Report 11-103: Track workers nearly struck by passenger train
near Paekakariki, North Island Main Trunk, 25 August 2011

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

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

Final Report

Rail inquiry 11-103
Track workers nearly struck by passenger train near Paekakariki, North Island Main Trunk
25 August 2011

Approved for publication: April 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

Location of incident

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Abbreviations

Commission	Transport Accident Investigation Commission
km	kilometre(s)
km/h	kilometre(s) per hour
m	metre(s)
mg/L	milligram(s) per litre
ng/mg	nanogram(s) per milligram
ng/mL	nanogram(s) per millilitre
NIMT	North Island Main Trunk
THC acid	tetrahydrocannabinol metabolites
the passenger train	electric multiple unit passenger Train 6225
UTC	co-ordinated universal time
VHF	very high frequency

Glossary

Term	Description
Down Main	trains travelling on the Down Main line of the North Island Main Trunk (NIMT) are southbound trains, travelling to Wellington
EM80	a self-propelled track evaluation car that measures and records track geometry continuously, compares the recorded values with predetermined thresholds and then generates an exception report. The EM80 is scheduled to make at least 2 runs per year over passenger-carrying lines
hi-rail vehicle	a road vehicle dedicated to rail infrastructure maintenance or inspection tasks. The vehicle is also equipped with a rail trolley so that it can transfer from road to rail mode at a level crossing or other suitable location and then be driven along the track
information bulletin	an unnumbered instruction nominally issued daily by Network Operations Wellington at 1600 the day before it comes into effect. It includes alterations to train services, details of planned work activities scheduled to be carried out, details of mobile track maintenance machines operating as trains and special operational instructions for the day
metrage	an industry term to define a location along a track from the origin of the line and marked by fixed marker posts. The NIMT starts at Wellington, 0.0 kilometres (km) and ends at Auckland, 680.76 km
network control manager	the person responsible for managing both the safe access to the rail network and the service provided by train controllers. The role manages and co-ordinates incidents and ensures that safety reporting is performed and recovery plans are developed
person in charge	the person responsible for the safe operation of rail vehicles into and within a protected work area
proceed indication	a signal display that means a train can proceed at normal, intermediate, medium or low speed
protection person	the member of a work group who is the liaison point with the person in charge of the protected work area to ensure that all personnel and equipment are clear of the track for rail movements. The protection person has no authority to allow any rail personnel (including contractors) to obstruct the track before the person in charge has given authority to do so
training shuttle	a non-revenue Matangi-type electric multiple unit passenger train used for driver conversion training. A driver, already qualified to drive a Ganz Mavag-type passenger train, was fulfilling the practical driving requirements on a new class of train under the supervision of a minder driver
track ganger	the person responsible for leading and supervising a work group undertaking rail repair and renewal work. The track ganger is responsible for ensuring the work is carried out in compliance with KiwiRail's quality, safety and engineering standards
track gauge	the horizontal distance between rails on the railway track. The standard gauge for straight track is 1068 millimetres

track occupation	a train controller-authorised occupation of a section of the controlled network track by qualified infrastructure staff/contractors engaged in routine track maintenance or track inspections. Vehicles used in this type of work are not designed to activate track circuits, and therefore do not display on mimic screens in train control or on signal boxes' panels
Up Main	trains travelling on the Up Main line of the NIMT are northbound trains travelling from Wellington

Data summary

Vehicle particulars

Train type and number:	Train 6225 consisted of passenger cars EM1315 leading and ET3315 trailing. The train was 43 metres (m) long and had a tare weight of 72 tonnes
Classification:	electric multiple unit passenger train
Manufacturer:	Ganz Mavag in Hungary
Year of manufacture:	1982
Operator:	Tranz Metro, a business unit of KiwiRail
Fleet owner:	Greater Wellington Rail Limited, a business unit of Greater Wellington Regional Council

Date and time	25 August 2011 at 1019[1]
Location	35.7 km[2] NIMT between North Junction and Paekakariki on the Down Main line
Persons involved	one driver, and 7 others associated with the track maintenance work
Injuries	nil
Damage	nil

[1] Times in this report are New Zealand Standard Times (UTC + 12 hours) and are expressed in the 24-hour mode.
[2] The distance from a reference point at Wellington Station.

1. Executive summary

1.1. At about 1013 on Thursday 25 August 2011, electric multiple unit metro passenger Train 6225 (the passenger train) was travelling southbound from Waikanae to Wellington when it nearly struck 2 track workers who were repairing the track in a protected work area between Paekakariki and North Junction.

1.2. The person in charge of the work area had given permission for the passenger train to enter the work area after the "protection person" had given him assurance that the track workers were off and clear of the track. The protection person, however, could not see the track workers from where he was standing, and had given the assurance without first checking that they were off and clear of the track.

1.3. As the passenger train exited a curve travelling at about 60 kilometres per hour (km/h) the driver saw 2 members of a work group still on the track about 90 m ahead. He sounded the train whistle and applied maximum braking. The track workers managed to leap clear of the track just before the train passed. Neither was injured.

1.4. The Commission found that the planning of the work had not been completed in accordance with KiwiRail procedures. A communication plan had not been submitted by the acting track ganger (track ganger) and even though an informal communication plan had been developed the day before work commenced, that plan was altered to accommodate a change in circumstances. The amended communication plan was inherently flawed, and it was a breakdown in communication that led to the serious incident.

1.5. The Commission found that the work group collectively had insufficient experience in planning for and co-ordinating the work that day, and that the KiwiRail system for signing off, and the ongoing monitoring of infrastructure staff competency records, were incomplete and could not ensure that the staff involved were qualified to undertake their assigned duties.

1.6. The protection person, who failed to check that his co-workers were off and clear of the track, had been a regular user of cannabis, and post-incident drug and alcohol testing carried out by KiwiRail revealed tetrahydrocannabinol metabolites (THC acid) in his urine.

1.7. The Commission made recommendations to the Chief Executive of the NZ Transport Agency to take the necessary action to ensure that KiwiRail's safety system for proving staff competencies is accurate and up to date; and to work with the National Rail System Standard Executive in developing an industry standard requiring all rail participants to have drug and alcohol policies that: have zero tolerance of performance-impairing substances for workers engaged in safety-critical tasks; require post-incident and -accident and random testing for drugs and alcohol; and require a system for rail workers to report discreetly co-workers suspected of using or being under the influence of drugs or alcohol in the workplace.

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

- safe rail operations require the development of the right plan for the task
- rail staff engaged in safety-critical work must be properly trained and hold current certification for the work undertaken
- every step must be taken to prevent rail workers being affected by performance-impairing substances, particularly those involved with safety-critical tasks. Rail workers should have the opportunity to report discreetly co-workers suspected of using or being under the influence of drugs or alcohol in the workplace.

2. Conduct of the inquiry

2.1. On Thursday 25 August 2011 at about 1400, the NZ Transport Agency notified the Commission of a track occupation incident under section 13(4) of the Railways Act 2005. The Commission opened an inquiry under section 13(1) of the Transport Accident Investigation Commission Act 1990, to determine the circumstances and causes of the incident, and appointed an investigator in charge.

2.2. An investigation team was assembled and visited the site where the passenger train had nearly struck the track workers. Interviews were conducted with the driver of the passenger train, all staff working in the protected work area, KiwiRail's General Manager Legal and Governance, General Manager Infrastructure, Engineering and Operations, General Manager Operations and the National Systems and Standards Manager.

2.3. Evidence was gathered from the interviews, train control records, the train on-board event recorder, incident reports from the people working in the protected work area, KiwiRail's operating rules and procedures, telephone records, testing laboratory results and the National Rail System Standards.

2.4. On 13 February 2013 the Commission approved draft final report 11-103 for circulation to interested persons for comment.

2.5. Written submissions were received from the NZ Transport Agency and KiwiRail.

2.6. The Commission approved the final report for publication on 17 April 2013.

3. Factual information

3.1. Background information

3.1.1. On Thursday 11 August 2011, EM80 track evaluation car identified a short section of track between Paekakariki and North Junction on the Down Main line of the NIMT with wide track gauge. At that time, KiwiRail's Track Code required the fault to be fixed within 7 days. If the condition was not fixed within the time specified, a temporary speed restriction was required until the condition was fixed.

3.1.2. The track ganger said that on Tuesday 23 August 2011 he was instructed to repair the out-of-gauge track urgently because it was outside the repair action time. He discussed the job requirements with a person from the Wellington Upgrade Project Track Protection Unit to ascertain his availability before he submitted an "Application for Planned Work" (see Appendix 1).

3.1.3. The Application, submitted the next day, requested a track occupation between North Junction and Paekakariki on Thursday 25 August 2011, from 0900 to 1500, to carry out planned track maintenance work using a track protection method called Rule 905, Compulsory Stop Protection (see Appendix 2 for details of how this works).

3.1.4. The request was approved by Network Authorities and details of the planned work were shown on the information bulletin[3] for the Wellington metro area[4], dated 25 August 2011 (see Appendix 3). The bulletin showed the protected work area as between 35.10 km and 38.64 km for both the Up Main and Down Main lines.

3.1.5. Southbound trains could enter the protected work area from any of 3 tracks at Paekakariki. Entry was controlled by a compulsory stop board placed beside each of the 3 controlled signals (see Figure 1). These signals were set at red (stop) by the train controller for the duration of the work occupation. Drivers were required to stop their trains ahead of the compulsory stop board and call the person in charge of the work area for permission to proceed past the board.

3.1.6. When the person in charge had determined that the track in the protected work area was safe for the passage of a train, he gave the driver conditional authority to pass the stop board once train control had cleared the signal. He then contacted the train controller and asked him to set the controlling signal manually to "proceed"[5]. The train could then enter the work area.

