Final report RO-2014-104: Express freight train striking hi-rail excavator within a protected work area, Raurimu Spiral, North Island Main Trunk line, 17 June 2014

Final Report

Rail inquiry RO-2014-104
Express freight train striking hi-rail excavator within a protected work area, Raurimu Spiral, North Island Main Trunk line, 17 June 2014

Approved for publication: November 2016

Transport Accident Investigation Commission

About the Transport Accident Investigation Commission

The Transport Accident Investigation Commission (Commission) is a standing commission of inquiry and 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 and the public, 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 1982 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.

Verbal probability expressions

The expressions listed in the following table are used in this report to describe the degree of probability (or likelihood) that an event happened or a condition existed in support of a hypothesis.

Terminology (adopted from the Intergovernmental Panel on Climate Change)	Likelihood of the occurrence/outcome	Equivalent terms
Virtually certain	> 99% probability of occurrence	Almost certain
Very likely	> 90% probability	Highly likely, very probable
Likely	> 66% probability	Probable
About as likely as not	33% to 66% probability	More or less likely
Unlikely	< 33% probability	Improbable
Very unlikely	< 10% probability	Highly unlikely
Exceptionally unlikely	< 1% probability	

Source: mapsof.net

Location of accident

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Figures

Abbreviations

Commission	Transport Accident Investigation Commission
TPA	Track Protection Advanced
VHF	very high frequency

Glossary

electrical observer	the issuer of a permit to work near railway power lines
hi-rail vehicle	a road vehicle fitted with retractable hi-rail wheels such that it can be driven along a track and can be on/off tracked at suitable locations
information bulletin	an unnumbered instruction that includes details of activities such as planned track work and changes to train services
rail protection officer	the generic name given to a person protecting individuals or multiple worksites and responsible for co-ordinating the movement of trains and hi-rail vehicles through a protected work area. In this case the rail protection officer was a KiwiRail employee

Data summary

Vehicle particulars

Train type and number:	express freight Train 390, travelling from Palmerston North to Tauranga, consisting of two electric-powered locomotives hauling 21 wagons
Train length:	370 metres (including the locomotives)
Train weight:	915 tonnes (not including the locomotives)
Train operator:	KiwiRail
Hi-rail vehicle operator:	Downer New Zealand Limited (Downer)

Date and time	17 June 2014 at 0910[1]
Location	between National Park and Raurimu
Injuries	the excavator driver was critically injured
Damage	extensive damage to the hi-rail excavator minor damage to the locomotive

[1] Times in this report are New Zealand Standard Times (Co-ordinated Universal Time + 12 hours) and are expressed in the 24-hour mode.

1. Executive summary

1.1. On 17 June 2014 a track maintenance work area had been established between National Park and Raurimu on the North Island Main Trunk line. Part of the work involved the use of an excavator designed to operate on the rails.

1.2. Prior to the work group starting work, two trains were scheduled to pass through the area. The first train passed through without incident. The rail protection officer who was in charge of site safety and protection authorised the second train to pass through the area. Meanwhile, unbeknown to the rail protection officer, the excavator driver had driven his excavator onto the track to start work.

1.3. The train passed the main work group and rounded a curve in the track. The train driver saw the excavator on the track ahead and applied emergency braking, but was unable to stop his train colliding with the excavator.

1.4. The excavator was significantly damaged in the collision and the driver was critically injured.

1.5. The Transport Accident Investigation Commission (Commission) found that the train was authorised to travel through the work area, but the excavator was not authorised to occupy the track.

1.6. The excavator driver, working under KiwiRail supervision, likely thought he was authorised to occupy the track because he had misinterpreted a 'thumbs up' signal to mean that work was about to begin, and because he had not been fully briefed on the work plan for the day.

1.7. The Commission also found that non-compliance with KiwiRail standard operating procedures for the planning, the establishment and the running of the protected work area was a factor that contributed to the accident.

1.8. The key lessons identified from the inquiry into this occurrence are:

- workers with safety-critical roles can be placed in unsafe situations when standard operating procedures are not followed
- seatbelts are known to prevent injuries in vehicle accidents and should always be worn where fitted.

2. Conduct of the inquiry

2.1. The accident occurred between National Park and Raurimu at about 0910 on Tuesday 17 June 2014. The NZ Transport Agency notified the Transport Accident Investigation Commission (Commission) soon after the accident occurred. The Commission opened an inquiry under section 13(1)b of the Transport Accident Investigation Commission Act 1990 to determine the circumstances and causes of the occurrence and appointed an investigator in charge. The accident site was immediately 'frozen' until Commission investigators completed the site examination.

2.2. Commission investigators arrived at the accident site later that day. They inspected the hi-rail excavator, the train and the boards protecting the planned work area.

2.3. The following day the Commission investigators conducted individual interviews with KiwiRail's work group that had been on site at the time of the accident.

2.4. Owing to his injuries the driver of the hi-rail excavator was not able to be interviewed.

2.5. The Commission obtained the following records and documents for analysis:

- the application for planned work
- witness statements
- downloaded data from the train's event recorder
- the signals data log
- the train controller's voice recording
- training records for all personnel working at the accident site
- drug and alcohol test results for all KiwiRail personnel carrying out the planned work
- the emergency service's incident log.

2.6. The hi-rail excavator was transported to the Commission's secure wreckage facility in Wellington for a detailed examination. On 27 June 2014 WorkSafe New Zealand, supervised by Commission staff, carried out an inspection of the excavator.

2.7. On 4 July 2014 the radio communication equipment was removed from the hi-rail excavator and taken to the manufacturer's laboratory in Wellington for testing.

2.8. On 27 July 2016 the Commission approved the draft report for distribution to interested persons for comment.

3. Factual information

3.1 Background information

3.1.1. KiwiRail owns and maintains the rail track throughout most of the New Zealand rail network. KiwiRail Network Authorities prepare and issue daily information bulletins that include planned track maintenance carried out under KiwiRail Track Safety Rules.

3.1.2. A KiwiRail track field engineer submitted an 'Application for Planned Work' to KiwiRail Network Authorities on 13 June 2014 for approval (see Appendix 1).

3.1.3. The application was for a worksite to be established between National Park and Raurimu from 0730 to 1630 daily, from 16 June to 20 June 2014 inclusive. It was intended that planned track maintenance work would be carried out using KiwiRail Track Safety Rule 905, Compulsory Stop Protection.

3.1.4. The application was approved by Network Authorities and details of the planned work were shown on the information bulletin[2] for the central North Island area (see Appendix 2). The bulletin showed that compulsory stop boards protecting the work area would be erected at 348.60 kilometres[3] National Park, and 358.00 kilometres Raurimu.

3.1.5. The compulsory stop protection system controls the entry of trains and hi-rail vehicles[4] to a planned work area using a series of warning boards (see Appendix 3 for details). All trains and hi-rail vehicles must stop at the compulsory stop board and the drivers must contact the rail protection officer for authorisation to proceed.

3.1.6. A rail protection officer is a person who is responsible for protecting one or multiple worksites depending on the level of competency held. That person has overall responsibility for providing rail protection for the work area by co-ordinating the movement of trains and rail vehicles within and through the work area, and for communicating with train control.

3.1.7. Southbound trains[5] could enter the protected work area from either the main line or the crossing loop at Raurimu. Entry was controlled by a compulsory stop board placed beside two signals (signals 4LA and 4LB). These signals were set by the train controller at red (Stop) for the duration of the planned work.

3.1.8. Before authorising a driver to proceed, a rail protection officer must have confirmation that all personnel and machines are clear of the track. Conditional authority can then be given to the driver to pass the stop board once train control has cleared the signal. The rail protection officer then contacts the train controller and asks for the controlling signal to be set to 'proceed'[6]. The train can then enter the work area.

3.2. The accident

3.2.1. Work at the site began on Monday 16 June 2014. A Palmerston North-based KiwiRail track production work group (the work group) was being supported by the local KiwiRail Ohakune track maintenance team. and a contractor who provided a hi-rail excavator with a driver.

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[2] An information bulletin is an instruction issued by KiwiRail's Network Authorities Wellington, usually the day before it comes into effect. The information bulletin is distributed to all operating staff who may be affected, including drivers and track maintenance staff.
[3] The location is referenced as the distance from Wellington Station platform.
[4] A hi-rail vehicle is a road vehicle fitted with retractable hi-rail wheels such that it can be driven along a track and can be on/off tracked at suitable locations.
[5] Southbound trains are trains travelling towards Wellington.
[6] A proceed indication is a signal showing a clear or caution indication for normal, intermediate, medium or low speed.

3.2.2. The excavator was a Hitachi Zaxis 70 and was fitted with a retractable hi-rail attachment that enabled it to travel on and operate from a railway track. The excavator was fitted with a multi-channel Tait TM8200 radio that had a KiwiRail-allocated radio call sign, 60264.

3.2.3. The team leader was from the Palmerston North work group and the rail protection officer was from the Ohakune work group.

3.2.4. The planned re-rail work was on a 400-metre-long, 165-metre-radius curve that had a posted curve speed of 45 kilometres per hour.

3.2.5. Trains operating on the single-line track between National Park and Raurimu were signalled from the national train control centre in Wellington under centralised traffic control regulations.

3.2.6. The section of track was part of the electrified main trunk line. An electrical safety observer (electrical observer) issued a 'Permit to Work Near Railway Power Lines' (the permit) to the hi-rail excavator driver at 1200. The excavator driver signed the permit to confirm receipt and that he understood the conditions under which it was issued. The first day's maintenance passed without incident.

3.2.7. The team leader was notified very late on 16 June that the Ohakune-based work group would not be on site the next day due to training commitments at Wanganui. The information was not shared with his work group that day. The next morning a member of the Palmerston North work group volunteered to carry out rail protection duties. The work group departed from the Ohakune depot at about 0630.

3.2.8. The rail protection officer was due to pass through the worksite in a hi-rail vehicle in order to place the compulsory stop boards and various other warning boards at each end of the worksite for that day. At about 0650 the team leader met the excavator driver at National Park and suggested that he on-track the excavator behind the rail protection officer's hi-rail vehicle and follow him to the worksite.

3.2.9. At about 0700 the electrical observer and the excavator driver discussed the day's work plan. The electrical observer issued the driver with a new permit. Unlike the previous day the planned work would be carried out with the electrical overhead traction equipment 'live'. The excavator driver signed the permit confirming that he understood that the excavator was not to be operated within two metres of the overhead equipment and that the electrical observer was required to be present whenever the excavator was working (see Appendix 4).

3.2.10. At 0737 the rail protection officer radioed train control and requested a track occupation for his hi-rail vehicle to travel from National Park to Raurimu so that he could erect the various boards (see Figure 1). The train controller set the control signals at National Park and Raurimu at 'Stop', and authorised the track occupation.

3.2.11. At 0738 the rail protection officer completed a 'Track Occupation Cross Check' form (see Appendix 5). He was authorised to occupy the track section until 0810 when a southbound freight train was expected to approach from the direction of Raurimu.

3.2.12. The rail protection officer erected the warning boards at the south (National Park) end of the protected work area then drove along the track north towards Raurimu. He stopped where the excavator had been parked overnight and gave the excavator driver verbal permission to on-track his excavator and follow him to the worksite. The electrical observer drove along the KiwiRail access road to the worksite.

3.2.13. At 0753 the rail protection officer radioed train control and arranged a five-minute extension to his track occupation. He stopped briefly at the worksite and told one of the work group to *"Stay off the track as I may not get all the boards up in time and there are two trains coming".* The rail protection officer then continued towards Raurimu.

