Transport Accident Investigation Commission

Final report
Tuhinga whakamutunga

Rail inquiry RO-2023-103
Safe-working irregularity
3.85 km mark Johnsonville line – tunnel 5
04 May 2023

March 2024

The Transport Accident Investigation Commission
Te Kōmihana Tirotiro Aituā Waka

No repeat accidents – ever!

"The principal purpose of the Commission shall be to determine the circumstances and causes of accidents and incidents with a view to avoiding similar occurrences in the future, rather than to ascribe blame to any person."

Transport Accident Investigation Commission Act 1990, s4 Purpose

The Transport Accident Investigation Commission is an independent Crown entity and standing commission of inquiry. We investigate selected maritime, aviation and rail accidents and incidents that occur in New Zealand or involve New Zealand-registered aircraft or vessels.

Our investigations are for the purpose of avoiding similar accidents in the future. We determine and analyse contributing factors, explain circumstances and causes, identify safety issues, and make recommendations to improve safety. Our findings cannot be used to pursue criminal, civil, or regulatory action.

At the end of every inquiry, we share all relevant knowledge in a final report. We use our information and insight to influence others in the transport sector to improve safety, nationally and internationally.

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Kōrero tāpiri ki ngā pūrongo o te Kōmihana

Citations and referencing

The citations section of this report lists public documents. Documents unavailable to the public (that is, not discoverable under the Official Information Act 1982) are referenced in footnotes. Information derived from interviews during the Commission's inquiry into the occurrence is used without attribution.

Photographs, diagrams, pictures

The Commission owns the photographs, diagrams and pictures in this report unless otherwise specified.

Verbal probability expressions

For clarity, the Commission uses standardised terminology where possible.

One example of this standardisation is the terminology used to describe the degree of probability (or likelihood) that an event happened, or a condition existed in support of a hypothesis. The Commission has adopted this terminology from the Intergovernmental Panel on Climate Change and Australian Transport Safety Bureau models. The Commission chose these models because of their simplicity, usability, and international use. The Commission considers these models reflect its functions. These functions include making findings and issuing recommendations based on a wide range of evidence, whether or not that evidence would be admissible in a court of law.

Terminology	Likelihood	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	

Figure 1: CCTV showing track workers coming into view as train exits tunnel 5
(Credit: Transdev, modified for anonymity by TAIC)

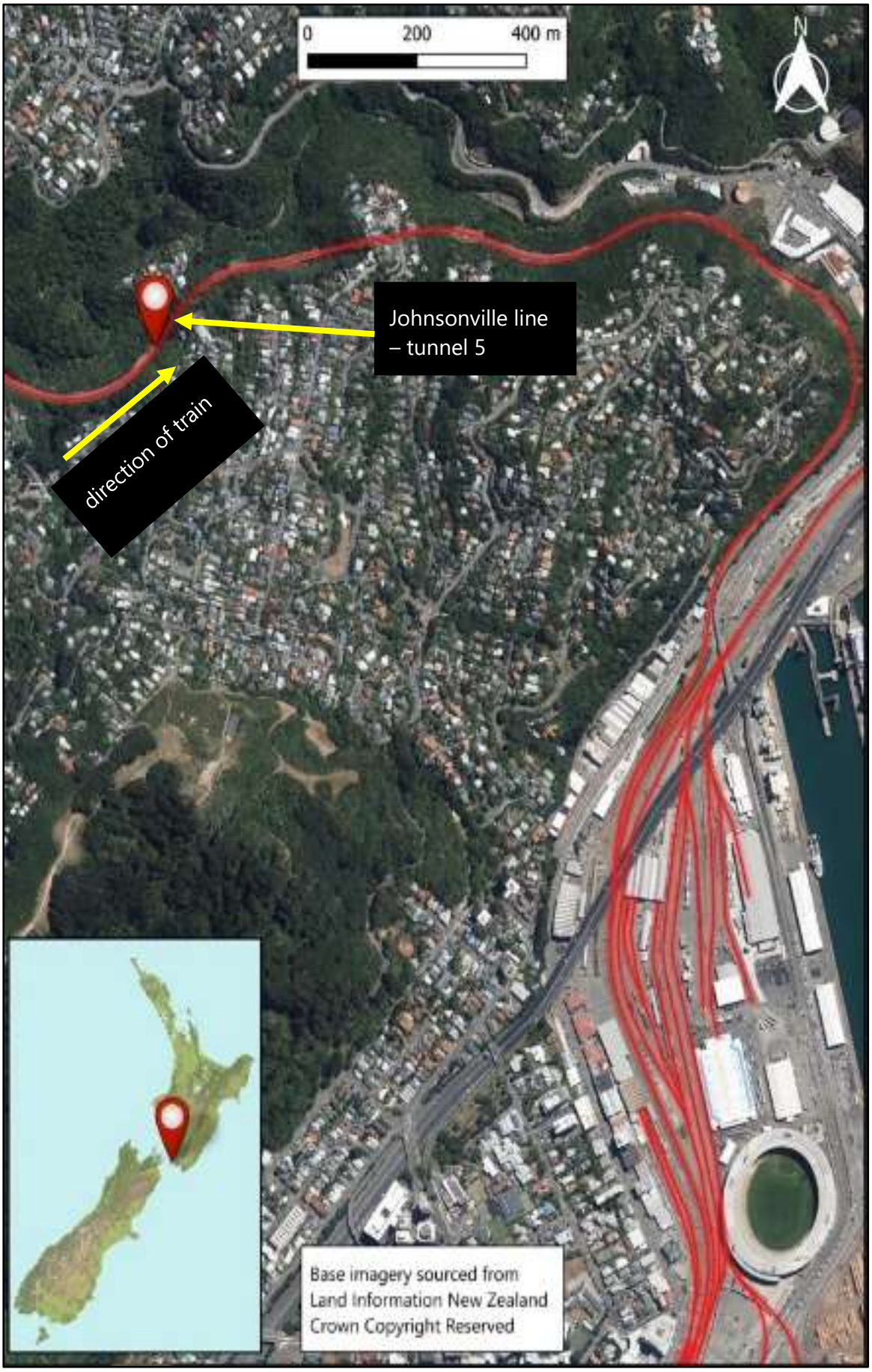

Figure 2: Location of incident

(Credit: Toitū Te Whenua Land Information New Zealand)

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1 Executive summary
Tuhinga whakarāpopoto

What happened

1.1. At 1241[1] on Thursday 4 May 2023, a team of two KiwiRail track workers entered the rail corridor[2] at Crofton Downs without permission and walked alongside the rail line towards tunnel 5 (the tunnel). On arrival at the northern end of the tunnel one of the track workers contacted train control[3] by telephone and requested time to conduct work on the Johnsonville line (JVL), stating their location to be at the 3.85 kilometre (km) mark[4] north of tunnel 5 and that they wanted to travel on foot through the tunnel to the south end. The tunnel is located between Wadestown and Crofton Downs.

1.2. The train controller (the TC) went through their usual procedure for allocating track time[5] and putting protection for the track workers in place before the track workers began making their way through the tunnel.

1.3. However, the required protection from rail traffic, in the form of track signals being held at red (stop), was established by the TC at locations different from where the track workers were intending to work.

1.4. As there was no protection in place at the correct locations, a Transdev passenger train entered the section of track that the track workers thought was blocked for their work.

1.5. The two track workers were nearing the southern portal[6] of the tunnel when they became aware of the Transdev passenger train entering the tunnel from the northern end. The track workers were able to exit the tunnel and move to a safe position before the train reached the southern portal.

1.6. At 1248 the driver of the Transdev passenger train reported unexpectedly sighting the track workers to train control.

Why it happened

1.7. The track workers arrived at the northern entrance to the tunnel without the required permission and without any protection from rail traffic.

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[1] Times in this report are New Zealand Standard Time and are expressed in 24-hour mode.

[2] For the purposes of this report, the term 'rail corridor' refers to anywhere within 5 metres (m) of the centre of the railway track.

[3] At the time of the incident, the national train control centre was located in Wellington Railway Station and was responsible for track authorisations and the safe movement of rail traffic throughout New Zealand.

[4] The JVL is measured by each kilometre starting at Wellington Railway Station (0 km). This increases in a northerly direction to Johnsonville (10.49 km). These measurements are referred to as kilometre marks.

