

Final report RO-2015-103: Track occupation irregularity, leading to near collision,
Between Manunui and Taumarunui, 15 December 2015

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Final Report

Rail inquiry R0-2015-103
Track occupation irregularity
leading to near collision,
Between Manunui and Taumarunui,
15 December 2015

Approved for publication: August 2017

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

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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.

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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

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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	



Bridge 197 between Manunui and Taumarunui (looking north)

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Abbreviations

Commission	Transport Accident Investigation Commission
RMTU	Rail and Maritime Transport Union

Glossary

non-technical skills	generic operational skills that underpin and enhance technical skills. Safety-critical staff such as track maintenance workers can draw on the skills to: carry out tasks that require information to be understood; focus on tasks at hand; make good decisions; and communicate effectively with other staff. Non-technical skills were previously referred to as crew resource management
rail protection officer	the generic name given to a person protecting track maintenance workers and equipment, and responsible for co-ordinating the movement of trains and hi-rail vehicles through a protected worksite

Data summary

Incident detail

Occurrence:	track occupation irregularity leading to a near collision between KiwiRail's northbound Northern Explorer passenger train and a group of KiwiRail maintenance workers with equipment on Bridge 197
Date and time:	15 December 2015 at 1420 (New Zealand standard time)
Persons on bridge:	six KiwiRail structures maintenance workers and their manager
Injuries:	nil
Damage:	nil

Incident site detail

Location:	Bridge 197 at the 394.05 kilometre point between Manunui and Taumarunui on the North Island Main Trunk line
Maximum authorised line speed:	90 kilometres per hour

Incident train detail

Service:	KiwiRail's northbound Northern Explorer passenger train travelling from Wellington to Auckland
Persons on train:	train driver, on-board train staff and passengers
Maximum authorised train speed:	100 kilometres per hour

1. Executive summary

- 1.1. On 15 December 2015 track maintenance workers were replacing sleepers on Bridge 197 between Manunui and Taumarunui on the North Island Main Trunk line. The worksite was protected by compulsory stop boards, where trains were required to stop and get authority from a rail protection officer before passing through the worksite. In this case the rail protection officer was also the team leader responsible for the project.
- 1.2. During the morning four freight trains passed through the worksite without incident. The workers were already clear of the worksite when a fifth (passenger) train stopped at the stop boards and requested permission to pass through the worksite. The rail protection officer authorised the passenger train to pass through the worksite. He then engaged in a radio conversation with the train controller, left his work vehicle and 'locked on' to let the workers know it was clear to occupy the track.
- 1.3. Despite some of the workers knowing that a passenger train was supposed to be due through the worksite, all of them 'locked on' and occupied the bridge ahead of the approaching train.
- 1.4. When the train came into sight, the train driver saw the workers on the bridge ahead and stopped his train 72 metres short of the bridge. There was no collision and no-one was injured.
- 1.5. The Commission **found** that the rail protection officer's error was highly likely a lapse in memory influenced by the pressures he was under in his role as team leader.
- 1.6. The Commission also **found** that the rail protection officer's error should have been identified by others in the work group, and they should have intervened to prevent the incident.
- 1.7. The Commission identified three **safety issues**:
 - that the KiwiRail system allowed the team leader, with all of the tasks and responsibilities associated with that role, to take on the safety-critical role of rail protection officer
 - the poor standard of non-technical skills among all the workers who were on-site
 - the rail protection officer's positive post-incident test result for methamphetamine.
- 1.8. KiwiRail has been taking safety action to address two of the safety issues. The Commission has made one **recommendation** to KiwiRail to address the third safety issue.
- 1.9. The **key lessons** identified from the inquiry were:
 - workers responsible for the safety and wellbeing of track staff should not be allowed to be burdened with tasks and responsibilities that will detract from that role
 - the use of good non-technical skills could have prevented this incident. All operational staff need to be trained and well practised in those skills to prevent one-person errors resulting in accidents and incidents
 - it is not acceptable under any circumstances for workers to be affected by performance-impairing substances, regardless of what roles they are performing.

2. Conduct of the inquiry

- 2.1. The NZ Transport Agency notified the Transport Accident Investigation Commission (Commission) of the incident on 16 December 2015. The Commission opened an inquiry that day under section 13(1) of the Transport Accident Investigation Commission Act 1990, and appointed an investigator in charge.
- 2.2. The chief investigator of accidents and a recently appointed rail accident investigator travelled to Taumarunui on 17 December 2015 to gather evidence and interview the KiwiRail maintenance team leader, who was also the designated rail protection officer¹ for the worksite.
- 2.3. The investigator in charge and the manager for surface investigations travelled to Taumarunui and Hamilton in early January 2016 to interview: the remaining maintenance workers; the passenger train driver; the production manager responsible for the project; and the area engineering manager who had overall responsibility for the project and the workers.
- 2.4. The Commission obtained data from the passenger train's event recorder, data from the signalling system for the area, and the train control voice recordings. The three data streams were synchronised with written and oral evidence to determine the sequence of events leading up to the incident.
- 2.5. The investigator in charge obtained other records and documents relevant to the incident that included:
 - training, certification, assessment and performance records for the rail protection officer
 - KiwiRail's post-incident and random drug and alcohol testing policies
 - KiwiRail's records of random drug and alcohol testing results since the policies were introduced during 2009 and 2010
 - KiwiRail's non-technical skills² policy and training material
 - details of the safety actions taken by KiwiRail following the incident
 - results of the post-incident drug and alcohol test performed on the rail protection officer.
- 2.6. On 28 June 2017 the Commission approved a draft report for distribution to interested persons for comment.
- 2.7. Submissions were received from the regulator and the operator whose comments have been considered and included in the final report where appropriate.

