workload issues irrespective of whether desks were merged or not. KiwiRail said:

> In all railways, and most infrastructures for that matter, the management of the interface between infrastructure maintenance and real time operations is an inherent function that requires command and control. It is not valid to conclude that this 'places unreasonable pressure' on the controller.

4.7.7. The Commission accepts that a core function of train control is to manage the interface between infrastructure maintenance and real-time train operations. It also accepts that every person, no matter what organisation they are with and no matter what role they perform, must prioritise their work demands. However, KiwiRail's comments miss a fundamental point – that train controllers perform the safety-critical role of managing the safe movement of rail traffic across the entire national rail network. It is concerning then that they are also expected to co-ordinate and manage a high volume of routine and unplanned track infrastructure activities on an ad-hoc basis. The more of this work that is pre-planned by KiwiRail's Infrastructure and Engineering team, the easier it will be for the train controllers to manage the interface between infrastructure maintenance and real-time operations.

4.7.8. In terms of this incident, the train controller's workload on the day of the incident would have been less demanding if:

- proper processes had been in place at the time of the incident to better co-ordinate and manage track infrastructure activity to ensure, for example, that the train controller only received track occupation requests for priority, planned tasks only
- the train controller had known that she had the ability to decline track occupation requests for routine maintenance tasks.

4.7.9. Whether or not this would have been enough to prevent the train controller making the error is unknown; however, at the very least it would have decreased the likelihood of her doing so.

4.7.10. Finally, the train controller referred to a sarcastic comment made by a track inspector shortly before the incident, which unsettled her. Given the critical and complex role that train controllers perform, it is important that people who contact train control conduct themselves in a way that does not distract train controllers. KiwiRail has operating protocols for communications to train control and standard radio phraseology[6], which require communications to be clear, concise and focused. Casual conversation, superfluous information and unnecessary comments are not permitted. It is important that KiwiRail has proper protocols in place to monitor people's compliance with these protocols.

Safety actions

4.7.11. During the course of this inquiry KiwiRail created a new position within its infrastructure and engineering division with responsibility for developing and implementing a system to integrate track occupations better with the running of trains. This is a positive step, particularly if the new system is operational and track infrastructure activity is better co-ordinated and managed. The Commission would welcome comment from KiwiRail on the status and effectiveness of this safety action, particularly in terms of whether or not it has reduced, or is reducing, the number of calls to train controllers for unpredicted track occupation authorisations.

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

4.7.12. On 22 March 2013 KiwiRail informed the Commission that it was in the early stages of moving the fortnightly co-ordination of train control rosters to a single non-train-controller co-ordinator. This person will use a dedicated computerised application that will provide improved monitoring and reporting of all roster arrangements. This safety action is also positive, provided that this person's role and responsibilities are well defined, and proper processes are in place to require them (or whomever the appropriate person is) to assess properly (from a risk management perspective) the impacts of any changes on train controllers' workload and on train control generally.

4.7.13. On 27 March 2013 KiwiRail informed the Commission about Train Control Instruction A028 (dated 11 October 2012) entitled Train Controller Workload Management. This instruction confirmed (among other things) that train controllers could decline requests, prioritise calls and not respond to low-priority calls or tasks if they were dealing with higher-than-usual workloads. This safety action is promising; however, Instruction A028 does not make it clear how train controllers are expected to know which routine track infrastructure activities to prioritise or decline without proper guidelines and scheduling plans available to them. For example, given that train controllers are not fully trained in scheduling or in infrastructure repair and maintenance, and given that they are not privy to decisions and information about which activities are high priority or not, how are they expected to prioritise routine maintenance or inspections properly under Instruction A028?

4.7.14. On 2 July 2013 KiwiRail informed the Commission of a national business improvement project that it had initiated in 2010 to move the prioritisation, planning and scheduling of infrastructure activity to an electronic system called an IBM Maximo platform. KiwiRail confirmed that the roll-out of this system had begun in June 2013 following a series of pilots, which showed that unplanned track infrastructure activities could be reduced to less than half their former levels.

4.7.15. KiwiRail also noted the introduction of a series of measures to improve safety and productivity by reducing the amount of work undertaken where trains and track infrastructure activities occur. The first trials of these measures were commenced on the East Coast Main Trunk during early 2013, with a further trial on the Midland and Stillwater/Ngakawau Lines during July 2013.

Findings

16. The train controller had to deal with a high volume of routine and unplanned track infrastructure activities during her shift. The poor planning and co-ordination of these activities unnecessarily exacerbated the complexity of her work.