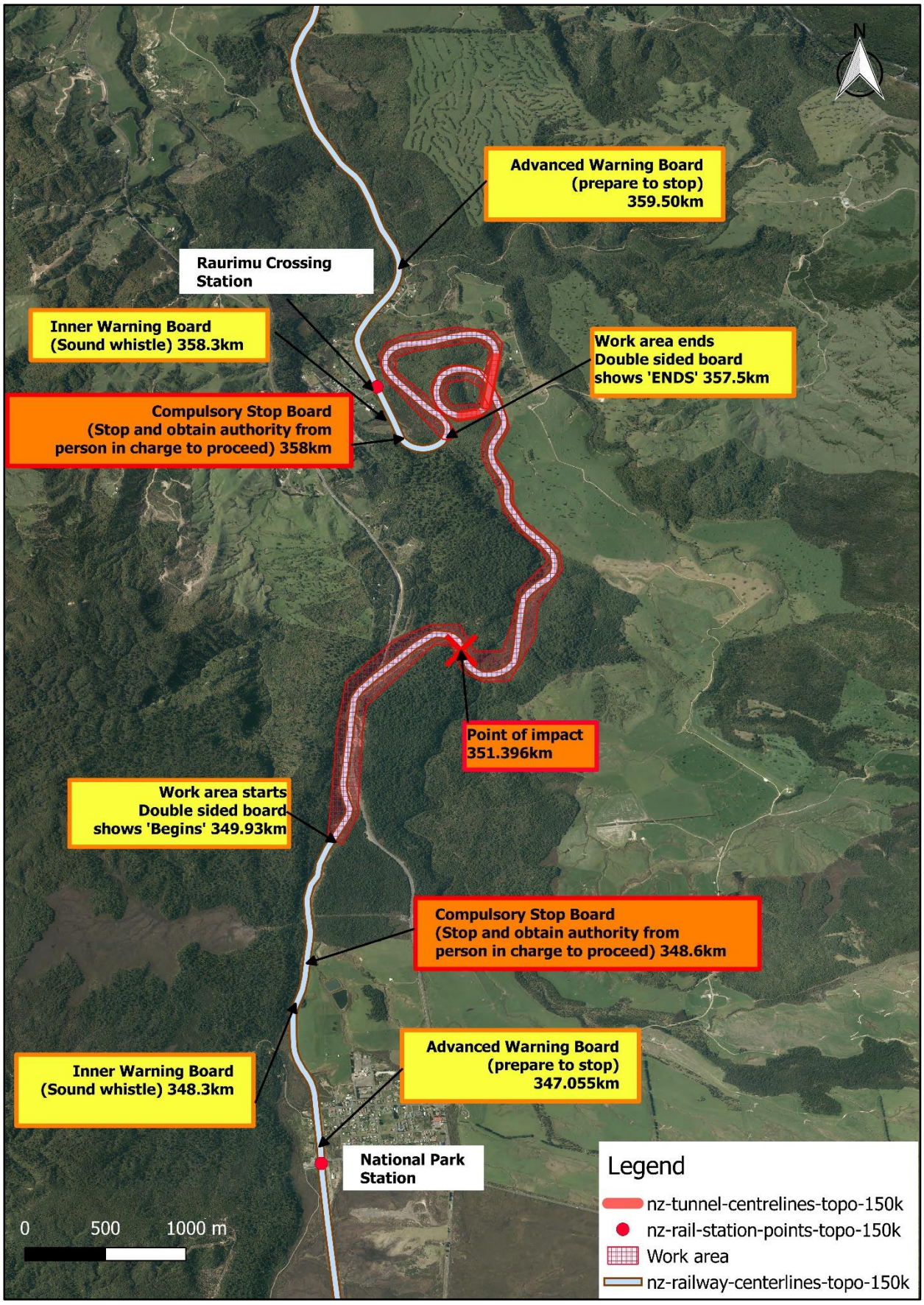


Figure 1
The protected work area

3.2.14. Meanwhile the excavator driver had on-tracked his excavator and driven along the track, arriving at the worksite about five minutes after the rail protection officer had passed through. He then off-tracked his excavator about 40 metres around a curve and out of sight of where the work group had parked their vehicles beside the track (see Figure 2).

3.2.15. The excavator driver then radioed the rail protection officer and told him that he was "off and clear of the track". The excavator driver sat in the cab for about 10 minutes before he walked back and joined other members of the work group who had congregated near their parked vehicles.

Figure 2
Access road along which the work group vehicles were parked

3.2.16. At 0815 the rail protection officer radioed train control to cancel his track occupation. He reported that the stop boards had been erected and that he was off and clear of the track. Train control confirmed that a southbound freight train would be the first train to pass through the work area. The southbound train would then cross with the northbound train at National Park station. The two trains would stop there and the drivers would then change trains. The northbound train would then pass through the work area.

3.2.17. The rail protection officer drove a further 1.5 kilometres to erect the northern-end warning boards then started to drive back to the worksite by road. He radioed the team leader at the worksite to test radio coverage, but got no response. He then used his cell phone to call the team leader but the call was not answered.

3.2.18. The rail protection officer was back at Raurimu by the time the southbound freight train stopped at the compulsory stop board. At 0827 the train driver radioed the rail protection officer and asked him for permission to pass the compulsory stop board at Raurimu. The rail protection officer called the worksite on his radio and received confirmation that the track was clear for the southbound train to travel through the worksite at normal speed. The rail protection officer also confirmed with the maintenance work group that there would be a crew change at National Park then a northbound train would come through the worksite. He repeated that everyone was to stay clear of the track.

3.2.19. The rail protection officer then gave the driver of the southbound train permission to pass the compulsory stop board once the signal had changed to 'proceed'. The rail protection officer radioed the train controller, who then changed the signal to 'proceed'.

3.2.20. The southbound train then passed through the work area without incident. The northbound freight train had already berthed on the crossing loop when the southbound train entered the main line at National Park. The drivers changed trains and the northbound train departed National Park at about 0900.

3.2.21. Three minutes later the northbound train stopped at the compulsory stop board. The driver radioed the rail protection officer and requested permission to pass the compulsory stop board between National Park and Raurimu.

3.2.22. The rail protection officer was in his truck at the worksite when the train driver made the radio call. He authorised the driver to pass the compulsory stop board and to proceed through the protected work area at the authorised line speed. The radio communication between the rail protection officer and the train driver was broadcast over external speakers on his truck. It is not known whether the excavator driver heard or understood the radio conversation.

3.2.23. The rail protection officer then left his truck and gave a 'thumbs up' signal to the work group. He received a similar acknowledgement from some of the workers. Witnesses recalled that the excavator driver was in the vicinity when the rail protection officer gave the 'thumbs up' signal. They also recalled seeing him walk off in the direction of the excavator shortly afterwards.

3.2.24. The train passed the work group travelling at about 45 kilometres per hour, the maximum permitted speed. The train then entered a right-hand curve, and as it did so the train driver saw the excavator on the track ahead with its bucket facing north. At 0909:48 the driver made an emergency brake application and sounded the locomotive whistle to alert the excavator driver.

3.2.25. The train driver saw the excavator driver look over his shoulder at the train and begin to rotate the bucket in the direction of the locomotive.

3.2.26. The train was travelling at 42 kilometres per hour when it struck the excavator, but it took a further 103 metres to come to a stop (see Figure 3). The excavator was extensively damaged in the collision. The train driver informed the train controller, who alerted the emergency services. KiwiRail staff on site tried to keep the excavator driver alert until emergency services personnel arrived.

Figure 3
The collision

3.3. Communications

3.3.1. Three communication systems were used within the protected work area: radio channel 1, radio channel 3 and cell phones assigned to the rail protection officer, the team leader, the electrical safety observer, various members of the work group and the driver of the hi-rail excavator. Channel 1 is a very-high-frequency (VHF) point-to-point (line-of-sight) that under normal circumstances was expected to have coverage of up to five kilometres, but this was dependent on the radio's power output and the surrounding terrain. Channel 1 was referred to as the 'local channel' and was used by the rail protection officer to communicate with drivers stopped at the compulsory stop board, the excavator driver, and other members of the work group. The rail protection officer was stationed near the worksite about 2.7 kilometres from the south-end compulsory stop board and nearly seven kilometres from the north-end compulsory stop board.

3.3.2. Channel 3 was a repeater-assisted VHF radio channel for communication with train control. The radio system was 'open channel', allowing any person within the coverage area to hear all radio transmissions using that repeater.

3.3.3. The use of cell phones was considered an acceptable means of communication between the rail protection officer and drivers waiting for permission to enter the protected work area. The information bulletin dated 17 June 2014 made reference to both the cell phone number and the phonetic radio call sign for the rail protection officer.

3.3.4. The rail protection officer had difficulty contacting his work group with both radio and cell phone while he was erecting the boards at the northern end of the work area.

3.4. Key personnel

3.4.1. All KiwiRail personnel on site at the time of the accident participated in a post-incident drug and alcohol screening test. All personnel returned negative results.

The rail protection officer

3.4.2. The KiwiRail Track Safety Rules, effective from 6 October 2013, defined the rail protection officer as:

> The person with overall responsibility for:
>
> - *Providing rail protection for the Work Area with one or multiple work sites; the nature of the work sites and activity will determine the level of protection required.*
> - *Co-ordinating movement of all rail vehicles within and through the Protected Work Area.*
> - *Responsible for communicating with Train Control.*
> - *Where more than one work site is operating, Site Protectors will report to the rail protection officer.*
>
> ***Note:***
> *rail protection officer who is Track Protection Advanced (TPA) 1.3[7] qualified are in charge of multi work sites within a Protected Work Area.*

3.4.3. KiwiRail Track Safety Rule 901 (h) stated:

> ***h. Safe Place briefings***
>
> *Before work commences for the day and when the Work Site relocates, the Site Protector/RPO [rail protection officer] must brief all personnel on the 'Safe Place'.*

[7] A person with an Advanced TPA 1.3 qualification may use a variety of protection systems for multiple worksites within one major work area protected in accordance with KiwiRail's Track Safety Rule 910 'Work Arrangements – Multiple Activities'.

The Track Safety Rules defined the 'Safe Place' as:

> *A place where people and equipment cannot be struck by passing rail traffic.*

3.4.4. The person carrying out the rail protection officer duties on the day of the accident held a TPA qualification that allowed him to protect a single worksite using compulsory stop protection. He was certified to operate a hi-rail vehicle and his Electrification Awareness certification was current.

The team leader

3.4.5. KiwiRail's position profile for a team leader of a track maintenance work group stated in part:

> **Role Purpose**
>
> Working as part of the team, the team leader is responsible for leading, supervising and for the efficient operation of the work group, to achieve track maintenance, repair and renewal work both planned and unplanned, in a timely and cost effective manner which reflects operational priority. Ensure work is carried out in a way which complies with all KiwiRail Network quality, safety and engineering standards.
>
> **Rail Safety System Responsibilities**
>
> - Safety is the first priority of all employees on the national rail system
> - Responsible for complying with rail safety system standards, procedures and statutory requirements within your area of responsibility
> - Responsible for your own safety and that of other rail employees, contractors and visitors within your work environment
> - Responsible for the identification, reporting and initial control of any safety or environmental hazard identification within your area.

3.4.6. The team leader's track protection qualification TPA 1.3 was current and he was competent to carry out the rail protection officer's duties covering multiple worksites within a major protected work area.

3.4.7. The most recent safety observations had been carried out on the team leader and his work group on 14 November 2013 and 21 March 2013 while carrying out work under compulsory stop protection.