¹ 'Rail protection officer' is the generic name given to a person protecting track maintenance workers and equipment, and responsible for co-ordinating the movement of trains and hi-rail vehicles through a protected worksite.

² Non-technical skills are generic operational skills that underpin and enhance technical skills. Safety-critical staff such as track maintenance workers can draw on the skills to: carry out tasks that require information to be understood; focus on tasks at hand; make good decisions; and communicate effectively with other staff. Non-technical skills were previously referred to as crew resource management.

3. Factual information

3.1. Background information

- 3.1.1. All 405 timber sleepers required replacing on rail Bridge 197 located between Manunui and Taumarunui on the North Island Main Trunk line. The work started on 25 November 2015, and was scheduled to be completed within eight working days.
- 3.1.2. KiwiRail assembled a team of six maintenance workers from several depots in the upper North Island to perform the work. A team leader from Taumarunui was responsible for managing the project. He appointed himself as the rail protection officer for the worksite. This person is mostly referred to as the rail protection officer in this report.

3.2. Track safety rules

- 3.2.1. KiwiRail's Track Safety Rule 902 described how maintenance workers and vehicles were to be managed under the direction of a rail protection officer. Each worker was provided with a numbered padlock and a key that were registered against their name on an approved form. When the rail protection officer had confirmed that it was safe for the workers to occupy the track, he attached his own padlock to a lock-on frame. Each worker was then required to lock their padlock to the frame before occupying the track (see Figure 1).

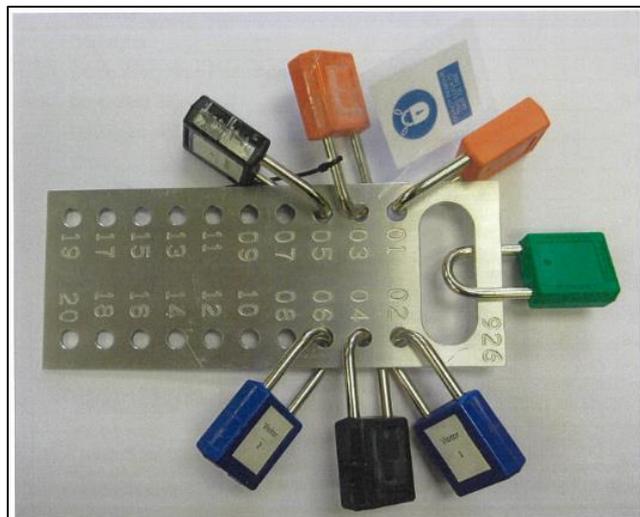


Figure 1
A lock-on frame with padlocks secured

- 3.2.2. The reverse process applied when it became necessary to clear the worksite for a train or on the completion of work for the day. The maintenance workers were required to unlock and remove their padlocks from the lock-on frame after they reached the designated safe place. The process was supervised by the rail protection officer, and when all other padlocks had been removed he then removed his own padlock.
- 3.2.3. KiwiRail's Track Safety Rule 905 described how maintenance workers were to be protected from passing trains. The trains were required to stop at compulsory stop boards (stop boards). The stop boards were positioned a minimum of 500 metres from both ends of a worksite. For northbound trains a stop board was placed adjacent to a signal, which the train controller held at red until the rail protection officer asked them to change it to green to allow the passage of a train through the worksite.
- 3.2.4. The train driver would contact the rail protection officer by radio to obtain authority to pass the stop boards and travel through the worksite. The rail protection officer would give authorisation after all maintenance workers had removed their padlocks from the lock-on frame. The rail protection officer would maintain an overview of the assembled workers in the designated safe place while the train travelled through the worksite.

3.3. The incident

- 3.3.1. The maintenance workers assembled at Bridge 197 from 0700 on 5 December 2015, 15 working days after the start of the project. During the morning three trains passed through the worksite without incident.
- 3.3.2. A production manager arrived at the worksite at about 1300 to discuss the project with the rail protection officer.
- 3.3.3. At 1345 the rail protection officer instructed the maintenance workers and the production manager to clear the worksite for the passage of two trains: a northbound freight train and the northbound Northern Explorer passenger train (the passenger train). The maintenance workers assembled in the designated safe place and removed their padlocks from the lock-on frame.
- 3.3.4. The freight train stopped at the stop boards and requested authority to pass through the worksite. At 1349 the rail protection officer requested the train controller to change the adjacent signal from red to green, then authorised the freight train driver to pass the stop boards at Manunui (see Figure 2).