[5] Track time is the time allocated by train control for track workers to take possession of a section of track to conduct maintenance or repair work. Train control provides track workers with protection from rail traffic for the duration of that time.

[6] The opening at each end of a tunnel.

1.8. The TC recorded the intended track occupation on the train control diagram[7] at locations different from those requested by the track worker and applied electronic blocking protection at those incorrect locations. The TC authorised the track occupancy to the track worker over the telephone rather than the radio.

1.9. The track worker did not identify the location discrepancy while listening to the TC state the protection details and repeated back the incorrect locations without challenge.

What we can learn

1.10. All personnel undertaking safety-critical roles should adhere to the principles underlying the application of non-technical skills to ensure that they share the same mental models and have a clear understanding of what is required of themselves and others to complete tasks safely.

Who may benefit

1.11. Rail operators (including train controllers), rail protection officers and track maintenance personnel may all benefit from the findings in this report.

[7] A document that records all information about activity on the relevant railway line over a 24-hour period. Train controllers annotate the diagram in real time to show activities such as train movements, track occupations, track faults, temporary speed restrictions, weather events, and any other pertinent information that arises.

2 Factual information
Pārongo pono

Narrative

2.1. From 26 April until 4 May 2023, passenger rail operations were disrupted in the Wellington region because of operational issues with KiwiRail's track evaluation car.

2.2. This led to the implementation of temporary speed restrictions for trains, causing a reduction in the number of passenger services running daily and cancellation of some services.

2.3. During this period, train controllers tasked in the Wellington metropolitan passenger train control area experienced an unusually low workload in comparison to their normal activity.

2.4. On 4 May 2023 the issue with the track evaluation car was resolved and rail services returned to normal operations.

2.5. The day before this, at 1214 on 3 May 2023, train control received a slip-detector[8] alarm activation on the JVL at the 2.44 km mark.

2.6. Slip detectors are placed at strategic locations on KiwiRail's network to provide early warning to train controllers that an area of line may be compromised by slip debris.

2.7. On receipt of the alarm, the on-duty train controller followed KiwiRail procedure, initiating a speed restriction for rail traffic, annotating the train control diagram and arranging for the area of line to be inspected.

2.8. As there was reduced rail traffic at the time, an inspection team rode on a Transdev passenger train later that day to view the site of the alarm activation. No slip debris was observed by the inspection team and trains were authorised to pass through the area at a reduced speed of 25 kilometres per hour (km/h) until the slip alarm could be reset.

2.9. Resetting the slip alarm required physical access to the rail-side equipment. To avoid further disruption to the rail schedule, the infrastructure team planned to reset the slip alarm after the passage of the final scheduled train for that day.

2.10. Between 0145 and 0330 on 4 May, the infrastructure team inspected the JVL while they travelled by hi-rail vehicle[9] to the slip-detector location at the 2.44 km mark to reset the equipment. Once this was done, they advised train control that the JVL was cleared for normal line speed.

2.11. At about 0330 the train controller acknowledged this authorisation and made the necessary annotations on the train control diagram.

2.12. At 0530 the TC, who was the day-shift train controller, started their shift on the Wellington metropolitan desk after receiving a handover from the night-shift train controller. Part of the handover process involved reading and understanding the information recorded on the train control diagram.

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[8] In regions with hilly or mountainous terrain, a 'slip' refers to rockfalls or landslides that may endanger railway activities. Slip detectors within this context are trackside equipment designed to detect rockfalls or landslides and initiate an alert and provide details of the location to the responsible rail personnel.

[9] A vehicle fitted with equipment that gives the capability to travel on both road and rail.

2.13. At 0538 the driver of the first northbound JVL Transdev passenger train of the morning contacted train control to advise that a train stop trip (TST)[10] (*see* Figure 3) had been activated between tunnels 4 and 5 and gave the location as "south of tunnel 5".

Figure 3: Train stop trip lever fitted to Transdev passenger trains

2.14. The TST location south of tunnel 5 corresponded with a build-up of loose rockfall at the 3.567km mark (*see* Figure 4).

[10] A piece of equipment fitted to some passenger trains that activates emergency braking if the train passes certain signals at stop. Because of its design, the equipment can also be activated by an obstruction on the trackside, such as a build-up of vegetation or rock debris.

Figure 4: Rockfall site at the 3.567 km mark

(Credit: KiwiRail)

2.15. The TC recorded the TST activation by marking "Trip #5 tunnel sth" on the train control diagram at the same location that the slip alarm was activated the previous day, although the two alarms were in fact activated at different locations – the slip alarm at the 2.44 km mark between Wellington and Wadestown, and the TST alarm at the 3.567 km mark between Wadestown and Crofton Downs (*see* Figure 5).

2.16. An hour later at about 0638 a second driver reported that the TST had been activated on their train at the same location, south of tunnel 5.

2.17. On receiving this information, the TC notified operations support (a help desk referred to within KiwiRail as 155). The help desk tried to call out members of the infrastructure team to attend the TST activation site but could not contact them.

2.18. At 0640, after receiving no response from the infrastructure team, 155 sent text messages to the infrastructure supervisor and field production manager but did not receive any response.

2.19. As the fault had not been attended to it remained active in KiwiRail's fault logging system.

2.20. No further action was taken by 155, and there were no further reports of trains encountering TST activations that morning.

2.21. At about 1100 the infrastructure supervisor read the text message sent earlier by 155 and began to arrange for the fault to be inspected.

2.22. The infrastructure supervisor assigned a track worker (TW1) to inspect the track at the TST activation site, reported by 155 to be at approximately the 3.533 km mark on the JVL.

2.23. TW1 arranged for another track worker (TW2) to assist and they both left the Wellington yard, travelling by road in a KiwiRail service truck towards Ngaio station.

2.24. On arrival at Ngaio station the track workers realised they would not be able to access the alarm site from there and continued driving to Crofton Downs station, approximately 1 km north of the tunnel.

2.25. At Crofton Downs, TW1 confirmed they were at the closest access point to the reported alarm site by checking a track metrage sign.[11]

2.26. The two track workers collected shovels and a Mis 71 pad[12] from the truck before waiting for a southbound passenger train to depart Crofton Downs station.

2.27. Once the southbound train had departed, the two track workers made their way to the side of the track and walked along an access path beside the railway line for about a kilometre before arriving at the northern portal of the tunnel (*see* Figure 5).

2.28. This access path was for maintenance purposes only, and the track workers should have obtained permission before its use to ensure that protection from rail traffic was established.

2.29. At about 1240 TW1, who was not carrying a portable radio, contacted train control using a personal mobile phone and requested track time to walk through the tunnel to the alarm site.

[11] Trackside signage indicating the track meterage.

[12] A Mis 71 pad contains printed forms to be completed for track occupation cross checks when requesting track time. KiwiRail has several different Mis (Miscellaneous) forms.