17. Train controllers, generally, have to deal with a high volume of routine and unplanned track infrastructure activities in addition to managing the flow of rail traffic. This increases the complexity of their role by requiring them to manage and co-ordinate large volumes of unknown and unplanned work. In these circumstances, mistakes can occur.

18. KiwiRail has implemented a number of safety actions to address the risks associated with train controllers co-ordinating and managing the interface between infrastructure activities and rail movements.

4.8. Knowing where rail vehicles are on the rail network

Safety issue: A large number of rail movements and track activities are not electronically visible to train control at any given time.

4.8.1. In New Zealand, about 40% of the controlled network is configured with one of 4 types of automatic signalling system. Trains operating within automatic signalling systems are for the most part displayed on train controllers' mimic screens. The other 60% of the controlled network is track warrant control territory, colloquially referred to as "dark territory". Trains operating in track warrant control territory are not electronically visible to train controllers. Other rail vehicles such as hi-rail vehicles are not electronically visible to train controllers anywhere on the controlled network.

4.8.2. The Midland Line, which includes the Otira/Rolleston section, is also the only line in New Zealand that operates single-line automatic signalling, one of the 4 types of automatic signalling. Along this line are 15 crossing stations. As a train passes through 4 of these stations, signals are triggered and relayed back to train control. These signals appear on a mimic screen that the train controller can see, thereby telling the train controller which crossing stations the train has passed. Apart from when a train passes one of these 4 stations, the train is not electronically visible to train control.

4.8.3. Accordingly, a train controller will only know the approximate location of a train on the Midland Line by relying on: their paper-based train control diagram; the issue of running authorities; and compulsory radio calls from train drivers. This system relies heavily on train controllers having a high degree of situational awareness and excellent memories. It also relies on train controllers accurately recording trains' progress on train control diagrams, and on train drivers and other track users complying with the terms of their running authorities and track occupations.

4.8.4. 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. 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 system technology. A project to provide visibility for hi-rail vehicles through the same system is nearing completion.

4.8.5. If the train controller in this case had had access to the GeVIS system and could have seen, at a glance, all train movements along the Otira/Rolleston section in real time, **and** if she had glanced at the screen before issuing the track occupation authorisation to the track engineer, she would have seen that the loaded coal train had not yet passed Staircase.

Findings

19. Single-line automatic signalling, by itself, did not directly contribute to the incident. Rather, it was more a factor that increased the complexity of the train controller's job on the day of the incident. Given this, the signalling system should have been properly examined as part of a wider risk assessment of the merger.

20. 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 train control at all times. That way, they could see at a glance all rail vehicle movements on a particular track at any given time. Since this incident, KiwiRail has introduced a system that makes all trains on 95% of its controlled network electronically visible to train controllers.

5. Findings

Risk management approach to assessing and managing a safety-critical function

5.1. Train control is a safety-critical function on which people depend for their wellbeing. A mistake by a train controller could result in loss of life and/or significant damage to property and/or the environment.

5.2. Merging the Otira/Rolleston section and the West Coast area created a higher-than-usual level of risk for train control because it resulted in 2 normally busy lines having to be managed by one train controller.

5.3. KiwiRail did not properly assess the implications of merging the Otira/Rolleston section and the West Coast area during the daytime. Accordingly, it did not recognise the need for appropriate arrangements to be put in place to manage the risks associated with this merged desk arrangement.

5.4. A merged desk arrangement during daytime was a change to the normal roster that should have been assessed. Appropriate measures should also have been put in place to mitigate or control the risks arising from this change.

Stress and mental fatigue

5.5. During the train controller's last hour of her shift she dealt with a greater number of calls than she had dealt with during each of the previous 4 hours of her shift, and she dealt with a greater number of calls than she, and other train controllers, ordinarily had to deal with.

5.6. The train controller was stressed, mentally fatigued and operating well below an optimal level when she made her error.

5.7. No-one within train control was aware of the train controller's growing stress and mental fatigue, even though she was performing a safety-critical function with a higher-than-usual level of risk.

5.8. Proper training about managing stress and fatigue was not available to train control personnel before or at the time of the incident.

5.9. No proper systems existed at the time of the incident to detect and manage stress and fatigue in the workplace.

5.10. KiwiRail has implemented a number of safety actions addressing some aspects of the safety issues relevant to poor stress and fatigue management.