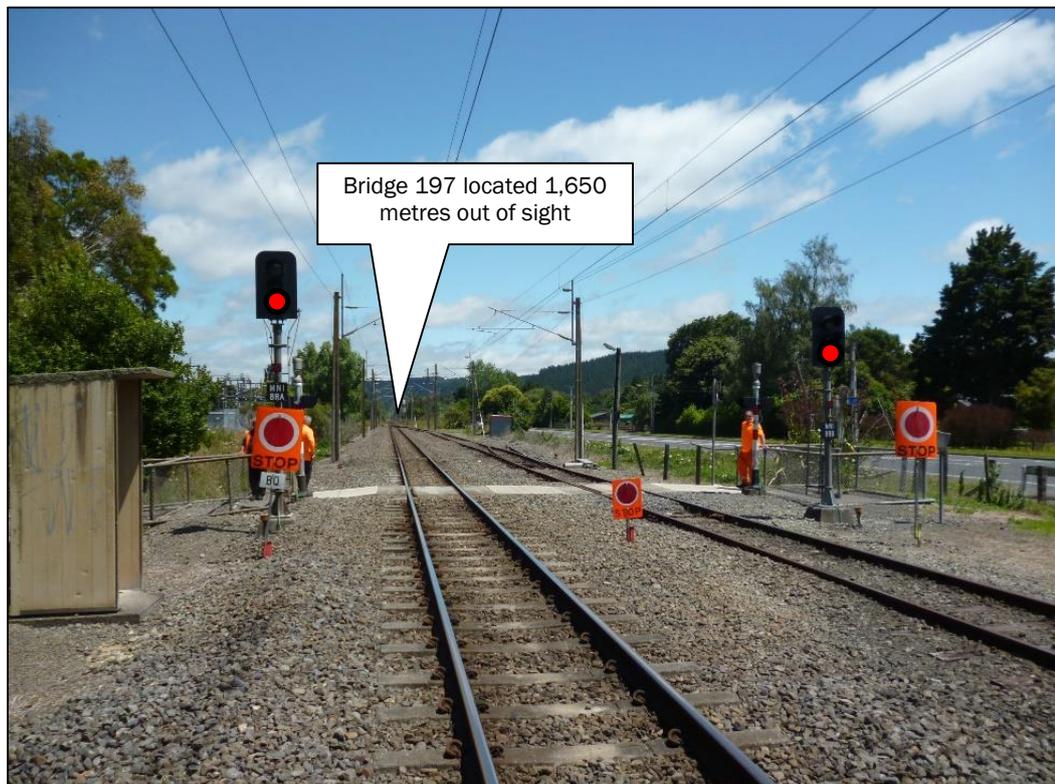


Figure 2
The stop boards and signal at Manunui (looking north)

- 3.3.5. At about 1355 some of the maintenance workers questioned the rail protection officer regarding the whereabouts of the passenger train after the freight train had passed. He returned to his work vehicle, referred to an information display system he was using and saw that the passenger train was nearing Manunui.
- 3.3.6. The passenger train stopped at the stop boards and requested permission to pass through the worksite while the rail protection officer was in his vehicle. At 1415 he radioed the train controller and asked him to switch the signal to green and authorised the passenger train to pass the stop boards. The rail protection officer instructed the train driver to slow his speed to 40 kilometres per hour through the worksite. Following that, he had a radio conversation with the train controller about the order of the next two trains that were scheduled to pass through the worksite.

- 3.3.7. None of the maintenance workers or the production manager who were all assembled nearby at the safe place heard the radio conversations. Some KiwiRail vehicles are fitted with external speakers for radios, but they were not fitted to the rail protection officer's vehicle. The rail protection officer recorded the times of the radio calls in compliance with KiwiRail's Track Safety Rule 905. Although the information he recorded was correct, it was written on the wrong page in his events log book.
- 3.3.8. The rail protection officer left his vehicle and returned to the safe place after recording the times of the radio calls. He then secured his padlock to the lock-on frame in spite of having just authorised the passenger train to pass through the worksite. None of the workers questioned the rail protection officer on the whereabouts of the passenger train. They all secured their padlocks to the frame and some of them walked back onto the bridge with their equipment to resume work.
- 3.3.9. Meanwhile the passenger train had passed the stop boards and reached a speed of 72 kilometres per hour. The driver began to slow his train when he was 590 metres from the bridge. He then noticed the maintenance workers and equipment on the bridge ahead and brought his train to a stop 72 metres from the bridge. There was no collision and no-one was injured.
- 3.3.10. The rail protection officer realised an incident had occurred and telephoned the train controller to report the incident. The rail protection officer was relieved of his duties.

3.4. The rail protection officer

- 3.4.1. The rail protection officer had worked for KiwiRail for 10 years and his licence to operate was valid. He held current competency for KiwiRail's Track Safety Rules 902 and 905. His work experience was mostly bridge maintenance similar to that being carried out on Bridge 197.
- 3.4.2. Following this incident he underwent a mandatory post-incident drug and alcohol test. The urine test returned a positive result to methamphetamine and its metabolite amphetamine.
- 3.4.3. The rail protection officer was aware of KiwiRail's drug and alcohol policy, which included random testing. He said that he had not been required to undergo a random drug and alcohol test during his 10-year career with KiwiRail.
- 3.4.4. The rail protection officer later said that he had been struggling to cope with all of his responsibilities at work, particularly the late running of the project and a relationship issue that existed between himself and one of the workers. He said that he had also been affected by the death of a close friend three weeks earlier.
- 3.4.5. The rail protection officer said that he had started inhaling methamphetamine during the last months of his friend's life and had continued during the three-week period between his friend's death and this incident. He said that he had last inhaled methamphetamine three days prior to the incident.

3.5. Methamphetamine/Amphetamine

- 3.5.1. The effects that methamphetamine/amphetamine can have on individuals are complex. The half-life of methamphetamine in a person's body is about 24 hours, but can be longer. Some authors³ have pointed out the different effects that they have seen. "Low single doses may stimulate performance, while on the other hand, high doses, which often indicate chronic abuse, may decrease human related performance with displays of irrational behaviour."

³ Logan, 1996 and 2002; Morland, 2000.