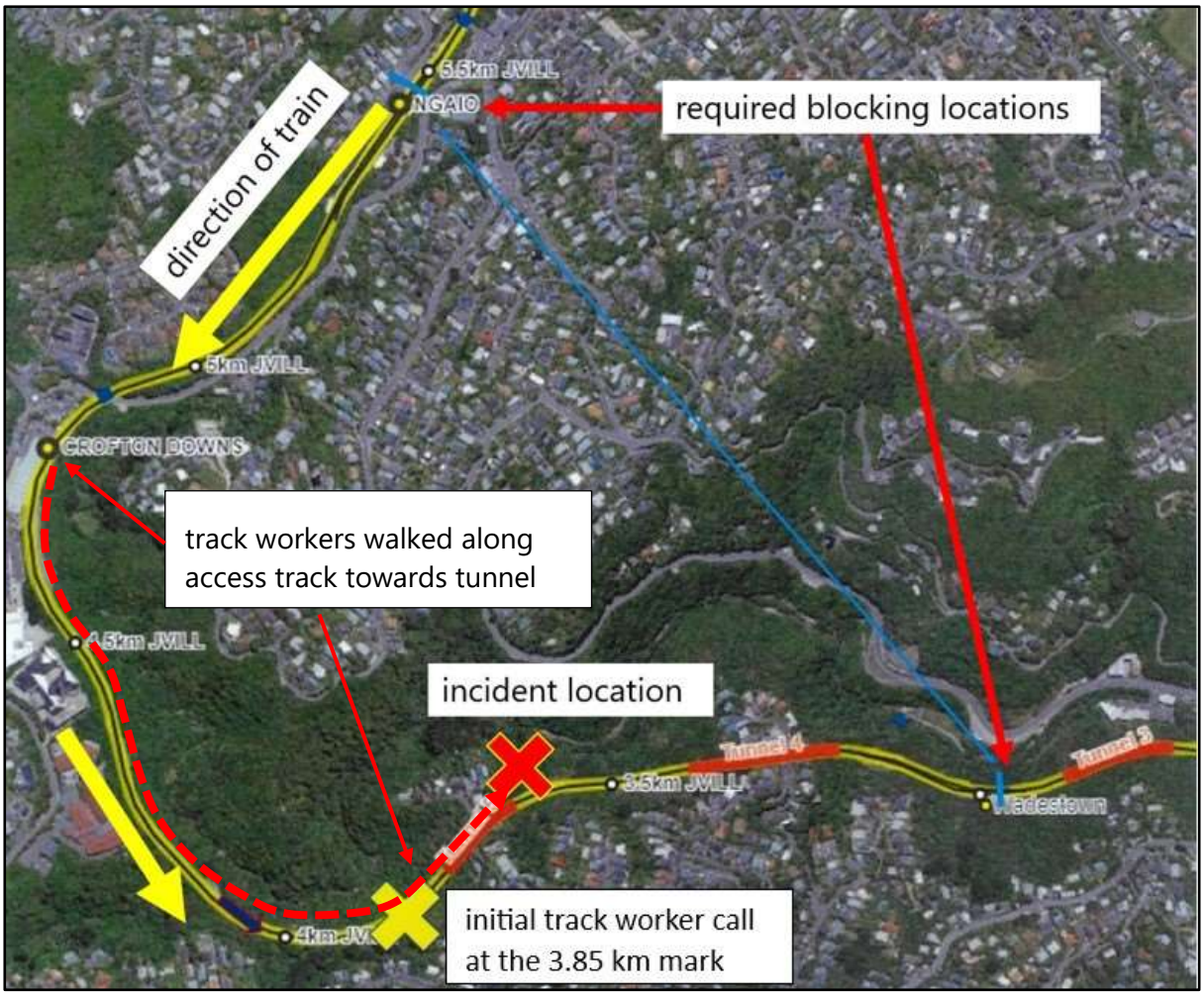

Figure 5: Incident map

2.30. TW1 gave the TC the location as being at the 3.85 km mark, north of tunnel 5. This location was between Wadestown and Crofton Downs (*see* Figure 6).

2.31. The TC applied electronic blocking[13] by first ensuring that the required signals were at red (stop), then moved the cursor on the mimic screen[14] over each signal before right-clicking on the signal and activating a block command through the train control system. This ensured that the signals could not be changed to either green or yellow (proceed) without removing the blocking. Before removing any blocking from the signals, the TC had to conduct a series of checks, including ensuring that all workers were clear of the area.

2.32. The TC advised TW1 that they had permission to work between the 3.85 km mark and Wellington, and that blocking had been applied between 97 signal Wellington and 4L signal Wadestown (*see* Figure 6). TW1 was given a start time of 1243 and was to be clear of the track by 1248 (five minutes later).

[13] Electronic blocking is a method of protection whereby the train controller uses the train control system to prevent signals held at red (stop) being placed at green or yellow (proceed). Having to stop for red signals prevents rail traffic from entering a section of track that has been blocked.

[14] A mimic screen is a visual display of the train control system whereby the train controller commands the movement of points and the operation of signals.

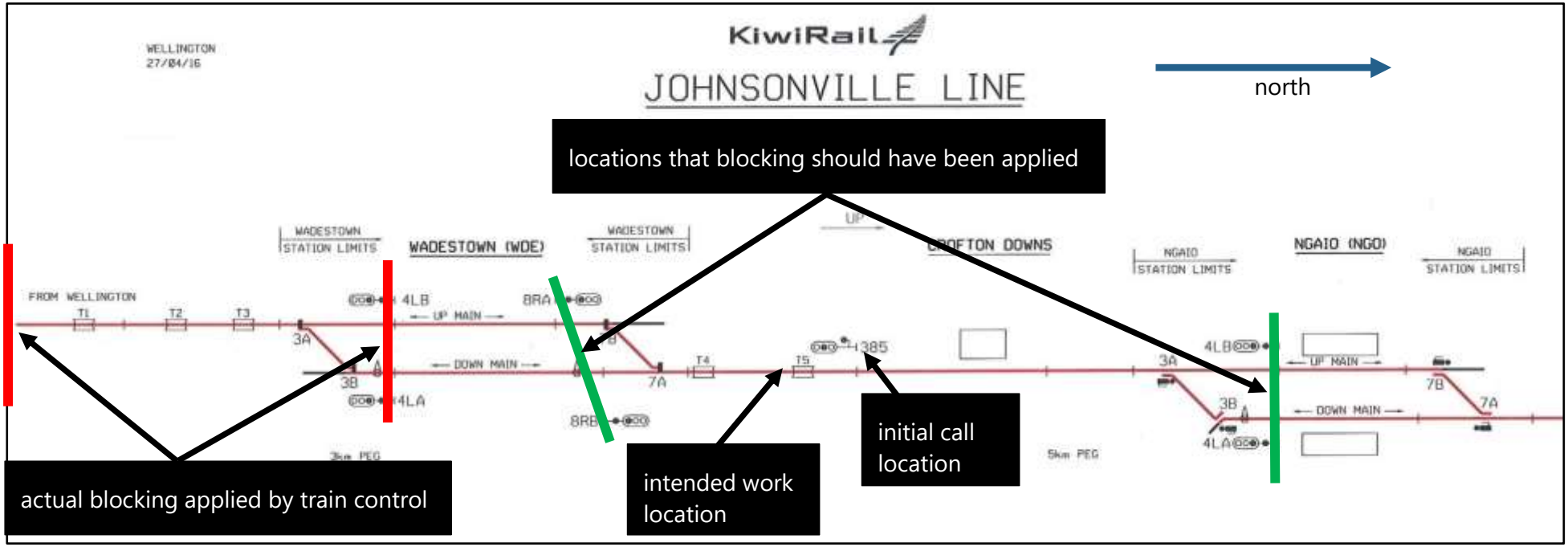

Figure 6: Signals and Interlocking diagram (simplified and not to scale) of incident

(Credit: KiwiRail, modified by TAIC)

2.33. TW1 repeated this information back to the TC while filling out the Mis 71 form.

2.34. The blocking established by the TC (between 97 signal Wellington and 4L signal Wadestown) was incorrect. It did not prevent rail traffic from entering the section of track in which TW1 and TW2 were working.

2.35. The correct blocking should have been between 8R A and B signals Wadestown and 4L A and B signals Ngaio (*see* Figure 6).

2.36. Neither the TC nor TW1 identified during the telephone conversation that the blocking locations were incorrect. This is discussed further in the analysis section (*see also* para 2.66).

2.37. On completion of the telephone call, TW1 and TW2 began jogging through the tunnel from the north end towards the south end. They only had five minutes of track time originally allocated, which by the end of the call effectively left only four minutes remaining. The tunnel was 127 m long and curved to the right in the direction the track workers were moving.

2.38. TW1 was in front using the flashlight function of their mobile phone to illuminate the path as there was no form of internal lighting within the tunnel and the track workers did not have torches with them.

2.39. As they jogged through the tunnel, TW2 heard the sound of train wheels and saw light appearing on the tunnel walls coming from behind them. TW2 called out to TW1 and the pair began running faster towards the southern portal.

2.40. The pair exited the south end of the tunnel and immediately moved to a safe distance from the track on the eastern side of the portal (*see* Figure 1).

2.41. Transdev passenger train TDW9237 exited the tunnel about 5 seconds after the track workers had reached a place of safety.

2.42. At 1248, TW1 contacted train control by telephone to rescind the blocking protection. No mention of the near miss with the train was made during this call.

2.43. The driver of the train was concerned that they had not known about the track workers on the JVL and, knowing that other trains were in the area, contacted train control by radio to report the location of the track workers.