[3] An information bulletin is an unnumbered instruction issued by Network Operations Wellington, usually the day before it comes into effect, for operational reasons that include an alteration to train services, planned track work being carried out, mobile track maintenance vehicles operating as trains, or special instructions for the day. The information bulletin is distributed to all operating staff affected, including drivers and track maintenance staff.

[4] The Wellington metro area covers Wellington to Waikanae on the NIMT, Wellington to Masterton on the Wairarapa Line, the Johnsonville Line and the Melling Line.

[5] A proceed indication is a signal showing a clear or caution indication for normal, intermediate, medium or low speed.

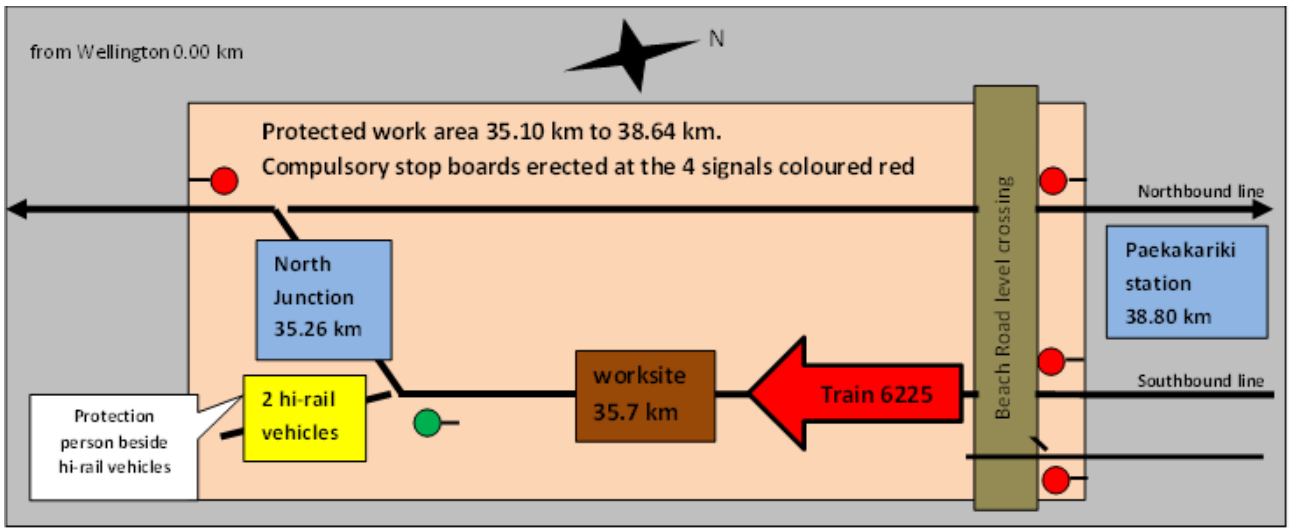


Figure 1
Diagram of the protected work area (not to scale)

3.2. The incident

3.2.1. The person in charge established protection for the work area between North Junction and Paekakariki by 0917 in accordance with the information bulletin (see Appendix 3).

3.2.2. The track ganger first learned that non-scheduled training shuttles[6] were operating through the protected work area during his on-site, pre-shift briefing with the person in charge. Because of these extra trains, the person in charge delayed the work group's access to the track until about 0945.

3.2.3. The track ganger held a task briefing with his 4 staff during which he assigned protection duties to the only other person (the protection person) in the group who had attended a track occupancy protection training course. The protection person did not carry out any track repairs but carried a channel 1 radio so that he could be contacted by the person in charge when a train was waiting at the compulsory stop board. The track ganger instructed the protection person to confirm with the person in charge once the hi-rail vehicles had been stabled on the runaway track from the Down Main line at North Junction.

3.2.4. At about 0947 the person in charge gave authority for 2 hi-rail vehicles to on-track[7] at Beach Road level crossing, in the protected work area, and travel on the southbound line to the re-gauge site. It was not until the materials and equipment had been unloaded at the worksite that the track ganger realised that not enough of the correct-sized screw spikes had been transported to complete the re-gauge work. He discussed the issue with the person in charge and they agreed that one hi-rail vehicle would return to Paekakariki on the Down Main line from the runaway road after the next 4 train movements had cleared the work area. These were a northbound passenger train and a northbound training shuttle followed by a southbound passenger train and a southbound training shuttle.

3.2.5. The track ganger discussed the work-plan change with his work group. He and one other from the work group stayed at the worksite and started preparing the sleepers, while the protection person and the other 2 members of the work group stabled the hi-rail vehicles. The track ganger instructed the protection person to call him on his mobile phone before he confirmed with the person in charge that the work area was clear. The track ganger did this because he intended to start work on the track between train movements without having a local channel radio at hand.

[6] Drivers qualified on Ganz Mavag-type passenger trains were undertaking supervised practical training on non-revenue Matangi-type passenger trains as part of their conversion training.
[7] The process of transitioning from a road vehicle to a rail-mounted vehicle.

3.2.6. The track ganger wanted the trailing hi-rail vehicle stabled facing north so that it would take less time for the protection person to drive to Paekakariki to get the extra screw spikes. The protection person stayed near his radio-equipped hi-rail vehicle while he waited for the next 4 train movements to clear. From there, the protection person could not see the re-gauge worksite (see Figure 2).

3.2.7. At 0959 the person in charge radioed the protection person to find out whether the work area was clear for the passage of the first northbound train. The protection person gave the person in charge an "all clear" response, so he wrote a clearance time of 0959 on the "Work Area – Protection Sheet". Mobile phone records showed that the protection person had not telephoned the track ganger to find out if the work area was clear.

3.2.8. The communication process was repeated for the second northbound train. The person in charge radioed the protection person and was again told that the track was clear and safe for the second northbound train movement through the work area. The person in charge recorded a clearance time of 1010. Again, the protection person had not telephoned the track ganger to make sure that the work area was clear.

3.2.9. At about 1013 the southbound passenger train stopped at Paekakariki Station for passenger work. The driver radioed the person in charge to ask for permission to pass the compulsory stop board. The person in charge contacted the protection person by radio and he told him that the protected work area was clear for the passenger train to enter. The person in charge recorded a clearance time of 1014. Once again the protection person had not telephoned the track ganger to make sure that the work area was clear.

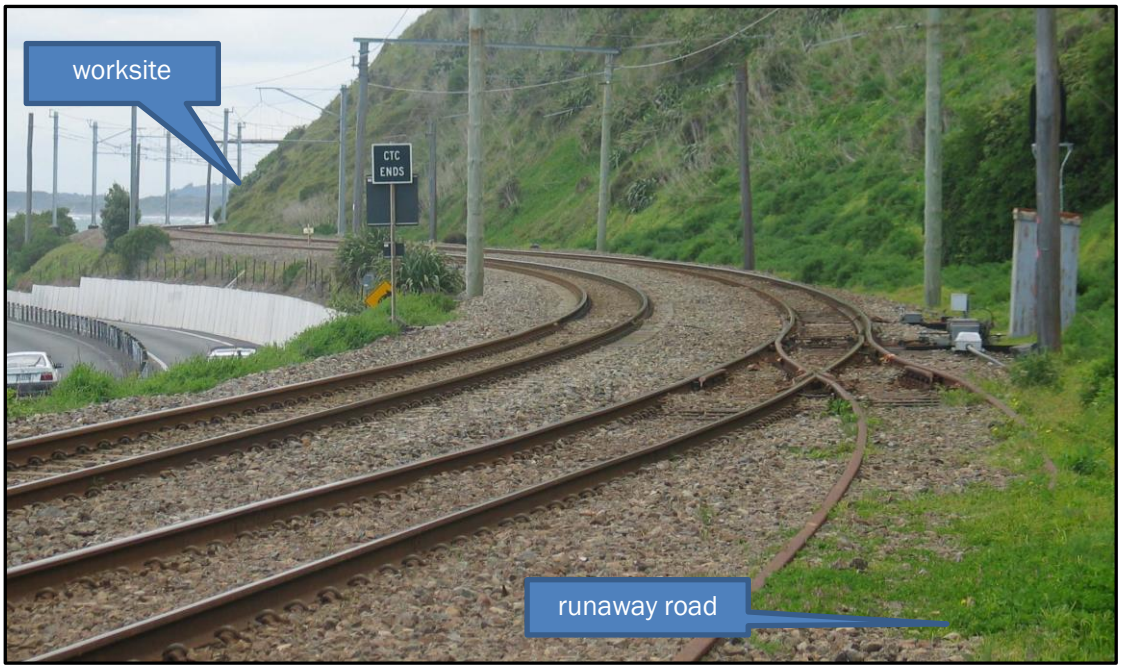


Figure 2
The protection person's view line facing north

3.2.10. The person in charge radioed the driver and told him that he had permission to enter the protected work area once the controlling signal displayed a proceed indication. The person in charge then asked train control to set a proceed indication on the controlling signal. The train controller changed the signal to "proceed" at about 1016.

3.2.11. The person in charge radioed the protection person after the passenger train entered the protected work area and asked him to call back as soon as the passenger train cleared the work area so that the southbound training shuttle following could be authorised to enter the protected work area.

3.2.12. At 1018:38, the passenger train was travelling at the authorised curve speed of 70 km/h. The train then slowed to the displayed curve speed of 60 km/h for the next curve, which was immediately before the place the track ganger was working.

3.2.13. Two other members of the track work group were walking from the runaway road towards the re-gauge site. They were about 200 m away when they saw that their colleagues were working on the track in the path of an approaching passenger train. They then ran towards their colleagues, waving their arms and shouting in a vain attempt to warn them of the approaching train.

3.2.14. The train driver said he was about halfway around the left-hand curve when he first saw 2 track workers wearing hi-visibility clothing about 90 m ahead facing away from his train. He sounded the train horn and applied maximum braking. The track workers turned and saw the train bearing down on them (see Figure 3). They both jumped clear of the track, one towards the adjacent line and the other towards the hillside just before the train passed. The driver said the track workers cleared the track when his train was less than 20 m away.