3.6. Drug and alcohol testing

- 3.6.1. KiwiRail introduced its post-incident drug and alcohol testing policy and associated procedures during 2009 (see Appendix 1) in agreement with the Rail and Maritime Transport Union (RMTU). The policy said that an employee would be asked to submit to a test following an incident or accident if that person had had a direct involvement. KiwiRail provided some examples of the types of incident/accident to assist its managers in carrying out this process.
- 3.6.2. In this case the rail protection officer and the driver of the passenger train were tested, but none of the other track maintenance staff were tested.
- 3.6.3. The policy between KiwiRail and the RMTU was extended to include random drug and alcohol testing during 2010. KiwiRail and the RMTU both stated that one of the objectives of the policy was that they wanted their employees and members to be safe at work. KiwiRail also introduced similar policies that covered members of its workforce who were not members of the RMTU (see Appendix 2).
- 3.6.4. KiwiRail said that it randomly tested 10% of its workforce annually at all levels of the business. The company retested an employee who initially returned a positive result, then facilitated a rehabilitation programme.
- 3.6.5. By comparison, the Australian rail regulatory authority introduced a requirement during early 2012 for rail operating companies throughout the country to test their workers randomly for drugs and alcohol. The Australian authority stipulated that 25% of rail safety workers must be tested annually.
- 3.6.6. Queensland Rail randomly tests 50% of its safety-critical workers annually, including track maintenance workers.
- 3.6.7. Four other New Zealand licensed rail participants said that it was policy for them to randomly test between 25% and 100% of their workers annually.
- 3.6.8. An independent review of KiwiRail's random drug and alcohol test results conducted between July 2014 and June 2015 showed that 18 out of 1,013 individuals had returned positive results. All the positive results had been for drugs. All but one of the 18 individuals had worked in KiwiRail's operational sectors that included train drivers and track maintenance workers.

4. Analysis

4.1. Introduction

- 4.1.1. Protecting workers who are maintaining rail tracks is a safety-critical process that carries a high level of responsibility. Any lack of adherence to the process for facilitating such protection can have severe consequences. In this instance there would have been nowhere for the workers to escape to had the train crossed the bridge.
- 4.1.2. In human factor terms the type of error the rail protection officer made in locking on to the frame when he had just authorised the passenger train to pass through the worksite is considered a 'lapse'⁴. It was not an intentional act and it was not a knowledge-based error. The rail protection officer knew what the correct procedure was and had successfully undertaken it for the passage of four other trains that day.
- 4.1.3. However, such an error need not result in an accident or incident. There were opportunities for the other workers involved to intervene and prevent it happening.
- 4.1.4. The Australian Transport Safety Bureau identified in a report (Safety Issues Investigation - Safe work on track) that the majority of incidents in Australia could be attributable to individual actions rather than environmental or organisational influences. In this case the individual actions of the rail protection officer were a factor. However, there were also organisational factors that influenced the actions of those involved.
- 4.1.5. The reasons for such a lapse are discussed below. Also discussed are three safety issues:
- the first safety issue was that the KiwiRail system allowed the team leader, with all of the tasks and responsibilities associated with that role, to take on the safety-critical role of rail protection officer
 - the second safety issue was the poor standard of non-technical skills among all the workers who were on site
 - the third safety issue was the rail protection officer's positive post-incident test result for methamphetamine.
- 4.1.6. The rail protection officer and the maintenance workers should not have locked their padlocks to the frame and been allowed to proceed on to the track until the passenger train had passed. The situation could have been prevented if the workers had questioned the rail protection officer as to the whereabouts of the passenger train. A more serious incident might have occurred but for the slow speed request made to the train driver by the rail protection officer.

4.2. Rail protection officer or team leader

Safety issue – the KiwiRail system allowed the team leader, with all of the tasks and responsibilities associated with that role, to take on the safety-critical role of rail protection officer.

- 4.2.1. The responsibility for overseeing the sleeper replacement project and ensuring the safety of the workers should never have been placed on one person. In this case the team leader did have other members of the work group who were qualified to take on the rail protection officer role. However, because of personal and professional issues within the team, he felt more comfortable taking on the role himself.

⁴Reason J. Human error. New York: Cambridge University Press; 1990 describes these as missed actions or omissions – when someone fails to do something due to lapses in memory and/or distraction.

- 4.2.2. The rail protection officer was under considerable pressure at the time of the incident, mainly related to his responsibilities as team leader. The project was significantly behind time, although this was mainly related to KiwiRail's resourcing of the project.
- 4.2.3. A principal reason for the project running late was the scaffolding arrangements put in place to provide the maintenance workers with a safe platform from which to work. Insufficient equipment had been provided to scaffold the whole length of the bridge for the duration of the project. As sleeper replacement work progressed, scaffolding was removed and re-secured along small sections of the bridge. It was a task that took about two hours each day and that had an adverse effect on the project timeline.
- 4.2.4. Additionally the production manager, who was on site at the time of the incident, and the area engineering manager had been closely monitoring the rail protection officer's performance after a number of previous alleged performance issues relating to the late running of projects for which he was responsible. The rail protection officer said that the manager's presence had increased the pressure he was already feeling on the day.
- 4.2.5. At the time of the incident, the eight-day project was only 50% complete after 15 days. The rail protection officer was unable to see a way to catch up despite working in his own time. He said he had become overwhelmed with the responsibility of managing all aspects of the project.
- 4.2.6. The rail protection officer's error in allowing the workers to on-track ahead of the passenger train is symptomatic of what James Reason describes as 'lapses in memory and/or distraction'. The rail protection officer was clearly distracted by stressors associated with his other roles. This incident is a good example of why staff assigned to the safety-critical role of rail protection officer should be able to dedicate their full attention to fulfilling that role.
- 4.2.7. The issue is not unique to New Zealand. The United Kingdom Rail Accident Investigation Branch and the Australian Transport Safety Bureau have both identified safety issues at protected rail maintenance worksites in recent reports. The two agencies identified that rail infrastructure maintenance operators in both countries had been experiencing about one incident each work day in separately defined periods between 2009 and 2014.
- 4.2.8. The Rail Accident Investigation Branch has recommended that an action plan be developed to reduce the risks associated with worksite protection (Class investigation into irregularities with protection arrangements during infrastructure engineering work).
- 4.2.9. On 8 August 2016 KiwiRail introduced a plan to reduce the risks of track occupation incidents by separating out the rail protection officer and work supervisor (team leader) roles. Additionally, new positions were to be created called protection planners, which would be responsible for ensuring that worksites had the appropriate levels of worker protection.
- 4.2.10. KiwiRail implemented the plan on 31 May 2017. Twenty-one new protection planners and worksite protector positions were created and most of the positions have been filled with qualified workers. Based on this safety action taken by KiwiRail the Commission did not issue a proposed recommendation to KiwiRail to address this safety issue.