The electrical safety observer (the electrical observer)

3.4.8. The electrical observer's certification was current for the task he was undertaking. He had acted as an observer for the excavator driver on previous occasions.

The driver of the hi-rail excavator (the excavator driver)

3.4.9. The excavator driver, employed by Downer, was working under the supervision of KiwiRail. He had operated hi-rail excavators on the railway network since 2008. His certification for TPA (Theory), and AC and DC Electrification Awareness was current. However, records showed that KiwiRail had not carried out a safety observation of the excavator driver since 24 November 2010.

3.4.10. The excavator driver underwent an alcohol screening test on admission to Waikato Hospital. The result was negative.

3.4.11. The excavator driver suffered severe head injuries in the collision and remained in an induced coma for several months. Owing to the severity of his injuries, he was not capable of being interviewed. He has since made a minimal recovery and has no recollection of the accident.

4. Analysis

4.1. Introduction

4.1.1. The protection of work groups while they are maintaining the rail tracks is a safety-critical process. Any flaw in, or lack of adherence to, the processes for providing such protection can have high consequences, as this accident showed.

4.1.2. The driver of the northbound train followed the required procedures and had the appropriate authority before entering the work area. The train was travelling at less than the maximum speed limit and the driver did everything possible to prevent the collision when he saw the excavator on the track ahead.

4.1.3. The excavator should not have been occupying the track at the time.

4.1.4. The following analysis discusses what happened to cause the collision between the train and the excavator.

4.1.5. Two safety issues have been identified that contributed in some way to the collision.

4.1.6. The first is the process for protecting the work group. It relied too heavily on the rail protection officer being able to check the whereabouts of every member of what was a large work group, and relied too heavily on the assumption that all workers on site clearly understood when it was safe for them to occupy the track.

4.1.7. The second safety issue is that notwithstanding the weakness in the process, the process was not adhered to, neither at the planning stage nor in the implementation of the work plan.

4.2. What happened

4.2.1. When the rail protection officer arrived back to where the work group was assembled he had no idea whether the southbound train had passed their location.

4.2.2. As it happened, the track was clear and the southbound train had not yet passed through the work area.

4.2.3. It was a breakdown in communication at the work area assembly point that led to the collision. When the driver of the northbound train requested permission to drive through the work area, he received the authority from the rail protection officer. The rail protection officer then assumed that the members of the work group had overheard him giving the train authority over the external loud speakers on the truck. He then exited the truck and gave the group a 'thumbs up' signal.

4.2.4. It is likely that the excavator driver interpreted this signal as indicating that work was about to begin on the track. He then walked around the curve and on-tracked the excavator, which was out of sight of the work group.

4.2.5. The authority for the northbound train to enter the protected work area was given some time between 0903:09, when the train stopped, and 0904:35 when it started to move again.

4.2.6. Data from the train event recorder showed a period of five minutes and 15 seconds between the time the train entered the protected work area and the collision. This was sufficient time for the excavator driver to acknowledge the 'thumbs up' signal given by the rail protection officer, walk to the excavator and place it on the track ahead of the northbound train. It was very likely that he had only just placed the excavator on the track when the train rounded the curve, because he had not yet lowered the hi-rail equipment onto the rails.

4.2.7. The excavator driver had signed a 'Permit to Work Near Railway Power Lines' that morning. One of the conditions of the permit was that the overhead was 'alive', and the electrical observer was required to be present when the excavator was operating on or near the track. The electrical observer was nowhere near the excavator at the time of the accident. He was

waiting for the northbound train to pass and had stayed near his vehicle at the southern end of the curve, which was out of sight of the excavator.

4.2.8. The excavator driver was employed by Downer. One of Downer's 10 'Cardinal Rules' was "NEVER operate a vehicle while using a handheld mobile phone nor without wearing a seatbelt where fitted". There was no evidence that the excavator driver was using a cell phone at the time. However, he was not wearing the seatbelt that had been fitted to the excavator. This was confirmed by the train driver and subsequently noted by the attending police officer. The seatbelt had been placed behind the driver's seat. Had he been wearing his seatbelt it is likely that the severity of his injuries would have been reduced.

Findings:

1 The northbound freight train had been authorised to pass through the work area and at the time of the accident was being driven at less than the maximum permitted line speed.

2 The excavator was not authorised to occupy the track at the time of the accident.

3 It is likely that the excavator driver thought he had been authorised to occupy the track and begin work when he was given an ambiguous 'thumbs up' signal by the rail protection officer.

4.3. Operating procedures

Planning

***Safety issue** – A failure by KiwiRail to follow its operating rules and procedures at the planning stage of the work assignment resulted in the work group being under-resourced to manage the protection and safety of the track maintenance workers effectively.*

4.3.1. The application for the planned work between National Park and Raurimu (see Appendix 1) was submitted in a timely manner. The submitter proposed that KiwiRail Track Safety Rule 905, Compulsory Stop Protection, be used to manage train movements through the planned work area.

4.3.2. The submitter identified that the planned work involved multiple activities at multiple worksites within the work area, and that a person certified for safe working at a major work area (KiwiRail Track Safety Rule 910) had been arranged. The team leader's name and his cell phone number were recorded on the application form as the 'Protection Person'. However, it was not appropriate for the team leader to fulfil the duties of the rail protection officer over and above his main responsibility for the output and performance of the work group.

4.3.3. As set out in paragraph 3.4.4 the team leader was responsible for leading, supervising and the efficient operation of the work group, and for ensuring that the work was carried out in a way that complied with all "KiwiRail Network quality, safety and engineering standards".

4.3.4. The role of the rail protection officer was created in response to protection issues encountered at multiple worksites. The role was formalised in September 2011 and more recently issued in KiwiRail's Track Safety Rules, effective from 6 October 2013. KiwiRail described the rail protection officer as the person with overall responsibility for:

- *Providing rail protection for the Work Area with one or multiple work sites*
- *Co-ordinating movement of rail vehicles within and through the Protected Work Area*
- *Responsible for communicating with Train Control*

4.3.5. The planned work potentially involved multiple activities within a 7.5-kilometre-long section of track. KiwiRail's Track Safety Rule 910 'Work Arrangements – Multiple Activities' required the rail protection officer to appoint a site protector at each worksite within the protected work area.

4.3.6. The application to KiwiRail Network Authorities did show that the protected work area would be managed under KiwiRail Rule 910, 'Work Arrangements – Multiple Activities'. However, after processing the application, Network Authorities distributed the daily information bulletin with the work area shown as a single activity. This removed the requirement for the rail protection officer to appoint site protectors at each worksite, leaving him with the unrealistic task of managing the protection and safety of all personnel within the entire 7.5-kilometre-long work area. It also meant that, theoretically, the rail protection officer required only a TPA 1.1 qualification (manage single worksites), which he held, rather than the TPA 1.3 qualification (manage multiple worksites), which he did not hold.

4.3.7. Another issue arose with the 'Application for Traction Overhead Power Off' that was submitted to Network Authorities. The application was erroneously made for the 1,500-volt DC Wellington network instead of the 25,000-volt AC system present at the work area. The error went unnoticed and the application was approved.

At the work area

***Safety issue** – Numerous examples of non-compliance with KiwiRail operating standards were evident at the worksite, of which some were contributory to the accident.*

4.3.8. The day before this accident a pre-shift safety briefing was held. Fourteen workers, including the excavator driver, signed the 'Job Plan' form to confirm that they understood the hazards and controls in place. However, there was no register to record the names of the workers on site, when they arrived or when they departed. This omission made it potentially more difficult for the person in charge of protecting the workers to know with any certainty whether all persons at the worksite were accounted for (and off and clear of the track) before allowing a train to enter the work area.

4.3.9. Before work commenced on site each day, all personnel, including contractors, were required to participate in a pre-shift briefing and sign the 'Job Plan' form to confirm that they:

- knew where the safe place was
- understood the track protection procedures in place for the day
- had been briefed on and understood the relevant content of the information bulletin
- understood the work area communications plan
- understood the emergency procedures that had been communicated
- had been made aware that a contractor was operating a hi-rail excavator near the overhead line under the direction of an electrical safety observer
- were fit for duty
- had considered the prevention of slips and falls
- wore the personal protective equipment suitable for the tasks allocated.

4.3.10. However, on the day of the accident a pre-shift briefing was not held. The reason given was that there was no job plan booklet available. The booklet used the day before was provided by the local Ohakune track group, which was not part of the work group this day. There were six KiwiRail work vehicles parked within the work area. It would have been unusual for job plan booklets to be missing from all of these vehicles. Regardless of whether a job plan booklet was available, this should not have prevented a safety briefing being held and the 'safe place' being designated.

4.3.11. A safety briefing would have reminded the excavator driver of two important points: he should not wander from the 'safe place' before receiving confirmation from the rail protection officer that it was safe to begin work, and he should have the electrical observer with him while working near the electric traction overhead line.

4.3.12. Another example of non-compliance was when the rail protection officer was establishing the boards protecting the work area. He realised that he would not clear the limits of his track occupation within the authorised 'clear by' time, so he radioed train control for additional time. Instead of cancelling the authority and completing a new form, the rail protection officer crossed out the previously recorded times and substituted 0753 as the commence time and 0815 as the complete time. KiwiRail procedures required that the original track occupation cross-check be cancelled and a new authority issued and recorded.

4.3.13. It was the rail protection officer's belief that work had not started before the accident because he had yet to give the work group authority to occupy the track. The Commission takes a different view, because:

- the work had started when the work group began to assemble at the worksite from 0700 onwards and were exposed to the potential risks
- the rail protection officer was given authority from train control to establish the protected work area at 0738
- the driver of the hi-rail excavator was given permission to on-track his digger, follow the rail protection officer's hi-rail vehicle and off-track his vehicle within the protected work area
- the rail protection officer gave the drivers of a southbound train and a northbound train permission to pass through the protected work area.

4.3.14. Although the protected work area was being operated as a single worksite at the time of the accident, the rail protection officer was about seven kilometres away from the work group when he authorised the first (southbound) train to enter the protected work area. Before giving that verbal authority to the train driver by radio, he had sought and received confirmation by radio that all members of the work group and machines were clear of the track. However, the person providing this confirmation was neither a dedicated rail protection officer nor a 'site protector' who would normally have been appointed for each individual worksite had more than one existed within the protected work area.

4.3.15. Since this accident KiwiRail has introduced a new 'lock-out' procedure to ensure that all track workers are accounted for before trains are permitted to enter a work area. As a result of the actions taken by KiwiRail to address this issue no recommendation has been made. Refer Section 6 and Appendix 6.

Qualifications

4.3.16. KiwiRail operating procedures required that anyone carrying out safety-critical tasks be appropriately trained and undertake biennial theory assessments as well as undergo three practical assessments within a 24-month period. These assessments had to also be carried out on contractors who held operating certificates.

4.3.17. The driver of the hi-rail excavator had the TPA theory qualification. However, he had not undergone a safety observation by KiwiRail personnel since 24 November 2010 and therefore his qualification was deemed to have expired. Neither the team leader nor the rail protection officer had the means to determine the status of the contractor's operating qualifications because the records were maintained remotely. The Commission has previously made a recommendation to address this issue in its report 11-103[8]. That recommendation still has

[8] Commission Report 11-103, Track workers nearly struck by passenger train near Paekakariki, North Island Main Trunk, 25 August 2011.

an open status pending confirmation from KiwiRail that the intent of the recommendation has been met.

Summary

4.3.18. There are several examples given above of non-adherence to KiwiRail procedures for planning track maintenance, setting up a work area, and protecting track workers from injury while they are working. Some of the non-adherences to standard operating practices were factors that contributed to the accident.