3.2.15. The driver's initial thought was to stop the train to check on their wellbeing, but he decided to continue on after he passed the other 2 track workers walking clear of the track towards those who had been working on the track. None of the 4 track maintenance staff reported the incident.

3.2.16. The protection person radioed the person in charge as soon as the passenger train had crossed over from the southbound line to the single line. The person in charge then recorded a clearance time of 1019.

Figure 3
The work group's view of an approaching passenger train

3.2.17. Between 1020 and 1031 the following southbound training shuttle went through the work area without incident.

3.2.18. At about 1033 the driver of the passenger train reported to train control that his train had "nearly hit staff working in the middle of the Down Main line, just north of Tunnel 7".

3.2.19. The train controller contacted the person in charge of the protected work area and gave him the train driver's account of the incident. The person in charge said that he was not aware of the incident.

3.2.20. The train controller then reported the incident to the duty network control manager, who after further consultation declared that the maintenance work be suspended. He instructed the person in charge to clear the work area of all personnel and equipment.

3.2.21. The person in charge relayed the instruction to the track ganger. The entire work area was cleared and all staff were instructed to assemble at Paekakariki for an incident debrief with the area manager's representative. The work group waited at Paekakariki for about 45 minutes until their manager's representative arrived.

3.2.22. In accordance with KiwiRail's drug and alcohol policy, all staff associated with the planned work were tested for drugs and alcohol.

3.3. Site and operating information

3.3.1. The rail track between North Junction and Paekakariki was double line, having an Up Main line (from Wellington) and a Down Main line (to Wellington). Trains travelled on the left-hand line in the direction of travel.

3.4. Train 6225 (the passenger train)

3.4.1. The passenger train was a 2-car electric multiple unit passenger train consisting of powered motor coach EM1315 leading and unpowered trailer coach ET3315. The passenger train had been built by Hungarian firm Ganz Mavag and commissioned during the early 1980s. The 43 m long train had a tare weight of 72 tonnes. The train had a seating capacity of 148 but was designed to carry 296 passengers.

3.4.2. KiwiRail restricted the passenger train's maximum operating speed to 95 km/h. The maximum braking distance was 460 m for a fully laden train travelling at the maximum operating speed on level track.

3.5. Communication

3.5.1. Three communication systems were used in the protected work area: radio channel 1, radio channel 2, and a mobile phone assigned individually to the person in charge, the protection person and the track ganger.

3.5.2. Channel 1 was a very-high-frequency (VHF) point-to-point (line-of-sight) simplex channel that did not use repeaters. Under normal circumstances the coverage was expected to be up to 5 km but this was dependent on the power output of the radio in use and whether the surrounding terrain affected the line-of-sight coverage. The channel 1 radio was referred to as the "local channel" and on this day was used by the person in charge for communicating with drivers and the protection person. The person in charge was stationed at about the midpoint of the 3.54 km long protected work area to minimise the risk of marginal performance of the "local channel", something he had experienced intermittently when working in the same protected work area in the previous 2 weeks. On this occasion the person in charge stationed an assistant near the south-end limit board, in full view of a driver stopped at the signal controlling the entry of northbound trains into the protected work area, to reduce the potential for communication reliability issues.

3.5.3. Channel 2 was a repeater-assisted VHF radio channel for communication to train control from anywhere between Wellington and Otaki on the NIMT. The radio system was "open channel", whereby any person in the coverage area of the repeater heard all calls from that repeater.

3.5.4. KiwiRail considered the use of mobile phones an acceptable means of communication between the person in charge and maintenance staff, between the person in charge and train control, and between the person in charge and the driver of a train waiting for permission to enter the protected work area. The information bulletin dated 25 August 2011 showing the planned work activity between North Junction and Paekakariki made reference to both the mobile phone number and the phonetic radio call sign for the person in charge.

3.5.5. The track ganger said that in his experience, the channel 1 radio reception at the re-gauge site was sometimes poor and intermittent. It was for that reason that he decided to start the preparatory work without having a channel 1 radio nearby, knowing that he had made alternative communication arrangements. He said that he had asked for and had expected a call to his mobile phone from the protection person before the person in charge was told that the track had been cleared for a train to enter the work area.

3.5.6. A communications timeline was established from conversations recorded in train control and mobile phone call logs. Although channel 1 radio transmissions were not recorded, 2 track staff confirmed independently that they overheard the site protector confirm to the person in charge over a channel 1 radio that the track was clear for the passenger train to enter the protected work area.

3.6. Personnel

The track ganger

3.6.1. The track ganger had been a member of track maintenance work group MT3 for about 6 years. Although he had been the acting track ganger for almost a year, he had not been permanently appointed to the position. Work group MT3 had a complement of 6 members, but one of the team had been temporarily assigned to another work group on the day of the incident. The work group included 4 trainee track workers, of whom 3 had been working for KiwiRail for less than a year.

3.6.2. The track ganger was a first-line supervisor reporting to the area manager, and was responsible for leading and supervising members in the work group to achieve track maintenance and repair in a timely and cost-effective manner in compliance with KiwiRail's quality, safety and engineering standards. He was required to develop a safety and quality culture within the team by encouraging the team to improve health and safety by ensuring that they operated in a manner that reduced safety risks to themselves and others working alongside. All accidents and incidents were required to be reported to his manager within one hour.

3.6.3. A review of the track ganger's training records showed that by 18 November 2009 he had satisfactorily completed the classroom theory content for Track Occupancy Protection (called "Level C[8]"), covering all track safety rules and the operation of hi-rail vehicles. He was therefore permitted to start practical on-the-job training. There was no corresponding training record to verify that his practical training had been assessed and that he had demonstrated competency in that role.

3.6.4. The Level C theory training included a module on preparing and submitting an Application for Planned Work. The track ganger said that this had not been the first time he had submitted an application and that he was comfortable with the process.

[8] Level C was a KiwiRail training course designed to teach an operational understanding of the rules, codes and instructions required where the track occupancy and the movement of rail service vehicles were authorised by train control.

The person in charge of the work area

3.6.5. The person in charge of the work area was independent from work group MT3. He had been a member of the Wellington track project team since February 2009 and was part of a core group dedicated to protecting contractors and KiwiRail staff carrying out planned work.

3.6.6. Although he had been contacted by the track ganger to determine his availability to carry out the person in charge duties, he was not party to planning the work or submitting the request for planned work. He did, however, suggest to the track ganger that the limits for the protected work area be the same as those used by traction overhead contractors about 2 weeks earlier. He provided the track ganger with a copy of the information bulletin covering that work.

3.6.7. The person in charge was qualified and held current certification for the work he was performing on the day.

The protection person

3.6.8. The work group member who was allocated "protection person" duties was designated a track worker and had carried out track maintenance work in the Wellington metro rail network since 2006. His training records showed that he had completed the Level C theory training course on 18 June 2010. KiwiRail advised the Commission that no follow-up training record existed to confirm that he had demonstrated competency and had achieved full Level C certification. Without such confirmation he was not qualified to drive a hi-rail vehicle on the rail network.

3.6.9. The protection person said that he understood the requirements of his role as the site protection person and was aware of the need to contact his track ganger before he could give confirmation to the person in charge that the track was safe for a train to pass the stop board. He knew that once the 2 hi-rail vehicles had been stabled on the runaway road at North Junction, he had to wait for 4 trains – 2 northbound followed by 2 southbound – to pass before he could ask the person in charge for permission to return to Paekakariki on the Down Main to pick up the additional track fastenings needed to complete the re-gauge work.

3.6.10. During the first 20 minutes that he was at North Junction he gave confirmation to the person in charge that the track was safe for 2 northbound trains and southbound passenger Train 6225 to enter the protected work area without having first checked with his track ganger that the re-gauge site had been cleared. He said that while he was beside the vehicles stabled on the runaway road he became distracted when he received about 5 phone calls and some 50 text messages from his partner, many of which he said he ignored.

3.6.11. The protection person said that he had been struggling to deal with personal relationship issues outside work for a number of weeks.

3.7. Toxicology and performance-impairing substances

3.7.1. The post-incident urine specimen provided by each participant associated with the planned work activity was tested by the Institute of Environmental Science & Research workplace drug testing laboratory at Porirua. All but one urine specimen tested negative. The specimen provided by the protection person tested positive.

3.7.2. The protection person's urine specimen was collected at 1358 on 25 August 2011. The urine specimen was analysed by mass spectrometry for cannabinoids under section 5 of Australian Standard/New Zealand Standard 4308:2008, and recorded a positive THC acid level of 99 nanograms per millilitre (ng/mL) of urine.

3.7.3. In line with KiwiRail policy, the protection person provided another urine specimen for analysis on 26 September 2011. This follow-up specimen recorded a positive THC acid level of 82 ng/mL.

3.7.4. The testing laboratory compared these THC acid results for the same person and on 29 September 2011 the workplace drug testing analyst made the following comments:

> Comparison reports are prepared to compare THC-acid results for the same person. The reason why the THC-Acid levels are not compared directly is that urine is always changing. For example the more fluid you drink the more dilute the urine is and subsequently any drug levels are lower. When comparing THC-Acid levels, the calculated THC-Acid levels are adjusted to take into account the urine strength. The adjusted results are called "normalised levels for THC-Acid". The normalised level is the ratio of the THC-Acid level over the creatinine level.
>
> Creatinine is a waste product of muscle metabolism found in human urine. Creatinine is excreted at a fairly constant rate, that is, about the same amount of creatinine is expelled from the body every day and this amount is relatively independent of the amount of fluid intake. Therefore creatinine is used to determine urine strength.