4.3. Non-technical skills

Safety issue – none of the workers, including the production manager, had been trained in or had any knowledge of KiwiRail's non-technical skills practices. The application of these skills could have prevented this incident.

- 4.3.1. Neither the rail protection officer nor any of the workers or the two managers could recall if KiwiRail had ever provided them with non-technical skills training. Non-technical skills (previously known as crew resource management) are a set of skills designed to create a safe working environment by, amongst other things, encouraging teamwork, improving communication skills, and improving situational awareness.

- 4.3.2. The Rail Safety and Standards Board of the United Kingdom defined non-technical skills as “the cognitive, social and personal resource skills that complement technical skills and contribute to safe and efficient task performance”. While technical skills describe what you need to do and know for a given safety-critical task, non-technical skills describe how you do that task. The non-technical skill components can be broken down further into sub-categories that include situational awareness, conscientiousness, communication, decision-making and action, co-operation and working with others, workload management and self-management.
- 4.3.3. Analyses of incident and accident reports within the rail industry conducted by the Rail Safety and Standards Board showed that the majority of errors that occur relate to people at the front line (63%) rather than management (30%) or design factors (7%). Making mistakes is inevitable, but the use of non-technical skills has been shown to help mitigate and manage these errors.
- 4.3.4. For example, Queensland Rail reported that trainee train drivers who did not complete non-technical skills training were more than twice as likely to pass a signal at danger within their first month than those who had received the training. Similarly, Canadian Pacific Railway reported a 46% reduction in human-caused incidents following non-technical skills training.
- 4.3.5. A review of the recorded radio transmissions between the rail protection officer and the train controller on the day of the incident showed that communications were good.
- 4.3.6. The rail protection officer was working within the confines of his vehicle when he was communicating with the train controller and recording the event times in his events log book. The vehicle was not equipped with external speakers to broadcast the radio calls. As a result the workers were excluded from hearing the radio transmissions and were not aware of the authorisation details for train movements through the worksite. It would have been helpful if the rail protection officer had briefed the workers on the communications and the plan, specifically the whereabouts of the passenger train.
- 4.3.7. Equally, a number of the workers were aware that the passenger train would be closely following the freight train that had just passed through the worksite. It would have been useful for them to have questioned the rail protection officer about the whereabouts of the passenger train, rather than silently following his lead and locking back on to the worksite.
- 4.3.8. Either scenario would have been a good example of non-technical skills at work, and either would highly likely have prevented the incident.
- 4.3.9. The absence of any challenge from the workers was in part likely to have been a result of a relationship issue between the rail protection officer and workers in the team. Some of the workers said that the relationship issue had created a lack of cohesion and unity within the team. Non-technical skills training is a way or circumventing such a situation and ensuring that it does not interfere with achieving the end goal, safely.
- 4.3.10. The Commission has raised the issue of non-technical skills in two recent rail occurrence reports shortly to be published. Both reports contain references to an open recommendation made to the Chief Executive of the NZ Transport Agency in 2012. The recommendation was that the practice of non-technical skills should be recognised in the National Rail System Standards.
- 4.3.11. On 26 October 2016 KiwiRail provided the Commission with an updated implementation plan to develop non-technical skills within its workforce. The plan stated that non-technical skills had to be embedded and promoted in the workforce in order to build a strong safety culture. The plan showed that between 2014 and 2016 the following number of KiwiRail workers had participated in training programmes that included the principles of non-technical-skills:

2014	2015	2016	2017 (proposed)
337	502	638	625

4.3.12. On 3 April 2017 the NZ Transport Agency said that it was continuing to work with KiwiRail on addressing the recommendation. The NZ Transport Agency added that it had issued a safety improvement plan notice during December 2016 in accordance with section 36 of the Railways Act 2005 requiring KiwiRail to prepare a safety improvement plan to address the implementation of non-technical skills in its rail operations.

4.3.13. The Commission will not be making a further recommendation on this matter.

4.4. Drugs and alcohol

Safety issue – the rail protection officer tested positive for methamphetamine during a post-incident drug and alcohol test. Under KiwiRail’s random testing policy, only 10% of workers were tested each year. The rail protection officer had not been tested for 10 years.