2.44. On receiving this information, the TC rechecked the train control diagram against the known location of the track workers and realised that protection had been put in place to cover the site of the earlier slip detector alarm at the 2.44 km mark, and not the TST activation site at the 3.567 km mark.

2.45. The TC immediately reported this to their supervisor, who remained with the TC while they investigated what had happened.

2.46. Meanwhile, the two track workers, remaining clear of the track, had walked to the site of the loose rockfall, about 60 m further south of the tunnel's southern portal.

2.47. At about 1252, TW1 called train control and requested further track time to clear the rockfall that had caused the earlier TST activations.

2.48. The TC, under supervisor observation, established protection for the track workers at the correct location to carry out the clearing of the rockfall.

2.49. The supervisor informed the Network Control Manager (NCM)[15] of the potential safe-working irregularity and the NCM remained near the train control desk while the circumstances of the incident were being investigated.

2.50. At the end of their allotted track time, TW1 called train control to advise that the work was complete and that blocking could be removed. The NCM then advised TW1 that an irregularity had occurred and that TW1 should contact their line manager.

2.51. TW1 attempted to contact their line manager by telephone but was unsuccessful as the manager had completed an overnight shift that morning and had not yet returned to work.

2.52. Meanwhile, the NCM had replaced the TC involved in the incident with a relief train controller who continued working the Wellington metropolitan train control area.

2.53. At this stage, TW1 and TW2 were still at the southern end of the tunnel and needed to walk back through the tunnel to return to their vehicle parked at Crofton Downs.

2.54. At 1316 TW1 contacted train control for permission to walk back through the tunnel. This permission was approved and the trackworkers were allocated time to walk back through the tunnel and return to their vehicle.

2.55. On returning to the vehicle, TW1 was contacted by their line manager who advised the track workers to return to the depot in Kaiwharawhara.

2.56. TW1 drove the vehicle 4 kilometres to the depot, whereupon both track workers were required to undergo post-incident drug and alcohol testing.

Personnel information

2.57. TW1 had three years' experience as a track worker, held all the required current competencies for the role and was qualified to establish track protection. On the day of the incident, TW1 was the senior track worker within the team as the qualified supervisors were off shift. TW1 underwent post-incident drug and alcohol testing and provided a non-negative[16] (failed) result. Further laboratory analysis confirmed the initial result as a positive (failed) test.

2.58. TW2 had one years' experience as a track worker and held all the required current competencies for the role. TW2 underwent post-incident drug and alcohol testing and provided a negative (passed) result.

2.59. The TC had 19 years' experience as both a signaller and train controller. They held all the required current competencies for the role. The TC underwent post-incident drug and alcohol testing and provided a negative (passed) result.

Meteorological information

2.60. The weather at the time of the incident was inclement. It was raining heavily with a temperature of 17 ^{O}C.

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[15] The Network Control Manager is a shift-working manager based in the train control centre who is responsible for activity on the rail network throughout the country.

[16] Indicating the possible presence of the substance being tested for, but not reliable as a final result and requiring laboratory analysis. If laboratory analysis confirms the presence of the substance it is referred to as a positive test result for that substance.

Recorded data

2.61. The Commission obtained CCTV[17] footage and Tranzlog[18] data for TDW9237 from Transdev.

Site information

2.62. Tunnel 5 is a 127 m curved tunnel located between the 3.633 km mark and the 3.76 km mark on the JVL. Stations either side of the tunnel are Crofton Downs and Wadestown. The tunnel has no road access, but there is a walkable access track for KiwiRail personnel that runs alongside the rail line from Crofton Downs to the northern portal.

Medical information

2.63. Laboratory testing confirmed the presence of tetrahydrocannabinol (THC)[19] in TW1's sample. The pattern of THC consumption and recency of use, and therefore the level of THC impairment, was not determined by a secondary test as TW1 left KiwiRail's employment immediately. As the level of impairment was not established, no determination could be made as to whether THC impairment was a factor in this incident. This is discussed further in the analysis section (*see* paras 3.29–3.31).

Survival aspects

2.64. Both track workers were able to reach the southern portal and a place of safety before the train reached their location. There was a refuge bay inside the tunnel that may have accommodated both workers if required. Had one or both of the workers not been able to reach either the refuge bay or portal they could have been fatally injured had they been struck by the train.

Previous occurrences

2.65. On 24 March 2019 a rail protection officer conducting protection duties in Westfield yard lost situational awareness and allowed a signals technician into a work area without the knowledge of train control. Subsequently electronic protection was removed by train control while the signals technician was still conducting work.[20] The key lesson from this investigation was that all personnel undertaking safety-critical roles should adhere to the principles underlying the application of non-technical skills to ensure that they share the same mental models and have a clear understanding of what is required of themselves and others to complete the task safely.

2.66. On 21 September 2020, a freight train on the East Coast Main Trunk line entered a section of track that the rail protection officer believed was part of a protected work area and which was already occupied by a contractor operating a hi-rail vehicle.[21] A collision between the train

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[17] Closed-circuit television.

[18] The train's onboard 'black box' data recorder.

[19] The principal psychoactive constituent found in cannabis.

[20] Rail inquiry RO-2019-101 Safe Working Occurrence, Westfield yard 24 March 2019, Transport Accident Investigation Commission, April 2020

[21] Rail inquiry RO-2020-104 Safe Working Irregularity, Hamilton – Eureka 21 September 2020, Transport Accident Investigation Commission, January 2022.

and the hi-rail vehicle was only avoided because the hi-rail vehicle had voluntarily cleared the track about five minutes earlier. The Commission found in part that:

> …the rail protection officer and the train controller had a different understanding of where the blocking was required. As a result, both parties had different mental models of the area that was being protected…

2.67. This investigation identified that KiwiRail recorded 61 track occupancy irregularities between June 2019 and May 2021. Of these 61 incidents, 21 were attributable to miscommunication.

2.68. The Commission recommended that KiwiRail carry out an analysis of how it could best incorporate engineering control measures into both its current and future operations to minimise the risks that human factors play in effective protection for track workers (Recommendation 009/21).

2.69. On 16 December 2021, KiwiRail replied:

> KiwiRail agrees with the intent of this recommendation. Work is currently underway to renew the Train Control system which will give us the technology to move to a form of hand-held track worker interaction in the future. The strategy is to deliver a Business Case for this next year to be funded and delivered in the 2025 - 2027 funding period. We will have completed implementation of the new Train Control system by 2025.

2.70. The Rail Accident Investigation Branch (RAIB) of the United Kingdom has investigated 58 accidents and incidents involving track worker safety since 2005. In 2023 RAIB published a 'summary of learning'[22] on the protection of track workers from moving trains. The main themes from the RAIB summary of learning relevant to this inquiry are:

- planning work
- the quality of leadership on site
- the supervision and monitoring of trackworkers
- the way that information is presented to track workers
- the willingness of staff to challenge unsafe practices.

2.71. The Australian Transport Safety Bureau (ATSB) released a report in 2017[23] developed after ATSB researchers reviewed 12,146 occurrence records from all state and territory rail safety regulators for the period July 2009 to July 2014. Of these, approximately 15 per cent were found to be associated with work on track.

2.72. In 2017, prompted in part by Commission recommendations, KiwiRail began the process of implementing Non-Technical Skills training for its staff. KiwiRail's integration plan[24] stated in part:

> KiwiRail previously conducted Crew Resource Management training for its employees to provide them with skills and confidence to be in a position to challenge instructions whenever they felt the instruction was not correct or required expanding. This was to ensure the employee clearly understood the task or the instructions they had been given. This training required refresher training every two years.

[22] Summary of learning – track workers, Rail Accident Investigation Branch, March 2023.
[23] ATSB research report RI-2014-011: Safe work on track across Australia: Analysis of incident data
[24] KiwiRail NTS Integration Project Plan for NZTA 20 April 2017.

> Over time we have reviewed the Crew Resource Management process and have decided that it did not meet our requirements. As previously mentioned we have researched other rail operators through RSSB in the UK and Australia and found that the Non-Technical Skills strategy being used was a better fit for our operations. This review process has led to the establishment of this project.