4.3.19. Non-compliance with KiwiRail's procedures by the track maintenance work group and the network authority is a safety issue.

4.3.20. The NZ Transport Agency conducted its own system-focused investigation into this accident in order to identify any safety deficiencies that were relevant to KiwiRail's Safety Case and safety system (refer Section 6, Safety actions). The investigation concluded that the failings sat within the following categories:

- training awareness
- work planning and practices
- communication at the worksite
- the vulnerability of controls to procedural failures.

4.3.21. The NZ Transport Agency required KiwiRail to make improvements in 11 areas of its worksite activities. In view of the safety actions taken by the NZ Transport Agency, the Commission has not made a recommendation to address this safety issue.

Findings:

4 The work plan for the day was not effectively communicated to the work group, including the excavator driver, which was a factor contributing to the accident.

5 Operational planning was not done in accordance with KiwiRail's standard operating procedures. Inadequate resourcing compromised the safety and protection of the track maintenance work group.

6 By not holding a safety briefing before work started, as was required by KiwiRail operating rules, the work group was not made aware of the 'safe place' where personnel and equipment were to remain until the rail protection officer authorised work to resume.

5. Findings

5.1. The northbound freight train had been authorised to pass through the work area and at the time of the accident was being driven at less than the maximum permitted line speed.

5.2. The excavator was not authorised to occupy the track at the time of the accident.

5.3. It is likely that the excavator driver thought he had been authorised to occupy the track and begin work when he was given an ambiguous ‘thumbs up’ signal by the rail protection officer.

5.4. The work plan for the day was not effectively communicated to the work group, including the excavator driver, which was a factor contributing to the accident.

5.5. Operational planning was not done in accordance with KiwiRail’s standard operating procedures. Inadequate resourcing compromised the safety and protection of the track maintenance work group.

5.6. By not holding a safety briefing before work started, as was required by KiwiRail operating rules, the work group was not made aware of the ‘safe place’ where personnel and equipment were to remain until the rail protection officer authorised work to resume.

6. Safety actions

General

6.1. The Commission classifies safety actions by two types:

(a) safety actions taken by the regulator or an operator to address safety issues identified by the Commission during an inquiry that would otherwise result in the Commission issuing a recommendation

(b) safety actions taken by the regulator or an operator to address other safety issues that would not normally result in the Commission issuing a recommendation.

Safety actions addressing safety issues identified during an inquiry

6.2. KiwiRail's operating Rule 910, 'Work Arrangements Multiple Activities', has been discontinued and replaced by Rule 902, 'Managing a Protected Work Area'. KiwiRail published revised Track Safety Rules, Issue 3, effective from 30 June 2015. The revision included new site safety Rule 902, Managing a Protected Work Area (see Appendix 6).

6.3. Rule 902, referred to as a 'Lock on, lock off' procedure, was developed to ensure that a protected work area is clear of personnel and machinery before trains are authorised to enter. All workers, including contractors and visitors, are required to carry a coloured personal padlock that they lock on to a numbered aluminium frame kept by the rail protection officer or site protector when they are working on the track. The padlocks are colour coded: green for the protector, orange for workers trained under Rule 902, blue for visitors and workers who are not trained in the procedures (but are given instructions on arrival) and black for hi-rail vehicles and equipment on track.

6.4. When a train needs to pass through a work area, and before the rail protection officer can authorise the train through the work area, all padlocks are removed from the frame while the workers are assembled in the safe place.

6.5. A worksite register is maintained by the rail protection officer showing all people and vehicles within the worksite at any given time.

6.6. The rail protection officer is required to use a Work Area Tracking Board to display the status of each activity visually when managing a protected work area with multiple worksites.

6.7. The rail protection officer can only report that the work area has been cleared when all padlocks have been removed and all personnel have signed off on the worksite register.

6.8. KiwiRail has changed the bulletin application lead times to provide more time for checking and reviewing the application. A quality assurance audit and monthly quality reporting have been implemented for the production of bulletins.

6.9. The NZ Transport Agency undertook a systems-focused investigation into the accident, which identified a number of deficiencies in the areas of:

- training awareness
- work planning and practices
- communication on the worksite
- the vulnerability of controls to procedural failures.

6.10. A comprehensive update of the actions the NZ Transport Agency has taken to address the issues raised in the Commission's draft recommendation is included in Appendix 7.

7. Key lessons

7.1. Workers carrying out safety-critical tasks can be placed in unsafe situations when standard operating procedures are not followed.

7.2. Seatbelts are known to prevent injuries in vehicle accidents and should always be worn where fitted.

Appendix 1: The Application for Planned Work

13. Jun. 2014 11:40 KiwiRail PN Depot No. 7874 P. 1

KiwiRail

Application for Planned Work Form 1

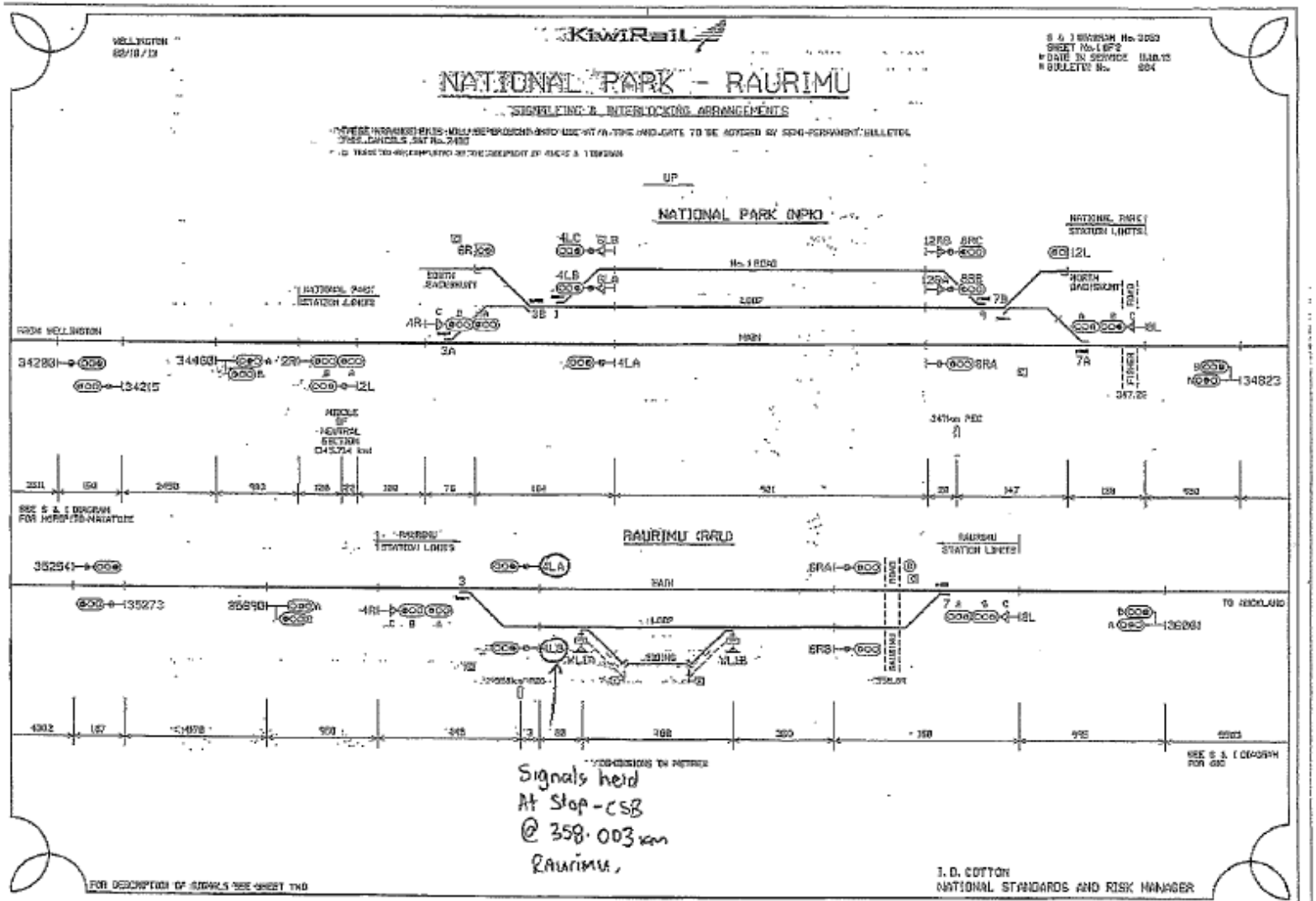
Submit this application form by:
16:00 hours Monday to Friday

Double / Multi line areas	minimum 24 hours in advance
Electrified Areas - Overhead Power off	minimum 48 hours in advance
Line Impassable	minimum 15 days in Advance

Email: netauth@kiwirail.co.nz - Fax: 04 473 1216 Phone 04 498 3216 or ext 43216

Person Filling out form: Name and Contact Number.	
Day(s) & Date(s):	From: 16th June 2014 TO: 20th June 2014
Work Site Hours: (do not include travelling time)	From: 0730 hrs. To: 1630 hrs.
Locations Between:	National Park and: Raurimu
Which Rule Are You Working Under:	☑ Rule 905 - Compulsory Stop Protection ☐ Rule 909 - Work Within Station Limits & Sidings ☐ Mis. 69 - Track and Time Permit, Rule 24 ☐ Mis. 68 - Track Warrant Regulation 401 (d)
Working in Double or Multi Line areas: (Specify lines being protected) *Protection is required on all lines; for work closer than 4 metres from the centre of an adjacent line*	☐ Both Up & Down main ☐ Up main only* ☐ Down main only* *Contact Network Authorities to discuss why protection is not being requested on adjacent lines ☐ Other lines## (specify) _____ ## Contact Network Authorities to discuss
Description of Work:	Re-Rail, Welding & De-Stressing.
Work Protection Plan: (Rule 905) Metrages Of Compulsory Stop Boards: If unable to erect advanced or inner Warning Boards as specified, name location(s)	km: 348·600 km. end km: 358·003 Between National Park AND Raurimu. 4LA & 4Lb Raurimu.
Is Work occurring or Protection being placed within Station Limits ??	Supply S&I diagram showing: placement of protection including the position of all Boards next to/ near all Signals ☑ S & I diagram attached
Call Sign: (required for R909)	Bravo Yankee (BY)
Work Area: (required for Mis 68 / 69) Write the metrages / Signals / Stations. Check that your worksite is between your locations shown above	
Does your work area have Multiple Activities ? Rule 910 Site reporting point is	☑ Yes Rule 910 certified Person arranged ☑ Yes Where 354·620km NIMT.
Communication Plan (Work Area exceeds 5km)	☑ Yes
	From: hours To: hours 15 days notice required
Re-railing Operations Level Crossing Alarms Disconnected Level Crossing Alarms On Manual Control 3.3kV Signals power supply turned OFF	☐ Yes ☐ Yes ☐ Yes ☐ Yes Signals Field Engineer /Sectionman advised ☐ Yes Signals Form 3 must accompany this form Signals Personnel must be advised a minimum of 10 days in advance of Re-Railing
Is Your Work Under Or Near Traction Overhead Do you need the Overhead Power Cut Off	☑ Yes ☐ Yes Traction Personnel advised ☑ Yes Traction Form 6 - DC / 7 - AC must accompany this form
Work train Required	☐ Yes If Yes, also complete Form 5
Protection Person and Contact Number:	[redacted]
Authorities Internal Use. Bulletin prepared#..... Drawn on graph..... Initials.....	Reference No. Please fax the bulletin to my Motel / Home or another number : Area Code: Number: 0...