Date	THC-Acid level (ng/mL)	Creatinine Level (mg/L)	Normalised Level (ng/mg)
25/8/11	99	82	1200
26/9/11	82	841	97

> mg/L milligrams per litre
>
> ng/mg nanograms per milligram
>
> A non-regular user of cannabis is expected to return a negative result within 2-3 days after use and a regular user within 20 days of ceasing use.
>
> The sample collected on 25 August 2011 had a creatinine level less than 200 mg/L, meaning the sample was dilute. Thus the normalised level is significantly higher than the THC-Acid level.
>
> The normalised level has decreased between 25 August 2011 and 26 September 2011 which are 32 days apart. I would have expected a negative result by 26 September even if [the person's name] was a regular user of cannabis. Thus, in my opinion, cannabis use has occurred after 25 August 2011.

3.7.5. KiwiRail's General Rule 8 stated in part:

> **8 Rail Personnel**
>
> **(a) Fitness for Duty**
>
> Rail Personnel are not fit for duty if they are under the influence of alcohol or drugs.
>
> Managers/Supervisors are to ***stand down*** Rail Personnel from operational duties if there are doubts about compliance.
>
> **(b) Drugs and Alcohol**
>
> The consumption of alcohol or unauthorised possession of alcohol is prohibited.
>
> The consumption of or possession of illegal drugs is prohibited.
>
> Managers/Supervisors must ensure that Rail Personnel do not undertake operational duties when taking medication that will affect the person's ability to work safely.

3.7.6. At the time of the incident, KiwiRail's Drug and Alcohol Testing Policy provided for post-incident and reasonable-cause testing. KiwiRail's Health and Injury Prevention Manager expected a track ganger or a member of the work group to advise their manager should one of the team suspect that the performance of a fellow employee or a contractor was affected by drugs or alcohol.

3.7.7. The National Rail System Standard / 3 Issue 1 stated in part:

> **6.1 Effect of Drugs on Safety Critical Work**
>
> Many of the physiological effects of illicit drugs are similar to both alcohol and psychoactive prescription drugs. Their usage is therefore likely to cause a significant safety hazard to rail safety work.
>
> Individual organisation policy generally address requirements for reporting of drug impairment by workers as well as testing for impairment.
>
> Illicit drugs are by their nature psychoactive (or psychotropic). This means their detrimental effects in safety terms are not limited to their demonstrated physiological effects on the worker's physical skills, but extend to their psychological or behavioural effects. Those under the influence of these drugs have a higher propensity to behave in a manner incompatible with safe working.
>
> Cannabis can impair psychomotor functions related to safety critical skills and has been shown to have adverse effects on driving skills and judgment.

3.7.8. In 2004 the Australian Transport Safety Bureau completed a review of literature on cannabis and its effects on pilot performance (ATSB, 2004). The executive summary stated:

> Cannabis is a commonly used recreational drug, which has widespread effects within the body. Smoking is the most common form of administration. The adverse effects of cannabis on behaviour, cognitive function and psychomotor performance are dose-dependent and related to task difficulty. Complex tasks such as driving or flying are particularly sensitive to the performance impairing effects of cannabis. Chronic cannabis use is associated with a number of adverse health effects, and there is evidence suggesting the development of tolerance to chronic use as well as a well- defined withdrawal syndrome. There is also evidence that the residual effects of cannabis can last up to 24 hours. Significantly, the modern dose of cannabis is much more potent than in the past, when the majority of the research was conducted. As such, the reported adverse health effects may be conservative. Although only a limited number of studies have examined the effects of cannabis on pilot performance, the results overall have been consistent. Flying skills deteriorate, and the number of minor and major errors committed by the pilot increases, while at the same time the pilot is often unaware of any performance problems. Cannabis use in a pilot is therefore a significant flight safety hazard.

4. Analysis

4.1. Introduction

4.1.1. This serious incident was the result of poor planning and poor communication – not just the planning for how the track repairs were to be achieved on the day, but KiwiRail's overall process for planning track occupations.

4.1.2. The final event that resulted in the southbound passenger train nearly hitting the track workers was the protection person not following his instructions. He was supposed to phone his track ganger to check that the work party was off and clear of the tracks before he told the person in charge that the track was safe for a train to enter the work area. He did not do this, and had not done so before the 2 earlier northbound trains passed through the work area on the adjacent line.

4.1.3. The analysis of the data from the passenger train's event recorder confirmed that the train was travelling at the authorised line speed of 60 km/h at the time the driver saw 2 track maintenance staff working on the track about 90 m ahead, facing away from his train. The driver had no more than 6 seconds to observe, analyse and respond to what was in front of him and then for the track staff to respond and react. The driver sounded the train horn and applied maximum braking, and fortunately those working on the track heard the horn, turned and jumped clear of the track just before the train passed.

4.1.4. The situation into which the protection person was put was less than ideal. He had been given the task of protecting a work group that he could not see, and every time a train stopped at the compulsory stop board he was required to switch from using the local radio channel to using the mobile phone then back to using the local radio channel to confirm with the person in charge that the work area was clear. His situation was the result of an ad-hoc communication plan put together to work around getting enough track occupation time to fix the track during a period of high train frequency.

4.1.5. Notwithstanding the less-than-ideal communication plan, the protection person's task would have been achievable had he followed the instructions given to him. The factors that might have influenced his performance are discussed in the following analysis.

4.1.6. Also discussed are the issues of planning occupations for track maintenance; communication; procedures for protecting work areas; training; and the certification process for track maintenance staff.

Findings:

The near miss[9] between southbound Train 6225 and the 2 track workers occurred when the driver was given authority to pass through the worksite without the protection person first checking that the track workers were clear of the tracks.

Before the near miss, the protection person had given permission for 2 other northbound trains to pass through the work area on the adjacent line without first checking that the track workers were clear of the tracks.

[9] A situation that did not result in an accident, but potentially could have done so under slightly different circumstances.

4.2. Planning and procedures for protecting work areas

Work planning

4.2.1. KiwiRail's Track Code T003[10] required the out-of-gauge track to be inspected regularly until it was fixed. When the condition was not fixed within 7 days, a temporary speed restriction of 60 km/h was required until it was fixed. However, the wide gauge was located within a sharp curve that was already permanently restricted to a maximum line speed of 60 km/h, so there was no requirement to impose any further speed restriction.

4.2.2. Notwithstanding the existing speed limit for the curve, the Code instruction to wait for 7 days before applying a speed restriction seemed unusual. If a speed restriction were needed, logic would say that it was needed immediately. KiwiRail changed the Code on 1 November 2011, requiring an immediate speed restriction when such a fault was detected.

4.2.3. Twelve days went by from the time the track fault was detected until the track ganger was instructed to fix it. The fact that the track where the fault was identified was already speed restricted meant there was time to plan for the repair to cause the least disruption to trains and the work gang.

4.2.4. Other work groups had been working on the overhead traction the previous evening. The section had been closed to all passenger trains to allow for that work, giving an ideal opportunity for the track ganger to repair the over-gauge fault without interruption. Any risks created by trains and maintenance gangs competing for the same section of track would have been eliminated.

4.2.5. Instead, the time and date for making the repair were based around the availability of the person in charge. This of course might have been a controlling factor, but no evidence could be found that the planning team in Network Authorities had considered combining the protected work areas and protecting the 2 separate worksites under Rule 910 of the Code, Multiple Activities. It would appear that better planning of track repair, maintenance and inspection by KiwiRail could result in operational efficiency while also reducing the risk of conflicts between maintenance gangs and rail vehicles.

4.2.6. A copy of that previously approved track work protection arrangement was appended to the Application for Planned Work with 2 changes: the term "Overhead work" had been replaced with "EM80" work and a new alphanumeric call sign for the person in charge was shown. However, the Application still referred to "multiple work activities" even though there was to be only one worksite in the protected work area.

4.2.7. KiwiRail's current work application process and request forms were set out in Semi-Permanent Bulletin No. 532, dated 15 July 2011. The process required a minimum of 24 hours' advance notice when making a request for minimal-impact work such as track re-gauging at a multi-line site (see Appendix 3). An accompanying work area communication plan was required when the work area was longer than one kilometre and/or where there was difficulty using the channel 1 or channel 5 radio frequency to communicate with the drivers of other rail service vehicles both within and outside the protected work area. The proposed North Junction-to-Paekakariki work area satisfied both criteria in that the work area was 3.54 km long and it was within an area identified in KiwiRail's Rail Operating Code[11] as an area of poor coverage when using VHF hand-held radios.

4.2.8. Despite receiving inaccurate and incomplete documentation without the required 24-hour minimum notice period, Network Authorities approved the Application and included details of the planned work on the information bulletin dated 25 August 2011, issued at 1600 the previous day.

[10] Amended by significant Information Notice T039.
[11] Section 10, Clause 3.28.

Worksite protection

4.2.9. The protection of staff and contractors working in a protected work area has been an ongoing safety issue for KiwiRail. Toolbox Topic No. 10058, issued on 16 August 2010, was distributed to all workplaces for discussion. Reference was made to an earlier incident that was not dissimilar to this incident. Staff were reminded to make sure that the line was clear before authorising movements through a work area. They were to do this by advising all maintenance staff of the rail traffic and by receiving confirmation that all personnel and equipment were clear of the track. The person in charge had to give authority before work resumed after the rail traffic had passed through the work area. This authority could be given face to face, by radio, by telephone or by approved hand signals.

4.2.10. The track ganger, the protection person and the person in charge were working for KiwiRail at the time the Toolbox Topic was issued and were aware of its content.

4.2.11. Between 1 July 2010 and 25 August 2011, KiwiRail had reported 46 unauthorised track occupations to the rail regulator, the NZ Transport Agency. Fourteen of these incidents had occurred in protected work areas – where the tracks had been obstructed after the person people in charge had authorised trains to enter the work areas. A further 19 occurrences had involved contractors working beyond the limits of protected work areas, or with no protection. Most of the unauthorised track occupations had involved major work areas where the people in charge were responsible for several worksites in single protected work areas.