Supervision and support

5.11. The train controller received no support and minimal supervision during her 5-hour shift, despite the high demands of working a merged desk and the higher-than-usual level of risk associated with this arrangement.

5.12. The lack of proper supervision meant that no-one within train control was aware of the train controller's workload and her increasingly stressed state in the last hour of her shift.

Rest breaks

5.13. Train control protocols required train controllers to work their shifts without scheduled breaks. Meal, toilet and rest breaks were to be taken as and when workloads permitted.

5.14. The train controller believed that she could not leave her room during her 5-hour shift because of her high workload. Accordingly, she did not have a rest, get something to eat or drink or go to the toilet during her shift. Not only was this unsafe for the train controller because of the potential effects on her mental and physical wellbeing, it was also unsafe for those relying on her judgement.

5.15. KiwiRail's approach to rest breaks, where its train controllers work 8-hour shifts without any certainty of breaks, is not safe – certainly not without proper processes in place to manage and mitigate properly the risks of this approach such as fatigue and stress. This is a significant safety issue that must be properly assessed and managed.

Planning and co-ordination of track infrastructure activity

5.16. The train controller had to deal with a high volume of routine and unplanned track infrastructure activities during her shift. The poor planning and co-ordination of these activities unnecessarily exacerbated the complexity of her work.

5.17. Train controllers, generally, have to deal with a high volume of routine and unplanned track infrastructure activities in addition to managing the flow of rail traffic. This increases the complexity of their role by requiring them to manage and co-ordinate large volumes of unknown and unplanned work. In these circumstances, mistakes can occur.

5.18. KiwiRail has implemented a number of safety actions to address the risks associated with train controllers co-ordinating and managing the interface between infrastructure activities and rail movements.

Knowing where rail vehicles are on the rail network

5.19. Single-line automatic signalling, by itself, did not directly contribute to the incident. Rather, it was more a factor that increased the complexity of the train controller's job on the day of the incident. Given this, the signalling system should have been properly examined as part of a wider risk assessment of the merger.

5.20. 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 train control at all times. That way, they could see at a glance all rail vehicle movements on a particular track at any given time. Since this incident, KiwiRail has introduced a system that makes all trains on 95% of its controlled network electronically visible to train controllers.

6. Key lessons

6.1. An organisation that performs a safety-critical function must have effective risk management systems in place. The responsibilities of everyone involved in managing and implementing these systems must be clearly defined and well understood.

6.2. Any changes to a safety-critical function that are likely to increase its risk profile must be properly risk assessed and managed.

6.3. Persons who perform safety-critical functions must be properly supervised and supported.

6.4. An organisation that performs a safety-critical function should foster a workplace culture that encourages its people to ask for help and to support one another.

6.5. Train controllers must be given adequate breaks during their shifts to eat and rest.

6.6. An organisation that performs a safety-critical function should have proper systems in place to detect and manage stress and fatigue in the workplace, including appropriate training and education.

6.7. Persons who perform safety-critical functions must not be unduly burdened by routine activities or distracted by unplanned activities.

6.8. People who contact train control must conduct themselves in a way that does not distract train controllers. Their communication must be clear, concise and professional. They should not say more than is required.

7. Safety actions

7.1. General

7.1.1. The incident occurred more than 2 years ago. Since then KiwiRail has implemented a number of safety actions to address some of the safety issues (or parts of the safety issues) identified in this report. These are listed below.

7.1.2. 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.

7.2. Safety actions addressing safety issues identified during an inquiry

7.2.1. On 13 April 2011 KiwiRail issued a Safety Briefing to train control personnel about track occupancy accuracy (see Appendix 2). This Briefing provided guidelines to help train controllers ensure that track occupation authorisations were accurate and clear.

7.2.2. On 18 June 2012 KiwiRail informed the Commission that the train control radio computer system had been upgraded with an option for train controllers to use a keyboard-initiated "push to talk" function in addition to the standard foot pedal option.

7.2.3. On 22 March 2013 KiwiRail informed the Commission that train controllers were being provided with alertness management training before starting on-the-job training, and biennially after that. It had also introduced compulsory medical assessments for all train controllers on 1 April 2012, including mental and physical checks.

7.2.4. On 22 March 2013 KiwiRail informed the Commission that it was in the early stages of moving the fortnightly co-ordination of train control rosters to a single non-train-controller co-ordinator. This person will use a dedicated computerised application that will provide improved monitoring and reporting of all roster arrangements.