2.73. This training project was fully implemented within KiwiRail by 2020.

Organisational information

2.74. KiwiRail Holdings Limited (trading as KiwiRail) was the operator of the railway line and employer of the track workers and train controllers.

2.75. Transdev Wellington Limited (Transdev) was the operator of the passenger train and employer of the train driver.

3 Analysis
Tātaritanga

Introduction

3.1. Having systems in place to protect track workers from rail traffic is a fundamental premise of rail operations worldwide. Those systems are only effective if established procedures are followed. On this occasion, the track workers were able to avoid being struck by the passenger train by running through a dark tunnel to reach the exit. A potentially fatal accident was avoided by seconds.

3.2. This section analyses the circumstances surrounding the event to identify those factors that increased the likelihood of the event occurring or increased the severity of its outcome. It also examines any safety issues that have the potential to adversely affect future operations.

Factors leading to the incident

Train control

3.3. Train control diagrams (*see* Figure 7 and Appendix 1) have been in use by rail operators worldwide for many decades. Whilst modern electronic and digital diagram systems are available, most operators have retained the paper-based diagrams for their ease of use, ready availability to reference and simplicity of storage.

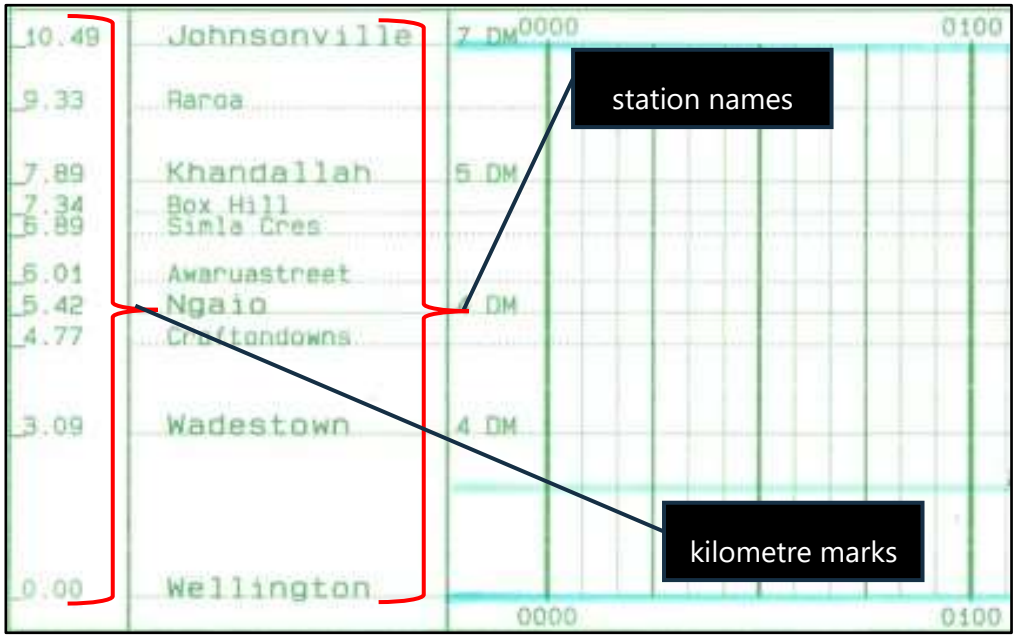

Figure 5: Section of a train control diagram showing the Johnsonville line

(Credit: KiwiRail, modified for anonymity by TAIC)

3.4. Paper-based diagrams do have disadvantages. High-traffic areas can become clustered with information, making them difficult to decipher. Train controllers do not have the ability to 'zoom in' to a specific area as they might with a digital diagram.

3.5. Paper-based diagrams are also not interactive, in that their effectiveness is reliant on the train controller recording accurate information and also interpreting any recorded information on

the diagram correctly. There is no risk control other than the train controller's ability to carry out these functions accurately.

3.6. Train controllers undertake 10 weeks' classroom training, followed by up to 16 weeks' on-the-job training before becoming qualified to work alone. They are regularly assessed and audited on safety-critical activities including diagram recording performance. Newly certified train controllers are audited at least six times within their first nine months of certification. The TC on duty at the time of the incident was considered by KiwiRail to be very experienced.

3.7. The train control diagram is based on a simple time/distance graph with metrages and stations annotated on both the lefthand and righthand side of the document (*see* Figure 7). The train controller uses the diagram to record the movements of rail traffic (trains, hi-rail vehicles, track machines), establish the boundaries of track occupation areas and record any other information such as weather conditions and faults pertinent to safe working. Train control diagrams are kept by the rail operator for 10 years in case they may be required for reference.

3.8. During the day before the incident a slip alarm had been activated at the 2.44 km mark between Wellington and Wadestown. The night-shift train controller annotated this alarm activation in green highlighter on the diagram (*see* Figure 8) and ruled a line from midnight until 0330. When at 0330 confirmation was received that the alarm had been reset, the night-shift train controller further annotated the diagram by crossing out the green highlighted line with black pen and writing "Track Cleared for Normal Speed'', to denote that the alarm condition was no longer present.

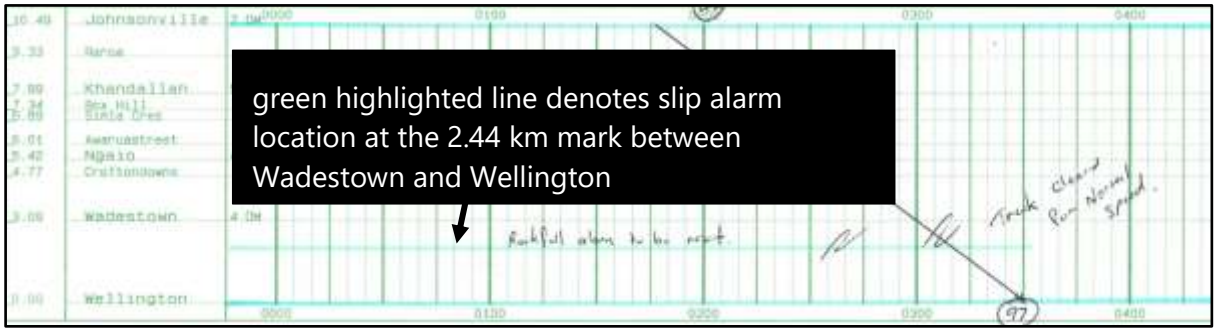

Figure 6: Section of diagram showing the slip alarm location

(Credit: KiwiRail, modified for anonymity by TAIC)

3.9. The TC started their shift at 0530 and was made aware during handover of the annotations on the diagram and the previous alarm activation. At that time of the morning there was little other information on the diagram as trains had not yet started running on the JVL. The TC was effectively looking at a blank diagram, except for the alarm activation and reset annotations at the 2.44 km mark.

3.10. Minutes after the TC started their shift, the first JVL train departed Wellington heading towards Johnsonville. At about 0538 the train driver called the TC by radio to inform them that the train had stopped due to a TST activation south of tunnel 5 (*see* Figure 9).

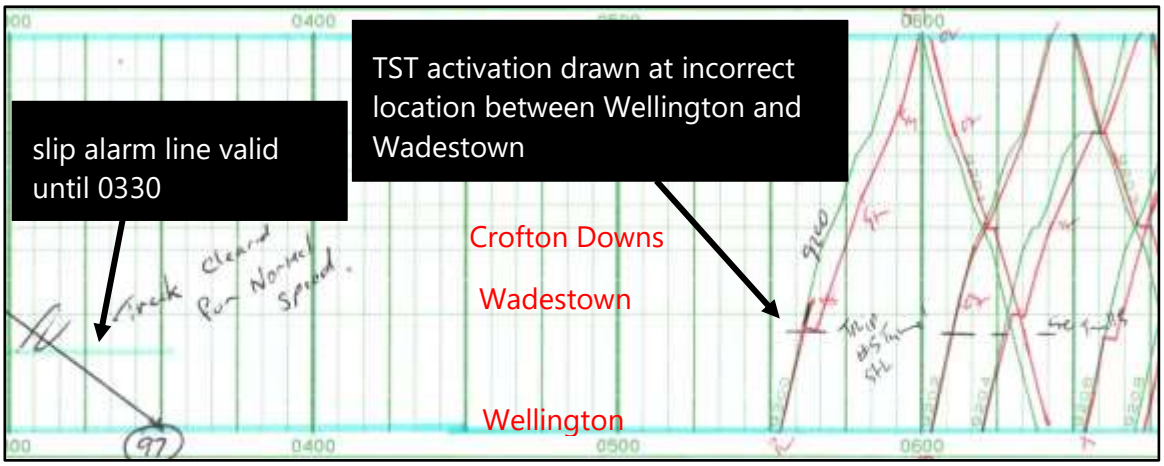

Figure 7: Diagram annotation showing the first TST activation at 0538

(Credit: KiwiRail, modified for anonymity by TAIC)

3.11. While the TC could offer no explanation why they incorrectly annotated this on the diagram at the same location as the previously annotated slip alarm (at the 2.44 km mark, between Wellington and Wadestown rather than at the 3.567 km mark between tunnels 4 and 5), it was **likely** because the now obsolete green highlighted line was a point of visual reference that stood out on the otherwise almost blank diagram.