4.2.12. In response to these incidents KiwiRail engaged a consultant to review interface arrangements between KiwiRail and rail infrastructure service providers. The aim of the review was to come up with training solutions and provide recommendations to improve worksite safety performance.

4.2.13. The review primarily focused on activities associated with managing access to the rail network and how KiwiRail's internal processes interacted with and affected large construction projects currently underway within the Auckland rail network. One of the key safety conclusions from the review dated 5 September 2011 was:

> Workers are routinely committing rule violations at large construction worksites as they attempt to work around ineffective KiwiRail processes to minimise unnecessary delays – as they see them.

4.2.14. The review made 6 recommendations to address organisational issues that caused delays at worksites. The recommendations were aimed at giving staff and contractors at worksite level direct roles in reducing locally controllable delays to reduce the incentives for rule violations. Four of the recommendations had some relevance to this incident. These are repeated below:

> That KiwiRail urgently reviews its construction planning and coordination processes with the aid of an experienced rail sector consultancy and introduces current best practice.
>
> That KiwiRail introduces dedicated construction control desks at National Train Control Centre for local construction work.
>
> That KiwiRail identifies and introduces a radio communication facility for construction in Auckland that works over the entire length of long worksites and has recording of all voice traffic.
>
> That KiwiRail reviews and updates the processes and technology used in preparing and distributing the daily Networks Operations Information Bulletin.

4.2.15. The role of protection person was one that had emerged within KiwiRail in answer to some of the protection issues being experienced at multiple worksites. At the time of this incident there was no formal recognition of the role, and no description of a protection person's responsibilities. In September 2011 KiwiRail issued Semi Permanent Bulletin No. 792 (refer Section 6.3). The Bulletin formalised the site protector and defined the role and the operating certification required to become one. The protection person for this incident was

performing tasks similar to those of a site protector as defined in the Semi-Permanent Bulletin.

4.2.16. KiwiRail's procedures make no reference to the positioning of the site protector in relation to the worksite that they are protecting. While in some rare cases it might be that the protection person cannot remain in sight of the work gang while still maintaining radio contact with the person in charge, the procedures should make it clear that this should be the exception and stress the importance of the protection person being able to see the work group when making radio contact with the person in charge. Having the work gang in sight will reduce the probability of the system failing, as it did on this occasion.

Findings:

The timing of the maintenance work was planned around the availability of the person in charge rather than optimising efficiency with the least disruption to rail services.

The Application for Planned Work submitted by the track ganger was incomplete because it did not include a communication plan, and it contained erroneous information. The work plan therefore should not have been approved by the work planning group.

The KiwiRail system for planning track maintenance did not promote the co-ordination of separate jobs to be done on the same section of track into one track occupation.

The protection person was being used by KiwiRail to provide protection for individual worksites within longer work areas, but KiwiRail had not formally incorporated this work practice into its rules at the time of this occurrence. Consequently, the role and methods of operation were not clear.

4.3. Communication

4.3.1. Soon after the maintenance gang arrived at Paekakariki, the person in charge and the track ganger developed a communication plan. This initial plan followed the standard KiwiRail protocols.

4.3.2. While developing the communication plan, the track ganger was also told that there were additional non-revenue passenger trains operating throughout the morning that would delay their start time by about 45 minutes, and that throughout the day the gang would have to clear the track for more trains than usual.

4.3.3. The track ganger made use of the 45 minutes' waiting to access the protected work area by holding a pre-shift briefing with his work group. He explained the work programme for the day, and informed his team that they would have to clear the track for more trains than usual. The appointed protection person confirmed that he understood the communication plan and was aware of his responsibilities.

4.3.4. The communication plan then changed with the discovery of the equipment shortage. The amended communication plan that had the protection person standing next to the stabled hi-rail vehicle was not a good one. He was at a location that was farther away from the person in charge than the re-gauge site and therefore less likely to have good radio coverage. It would have been more logical for the track ganger to keep the portable VHF radio himself, or if that was going to interfere with his work, then have someone else stand beside him with the radio.

4.3.5. By starting the preparatory work without having a channel 1 radio at hand, the track ganger denied himself the opportunity to listen to the open radio channel communication between the person in charge and his protection person and between the person in charge and a

driver waiting to enter the protected work area, or to even have a direct line of communication with the person in charge himself.

4.3.6. The amended communication plan made the protection person's role critical to the safety of the work group – specifically, the mobile phone call he was supposed to make to the track ganger to ensure that he and his colleague were off and clear of the tracks. This system failed twice before the first southbound train came around the curve because the protection person did not make the phone calls as required. Two trains were allowed through the work area without the track ganger's knowledge. This should immediately have told the track ganger that the communication plan was not working, and work should have stopped until the situation had been resolved. Even when he and his co-worker were nearly hit by the southbound passenger train, he still did not contact the protection person, nor did he contact the person in charge to report the near miss.

4.3.7. The near miss would have been avoided had the track ganger stopped the preparatory work after the 2 northbound passenger trains passed. It also could have been avoided had he delayed the start of the preparatory work until his 2 other workers returned from the stabling road, because one of them carried a portable local channel radio. Carrying out track maintenance work without having a radio nearby created an unnecessary safety risk.

4.3.8. Mobile phone records showed that between 0930 and 1019:13 (the time of the near miss) the protection person received 2 voice messages from his track ganger and 2 text messages from his partner. He also sent 2 text messages to his partner during that time. The times at which the transmissions were received and made were:

Time	From	To	Type
1003:02	Track ganger	Protection person	Voice
1007:02	Partner	Protection person	Text
1010:10	Track ganger	Protection person	Voice
1014:40	Protection person	Partner	Text
1015:17	Partner	Protection person	Text
1015:41	Protection person	Partner	Text

4.3.9. The mobile phone records also showed that between 1027:29 and 1035:02 the protection person received 4 more text messages from his partner and he sent one to his partner. There were no other entries allocated to the mobile phone used by the protection person before 1100.

4.3.10. The mobile phone records confirmed that the protection person had made no attempt to call his track ganger before he told the person in charge on 3 separate occasions that the track was clear for a train to enter the protected work area.

Findings:

A communication plan was considered by and agreed between the track ganger and the person in charge of the worksite. That initial plan complied with KiwiRail procedures and most probably would have prevented the incident.

The amended communication plan increased the risk to the maintenance operation because: the protection person with the radio was in an area less likely to have good radio reception; the protection person could not see the work gang; and it added an additional step using another means of communication. It is a safety issue that the amended communication plan still complied with KiwiRail procedures.

The track ganger should have recognised that the amended communication plan had failed when 2 passenger trains had been allowed through the work area on the adjacent track without being contacted by the protection person.

The protection person did not follow the amended communication plan. He did not, as required, phone the track ganger to ensure that he and his colleague were off the tracks before allowing the train to proceed. His failure to do so was the final act that contributed to the incident.

4.4. Training and certification for maintenance staff

4.4.1. On the day of the near miss the track ganger was responsible for a work group of 5, including himself. The other members of the work group had rail track maintenance experience ranging from 9 months to nearly 5 years. Three of the work group were designated trainee track workers and had not been signed off with their Level C certification. Level C covered all track safety and protection rules, and was also a qualification needed to drive a hi-rail vehicle on the track.

4.4.2. Although the track ganger had been acting in the role for almost a year, he had been involved with track maintenance for about 7 years. A review of his training records showed that he had satisfactorily completed the classroom theory content for Level C on 18 November 2009 and was therefore able to start practical on-the-job training. However, it could not be established from KiwiRail's training records whether his practical training had been signed off.

4.4.3. The training records showed that the track ganger had attended a Ganger skills training course during 2008 and a Project Reset (Level C refresher) course the following year. One of the prerequisites for attending these courses was that the person had been signed off with Level C competency, so it is most likely that he had been signed off, but the training records did not show that.

4.4.4. The Level C theory training also covered preparing and submitting an Application for Planned Work. The track ganger said that the Application submitted for the re-gauge work had not been the first application he had made and that he was comfortable with the submission process. However, the errors and omissions made with the submission, and some of his decisions made at the worksite, suggested a lack of training and/or experience to undertake the task, particularly with such an inexperienced team.

4.4.5. The track ganger adjusted his work plan in an effort to improve productivity after he was made aware of the additional train movements. However, he did this without properly thinking through the protection of his work group. His plan was further exacerbated when he realised that one of his hi-rail vehicles would have to wait for a time slot to return to Paekakariki to collect more materials to finish the job.

4.4.6. KiwiRail's Signal Rules did not permit hi-rail vehicles or other rail service vehicles to be stabled on a runaway road. The purpose of a runaway road was to divert trains away from conflicting movements if the trains overran a controlling signal at "stop". Had a southbound train overrun the down departure signal at North Junction it would have been directed towards the hi-rail vehicles stabled on the runaway road. A collision with the hi-rail vehicles could have occurred.

4.4.7. The protection person had progressed from a trainee track worker to a track worker by demonstrating competence in a limited range of on-the-job tasks and attending a series of short courses. KiwiRail's expectation was that such progression would occur with 3 to 6 months' work experience. Because the other 3 staff in the work group had yet to achieve that competency level, the track ganger had no alternative but to allocate the protection duties to the track worker (protection person). However, it could not be established from KiwiRail's training records that the track worker had demonstrated competency in that task.

4.4.8. The protection person had attended a Project Reset course in 2009. Again, a prerequisite for attending that course was that the person had been previously signed off with Level C competency, so it is possible that he had been signed off, but the records did not show that.

4.4.9. A review of the KiwiRail training records for the track staff involved with this incident showed that at the time they were in some disarray. Numerous records were not available or had been lost, so it was not possible to tell who was competent to do what, or whether revalidations and safety assessments had been carried out. This was true for the entire country – not just for Wellington-based staff.