Issue 10 June 2009


KiwiRail
NATIONAL PARK - RAURIMU
SIGNALLING & INTERLOCKING ARRANGEMENTS
UP
NATIONAL PARK (NPK)
No.1 ROAD
LOOP
MAIN
FROM WELLINGTON
TO AUCKLAND
RAURIMU (RARU)
Signals held
At Stop - CSB
@ 358.003 km
Raurimu.
J. D. COTTON
NATIONAL STANDARDS AND RISK MANAGER

KiwiRail

Work Area Communication Plan

Form 2

Line: NIMT — from km/Signals: 348·600 — to km/Signals: 4LA 4L8 Rewiring

Stations between: National Park — and: Raurimu.

Working on the (tick box): Single Line ✓ | Up Main | Down Main | Sidings/loops

Work Area start: 0730 hrs — Mon, Tue, Wed, Thur, Fri day — 16th - 20th June 2014 date

		or		or		or	
List the actual location/s the PIC will be in the work area on the day:	351 - 353 km						
Is T/C contact available from location?	No (Yes)		No Yes		No ☐ Yes ☐		No ☐ Yes ☐
Is communication confirmed from PIC location/s in the work area on the day to CSB board locations?	No (Yes)		No Yes		No ☐ Yes ☐		No ☐ Yes ☐

Is Channel 1/5 radio coverage confirmed between PIC location/s and each work site?		Is Cell phone coverage confirmed between PIC location/s and each work site?	
351 - 353	No (Yes)	(No)	Yes
355	No (Yes)	(No)	Yes
Work Site 3	No ☐ Yes ☐	No ☐	Yes ☐
Work Site 4	No ☐ Yes ☐	No ☐	Yes ☐
Work Site 5	No ☐ Yes ☐	No ☐	Yes ☐
Work Site 6	No ☐ Yes ☐	No ☐	Yes ☐
Work Site 7	No ☐ Yes ☐	No ☐	Yes ☐

If you have ticked any 'no' boxes; what is the alternative communication process confirmed between PIC location/s and:

- CSB board locations?
- Train Control?
- Work sites? Provide details below for Daily Info Bulletin.

Access to use Train Control CH 13 to Communicate IF needed.

Form 2 - Work area communication plan (KRNF-PL-0008) V3 **Have you attached this to application form 1 planned work form?** No ☐ Yes ☑

13. Jun. 2014 11:41 KiwiRail PN Depot No. 7874 P. 4

KiwiRail

Application for Traction Overhead Power Off Form 6

1500V DC - Wellington

This form application must be submitted minimum of 48 hours in advance (by 15:00hrs Monday - Wednesday)
forms for the following week must be supplied by 12:00hrs Friday

Email: netauth@kiwirail.co.nz - Fax: *04 473 1215* Phone 04 498 3216 or ext 43216

Copy to
TractionControlOperatorsWGN@kiwirail.co.nz

Person Filling out form: Name and Contact Number.	[redacted]
Day(s) & Date(s):	From: 16th June 2014 to: 20th June 2014
Work Site Hours: (do not include travelling time)	From: 0730 hrs. to: 1630 hrs.
Locations Between:	National Park and: Raurimu
Description of Work:	Re-Rail-Destres
Specify Protection arrangements	☑ Form 1 supplied
Restriction of Electric Train movements	☐ Electric Trains Stop Board Board positioned at km between and only Non Electric trains may pass the board
Which Line(s) will the Power be Cut Off:	☑ NIMT ☐ Melling ☐ Woburn Loop ☐ J Ville ☐ WL ☐ Other lines (specify)
DC Wellington ---	☐ Single ☐ Up ☐ Down ☐ Both Up & Down ☐ Other lines if (specify) *(If in doubt of cut off locations clarify with Traction Control)* From: Wellington Platform Substation: Metrage. Isolator: Metrage. To: Substation: Metrage. Isolator: Metrage. Termination
Do you need a KiwiRail Network Electrical Safety Observer	☑ Yes Hours: 0730 - 1630
Person in charge of Isolation and Contact Number:	

Authorities Internal Use.
Bulletin prepared.....
Drawn on graph.....
Initials.....

Appendix 2: The Information Bulletin

	Tuesday 17 June 2014 Waikanae – Te Rapa, M.N.P.L,. P.N.G.L Woodville – Masterton and Branches

Track Work Protection Arrangements

Waikanae – Te Rapa

Protected Work Area		Rule	Work Details
Tokomaru	Tokomaru	**908** Blocking	Resleeper 0730 – 1600 J.Egger, 020 404 18267
Palmerston North	Marton	**908** Blocking Protection **/ 914** Mobile Track Maintenance Vehicle	Tamper 648, Regulator 635 0630 – 1600 G.Thompson, 027 241 1051
165.00 km Maewa	168.60 km (4LA 4LB) Rangitawa	**905** Compulsory Stop Protection	Level crossing tamping 0730 – 1700 021 890 148 Call sign: **Whiskey Alpha Yankee**
The Rail Protection Officer of the Compulsory Stop Protected work area, when working in conjunction with the M.T.M.V., will be responsible for their safe working in accordance with Rule 910.			
Taihape	Mataroa	**908** Blocking	Bridge inspections 0600 - 1800 J.Haycock, 021 619 594
319.50 km Ohakune	323.00 km Horopito	**905** Compulsory Stop Protection	Clearing slip 0700 – 1700 027 842 4297 Call sign: **Bravo India Lima**
348.60 km National Park	358.00 km (4LA 4LB) Raurimu	**905** Compulsory Stop Protection	Destressing, rerail, welding 0730 – 1630 027 581 8194 Call sign: **Bravo Yankee**
During the period of work, when required, the overhead power may be cut off, clear of electric hauled trains on a EF 25 authority.			

Appendix 3: Compulsory stop protection

905 b Compulsory Stop Protection - continued

In Single Line areas

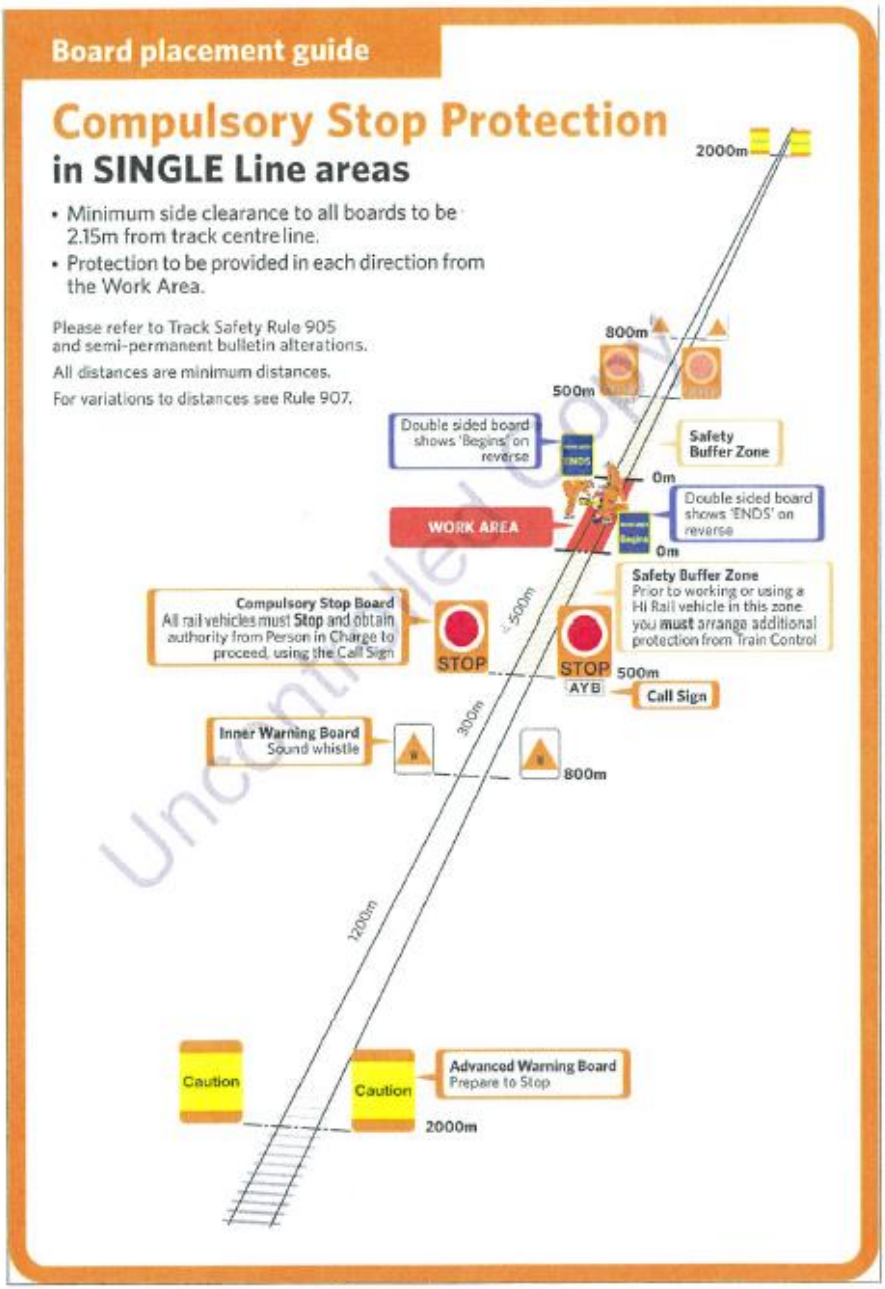
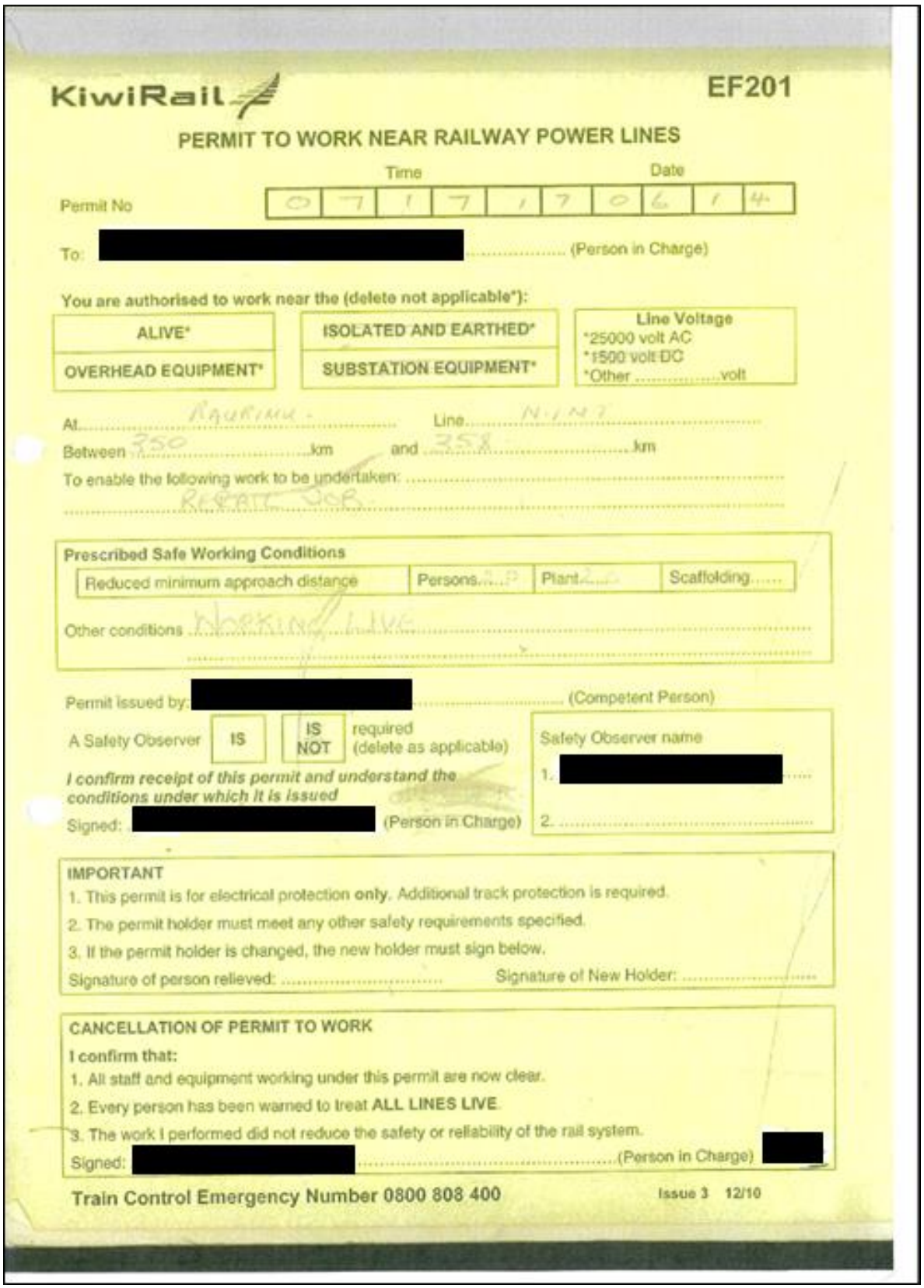