3.12. In turn, it was **likely** the incorrect annotation led the TC to make a false association[25] between the earlier slip alarm and the TST activation when they were in fact two separate events.

3.13. The actual location of the TST activation was just over one kilometre north of where it was annotated by the TC on the diagram.

3.14. The TC continued their shift in what was becoming an increasingly busy environment as passenger train services resumed their normal week-day commuter schedule after a week of minimal activity because of the track evaluation vehicle issues.

3.15. The TC was controlling the JVL, rail traffic on the Wairarapa line between Masterton and Wellington, and passenger trains on the Melling line. There was also a non-timetabled driver-training train[26] operating on the JVL, which added to the workload.

3.16. The timetable software[27] not having been uploaded that morning because of the short notice of the resumption of normal operations, meant the TC had to be extremely vigilant for trains approaching or leaving Petone station. An error in the order of any of these trains would lead to significant passenger service delays.

3.17. With this level of activity, the TC's focus was directed at the task of running trains and not at the TST activation, as at this stage it was a relatively low priority.

3.18. When a second train encountered a TST activation at the same location as the first, the issue became more pressing as it could potentially cause major timetable disruptions. The TC

[25] A false association occurs when someone mistakenly believes that two events are related or connected. This often arises when there are superficial similarities or shared characteristics between the two events.

[26] An empty passenger train operated by a trainee driver under instruction from a qualified person. Trainees learn route-knowledge and train-handling skills before being allowed to drive with passengers onboard.

[27] The timetable software used was the Operational Management System (OMS), which provided information to the train controller such as train sizes and destinations. It was used for, among other things, scheduling and train routing decisions.

recorded the second TST activation on the train control diagram at the same incorrect location as they had recorded the first TST activation.

3.19. The TC contacted 155, who initiated a 'priority one'[28] job and began their callout process to notify infrastructure staff to attend.

3.20. Because of staff absences, nobody on the callout list responded to 155, and the job remained unattended. However, by this stage the small rockfall that was causing the TST activations had been pushed away from the track by the passage of rail traffic to the point that it was no longer connecting with the TST levers[29] and had therefore ceased to be an issue.

3.21. When TW1 eventually responded to the 155 callout, seven hours had passed since the initial TST activation.

3.22. The TC stated in their interview that by the time they received the initial telephone call from TW1 at about 1240 requesting track time, they had forgotten about the TST activations as none had been reported since about 0600 that morning.

Track worker

Safety issue: Short staffing resulted in a track worker undertaking a task when they were not fully qualified to perform the role and were not familiar with the work area.

3.23. On the morning of the incident, TW1 was already engaged in track-work activities with their infrastructure team in Wellington yard. TW1 was qualified to take out track protection but was not in a supervisory position.

3.24. Because of staff resourcing issues, TW1 was the senior member of the team and assumed the responsibility of acting as the 'person-in-charge' of the work taking place in Wellington yard. The regular supervisor of the infrastructure team that TW1 belonged to had worked night shift the previous evening and was not available for work that morning.

3.25. When TW1 received notification of the issue on the JVL, they acted as they thought necessary to address the problem, as they were of the belief that the continuity of mainline passenger train services should take priority over yard maintenance.

3.26. TW1 and TW2 acquired a KiwiRail work truck and travelled towards Crofton Downs with little preparation and without preparing a cohesive plan for the work. No job plan or hazard analysis was completed. No equipment was taken other than a Mis 71 pad and shovels to clear the rockfall. All communication was conducted using TW1's personal mobile phone as portable radios, although they were available, were not uplifted by the trackworkers.

3.27. During their interview, TW1 advised Commission investigators that they had not worked on the JVL very often as their infrastructure team was mostly utilised for work in yards. However, TW1 was aware that any work on the JVL required protection from train control in the form of electronic blocking.

3.28. TW1, while acting with good intentions to attend to the fault, was not qualified in a supervisory position to plan, prepare or lead others to carry out the required work.

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[28] A condition requiring urgent rectification as it has already disrupted or could potentially disrupt rail operations.

[29] A lever connected to Transdev trains that is activated when it comes into contact with an obstruction and, in turn, activates the train's braking system. It was designed to interact with equipment at selected signal locations to mitigate trains running past signals at stop.

Substance use

3.29. While TW1 tested positive for THC immediately after the incident, the level of impairment was not determined. TW1 left KiwiRail employment soon after the incident, and therefore secondary testing that may have indicated the level of impairment was not undertaken.

3.30. While no determination has been made that drug-induced impairment was a factor in this incident, the Commission regards the use of recreational drugs by safety-critical transport personnel to be a significant safety concern.

3.31. In 2015, noting several other cases in which performance-impairing substances had been detected in people in transport safety-critical roles, the Commission added an item to its Watchlist:[30] *Substance use: regulatory environment for preventing substance impairment*.[31] The Commission was concerned about the lack of effective regulation against substance use by people performing transport safety-critical tasks in a transport environment. Judgement, decision-making and reaction time can all be affected by the use of drugs or alcohol. The use of performance-impairing substances by people carrying out safety-critical tasks in a transport environment is a significant risk.

3.32. The Commission will continue to monitor the incidence of accidents featuring alcohol or drug impairment and seek a regulatory environment that supports zero tolerance of alcohol or drug impairment in safety-critical transport roles.

The incident – protection establishment

Safety issue: The use of incorrect procedures to establish protection and ineffective communication between the train controller and TW1 indicate that non-technical skills were not being adequately utilised during a safety-critical task.

3.33. When TW1 arrived at the 3.85 km mark and made initial contact with train control, a safe-working breach had already occurred, with the track workers making their way to the 3.85 km mark without protection in place. Protection in the form of blocking was required on the JVL for all trackside work. Protection in the form of individual train detection (ITD)[32] (*see* Appendix 3) was not authorised for use on the JVL where, because of the geography of the terrain, the required clear sightline distances for ITD were not available. Blocking was required to walk alongside the track from Crofton Downs to the 3.85 km mark.

3.34. The TC was unaware anyone was responding to the TST activation until unexpectedly receiving a telephone call from TW1 at the 3.85 km mark location seven hours after the TC had contacted 155.

3.35. The TC, focused on train running, did not immediately recognise that TW1 should not have arrived at the calling location without any form of protection. They proceeded to issue the protection requested by TW1 to walk through the tunnel to the rockfall location.

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[30] The Watchlist draws attention of regulators, operators, the Government and people involved in transport every day to transport-related concerns of high social, economic or environmental risk, and systemic transport safety risks. For reference *see* https://www.taic.org.nz/watchlist

[31] https://www.taic.org.nz/watchlist/regulations-preventing-substance-impairment

[32] Individual Train Detection (ITD) is the lowest form of self-protection required to work on the rail corridor unsupervised. Workers using ITD must comply with conditions including calculating distances from which approaching trains will be sighted. If all conditions cannot be met then a higher form of protection, such as electronic blocking, must be used.

3.36. The TC advised TW1 that blocking was in place between 97 signal Wellington, and 4L signal Wadestown (*see* Figure 10). These locations for blocking were insufficient to protect the area the track workers were in. The TC **very likely** applied blocking to the incorrect area as they had formed an inaccurate mental model of the situation based on their earlier incorrect annotation of the TST activation location on the train control diagram.