4.4.1. People in safety-critical roles using any performance-impairing substances is a serious safety issue. The rail protection officer said that he had begun to inhale methamphetamine with some friends about once per week during the months leading up to the death of his close friend. The results of the post-incident drug and alcohol test exceeded detection thresholds, which according to research is an indication that the most recent usage had occurred in the week preceding the incident.

4.4.2. The research discussion of methamphetamine on cognition is divided into three main categories:

- the acute effects that occur shortly after the drug has been administered
- the long-term effects of repeated use
- the effects on cognitive functioning.

4.4.3. It is difficult to predict precisely what level of cognitive impairment the methamphetamine had on the rail protection officer’s performance on the day of the incident and throughout the previous 15 incident-free days.

4.4.4. The rail protection officer’s recall of having last used methamphetamine three days prior to the incident is consistent with the findings of the post-incident test. His story of recent methamphetamine use in relation to the death of his friend and the fact of his continuing to fulfil his work tasks suggested that he neither was a heavy user nor had any accumulated effects of protracted drug use.

4.4.5. It was unlikely that the rail protection officer was impaired at the time of the incident, although he may have been in the days prior to the incident. The short duration of methamphetamine use would suggest that he was not likely to have experienced chronic impairment by the drug.

4.4.6. This incident is the fourth rail occurrence investigated by the Commission where a person at the centre of an investigation has tested positive for illicit substances during a post-incident drug and alcohol test. The three previous occasions were at North Junction (KiwiRail maintenance worker) on 25 August 2011, at Melling (KiwiRail train driver) on 27 May 2014 and at Morningside (Transdev Auckland Limited train driver) on 29 January 2015.

4.4.7. The Commission has an open recommendation addressing the issue that under no circumstances should the performance of any rail worker performing any safety-critical task be affected by alcohol or drugs of any kind. On 19 April 2013 the Commission recommended that the Chief Executive of the NZ Transport Agency work with the National Rail System Standard executive in developing a 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
- 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)

The NZ Transport Agency replied on 24 April 2013 that the recommendation had been accepted and discussions on it would be initiated on the publication of the final report. These discussions would include, where appropriate, a projected timeframe for implementation. This would be advised to the Commission in due course. At the time of compiling this report, this recommendation remains open.

- 4.4.8. The Commission placed substance impairment on its watch list and published the watch list report titled Substance Use: Regulatory Environment for Preventing Performance Impairment, to highlight its concerns about the level of drug and alcohol use in the New Zealand transport sector.
- 4.4.9. KiwiRail's records of random drug and alcohol tests for the three years from 2013 to 2015 showed that 95% of the positive results had related to employees working in its safety-critical infrastructure maintenance and train operations areas. KiwiRail's practice of randomly testing 10% of its workforce annually means that an individual is potentially tested once every 10 years, which is consistent with the rail protection officer not having been randomly tested in the previous 10 years. Random testing is more useful than post-incident testing, as it is designed to act as a deterrent and prevent accidents and incidents instead of finding out after the event. The more likely staff are to be tested, the bigger the deterrent.
- 4.4.10. Comparative rail companies in New Zealand and Australia are testing at higher ratios, with some achieving a 50% testing programme during a 12-month period. There would be a safety benefit if KiwiRail increased the percentage of random testing to increase the deterrent to staff. The Commission has made a recommendation to KiwiRail to address this safety issue.

5. Findings

- 5.1. The passenger train involved in the incident was being operated in accordance with KiwiRail rules and procedures, and in accordance with the instructions of the train controller and the rail protection officer.
- 5.2. The workers were authorised by the rail protection officer to occupy the track ahead and in the path of the approaching passenger train. The rail protection officer's error was highly likely a lapse in memory influenced by the pressures he was under in his role as team leader.
- 5.3. The rail protection officer's error could have been picked up and nullified by any of the other staff on site if they had been trained in and working to a good standard of non-technical skills.
- 5.4. Post-incident drug and alcohol tests found a detectable level of methamphetamine in the rail protection officer's urine. The levels detected and the circumstances around his inhaling the drug meant that he was unlikely to have been impaired at the time of the incident. However, it was possible that he had been impaired during the preceding days after last inhaling the drug, while undertaking a safety-critical role.
- 5.5. It is unlikely that the frequency of KiwiRail's random drug and alcohol testing acted as a sufficient deterrent to workers working under the influence of performance-impairing substances.