4.4.10. At the time of this incident KiwiRail had recently appointed a dedicated operational safety co-ordinator for each of the 3 regions. Infrastructure staff were required to undergo safety observations annually as a form of competency check, then undergo theory and practical revalidations every 2 years. For the central region, the operational safety co-ordinator began systematically revalidating every infrastructure staff member to "reset" the system. At the time of this draft report he had completed the revalidation task and was on target to complete the few outstanding safety observations by the end of the calendar year. The operational safety co-ordinators for the northern and southern regions were subsequently assigned to other roles and as a consequence the revalidation task is incomplete. A selection process is underway to fill the vacancies. The status of the training and training records in those 2 regions is also unclear. The Commission has recommended that the Chief Executive of the NZ Transport Agency address this safety issue (see section 7.3).

Findings:

Both the track ganger and the protection person had completed their Level C track protection theory training but it could not be determined from KiwiRail's training records whether they had been assessed for and demonstrated competency in their respective roles.

KiwiRail's system for training and assessment did not ensure on this occasion that the track ganger and protection person were correctly certified to undertake the duties they were performing on that day.

KiwiRail's safety system could not ensure that infrastructure staff were competent to perform their roles, and could not ensure that the appropriate safety observations and revalidations of current staff competency had been undertaken.

The errors in the work plan submitted; the omission of the required communication plan; the decision to rely on a protection person located where he could not see the worksite; and stabling hi-rail vehicles on a runaway road without authority, are collectively suggestive that the track ganger was not sufficiently trained and experienced to be in charge of the work group on the day.

4.5. Performance-impairing substances and other possible factors

4.5.1. The personal and family issues of the protection person had been known to his colleagues in the weeks leading up to the near miss. Even though the protection person was aware of KiwiRail's policy on drugs and alcohol, he had not sought a referral for professional help that would have been made available through his employer despite having admitted to KiwiRail that he had been using drugs "for about 6 weeks" before the incident and on some occasions having "heavy sessions". The results from his follow-up drug test conducted about one month after the first test showed that he continued to use cannabis after the incident.

4.5.2. A forensic toxicologist from the Institute of Environmental Science and Research reviewed the urine drug test results and made the following comments:

> The THC acid level in the sample taken on 25/08/2011 was 99 ng/mL. The creatinine level was 82 ng/mL.

> The creatinine level of 82 ng/mL indicates a very large amount of water had been drunk recently – creatinine levels would 'normally' be over 200 and less than about 2000 ng/mL.
>
> Because drug levels in urine concentrations will vary depending on how much liquid has been drunk and collected in the bladder, creatinine is used to get an idea of how dilute or concentrated the urine is. Creatinine is excreted at a fairly constant rate.
>
> When comparing 2 urine samples the THC acid level is divided by creatinine concentration and multiplied by 1000 to even out possible dilution differences.
>
> A THC acid level in the urine of 99 ng/mL is not unusually high and even the normalised level of 1200 ng/mL is not uncommon in the samples we analyse here at ESR.
>
> With THC acid in the urine all that can be said is that he has used cannabis. It is not possible to say when he last used it or if he was potentially impaired by it.

4.5.3. The use of performance-impairing substances in any form is a serious issue, more so when staff are engaged in safety-critical tasks. The protection person was a user of cannabis. Although it could not be established scientifically that his performance was impaired by cannabis at the time of the incident he did have a detectable level of THC acid in his urine when he was tested after the incident. The Commission has made a recommendation to the Chief Executive of the NZ Transport Agency to address this issue (see section 7.4).

4.5.4. On 8 March 2011, in its report on a collision between a jet boat and a jet ski (Transport Accident Investigation Commission, 2011), the Commission made a recommendation to the Secretary of Transport regarding substance impairment in the maritime sector. The recommendation referenced persons in charge of any craft, but the same could apply to a person who has responsibilities or duties involving safety-critical activities within the rail industry. The recommendation and the reply on behalf of the Secretary of Transport are shown below:

> Until legislation is made setting limits for and testing of alcohol and other performance impairing substances for recreational and commercial boat drivers, the risk of alcohol-related accidents will be elevated.
>
> It is recommended that the Secretary for Transport address this safety issue by promoting appropriate legislation to set maximum allowable levels of alcohol and other performance impairing substances for persons in charge of recreational and commercial craft, and supporting legislation to allow testing for such levels in these cases. (005/11)

4.5.5. On 16 March 2011 the Manager Maritime and Freight of the Ministry of Transport replied to the recommendation:

> The recommendation is that the Secretary for Transport promote legislation to set limits and establish a testing regime to address the risk of recreational and commercial boating accidents due to the use of alcohol or other performance-impairing substances.
>
> Recreational and commercial boating is one of three areas of transport activity where no alcohol and drug limits or testing regime yet exists. The introduction of such a regime in any of these areas would be a major policy decision for government that would need to be informed by a thorough understanding of the problem and the policy options. The Ministry therefore intends to develop a report to government on the feasibility of a compulsory post-accident and incident drug and alcohol testing regime for the aviation, maritime and rail transport sectors.
>
> Accordingly, implementation of recommendation 005/11 would only be practicable once the relevant policy work has been undertaken by the Ministry, and then only if the results indicated that a drug and alcohol testing regime is a feasible option.

4.5.6. Because the Ministry of Transport has undertaken to develop such a feasibility report for government on a compulsory post-accident and incident drug and alcohol testing regime for the aviation, maritime and rail transport sectors, the Commission has not made any new

recommendations on this matter. However, the Commission notes that this proposed action falls short of what the Commission has recommended, that legislation should set maximum allowable levels of alcohol and other performance-impairing substances. Post-accident and -incident testing on its own will not act as a sufficient deterrent unless there are consequences.

4.5.7. The protection person cited personal circumstances that were distracting him at the time he was supposed to be protecting the safety of the work gang on the tracks. His mobile phone records do show that he was exchanging text messages with his partner around that time.

4.5.8. Mobile phone use has proven to be a major distractor in rail, air and marine accidents that the Commission has investigated. The danger has also been recognised and dealt with by recent changes in road legislation preventing the use of mobile phones while driving road vehicles.

4.5.9. In this circumstance, however, the protection person's phone usage was interrupted by radio calls from the person in charge. These radio calls would normally redirect one's attention away from the mobile phone and on to the task in hand. The fact that the protection person answered those radio calls but then did not complete the required checks would suggest that his focus was not really on the job, but elsewhere for some reason.

Findings:

The protection person had been a regular user of cannabis, and subsequent testing confirmed that he had probably continued to use cannabis during the month following the incident. It is not possible to determine if the protection person was impaired by cannabis at the time of the incident. Nevertheless, the use of cannabis by staff performing safety-critical tasks is of concern, and was contrary to KiwiRail's drug and alcohol policy at the time of the incident.

Mobile phone use has proven to be a major distractor in other rail, air and marine accidents that the Commission has investigated. The danger has also been recognised and dealt with by recent changes in road legislation preventing the use of mobile phones while driving road vehicles.

5. Findings

5.1. The near miss between southbound Train 6225 and the 2 track workers occurred when the driver was given authority to pass through the worksite without the protection person first checking that the track workers were clear of the tracks.

5.2. Before the near miss, the protection person had given permission for 2 other northbound trains to pass through the work area on the adjacent line without first checking that the track workers were clear of the tracks.

5.3. The timing of the maintenance work was planned around the availability of the person in charge rather than optimising efficiency with the least disruption to rail services.

5.4. The Application for Planned Work submitted by the track ganger was incomplete because it did not include a communication plan, and it contained erroneous information. The work plan therefore should not have been approved by the work planning group.

5.5. KiwiRail's system for planning track maintenance did not promote the co-ordination of separate jobs to be done on the same section of track into one track occupation.

5.6. The protection person was being used by KiwiRail to provide protection for individual worksites within longer work areas, but KiwiRail had not formally incorporated this work practice into its rules at the time of this occurrence. Consequently, the role and methods of operation were not clear.

5.7. A communication plan was considered by and agreed between the track ganger and the person in charge of the worksite. That initial plan complied with KiwiRail procedures and most probably would have prevented the incident.

5.8. The amended communication plan increased the risk to the maintenance operation because: the protection person with the radio was in an area less likely to have good radio reception; the protection person could not see the work gang; and it added an additional step using another means of communication. It is a safety issue that the amended communication plan still complied with KiwiRail procedures.

5.9. The track ganger should have recognised that the amended communication plan had failed when 2 passenger trains had been allowed through the work area on the adjacent track without his being contacted by the protection person.

5.10. The protection person did not follow the amended communication plan. He did not, as required, phone the track ganger to ensure that he and his colleague were off the tracks before allowing the train to proceed. His failure to do so was the final act that contributed to the incident.

5.11. Both the track ganger and the protection person had completed their Level C track protection theory training but it could not be determined from KiwiRail's training records whether they had been assessed for and demonstrated competency in their respective roles.

5.12. KiwiRail's safety system could not ensure that infrastructure staff were competent to perform their roles, and could not ensure that the appropriate safety observations and revalidations of current staff competency had been undertaken.

5.13. The errors in the work plan submitted; the omission of the required communication plan; the decision to rely on a protection person located where he could not see the worksite; and stabling hi-rail vehicles on a runaway road without authority, are collectively suggestive that the track ganger was not sufficiently trained and experienced to be in charge of the work group on the day.

5.14. The protection person had been a regular user of cannabis, and subsequent testing confirmed that he had probably continued to use cannabis during the month following the

incident. It is not possible to determine if the protection person was impaired by cannabis at the time of the incident. Nevertheless, the use of cannabis by staff performing safety-critical tasks is of concern, and was contrary to KiwiRail's drug and alcohol policy at the time of the incident.

5.15. Mobile phone use has proven to be a major distractor in other rail, air and marine accidents that the Commission has investigated. The danger has also been recognised and dealt with by recent changes in road legislation preventing the use of mobile phones while driving road vehicles.