7.2.5. On 22 March 2013 KiwiRail informed the Commission that it had issued Train Control Instruction A028 (dated 11 October 2012) concerning train control workload management. This instruction confirmed (among other things) that train controllers could decline requests, prioritise calls and not respond to low-priority calls or tasks if they were dealing with higher-than-usual workloads (see Appendix 3).

7.2.6. On 2 July 2013 KiwiRail informed the Commission of 2 new roles within train control that had been established, in part, because of this incident, i.e. the train control manager and the roster co-ordinator.

7.2.7. On 4 September 2013 KiwiRail informed the Commission that all trains are now electronically visible to train controllers through a system called 'GeVIS'. A project to provide visibility for hi-rail vehicles through the same system is nearing completion.

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 four recommendations to the Chief Executive of KiwiRail. KiwiRail is the appropriate organisation to address the safety issues addressed 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.

8.2. Recommendation 1

8.2.1. A standard arrangement where one train controller manages one train control area has a high risk profile simply because of the nature of the role (i.e. it is a safety-critical function). A change to this standard arrangement (no matter how small) will, in many cases, present new and at times additional risks, which must be properly assessed and managed.

8.2.2. On the day of the incident, a change to the standard train control arrangement saw a train controller controlling one and a half train control areas (i.e. the Otira/Rolleston section and the West Coast area). This arrangement had a higher-than-usual level of risk because it affected a busy rail line that operated a single-line automatic signalling system. The arrangement was also to apply on a weekday when rail activity was normally busy.

8.2.3. Evidence reviewed by the Commission indicated that train control management did not properly assess the implications of merging the Otira/Rolleston section and the West Coast area. Accordingly, it did not recognise the need for appropriate arrangements to be put in place to manage the risks associated with this arrangement.

8.2.4. As a result, a train controller was largely left alone for 5 hours to control this merged area with minimal supervision and support. Evidence shows that towards the end of her shift the train controller was stressed and mentally fatigued. No-one within train control was aware of this or the train controller's high workload. It was during this period that the train controller made an error, which resulted in the incident.

The Commission recommends that the Chief Executive of KiwiRail ensure that train control management has:

- *appropriate risk management protocols in place to assess and manage all risks associated with the train control function (including risks associated with merging train control desks), and that all relevant train control personnel are aware of these protocols and comply with them*
- *appropriate procedures in place to provide him and the Board of KiwiRail with assurance that train control is exercising an appropriate risk management approach to its operations. (013/13)*

8.3. Recommendation 2

8.3.1. Evidence reviewed by the Commission showed that at the time of the incident:

- train control's workplace culture seemed to value those who operated independently and with minimal supervision
- minimal training and education about detecting and managing stress and fatigue had been provided to train controllers, notwithstanding the safety-critical function that they were performing
- poor systems existed within train control to detect and manage stress and fatigue in the workplace
- the standard protocol within train control was to not provide train controllers with any certainty of reasonable breaks during their shifts.

8.3.2. KiwiRail has implemented safety actions to ensure that train controllers receive alertness management training and medical assessments. However, the Commission is not convinced that these safety actions fully address the safety issues that it has identified regarding workplace culture, training and education.

The Commission recommends that the Chief Executive of KiwiRail ensure that train control management has appropriate arrangements 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*
- *provide train controllers with certainty of reasonable breaks during their shifts. (014/13)*

8.4. Recommendation 3

8.4.1. Evidence reviewed by the Commission showed that train controllers often had to deal with a high volume of routine and unplanned track infrastructure activities (e.g. track inspections and maintenance) in addition to managing the movement of rail traffic. This could increase the complexity of their role by requiring them to manage and co-ordinate large volumes of unknown and unpredicted work. In these circumstances, mistakes could occur.

8.4.2. People who perform safety-critical functions should not be unduly distracted or burdened by routine and unplanned track infrastructure activities.

8.4.3. KiwiRail has implemented safety actions to try to better co-ordinate routine and unplanned infrastructure activities with the movement of rail traffic. However, the Commission is not convinced that these fully address the safety issue that it has identified relating to routine and unplanned track infrastructure activities.

The Commission recommends that the Chief Executive of KiwiRail ensure that appropriate protocols and/or arrangements are in place, and are being applied, to manage and co-ordinate routine and unplanned track infrastructure activities properly, so that train controllers are able to perform their safety-critical function without becoming unduly distracted or burdened. (015/13)

8.5. Recommendation 4

8.5.1. At the time of this incident, trains were electronically visible to train controllers on only 40% of the New Zealand controlled rail network. Other rail vehicles, such as hi-rail vehicles, were not electronically visible on any of the controlled rail network. This made 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 could do was to determine the most likely locations using a range of mechanisms, including a train control diagram, mimic screens, information from the electronic train register, compulsory radio calls and the "read back" of communications. For the most part, these mechanisms worked well.