Figure 5

Appendix 4: Permit to Work Near Railway Power Lines



KiwiRail

EF201

PERMIT TO WORK NEAR RAILWAY POWER LINES

Time Date

Permit No 0717 1706 14

To: [redacted] (Person in Charge)

You are authorised to work near the (delete not applicable*):

ALIVE*	ISOLATED AND EARTHED*	Line Voltage *25000 volt AC *1500 volt DC *Other .....volt
OVERHEAD EQUIPMENT*	SUBSTATION EQUIPMENT*	

At Aquinas - Line N.I.N.7

Between 350 km and 353 km

To enable the following work to be undertaken: REPAIR POR

Prescribed Safe Working Conditions

Reduced minimum approach distance	Persons 2	Plant 2	Scaffolding

Other conditions Working LIVE

Permit issued by: [redacted] (Competent Person)

A Safety Observer IS / IS NOT required (delete as applicable)

Safety Observer name

1. [redacted]

2.

I confirm receipt of this permit and understand the conditions under which it is issued

Signed: [redacted] (Person in Charge)

IMPORTANT

1. This permit is for electrical protection **only**. Additional track protection is required.
2. The permit holder must meet any other safety requirements specified.
3. If the permit holder is changed, the new holder must sign below.

Signature of person relieved: ..... Signature of New Holder: .....

CANCELLATION OF PERMIT TO WORK

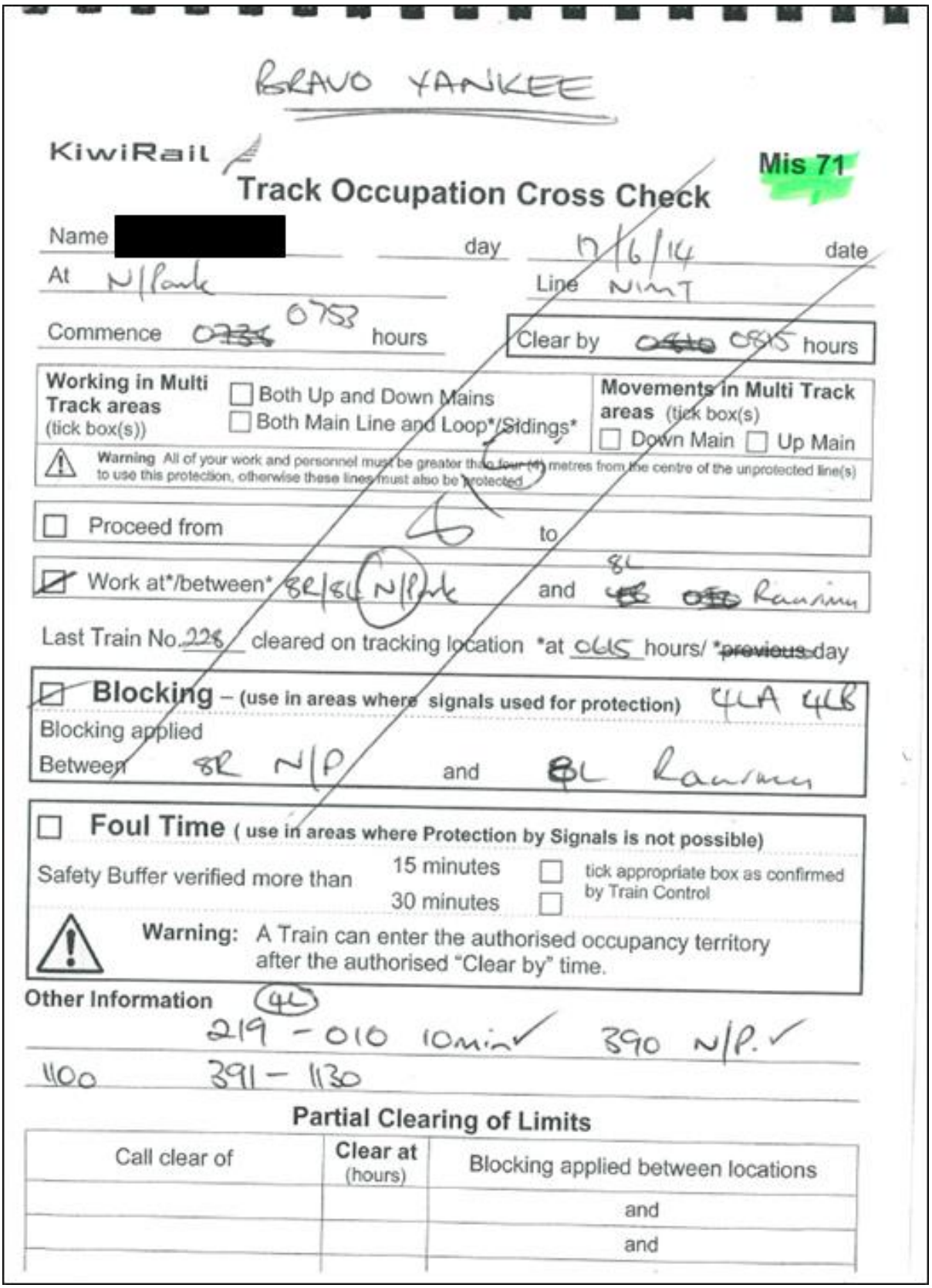
I confirm that:

1. All staff and equipment working under this permit are now clear.
2. Every person has been warned to treat **ALL LINES LIVE**.
3. The work I performed did not reduce the safety or reliability of the rail system.

Signed: [redacted] (Person in Charge) [redacted]

Train Control Emergency Number 0800 808 400 Issue 3 12/10

Appendix 5: Mis 71 Track Occupation Cross Check



BRAVO YANKEE

KiwiRail

Mis 71

Track Occupation Cross Check

Name [redacted] day 17/6/14 date

At N/Park Line NIMT

Commence ~~0735~~ 0753 hours

Clear by ~~0810~~ 0815 hours

Working in Multi Track areas (tick box(s))
☐ Both Up and Down Mains
☐ Both Main Line and Loop*/Sidings*

Movements in Multi Track areas (tick box(s))
☐ Down Main ☐ Up Main

⚠ **Warning** All of your work and personnel must be greater than four (4) metres from the centre of the unprotected line(s) to use this protection, otherwise these lines must also be protected

☐ Proceed from to

☑ Work at*/between* 8R/8L N/Park and ~~8L~~ ~~0815~~ Ranui

Last Train No. 228 cleared on tracking location *at 0615 hours/ *~~previous~~ day

☑ **Blocking** – (use in areas where signals used for protection) 4LA 4LB

Blocking applied
Between 8R N/P and 8L Ranui

☐ **Foul Time** (use in areas where Protection by Signals is not possible)

Safety Buffer verified more than 15 minutes ☐ tick appropriate box as confirmed by Train Control
30 minutes ☐

⚠ **Warning:** A Train can enter the authorised occupancy territory after the authorised "Clear by" time.

Other Information (4L)

219 – 010 10min ✓ 390 N/P. ✓

1100 391 – 1130

Partial Clearing of Limits

Call clear of	Clear at (hours)	Blocking applied between locations
		and
		and

Appendix 6: KiwiRail Track Safety Rule 902: Managing a Protected Work Area

902 Managing a Protected Work Area (PWA)

The Rail Protection Officer when managing a Protected Work Area with personnel and or machinery within, must:

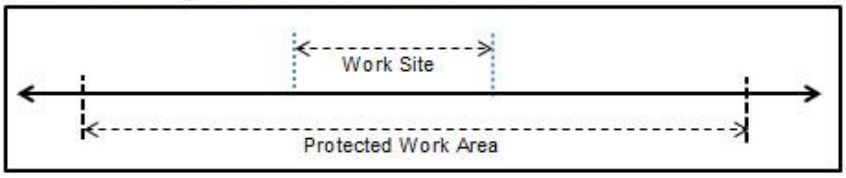
- Ensure all personnel and vehicles are accounted for in a Safe Place before authorising the rail movement to enter the Protected Work Area.
- Co-ordinate the movement of rail vehicles involved in the construction or maintenance activity.

a. Work Sites

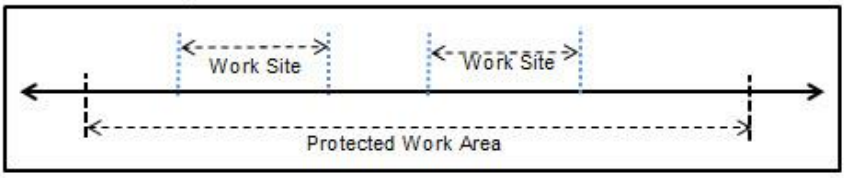
A Work Site is the actual location where work is taking place.

A Protected Work Area may include:

- A single Work Site with one Safe Place.



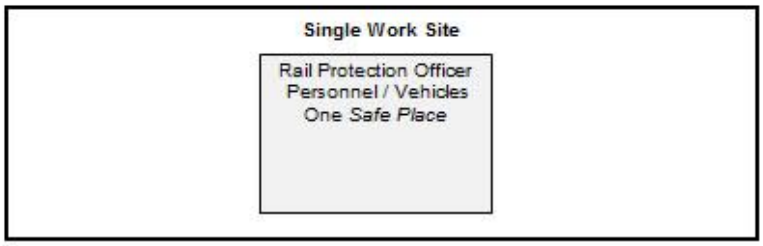
- Multiple Work Sites – more than one Work Site / *Safe Place*.