6. Safety actions

General

6.1. The Commission classifies safety actions by 2 types:

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

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

Safety actions addressing safety issues identified during an inquiry

6.2. Random drug and alcohol testing was introduced by KiwiRail on 1 April 2013.

The following extract on random testing is provided from the KiwiRail and Rail and Maritime Transport Union Drug and Alcohol Collective Agreement and the Individual Employment Agreement policy.

> Clause 3.2.4 Random Testing
>
> Random, unannounced testing will follow the periodic random selection of a defined number of persons and anyone may be tested at any time, even if they have been tested before.
>
> A random selection of all employees, selected from all positions within the business, will be notified that they are to participate in a drug and alcohol test. The selection process will be contracted out to an external service provider who will be required to use the two pot system for conducting the selection process.
>
> Random testing will be completed during the normal working hours of the employee
>
> Negative test for alcohol.

Negative Alcohol Test	Means below 100 micrograms per litre (µg/litre) of breath, or equivalent blood alcohol level. This level is equivalent to zero alcohol tolerance.

> **Appendix 3**
>
> **CUT-OFF CONCENTRATIONS FOR DRUG TESTING – Refer AS/NZ 4308:2008**
>
> **Screening Tests**
>
> **Screening Test Cut-Off Concentrations for Drug Classes**

Class of Drug	Cut-off level (microgram/litre)
Opiates	3
Amphetamine type substances	3
Cannabis metabolites	5
Cocaine metabolites	3
Benzodiazepines	2

Confirmatory Tests

Confirmatory Test Cut-Off Concentrations (As Total Drug)

Compound	Cut-off level (micrograms/litre)
Morphine	300
Codeine	300
6-Acetylmorphine*	10
Amphetamine	150
Methyl amphetamine	150
Methylenedioxymethylamphetamine	150
Methylenedioxyamphetamine	150
Benzylpiperazine*	500
Phentermine*	500
Ephedrine*	500
Pseudoephedrine*	500
11-nor-□9-tetrahydrocannabinol-9-carboxylic acid	15
Benzoylecgonine	150
Ecgonine methyl ester	150
Oxazepam	200
Temazepam	200
Diazepam	200
Nordiazepam	200
α-hydroxy-alprazolam	100
7-amino-clonazepam	100
7-amino-flunitrazepam	100
7-amino-nitrazepam	100

* these drugs may be optionally tested within each class and the specified cut-off levels shall apply

Any test result below the above concentrations will be treated as a negative test and will be equivalent to zero tolerance.

7. Recommendations

General

7.1. 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. In this case, recommendations have been issued to the NZ Transport Agency.

7.2. 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.

Recommendations made during this inquiry

7.3. At the time of this incident KiwiRail's safety system could not ensure that infrastructure staff were competent to perform their roles, and could not ensure that the appropriate safety observations and revalidations of current staff competency had been undertaken.

The Commission recommends that the Chief Executive of the NZ Transport Agency take the necessary steps to ensure that KiwiRail's safety system maintains accurate and up-to-date training and revalidation records of all staff competencies. The action taken should also check that KiwiRail's safety system ensures that all staff are qualified and competent for their roles. (006/13)

On 24 April 2013, Manager Rail Systems, New Zealand Transport Agency, replied:

> This recommendation is accepted. Discussion on it will be initiated on the publication of the final report. These discussions will include, where appropriate, a projected timeframe for implementation. This will be advised to TAIC in due course.

7.4. The protection person was a user of cannabis. Although it could not be established scientifically that his performance was impaired by cannabis at the time of the incident, he did have a detectable level of THC-acid in his urine when he was tested after the incident.

Under no circumstances should the performance of any rail worker performing any safety-critical task be affected by alcohol or drugs of any kind. The Commission recommends that the Chief Executive of the NZ Transport Agency work with the National Rail System Standard Executive in developing a National Rail System Standard that requires all rail participants to have drug and alcohol policies that: have zero tolerance of performance-impairing substances for workers engaged in safety-critical tasks; require post-incident and accident and random testing for drugs and alcohol; and require a system for rail workers to report discreetly co-workers suspected of using or being under the influence of drugs or alcohol in the workplace. (007/13)

On 24 April 2013, Manager Rail Systems, New Zealand Transport Agency, replied:

> This recommendation is accepted. Discussion on it will be inititated on the publication of the final report. These discussions will include, where appropriate , a projected timeframe for implementation. This will be advised to TAIC in due course.

8. Key lessons

8.1. Safe rail operations require the development of the right plan for the task.

8.2. Rail staff engaged in safety-critical work must be properly trained and hold current certification for the work undertaken.

8.3. Every step must be taken to prevent rail workers being affected by performance-impairing substances, particularly those involved with safety-critical tasks. Rail workers should have the opportunity to report discreetly co-workers suspected of using or being under the influence of drugs or alcohol in the workplace.

9. Citations

ATSB. (2004). *Cannabis and its Effects on Pilot Performance and Flight Safety: A Review*. Australian Transport Safety Bureau.

Appendix 1: Work application process and request forms

4.5 Work Application Process and Request Forms

There are three primary types of work:

4.5.1 **"Planned Major Work"** is work of a significant nature that will result in the line being closed or blocked and the line made impassable for an extended period of time.
Examples of Planned Major Work includes (but is not limited to):

- All work involving Work Trains
- Bridge replacements
- Concrete sleeper lays
- Level Crossing Upgrades
- Main Line turnouts
- O/H (traction) outages outside of Monday
- Signal & Interlocking work
- Tunnels

4.5.2 **"Planned Minimal Impact Work"** is planned work of a minor nature which may block the line for short periods of time but trains can be cleared through the work area.
Examples of Planned Minimal Impact Work includes but is not limited to:Track repairs / welding

- Maintenance or minor repairs of formation

4.5.3 **"Emergency work"** is work of an unplanned nature required to respond to an incident involving the network or rolling stock.
Examples of Emergency Work includes but is not limited to,

- Traction poles down
- Track wash out
- Power lost
- Derailments

Overhead Power
Where any of the above types of work is planned or is being carried out on or close to overhead power cables (traction or signals power cables) then work planning **must** consider the electrical safety implications under the Overhead Power Off work stream on the following matrix..

Approval of Work.

For Major Planned Work, prior notification of approval will be given to the person requesting the work verbally by Network Authorities Planners.

For Planned Minimal Impact Work, Network Authorities will only contact the person requesting the work if the requested work cannot be accommodated or there is a need to make changes.

Final approvals of requests for planned work will be advised by Bulletin.

Planned Work - Line Impassable Protection Systems

Track Warrant areas - Track Warrant for

Non Track Warrant areas –
Mis 60 (Rule 24) / Compulsory Stop Protection (Rule 905)

Form 1 **Application for Planned Work –** use for the following types of rail protection:

- Rule 905 Compulsory Stop Protection (CSP)
- Rule 909 working within Station limits
- Mis60 work (non Track Warrant areas)
- Track Warrant
- includes CSP work in Multi Line Areas
  requires a minimum of 24 hours advance notice
- includes line impassable, when required – 15 days notice

Form 2 **Work Area Communication Plan**

- required for any work area longer than 1km and or where difficulties prevent use of channel 1 or 5 to talk to other rail vehicles outside the protected area)

Form 3 **Application for Disconnect / Disarrangement / Alter Signals**

- Signals Activities (to be completed by Signals Personnel)

Form 4 **Application for Mobile Track Maintenance Vehicles using Rule 914**

- MTMV activities

Form 5 **Application for Work train**

- Work Trains – 15 days notice

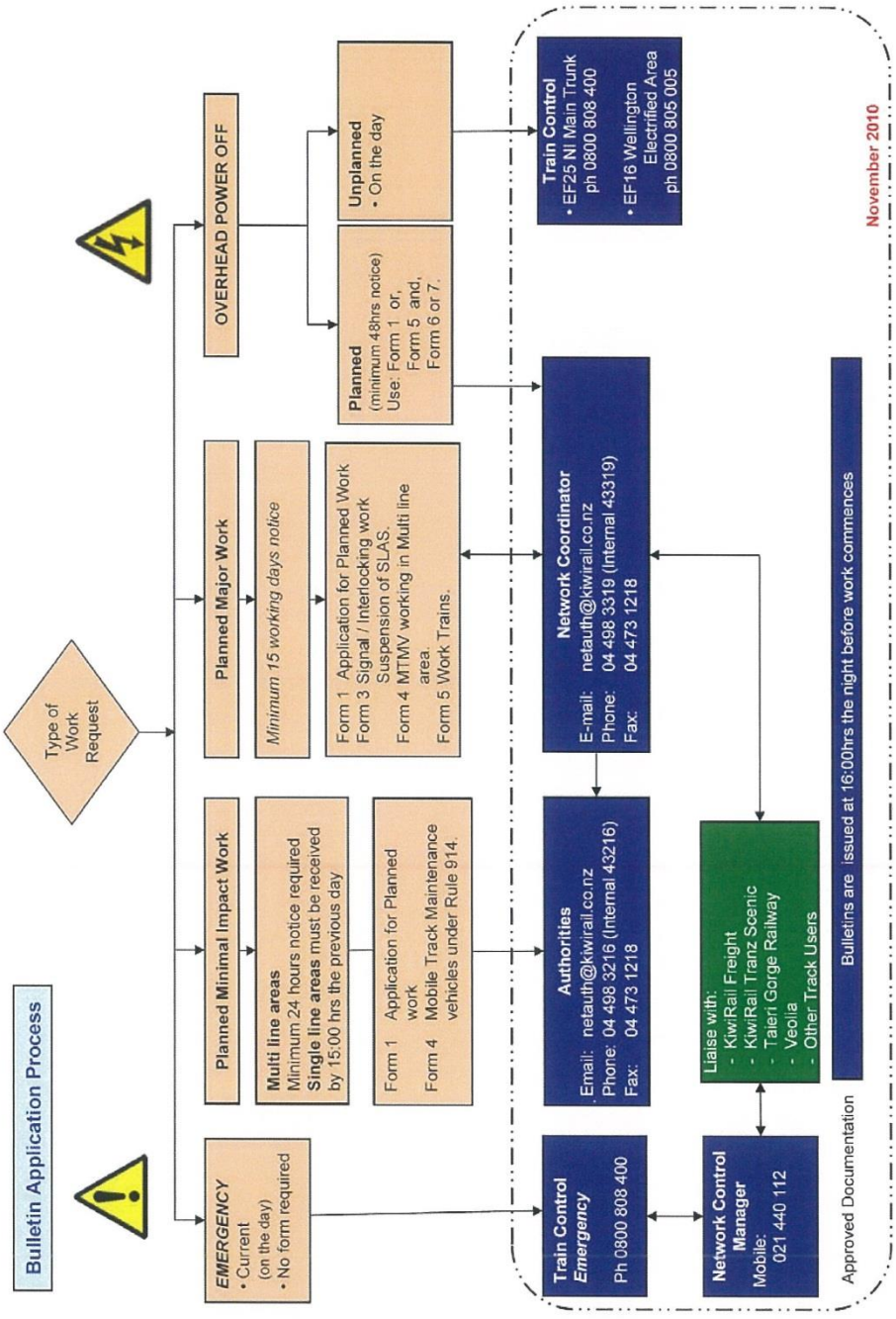
Electrified Areas - Overhead Power off 48 hours in advance