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. On 16 December 2016 KiwiRail's Group General Manager, Network Services, emailed his infrastructure line managers seeking assurance that the managers took worksite safety seriously. This included using vehicles at worksites with external speakers and having a second person listen in on radio transmissions with train control, train drivers and hi-rail vehicle users. Managers were to ensure that maintenance workers came to work in a fit state and were not impaired by fatigue or drugs/alcohol. Managers were also to check that paperwork was being completed correctly, and audit completed paperwork for clarity and accuracy. Lastly managers were to be clear about the roles their maintenance workers were undertaking at worksites.
- 6.3. On 1 February 2016 KiwiRail issued a Toolbox Topic titled Importance of Crew Resource Management. The document gave three examples of crew resource management at worksites that prevented incidents occurring.
- 6.4. On 1 February 2016 KiwiRail issued a Toolbox Topic titled Competency Card – Go Live Date. The card was to become effective on 29 February 2016. Every KiwiRail worker operating at an infrastructure worksite was required to carry the card on their person as proof that their competencies were valid and current.
- 6.5. During April 2016 KiwiRail issued a Rule of the Week document to its infrastructure workers, highlighting the need to co-ordinate the movement of rail vehicles within protected worksites such as that at Bridge 197.
- 6.6. On 1 July 2016 KiwiRail posted a new engineering services task instruction titled Use of the Worksite Entry Train Alert System. The document described the components, features, use and basic fault-finding of the electronic system for use in the field. KiwiRail issued semi-permanent bulletin 511, dated 3 August 2016, promulgating the trial installation of the Worksite Entry Train Alert as from 8 August 2016.
- 6.7. On 8 August 2016 KiwiRail issued a Toolbox Topic titled Consultation Document – Change Proposal for Track Protection. The document explained KiwiRail's plan to reduce the risks of track occupation incidents occurring by formally splitting out the rail protection officer and work supervisor (team leader) roles and having all planned worksites approved by protection planners.
- 6.8. On 7 November 2016 KiwiRail provided the Commission with a safety update on its Interceptor system, which built on the established and operating Watchdog system (originated from a 2007 Commission recommendation) and the established and operating Eprotect system (September 2016). The Interceptor system is expected to start trials from June 2017. The system will intervene with a brake application on a freight or passenger train that does not stop at a compulsory stop board protecting a worksite, such as Bridge 197 in this instance.
- 6.9. On 31 May 2017 KiwiRail updated the Commission on its August 2016 plan to separate the rail protection officer and work supervisor (team leader) roles and have all planned worksites approved by protection planners. KiwiRail provided a copy of the organisational chart that showed the structure and the members who had been appointed to the roles.

- 6.10. On 3 August 2017 the NZ Transport Agency updated the Commission that it has required KiwiRail to develop a safety improvement plan to raise the standard of non-technical skills training to its “at risk” staff. This request for a safety improvement plan has resulted in KiwiRail providing the Transport Agency with a 16-page document setting out their agreed actions and deadlines for implementation.

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, a recommendation has been issued to the Chief Executive of KiwiRail with notice of the recommendation given to the Chief Executive of 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.

Recommendation to KiwiRail

- 7.3. KiwiRail's records of random drug and alcohol tests for the three years from 2013 to 2015 showed that 95% of the positive results had related to employees working in its safety-critical infrastructure maintenance and train operations areas. KiwiRail's practice of randomly testing 10% of its workforce annually means that an individual is potentially tested once every 10 years, which is consistent with the rail protection officer not having been randomly tested in the previous 10 years.

Random testing is more useful than post-incident testing, as it is designed to act as a deterrent and prevent accidents and incidents instead of finding out after the event. The more likely staff are to be tested, the bigger the deterrent.

Comparative rail companies in New Zealand and Australia are testing at higher ratios, with some achieving a 50% testing programme within a 12-month period.

The Commission recommends to the Chief Executive of KiwiRail that he address KiwiRail's low-ratio random testing programme. (023/17)

- 7.3.1. On 7 September 2017, the Chief Executive of KiwiRail replied:

We confirm that KiwiRail is increasing its random drug and alcohol testing regime from 10% per annum to 20% per annum. This change will take effect from 01 October 2017.

As further requested, KiwiRail undertakes to confirm with the Commission once the change is fully implemented including confirmation of the implementation date, a description of how it was implemented, and evidence to demonstrate full implementation.

Notice to the NZ Transport Agency of recommendation to KiwiRail

- 7.4. KiwiRail's records of random drug and alcohol tests for the three years from 2013 to 2015 showed that 95% of the positive results had related to employees working in its safety-critical infrastructure maintenance and train operations areas. KiwiRail's practice of randomly testing 10% of its workforce annually means that an individual is potentially tested once every 10 years, which is consistent with the rail protection officer not having been randomly tested in the previous 10 years.

Random testing is more useful than post-incident testing, as it is designed to act as a deterrent and prevent accidents and incidents instead of finding out after the event. The more likely staff are to be tested, the bigger the deterrent.

Comparative rail companies in New Zealand and Australia are testing at higher ratios, with some achieving a 50% testing programme within a 12-month period.

The Commission gives notice to the Chief Executive of the NZ Transport Agency that a recommendation has been made to KiwiRail that it address KiwiRail's low-ratio random testing programme. (023/17)

8. Key lessons

- 8.1. Workers responsible for the safety and wellbeing of track staff should not be allowed to be burdened with tasks and responsibilities that will detract from that role.
- 8.2. The use of good non-technical skills could have prevented this incident. All operational staff need to be trained and well practised in those skills to prevent one-person errors resulting in accidents and incidents.
- 8.3. It is not acceptable under any circumstances for workers to be affected by performance-impairing substances, regardless of what roles they are performing.

9. Citations

Australian Transport Safety Bureau. Rail Safety Investigations & Reports, RI-2014-011 Safety Issues Investigation – Safe Work on Track, updated 22 October 2015

Reason J. Human error. New York: Cambridge University Press; 1990

Gustavsen I, Mørland J, Bramness JG. Impairment Related to Blood Amphetamine and/or Methamphetamine Concentrations in Suspected Drugged Drivers. *Accident Analysis and Prevention* (2006) 38, 490–495

Hart CL, Marvin CB, Silver R, Smith E. Is Cognitive Functioning Impaired in Methamphetamine Users? A Critical Review. *Neuropsychopharmacology* (2012) 37, 586–608

Kim I et al, Urinary Pharmacokinetics of Methamphetamine and Its Metabolite, Amphetamine Following Controlled Oral Administration to Humans. *Therapeutic Drug Monitoring* (2004) 26, 664–672

Rail Accident Investigation Branch of the United Kingdom, Rail Accident Report 14/2015: Class Investigation into Irregularities with Protection Arrangements During Infrastructure Engineering Work, dated August 2015

Appendix 1: KiwiRail and Rail and Maritime Transport Union Drug and Alcohol Collective Agreement Clause

Final – 19 October 2012

KiwiRail and RMTU Drug and Alcohol Collective Agreement Clause

KiwiRail and RMTU want their employees/members to be safe at work.