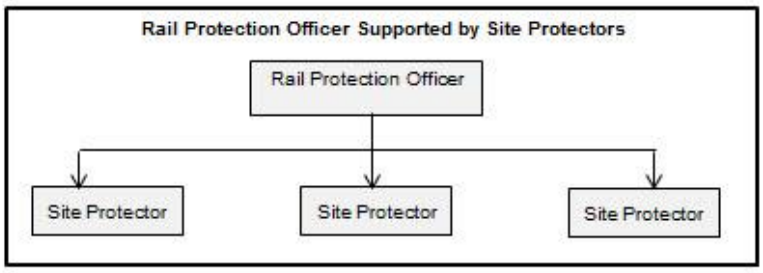
902 Managing a Protected Work Area (PWA) - continued

b. Management of Rail Personnel within a Protected Work Area:.

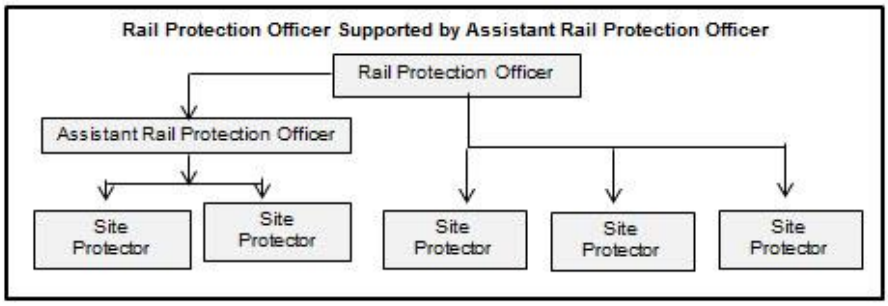
Single Work Site
A single Work Site must have one Rail Protection Officer (RPO) responsible for co-ordinating rail safety.



Multiple Work Sites
The RPO may directly control one of these work sites and where a PWA has more than one Safe Place a Site Protector (SP) must be appointed to each additional work site



Assistant Rail Protection Officers
may be appointed to reduce RPO workload for part of the Protected Work Area



902(b) Managing a Rail Personnel within a Protected Work Area (PWA) - continued

Rail Protection Officers and Site Protectors:

May undertake site work activity provided:

- They can safely cope with combining work activities and the protection role.
- When completing protection tasks they are not distracted by work related activities.
- The protector remains contactable for protection activities at all times.

Location of Rail Protection Officer

The RPO must remain in the limits of the Protected Work Area, unless the co-ordination of significant multiple work site activity is controlled from an approved location named on the Information Bulletin .

Where protection authorities are held for a continuous period, the RPO may leave the Protected Work Area or authorised location provided final clearances have been received from all Site Protectors.

Visibility of Protection Personnel

Rail protection personnel must wear an approved method of identification to distinguish them from other work site personnel and visitors.

Job Aid

Rail protection personnel must be issued with the relevant "*Rule 902 Managing a Protected Work Area Job Aid*" and must have it avaliable on site.

902 Managing a Protected Work Area (PWA) - continued

c. Liaison with Train Control

The work must be organised so that trains are not delayed unless previously agreed with Train Control.

The RPO must communicate with Train Control at agreed times to be updated on rail movements and report progress of work.

On completion of work, Train Control must be advised of the time that normal train services may be reinstated and conditions under which trains may run.

d. Safe Place

The RPO / SP must identify a Safe Place on one side of the rail corridor, where people and equipment cannot be struck by passing rail movements.

The Safe Place must be clearly visible using an approved method of identification and documented on work site briefing forms.

The RPO / SP must advise all personnel before the Safe Place is changed.

e. Hi-Rail Access Locations

The RPO must identify on / off track access locations for Hi-Rail vehicles. These must be discussed with SPs, Work Supervisors and Hi-Rail drivers at the pre-start briefing.

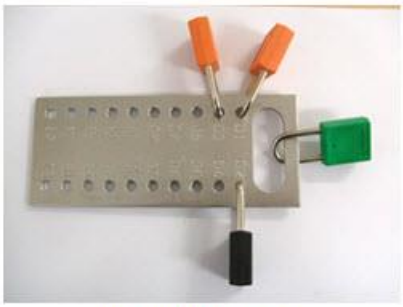
f. Pre-Start / Visitor Work Site Briefings

All personnel who come onto a Work Site must be briefed on the location of the *Safe Place*, rail protection arrangements for the Protected Work Area, rail specific hazards, communication arrangements and sign the TS90 Work Site Register acknowledging they have been briefed.

902 Managing a Protected Work Area (PWA) - continued

g. Work Site Register / Locking On & Off

RPOs / SPs must maintain a TS90 Work Site Register and Lock On Frame showing people and vehicles within the Work Site at any given time.



[Lock On Frame]

When joining a Work Site all personnel, including visitors, must sign the TS90 Work Site Register

Before the RPO / SP authorises personnel to leave the Safe Place they must attach their RPO / SP padlock to the Lock On Frame handle.

All personnel and visitors on site must then attach a padlock for themselves and a padlock for any vehicle under their control that will foul the track.

The RPO / SP must check the number of padlocks against the entries on the TS90 register to confirm all personnel and vehicles have locked on.

Continued next page

902(g) Work Site Register / Lock On & Off - continued

Exclusions:

- A person working alone will not be required to use a Lock On Frame . If a person(s) subsequently joins the work site the Lock On Frame must be used.
- Rail personnel operating Work Trains and Mobile Track Maintenance Vehicles will not be required to "lock on" provided they do not leave the rail vehicle.
  In a multi-line area where an adjacent line is being used as a Running Line and they are required to leave the rail vehicle, they must lock on
- Operators of other rail movements passing through a Protected Work Area will not be required to "lock on"
- A supervised vehicle driver picking up / delivering material at a designated location clear of the track and on the same side as the road access
- When working behind an approved barrier. If personnel or vehicles are required to cross a maintenance crossing located within the work site, it must be controlled by a barrier or by the RPO /SP before authorising rail movements.

RPO / SPs must carry spare padlocks for persons or vehicles not issued with padlocks.

Warning: Personnel must retain their personal padlock key and are not permitted to give it to other persons *under any circumstances*

Personnel must secure vehicle under their control in safe mode, clear of the track before returning to the Safe Place and locking off.

Note: When one line remains impassable, vehicles may be locked off when they remain on that line, secured in safe mode clear of any adjacent running line.

After removing their padlock, personnel must not foul the track until authorised to resume work by the RPO / SP.

902(g) Work Site Register / Lock On & Off - continued

The RPO / SP must not authorise a rail movement until all padlocks have been removed and the clear Lock On Frame has been exhibited to personnel. The RPO / SP must maintain a view of the track and Safe Place until the movement has passed.

Locking Off when Leaving Work Site or at Completion of Work:

When leaving the Work Site personnel must remove their personal (and vehicle) padlock(s) and sign out on the TS90 Work Site Register.

RPOs / SPs can only report the Work Site has finished when all padlocks have been removed and all have signed off the TS90 Work Site Register.

Hi-Rail Vehicles On/Off tracking, remote from Rail Protector's location

Before on tracking, within the PWA, vehicles must be locked on .

When hi-rail vehicles return to the off-tracking location on completion of work, the RPO / SP must travel to the off- tracking location to lock off the personnel / vehicles.

Note: The requirement to lock on / off will not apply for vehicles travelling clear of the track on access roads.

Remote from Rail Protectors location:

Should the entry / exit path be remote from the RPO/SP, they must apply the procedure described in the "Rule 902 Managing a Protected Work Area Job Aid".

Requests to enter / clearance from work sites must be completed individually.

Group requests / clearances must not be accepted.

Note: This procedure must not be used if the RPO / SP can travel to the entry / exit location to complete the Work Site Register and Lock on frame procedures.

902(g) Work Site Register / Lock On & Off - continued

Lost Key or Defective Padlock:

If a padlock cannot be removed, the padlock must be recorded as "out of use" on the TS 90 Work Site Register. The RPO and padlock owner must both sign to acknowledge that the padlock is "out of use".

Personnel, Visitors leaving the Work Site without Signing or Locking Off:

Personnel or Visitors who leave a Work Site without Signing or Locking Off must be contacted immediately by the RPO and instructed to return to the Work Site to sign off and remove the padlock(s).

If the person is unable to return or cannot be contacted the Network Control Manager must be contacted. The Network Control Manager must follow the prescribed procedures before authorising the padlock to be temporarily "out of use"

The Network Control Manager's name must be entered in the "User Signature" column on TS90 form.

Warning: Rail movements must not be authorised to enter the Protected Work Area until either of the above has been completed.

h. Managing a Single Work Site:

The RPO must apply the procedures prescribed in the "Rule 902 Managing a Protected Work Area Job Aid" single work sites when:

- Recording information as prescribed in the Job Aid.
- Completing pre-start tasks.
- Authorising work to start.
- Clearing the work site for rail movements.
- Authorising work to resume after rail movements.
- Clearing the work site on completion of work.

902 Managing a Protected Work Area (PWA) - continued

i. Managing Multiple Work Sites

Protected Work Area with multiple work sites must be notified by Bulletin see Rule 901.

Work Sites within a Protected Work Area may be either:

- **Fixed Work Sites**
  A work site at a single location within a Protected Work Area
- **Mobile Work Sites**
  Mobile work sites are used for Work Trains, Mobile Track Maintenance Vehicles and Hi-Rail vehicles required to operate at various locations in a Protected Work Area

Work Site Limits - *Fixed Work Sites* limits must be defined by Site Limit Boards.

The boards will only be required where the Protected Work Area comprises multiple work sites.Site Limit Boards must be reflectorized boards and must be:

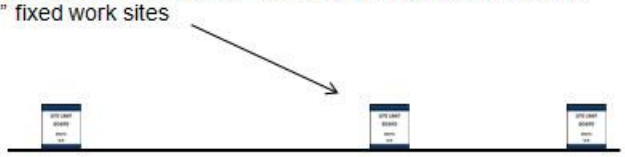
- Erected adjacent to the track, where they can be seen by approaching rail traffic, in a single line area.
- Erected between the tracks (not exceeding 850mm in height), in a position where they can be seen from all lines, in a multiple line area.
- Erected before work commences by the SP.

Entering Fixed Work Site

Exiting Fixed Work Site

902(i) Managing Multiple Work Sites

NOTE:
A single Site Limit Board may be used to separate two "back to back" fixed work sites



Bravo Bob Alpha Allan.

Mobile Work Sites limits may be defined by:

- Fixed signals (number)
- Station / Block entry boards.
- Level crossings.
- Station platforms.
- Sidings.
- Site Limit Boards.
- Bridges.
- Tunnel Portals.

Where a Fixed Work Site is located within the Mobile Work Site limits, the Operator must stop at the Site Limit Board and obtain authority from the Site Protector to enter the Fixed Work Site.

All Work Trains must be a piloted by a Site Protector, qualified for Pilot duties, who must:

- Ride in the locomotive cab when leading vehicle.
- Ride in an authorised safe riding position for infrastructure vehicles when propelling.
- Brief the Operator of the work train on intended movements, work site locations and restrictions before authorising movement.

902(i) Managing Multiple Work Sites

Speed within Work Site Limits:

Through rail movements may travel at line speed or at a lesser speed if instructed.

Rail movements that are part of the planned work within Work Site Limits, **must not exceed 30 km/h**, or lesser speed if instructed by RPO / SP.
Always being able to stop short of an obstruction within half the distance of clear line that is visible ahead, taking into consideration the physical characteristics of the track being traversed and the environmental conditions.

Co-Ordination of Activity:

Fixed Work Site: The SP must co-ordinate all work site rail movements in conjunction with the Work Supervisor(s).

Mobile Work Site: The RPO must co-ordinate all work site rail movements in conjunction with the SP.

The SP must co-ordinate all work site rail movements in conjunction with Work Supervisor(s) and with any other SP sharing overlapping work site limits.