Form 6 **Application for DC Traction / Overhead Power Off**

- DC Traction Power OFF (to be completed by Traction Personnel)

Form 7 **Application for AC Traction / Overhead Power Off**

- AC Traction Power OFF (to be completed by Traction Personnel)


Bulletin Application Process
Type of Work Request
EMERGENCY
• Current (on the day)
• No form required
Planned Minimal Impact Work
Multi line areas
Minimum 24 hours notice required
Single line areas must be received by 15:00 hrs the previous day
Form 1 Application for Planned work
Form 4 Mobile Track Maintenance vehicles under Rule 914.
Planned Major Work
Minimum 15 working days notice
Form 1 Application for Planned Work
Form 3 Signal / Interlocking work Suspension of SLAS.
Form 4 MTMV working in Multi line area.
Form 5 Work Trains.
OVERHEAD POWER OFF
Planned
(minimum 48hrs notice)
Use: Form 1 or, Form 5 and, Form 6 or 7.
Unplanned
• On the day
Train Control
Emergency
Ph 0800 808 400
Authorities
Email: netauth@kiwirail.co.nz
Phone: 04 498 3216 (Internal 43216)
Fax: 04 473 1218
Network Coordinator
E-mail: netauth@kiwirail.co.nz
Phone: 04 498 3319 (Internal 43319)
Fax: 04 473 1218
Train Control
• EF25 NI Main Trunk ph 0800 808 400
• EF16 Wellington Electrified Area ph 0800 805 005
Network Control Manager
Mobile: 021 440 112
Liaise with:
- KiwiRail Freight
- KiwiRail Tranz Scenic
- Taieri Gorge Railway
- Veolia
- Other Track Users
Bulletins are issued at 16:00hrs the night before work commences
Approved Documentation
November 2010

Appendix 2: Placement of boards

ONTRACK Rail Operating Rules Section: 9 – Track Safety Rules

Rules 905 update (Limited Distribution) June 2009

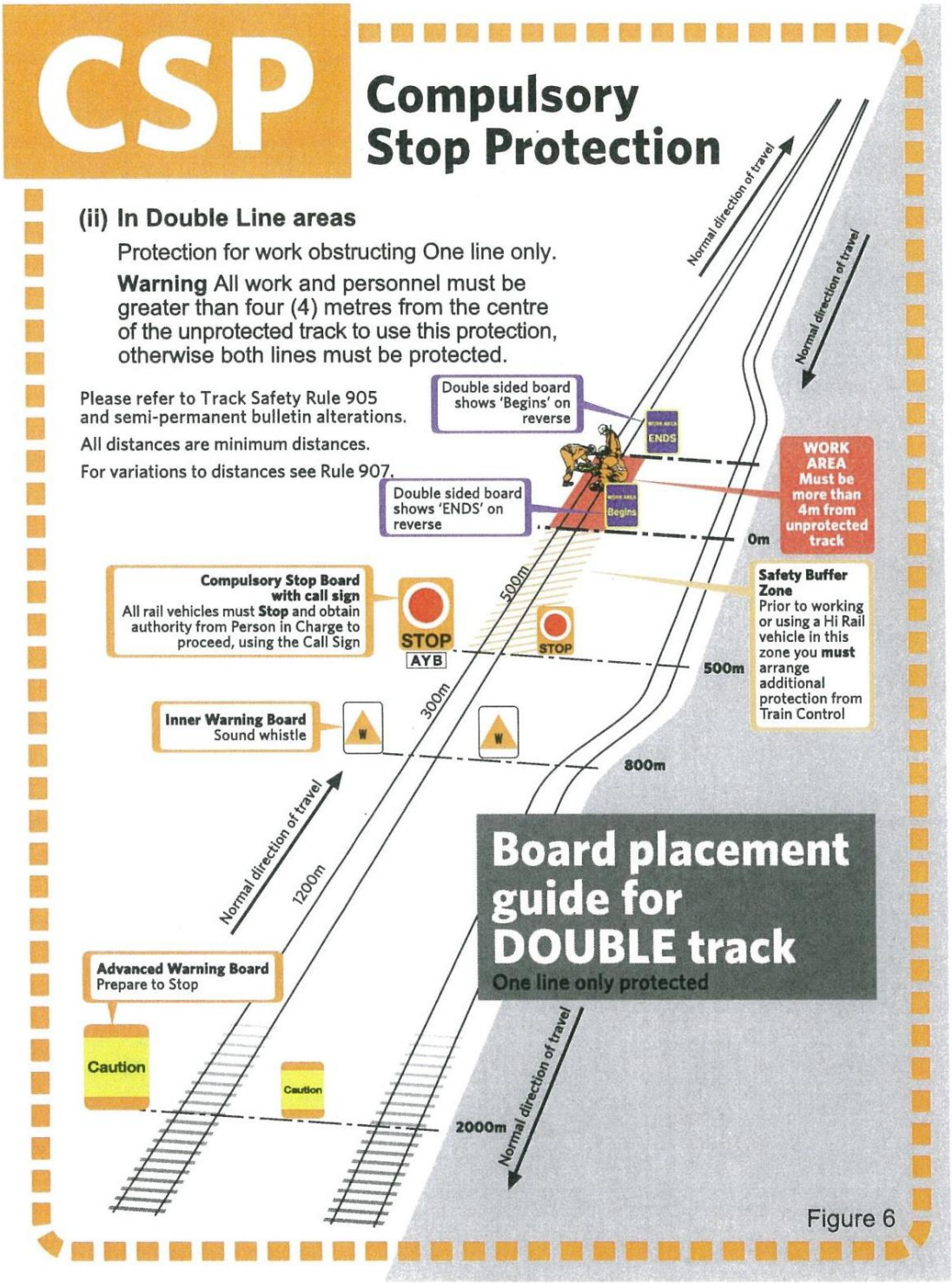


Figure 6

	Thursday 25 August 2011 Wellington – Waikanae, Johnsonville Line Wellington Junction – Masterton and Branches

Wellington – Waikanae(cont'd)

Protected Work Area		Rule	Work Details
30.59km Pukerua Bay Up & Down lines	38.64km 4L, 2L,14LAC signals. Paekakariki Up & Down lines	**905** Compulsory Stop Protection	**Multiple Activities: Rule 910** • Overhead work • Cabling 2300 previous day to 0500 2300 to 0500 next day 0272 634 5278 Call sign: **November Foxtrot Oscar**

"CAUTION" – Rules 905 (c) & 907 (b) applies. No Advanced & Inner Warning Board(s) exiting EMU siding, Paekakariki Loop & siding and for train services terminating and reversing at Paekakariki ."

Down Compulsory Stop Boards are erected at 14LAC, 4L and 2L signals Paekakariki. Safety Buffer Zone reduced. Rule 905 (c) is modified accordingly.

Work sites on lines not affected by the intended movement may remain occupied. The Person in Charge must inform all protected employees of the movement about to occur. Rule 902 is modified accordingly.

The overhead power will be cut off between:

- Pukerua Bay substation at 29.70km and Isolator 222 at 35.05km,
  Hours: 2005 previous day to 0455, 2005 to 0455, next day
- Isolator 222 at 35.05km and Paekakariki substation at 39.12km ,
  Hours: 2015 previous day to 0430, 2015 to 0430, next day

35.10km 10R North Junction Up & Down lines	38.64km 4L, 2L,14LAC signals. Paekakariki Up & Down lines	**905** Compulsory Stop Protection	**Multiple Activities: Rule 910** • EM80 faults 0900 to 1500 0212 414 726 Call sign: **Alpha Lima November**

"CAUTION" – Rules 905 (c) & 907 (b) applies. No Advanced & Inner Warning Board(s) exiting EMU siding, Paekakariki Loop & siding and for train services terminating and reversing at Paekakariki ."

Up Advanced Warning Board erected at 32.12km (by 8L signal).
Down Compulsory Stop Boards are erected at 14LAC, 4L and 2L signals Paekakariki. Safety Buffer Zone reduced. Rule 905 (c) is modified accordingly.

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

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
07-105	Push/pull passenger train sets overrunning platforms, various stations within the Auckland suburban rail network, between 9 June 2006 and 10 April 2007
08-110	Train control operating irregularity, leading to potential low-speed, head-on collision, Amokura, 23 September 2008

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