The work environment is unsafe if people are impaired at work by drugs and/or alcohol. Consequently, the possession, consumption, sale or storage of alcohol and/or unauthorised drugs in KiwiRail workplaces, including company vehicles, is prohibited.

KiwiRail and RMTU have developed a policy together with the purpose that our employees/members are clear about their responsibilities to be free from the risks associated with drug and alcohol misuse and to reassure KiwiRail customers that we have an agreed policy which is actively applied.

We expect people to come to work free from being under the influence of drugs and/or alcohol, including prescription and over-the-counter drugs. When being assessed by a medical professional, employees should inform the professional of the nature of their work so that appropriate medication and work attendance decisions can be made. Employees on prescription and over-the-counter medication that may impair their ability to perform their duties safely are required to inform their manager.

All employees will be subject to random testing at any time, even if they have been tested before.

KiwiRail and RMTU are committed to the rehabilitation of employees who have drug and/or alcohol issues and we encourage employees to voluntarily enter rehabilitation when they have a drug and/or alcohol problem.

Drug and alcohol testing will be conducted for pre - employment, for transfer from non - safety critical to safety critical roles, for post incident events and for reasonable cause. Post incident testing will be limited to those directly involved in the incident.

The disciplinary process will be invoked when test results warrant this and when there is a refusal to test.

The employer and the union will discuss the merits of the case. Rehabilitation is preferred, but KiwiRail and RMTU acknowledge that rehabilitation may not be appropriate in all cases. Required entry into, rehabilitation will only be offered to employees on one occasion. In the event of an employee returning a positive test rehabilitation may be offered. Once rehabilitation has been entered into and successfully concluded, if no further positive test is returned during a period of three years the employee may be offered another period of rehabilitation in the event of he or she returning a positive test.

If an employee voluntarily enters rehabilitation and does not return a positive result during the six random tests then the three year period will not be activated. If an employee voluntarily enters rehabilitation and returns a positive result through one of the six random tests, the nature of the rehabilitation will change to required entry and the three year period will apply.

Contractors will have an active Drug and Alcohol policy and procedures which meet all requirements of the KiwiRail Drug and Alcohol policy and procedures or be subject to KiwiRail's Drug and Alcohol Policy and Procedures with KiwiRail managing any testing.

The drug and alcohol process and procedures will be subject to and aligned with this policy.

KiwiRail and their employees retain their legal rights in the application of this policy.

Appendix 2: KiwiRail Drug and Alcohol Policy

Final – 19 October 2012

KiwiRail Drug and Alcohol Policy

Note this page does not apply to RMTU members covered by the RMTU and KiwiRail MECA

KiwiRail wants their employees to be safe at work.

The work environment is unsafe if people are impaired at work by drugs and/or alcohol. Consequently, the possession, consumption, sale or storage of alcohol and/or unauthorised drugs in KiwiRail workplaces, including company vehicles, is prohibited.

KiwiRail and RMTU have developed a policy together with the purpose that our employees be clear about their responsibilities to be free from the risks associated with drug and alcohol misuse and to reassure our customers that we have an agreed policy which is actively and positively applied.

We expect people to come to work free from the being under the influence drugs and/or alcohol, including prescription and over-the-counter drugs. When being assessed by a medical professional, employees should inform the professional of the nature of their work so that appropriate medication and work attendance decisions can be made. Employees on prescription and over-the-counter medication that may impair their ability to perform their duties safely are required to inform their manager.

All employees will be subject to random testing at any time, even if they have been tested before.

KiwiRail is committed to the rehabilitation of employees who have drug and/or alcohol issues and we encourage employees to voluntarily enter rehabilitation when they have a drug and/or alcohol problem.

Drug and alcohol testing will be conducted for pre-employment, for transfer from non-safety critical to safety critical roles, for post incident events and for reasonable cause. Post incident testing will be limited to those directly involved in the incident.

The disciplinary process will be invoked when test results warrant this and when there is a refusal to test.

The employer will evaluate the merits of the case, and when union members are involved, discuss the merits of the case with the appropriate representative. Rehabilitation is preferred, but depending on the circumstances, may not be appropriate in all cases. Required entry into, rehabilitation will only be offered to employees on one occasion. In the event of an employee returning a positive test rehabilitation may be offered. Once rehabilitation has been entered into and successfully concluded, if no further positive test is returned during a period of three years the employee may be offered another period of rehabilitation in the event of he or she returning a positive test.

If an employee voluntarily enters rehabilitation and does not return a positive result during the six random tests then the three year period will not be activated. If an employee voluntarily enters rehabilitation and returns a positive result through one of the six random tests, the nature of the rehabilitation will change to required entry and the three year period will apply.

Contractors will have an active Drug and Alcohol policy and procedures which meet all requirements of the KiwiRail Drug and Alcohol Policy and Procedures or be subject to KiwiRail's Drug and Alcohol Policy and Procedures with KiwiRail managing any testing.

The drug and alcohol process procedures which follow will be subject to and aligned with this policy.

KiwiRail and their employees retain their legal rights in the application of this policy.



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