Work Area Tracking Board:

When managing a Protected Work Area containing multiple work sites, RPO must use a Work Area Tracking Board to visually display the status of activity.

The Work Area Tracking Board must include the following:

- All rail lines within the Protected Work Area (using the S&I diagrams).
- All Fixed and Mobile Work Sites – including "occupied" or "clear" status.

Note: Additional information must be limited to ensure the details above are clearly exhibited.

902(i) Managing Multiple Work Sites

The RPO and SPs must apply the procedures in the "Rule 902 Managing a Protected Work Area Job Aid - Multi Work sites" when:

- Recording information in the TS 94 Protected Work Area Log Book and TS 96 Work Site Log Sheets.
- Completing pre-start tasks.
- Authorising work to start.
- Clearing the work site for rail movements.
- Authorising work to resume after rail movements.
- Managing the movement of rail vehicles within the Protected Work Area.
- Clearing the work site on completion of work.

Unplanned Work:

Before any unplanned work or activity is undertaken, permission must be obtained from the RPO.

Provided the RPO is satisfied the additional work can be managed safely:

- A new Work Site may be established, or
- Work incorporated within an existing Work Site.

A new Work Site must be managed by a SP.

The SPs of other Fixed and Mobile Work Sites that may be affected by a new Work Site must be advised, including work site limits.

The RPO must advise details of all unplanned work to the person responsible for planning the Protected Work Area.

902 Managing a Protected Work Area (PWA) - continued

j. Hi-Rail movements passing through a Protected Work Area

The HRV driver must:

- contact the RPO from the limits of the protected work area, and remain stationary until authorised by the RPO to enter
- record details of worksites advised by the RPO on the Mis.71, Mis. 88 or elsewhere (if travelling on a Mis.88 held by the RPO),
- contact each Site Protector and gaining authority before entering each Work Site (applies for multi worksites only)
- gain authority from the RPO before exiting a worksite (applies for multi worksites only).

The RPO must :

- Notify the location of worksite(s) to the HRV driver before authorising the HRV to enter the Protected Work Area,
- If the RPO holds a Track Warrant, Rule 902 K must be applied before authorising the movement to enter the Protected Work Area.

k. Rail movement travelling through a Protected Work Area on the Rail Protection Officer's track warrant (Mis88)

Single Work Site: All rail movements travelling through the Protected Work Area must be locked on by the RPO applying the procedure described in the Rule 902 Managing a Protected Work Area Job Aid.

Multiple Work Sites: All rail movements travelling through the Protected Work Area will be Mobile Work Sites and protected accordingly.

l. Communication within a Protected Work Area

Communication Equipment:

A communication link must always be available between the RPO, Assistant RPO's, SPs and Drivers / Operators of other rail movements.

Radio communication must be used where equipment and coverage is available.

902 Managing a Protected Work Area (PWA) - continued

If radios or radio coverage is not available, mobile phones may be used for internal Protected Work Area communications.

Call Signs:

The RPO must assign call signs to each Assistant Rail Protection Officer and SPs

The call signs and mobile phone numbers must be recorded on TS 94 and TS 96 log books.

Call signs must be used for all internal communication.

Internal Communication Protocols:

The protocols in "Rule 902 Managing a Protected Work Area Job Aid – Multiple Work sites" must be used when communicating:

- Authority to start work,
- Confirming work site clearances,
- Authorising resumption of work,
- Confirming final clearance when work is finished.

Communication protocols must be used when using radios or mobile phones.

m. Communication with rail vehicles at boundary of PWA

When it is not possible to communicate with the RPO due the limitations of radio Channel 1 the RPO must:

- Move to a location to contact the Operator on channel 1
  or
- Request Train Control to relay communications (by radio) between the RPO and the Operator
  or
- Request permission to use the Train Control radio system to contact the Operator.

n. Handover of Protected Work Area / Work Site

When a Work Area and associated Work Sites are handed over between RPOs, Assistant RPOs or SPs the procedures in the relevant "Rule 902 Managing a Protected Work Area Job Aid" must be applied.

Appendix 7: Actions taken by the NZ Transport Agency

On 14 September 2016, the Acting National Manager, Rail Safety, NZ Transport Agency stated in part:

> The Transport Agency undertook its own systems-focussed investigation into the hi-rail excavator accident at Raurimu in 2014. The purpose of that investigation was to identify any safety deficiencies in the rail transport system and/or practices connected with the collision that were relevant to KiwiRail's Safety Case and safety system. The investigation concluded that the failings sat within the following categories:
>
> 1. Training awareness.
>
> 2. Work planning and practices.
>
> 3. Communication on the work site.
>
> 4. Vulnerability of controls to procedural failures.
>
> Following the Transport Agency's investigation, it identified 11 improvements within these categories which it required KiwiRail to undertake. These were:
>
> 1. Staff training and procedures must ensure the responsibilities and authority of the Rail Protection Officer are clearly defined and implemented on-site.
>
> 2. Training and compliance systems must ensure staff and contractor training is kept current.
>
> 3. Site practices must enforce that only staff and contractors who have appropriate and current safety certification are permitted to operate at work sites.
>
> 4. A system for easy identification and checking of staff qualifications at a work site must be available to ensure staff and contractors have appropriate and current safety certification prior to commencing activities.
>
> 5. Staff training must ensure staff understand the relevance of safety-critical practices and are prepared to challenge their colleagues if they observe those practices being ignored.
>
> 6. KiwiRail must review whether a single activity site was appropriate for the work area where the collision occurred and, if not, amend documentation, procedures and training as appropriate.
>
> 7. Work planning forms must be maintained so they are always fit for purpose.
>
> 8. A quality assurance programme must reliably ensure deviations in work planning and practices are identified and remediated early.
>
> 9. There should be robust on-site communications protocols for track occupancy instructions.
>
> 10. An independent layer of safety controls, such as enhanced track protection and lock out technology, should be investigated to increase protection against work site collisions.
>
> 11. Comprehensive logs of work site activities must be available to aid with incident/accident investigation and audit purposes, such as recording of Channel 1 (or other work group specific) radio calls.
>
> The Transport Agency requires KiwiRail to report on progress and it continues to monitor progress into 2016.
>
> **2015 Ordinary Safety Assessment:**
>
> The KiwiRail 2015 Ordinary Assessment(audit) provided the Transport Agency with a further means to test the progress against the required improvements

from the investigation. These were reviewed under specific assessment themes related to:

1. The Raurimu Accident

2. Track Occupancy.

1. Theme - Raurimu

The 2015 Ordinary Safety Assessment identified that progress had been made against some of the required improvements noted in the Transport Agency's December 2014 investigation report. However, as also noted under the Track Occupancy theme, there were remaining system weaknesses that need to be resolved.

2. Theme - Track Occupancy

The 2015 Ordinary Safety Assessment identified that KiwiRail had developed a Track Occupancy Critical Risk network since the accident, with a corresponding strategic plan focussed toward eliminating track occupancy events.

The Assessment revealed that significant numbers of both Infrastructure and Asset Management staff and contractors in some regions had overdue safety observations. In addition, two of the sites visited demonstrated inappropriate application of track occupancy protection systems and ineffective Crew Resource Management. Assessors noted that these two concerns mirrored an area of system failure that allegedly contributed to the Raurimu accident.

Required actions post 2015 Ordinary Safety Assessment:

The 2015 Ordinary Safety Assessment, resulted in the following non compliances (NC) and recommendations (R) being identified and provided to KiwiRail for subsequent action to be taken.

The highlighted (see below list) non-compliances and recommendations have been raised specifically as 'remedial actions' to KiwiRail. These are non-compliances and recommendations which require remedial action pursuant to the Railways Act section 42 (1) (Notification of requirement for improvements).

The Transport Agency is actively monitoring the progress of these open actions. Most have milestones and action plans which have been agreed to by KiwiRail and the Transport Agency.

NC2 Safety observations and competency checks are not being completed for all KiwiRail staff within prescribed timeframes.

NC3 Safety observations and competency are not being completed and managed for all contractor personnel within prescribed timeframes.

NC4 Prescribed protection was not applied fully at work sites visited at Huntly and Kawerau Yard, and staff did not verify that it was safe to undertake tasks.

NC5 No evidence of Lead Auditor technical (field) competencies was available at the time of the assessment to determine suitability of person for the task or how they are linked with a technical expert. Closed

R16 Track Occupancy risk management process could be enhanced with the inclusion of further risks (and associated mitigations) identified during the assessment. Due to be closed.

R10 Develop a system for competency checks that over time ensures that all tasks a person has been deemed competent in are appropriately checked.

R11 Network Services should consider introducing the enhanced planning practices observed in the Auckland Metro area across all the other areas.

R12 When the component parts of track occupancy improvement are in place a consolidated internal audit of Track Occupancy is recommended to ensure that

the individual parts being checked are collectively achieving the desired outcome.

R13 Consider setting more risk adverse likelihood frequency rates to better reflect the exposure rate for which mitigations need to apply.

R14 Review the risk status of rules 908 and 401(d) to identify further controls to create a safety overlap to increase protection for track workers.

R15 It is recommended that KiwiRail establish a clear process, and maintain the necessary records to readily demonstrate that the required oversight and governance requirements for risk reviews are met.

Conclusion:

The Transport Agency proposes that the information provided in this letter should demonstrate to the Commission that the regulator has undertaken a robust review of this accident and the KiwiRail system failings which led to it–this includes undertaking an audit of KiwiRail's processes and procedures.

The Transport Agency also notes that work is on-going in this area by KiwiRail to both fulfil the Transport Agency's required improvements and also further address this area of its operational risk. We will continue to work with KiwiRail to ensure the improvements are fulfilled –as provided for and required by the Railways Act 2005.

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

RO-2013-103 and RO-2014-103	Passenger train collisions with Melling Station stop block, 15 April 2013 and 27 May 2014
RO-2015-101	Pedestrian fatality, Morningside Drive pedestrian level crossing, West Auckland, 29 January 2015
RO-2014-101	Collision between heavy road vehicle and the Northern Explorer passenger train, Te Onetea Road level crossing, Rangiriri, 27 February 2014
RO-2012-103	Derailment of freight Train 229, Rangitawa-Maewa, North Island Main Trunk, 3 May 2012
RO-2012-105	Unsafe recovery from wrong-route, at Wiri Junction, 31 August 2012
RO-2013-107	Express freight MP16 derailment, Mercer, North Island Main Trunk, 3 September 2013
RO-2012-104	Overran limit of track warrant, Parikawa, Main North line, 1 August 2012
RO-2013-104	Derailment of metro passenger Train 8219 , Wellington, 20 May 2013
Urgent Recommendations RO-2015-101	Pedestrian fatality, Morningside Drive level crossing, West Auckland, 29 January 2015
RO-2013-105	*Capital Connection* passenger train, departed Waikanae Station with mobility hoist deployed 10 June 2013
RO-2014-102	High-speed roll-over, empty passenger Train 5153, Westfield, South Auckland, 2 March 2014
RO-2013-106	Track occupation irregularity, leading to near head-on collision, Otira-Arthur's Pass, 10 June 2013
RO-2012-102	Train control power failure, 26 April 2012
Interim Report RO-2014-103	Metropolitan passenger train, collision with stop block, Melling Station, Wellington, 27 May 2014
RO-2013-108	Near collision between 2 metro passenger trains, Wellington, 9 September 2013
11-106	Hi-rail vehicle nearly struck by passenger train, Crown Road level crossing near Paerata, North Island Main Trunk, 28 November 2011

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