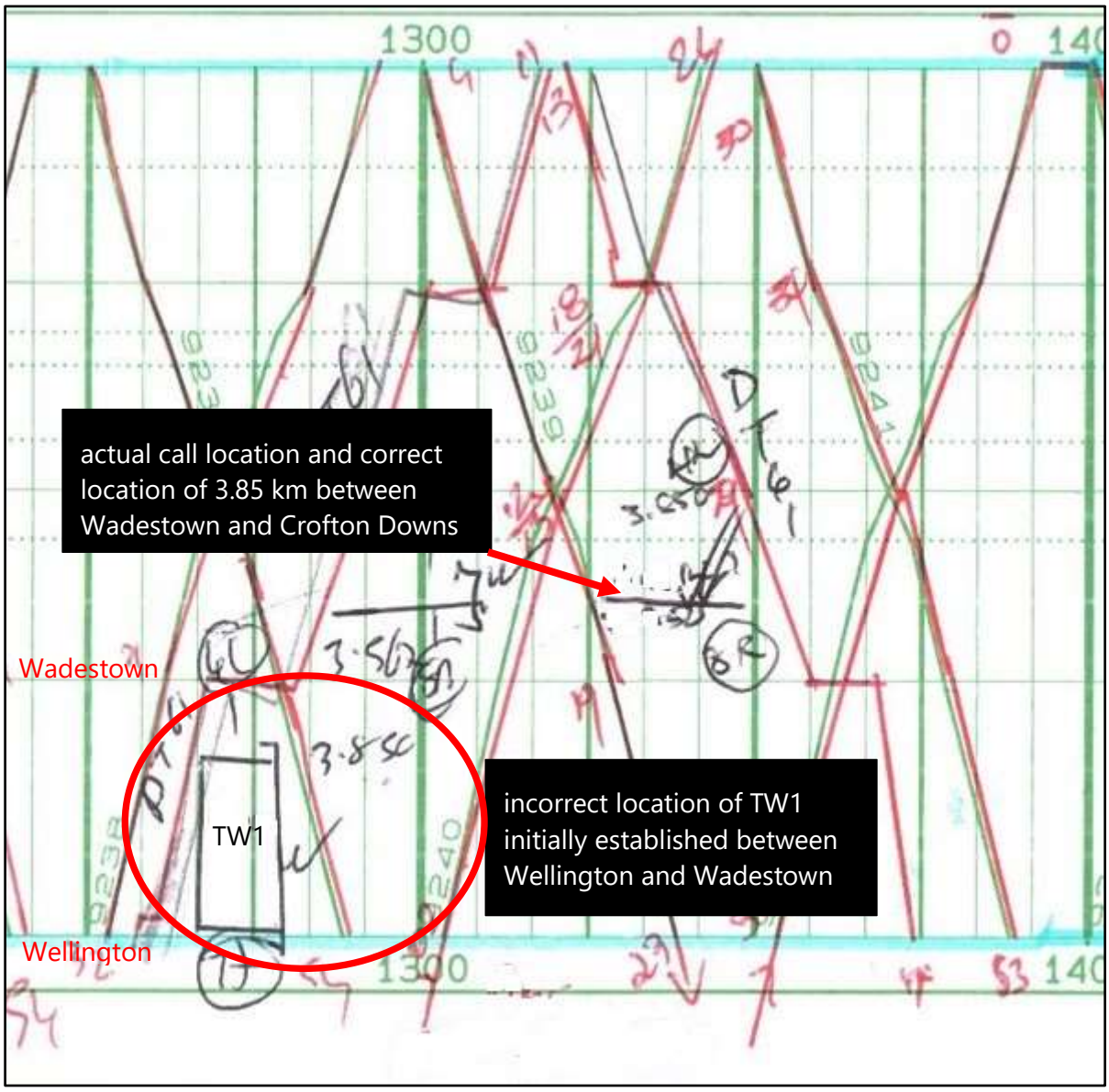


Figure 8: TW1 location incorrectly drawn on train control diagram

(Credit: KiwiRail, modified for anonymity by TAIC)

3.37. The incorrect diagram annotation **likely** led the TC to misinterpret the actual location of TW1, even though the location of "3.85 km, north of tunnel 5" was clearly stated by TW1.

3.38. KiwiRail's Rail Operating Rules and Procedures, Rule 908 – Blocking stated in part:

> Rail Personnel, who propose to occupy or obstruct the main line/crossing loop or other lines protected by interlocked signalling, **must** personally advise Train Control/Signaller of their … On tracking location* (at location)
>
> *Positively Identify Location

> When metrages are used the locations/station name/signals on either side are to be given to Train Control/Signaller to enable the **exact** location of the metrage to be positively identified … [emphasis KiwiRail's]

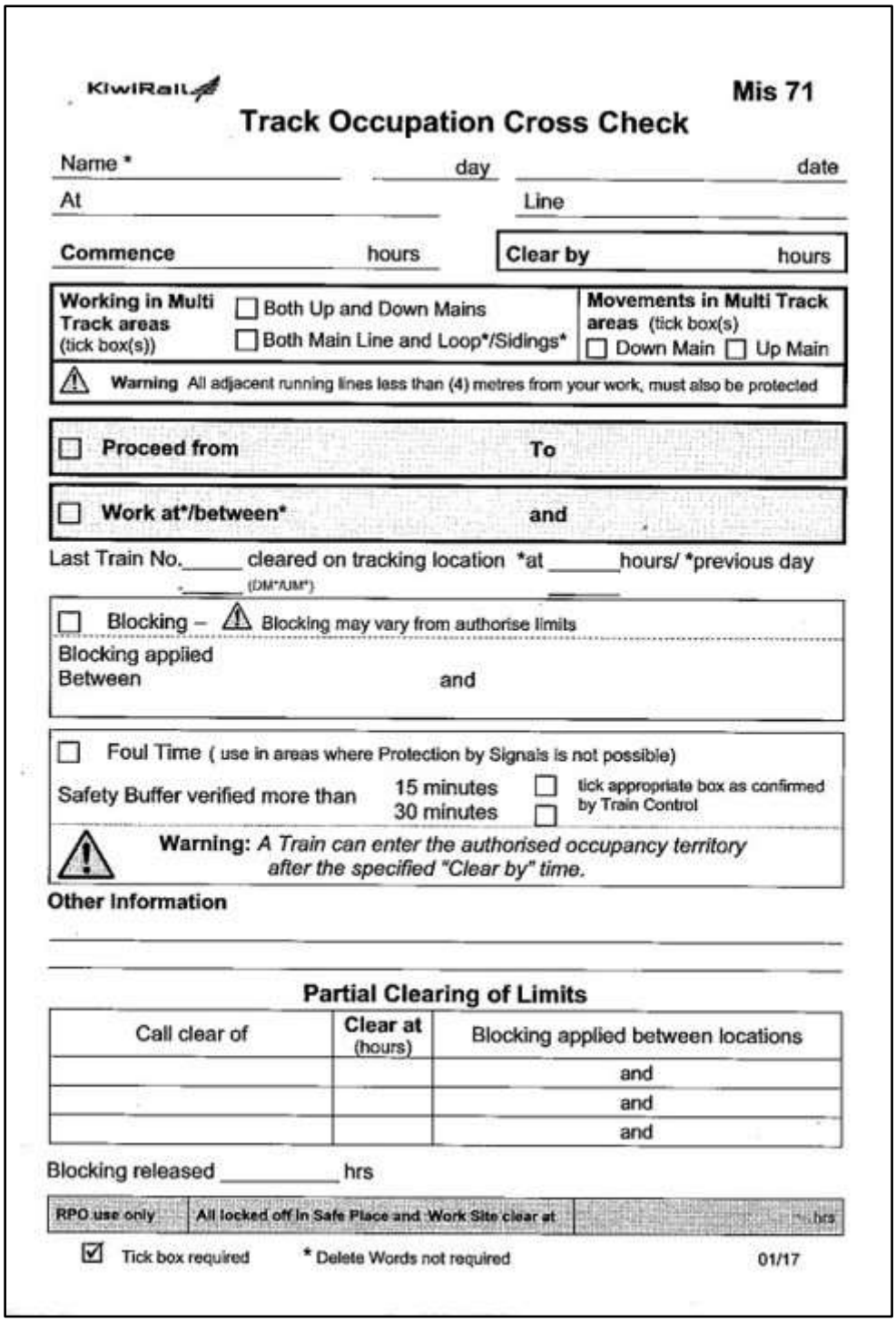
3.39. The correct application of the above rule, by giving the station names on either side, would have required TW1 to inform the TC that they were at the 3.85 km mark, *between Crofton Downs and Wadestown*.