8.5.2. However, rail vehicles not being electronically visible will always present a challenge to train controllers, who must interpret, analyse and understand information. This makes their jobs complex and demanding. High reliance on human input means that there will always be a risk of human error.

8.5.3. Since this incident, global positioning system technology has become available that will enable train controllers to see train movements across 95% of the controlled network in real time with a reasonable level of accuracy. KiwiRail intends to extend this technology to other rail vehicles as well.

8.5.4. If the train controller in this case had had access to this technology and could have seen, at a glance, all train movements along the Otira/Rolleston section in real time, and if she had glanced at the screen before issuing the track occupation authorisation to the track engineer, she would have seen that the loaded coal train had not yet passed Staircase.

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. (016/13)

8.5.5. On 14 October 2013, KiwiRail responded:

> Recommendations 013/13, 014/13, 015/13 and 016/13 made to the Chief Executive of KiwiRail are accepted. Recommendation 017/13 directed to the Chief Executive of the NZ Transport Agency is noted. KiwiRail will begin discussions with the NZ Transport Agency on the strategies to implement these recommendations upon release of this report. Details on these strategies along with projected timeframes for implementation will be advised to the Commission.

8.6. Recommendation 5

8.6.1. The Commission has made 4 recommendations to the Chief Executive of KiwiRail, that he ensure that:

- appropriate risk management protocols are in place to assess and manage risks associated with train control, and to ensure that these protocols are followed
- appropriate arrangements are in place to detect and manage stress, to remind train controllers about the importance of eating properly and regularly during their shifts, and to provide train controllers with proper and regular rest breaks during their shifts
- appropriate protocols are in place and are being applied to manage and co-ordinate routine and unplanned track infrastructure activities properly
- appropriate steps are being taken to ensure that rail vehicles on the controlled rail network are electronically visible to train control.

8.6.2. It is important that KiwiRail address these recommendations, which are 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 recommendations. (017/13)

8.6.3. On 11 October 2013, the NZ Transport Agency responded:

> Recommendations 013/13, 014/13, 015/13 and 016/13 that the Commission have directed to KiwiRail are noted. Recommendation 017/13 made to the Chief Executive of the NZ Transport Agency is accepted. Discussion on it will be initiated on the publication of the final report. These discussions will include a projected timeframe for implementation. This will be advised to TAIC in due course.

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3.0 Duties of Train Controllers

Instructions for the movement of trains under the Train Control system are set out in Rule 90.

Train Controller's must have a good knowledge of the various operating instructions (Rail Operating Rules and Regulations, Rail Operating Procedures, Controlled Network Instructions, Rail Operating Code, etc including station accommodation), and have had a run through their area (preferably in the cab of a locomotive) in order to familiarise themselves with local conditions. Knowledge of outside conditions is important to a Train Controller when called upon to deal with unusual matters, as situations can be better visualised when described by other Rail Personnel or Train Crews.

Train Controllers need to become familiar with access agreements, priority guidelines and the timetable of the day including the function, priority and connections of trains. Train Controllers need to make decisions to alter the work of trains in response to late running or missed connections to minimise customer delays and make the best utilisation of horsepower and the fleet.

On starting duty, each Train Controller must read and understand all Bulletins, instructions and information relevant to the shift. An acknowledgement that this has been done is to be indicated by signing on duty by endorsing the Train Controllers signature and duty times on the diagram.

Train Controllers undertake the following duties:

- Direct the movement of all trains, re-arranging crossings when necessary, and records such movements on the diagram.
- Liaise when necessary with Operators concerning train, crewing and locomotive requirements.
- Advise adjacent Train Control *areas* how connecting services are running and supplies particulars of the locomotive, crew, tonnage and *train* length. Obtains similar information in respect of inward trains affecting their own desk.
- Maintains contact with Roving Shunters regarding shunting of trains *and ensures enroute shunts are carried out.*
- Ensures that arrangements agreed with Operators Customer Service Centres are carried out.
- Keeps a check on Locomotive Engineer's hours to see that they are kept within the prescribed limits, also consults with Operators for prior permission concerning any variations proposed to crew runs and for any variation proposed to locomotive runs.
- Makes suitable arrangements in connection with all train failures, train mishaps, signal/communications failures, or other emergency situations that may arise. *Initiates and manages a response to recover any situation in the most expedient manner possible.*
- Reports *all* incidents/irregularities that occur on shift in the *incident reporting* system and keeps the NCM *promptly* informed *of all significant outages and all incidents / irregularities that must be notified to internal management and /or external agencies.*
- Plots appropriate Bulletins and details of extra and cancelled trains on diagrams.
- Issues and updates operating bulletins, the bulletins in effect summary and updates temporary speed restriction information.
- Authorises maintenance *access* on the day including the movement of on track equipment and the issue of Mis 60 Track and Time permits.
- Contacts the Police *or other emergency services/agencies* when requested by Locomotive Engineers *and other personnel.*
- *Contacts the Fire Service for any report of potential or actual leak/spill or damage to Hazardous goods.*
- Maintains train performance information *by entering times and delay reasons into reporting systems.*

3.3 Standard of Work

Systematic checks of various aspects of Train Control duties will be carried out *by the NCM* to monitor the standard of work being achieved.

Appendix 2: KiwiRail safety briefing; track occupancy accuracy

Track Occupancy Accuracy

In the last two months, we have experienced five track occupancy incidents where field personnel have been authorised to work and a train/other occupancy has been in potential conflict with the authorised area. While each incident has had its own unique sequence and contributing factors, I'd like to pass on some common key points about track occupancy process and risks. Please understand and act on these messages with the safety intent that is at their heart.

1) The highest track occupancy risk you have is verifying that a train has gone past a users location. If this is missed, the user will normally not know any different. Your diagram checks and then verification with the train is critical. (The new Track Safety rules are adding a new requirement for train control to always state the last train clear as a defence/prompt against such risk. They commence in the Northern Region next month).

2) Safely executing track occupancy relies heavily on clear and accurate communication.

3) Communication is weakened by assumption and the mind then hearing what you expect to hear not what is actually said.

4) The defence against assumption and mis-hearing is having rigid and consistent process that offers opportunity for parties to challenge & correct error.

5) The best protection for you and the users is to state what you understand and are authorising … for example:
   - "I understand that train 123 has going past on the up main …"
   - "I have verified train 456 is past you and you are following 456 …"
   - "I understand you are aware of HRV123 at ## …"
   - "I have a route set for train 789 to enter and blocking is therefore applied to …"

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.

Appendix 3: KiwiRail instruction: train controller workload management

KiwiRail

Train Control Instruction A028

TRAIN CONTROLLER WORKLOAD MANAGEMENT

11 October 2012

Train Control shifts are assigned spans of control (territory) that normally afford capacity to deal with unplanned and/or unpredictable events. Spans of control are set by subjective assessment based on timetable, safe working systems, call levels, controller experience and consultation.

Unpredictable and irregular occasions arise within a control area and circumstances will culminate (through break downs, unplanned work, faults, extra trains, combination of areas etc) to cause Train Controller workload to exceed a normal Controllers capacity to transact all requests and business. In such situations:

- Train Controllers are empowered to decline requests and prioritise calls and not respond to low priority calls or tasks.
- Train Controllers should apply the following general priorities when deciding what to deal with:
  - Priority 1 - Respond to emergency and safety situations: Telephone Emergency Calls, Radio Alarms, Faults affecting safety, Speed Restrictions etc,
  - Priority 2 - Apply safety processes: Read-out/Read-back of authorities and authorisations, application of protection etc,
  - Priority 3 - Movement of Premier and Passenger trains or initiation of Major Block of Line
  - Priority 4 - Movement of other trains
  - Priority 5 - Planned track maintenance using major plant/activity/resource
  - Priority 6 - Routine maintenance or inspections
- Train Controllers need to advise the Network Control Manager who has a duty to then provide support by:
  - Advising Area Managers and field personnel that delays and cancellations are necessary, and/or
  - Taking steps to cancel appropriate lower priority field activity, and/or
  - Determine if control areas can be changed/split to balance workload, and/or
  - Call in additonal staff to assist

Manager Network Operations

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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
09-103	Passenger Train 1608, collision with slip and derailment, Tunnel 1, Wairarapa Line, Maymorn, 23 July 2009 (incorporating investigation 08-106, collision with slip and derailment on the Johnsonville Line)
09-101	(Incorporating 08-105): express freight train derailments owing to the failure of bogie side frames, various locations on the North Island Main Trunk, between 21 June 2008 and 7 May 2009

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