3.40. Since the correct procedure was not carried out, an opportunity was missed for the TC to adjust their preconceived understanding of the track worker's location, which the TC thought was between Wadestown and Wellington.

3.41. Had this occurred, it would **very likely** have prompted the TC to verify TW1's location by using both the train control diagram and the train control mimic screen to calculate where the correct blocking was required. Consequently, the TC would **almost certainly** have recognised that a train was about to enter the area for which blocking had been requested, and track time would not have been granted until the train was clear.

Mis 71 form

3.42. Personnel requiring track time were required to complete a Track Occupation Cross Check form. This form was commonly referred to by KiwiRail personnel by its form number – *Mis 71* (*see* Figure 11).



KiwiRail

Mis 71

Track Occupation Cross Check

Name * _____ day _____ date _____

At _____ Line _____

Commence _____ hours **Clear by** _____ hours

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

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

⚠ **Warning** All adjacent running lines less than (4) metres from your work, must also be protected

☐ **Proceed from** **To**

☐ **Work at*/between*** **and**

Last Train No._____ cleared on tracking location *at _____hours/ *previous day
_____ (DM*/UM*)

☐ Blocking – ⚠ Blocking may vary from authorise limits

Blocking applied
Between and

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

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

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

Other Information

_____

_____

Partial Clearing of Limits

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

Blocking released _____ hrs

RPO use only	All locked off in Safe Place and Work Site clear at	hrs

☑ Tick box required * Delete Words not required 01/17

Figure 119: KiwiRail Track Occupation Cross Check (Mis 71) form

(Credit: KiwiRail)

3.43. Mis 71 forms were provided in A5 sized pads to be available to all staff that might be required to use them. Once completed the forms were to be kept as an auditable record.

3.44. At the time of the incident, the Mis 71 form had a section to be filled out for the 'At' location (*see* Figure 12). This 'At' section did not include prompts to ensure the 'At' description

complied with Rule 908 and identified the stations either side of the protection sought to enable the metrage to be confirmed.

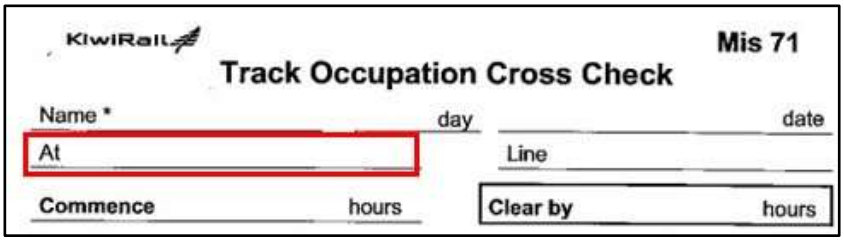


Figure 1210: Mis 71 form 'At' location did not include a prompt for 'between' locations

(Credit: KiwiRail)

3.45. Had the Mis 71 form reflected the requirements of Rule 908 by including prompts for stations either side, TW1 would **very likely** have complied with exactly what was prompted on the form and their location would have been positively identified. Had this occurred the incident would **almost certainly** have been avoided.

Non-technical skills

3.46. Non-technical skills can be defined as the cognitive, social and personal resource skills that complement technical skills and contribute to safe and effective task performance. Sub-categories of non-technical skills include situational awareness, communication, decision-making, leadership, teamwork, workload management and self-management.

3.47. The effective use of non-technical skills is an important defence to capture and/or mitigate the effects of human error. This is even more important in systems that, in the absence of more robust engineering controls, are primarily reliant on individual performance and less-effective administrative controls. The TC and TW1 had both received training in non-technical skills. However, as this incident highlights, ineffective communication can render a system that is already over-reliant on administrative controls even more vulnerable to accidents and incidents.

3.48. The likelihood of erroneous read-back and hear-back errors is increased when those communicating have a preconceived notion of what they are expecting to hear (expectation bias)[33]. While expectation bias cannot be eliminated, defences (such as specific phraseology and challenge-respond techniques)[34] go some way to ensuring a complete and correct understanding is shared by both parties.

3.49. On this occasion the TC misinterpreted the location described by TW1 as "3.85 km, north of tunnel 5" as being at the 2.44 km mark, which was the site of the previous slip alarm and where the TC had placed the TST activations earlier in the shift.

3.50. While the TC had an incorrect mental model of the required blocking, it was incumbent on TW1 to be aware of what blocking was required, and to challenge what they were being told by the TC as being incorrect.

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[33] The predisposition for individuals to perceive information according to what they are expecting to see or hear, as opposed to what is actually seen or heard. This expectancy can make it less likely that any mismatch in the information received is detected.

[34] Methods of verifying with the other party that information being presented is correct if errors are suspected.

3.51. Conversely, it was also incumbent on the TC to ensure that TW1 followed procedure by giving the station names either side of their call location.

3.52. In this incident, all communication was conducted using telephones, as TW1 had not taken a portable radio to the site. Had radio communication been used, a more formal communication procedure should have been adhered to and this would have increased the likelihood of either party applying their non-technical skills training to challenge and/or correct the other. KiwiRail has taken action to restrict the use of telephones between train control and track workers (*see* para 5.5).

3.53. Good communication is a key component of safety within the rail industry. In this incident the use of good communication skills would have helped to establish a shared mental model of the required blocking protection. Had the location of the blocking been challenged, a serious error **very likely** would have been identified and rectified.

4 Findings
Ngā kitenga

4.1. While the TC could offer no explanation as to why they incorrectly annotated the location of the track workers on the train control diagram (at the 2.44 km mark between Wellington and Wadestown rather than at the 3.567 km mark between tunnels 4 and 5), it was **likely** because a green highlighted line was a point of visual reference that stood out on the otherwise almost blank diagram.

4.2. In turn, the incorrect annotation **likely** led to the TC making a false association between the earlier slip alarm and the TST activation when they were in fact two separate events.

4.3. The incorrect diagram annotation **likely** led the TC to misinterpret the actual location of TW1, even though the location of "3.85 km, north of tunnel 5" was clearly stated by TW1.

4.4. The blocking established by the TC (between 97 signal Wellington and 4L signal Wadestown) was incorrect, in that it did not prevent rail traffic from entering the section of track in which TW1 and TW2 were working.

4.5. The TC **very likely** applied blocking to the incorrect area as they had formed an inaccurate mental model of the situation, based on their earlier incorrect annotation of the TST activation location on the train control diagram.

4.6. A Transdev passenger train entered the section of track being worked on by the track workers, who thought that protections had been put in place.

4.7. Had one or both of the track workers been unable to access the refuge bay or exit the tunnel, they could have been fatally injured had they been struck by the train inside the tunnel.

4.8. Had positive location identification occurred, it would **very likely** have prompted the TC to verify TW1's location by using both the train control diagram and the train control computer screen to calculate where the correct blocking was required.

4.9. Had the location been verified, the TC would **almost certainly** have recognised that a train was about to enter the area for which blocking had been requested, and track time would not have been granted until the train was clear.

4.10. The format of the Mis 71 form did not present the opportunity to record the full location details, specifically the stations either side of the 'At' location, which could have ensured the requirements of Rule 908 were met. TW1 would **very likely** have been prompted by the Mis 71 form and recorded and read to the TC the stations either side of their location, providing an opportunity for the TC to recognise the discrepancy and identify the location error.

4.11. Neither the TC nor TW1 identified that the blocking locations were incorrect during the establishing call. Had either party utilised their non-technical skills training to ensure correct procedures were followed and effective communication was being used, the incident would **very likely** not have occurred.

5 Safety issues and remedial action
Ngā take haumanu me ngā mahi whakatika

General

5.1. Safety issues are an output from the Commission's analysis. They may not always relate to factors directly contributing to the accident or incident. They typically describe a system problem that has the potential to adversely affect future transport safety.

5.2. Safety issues may be addressed by safety actions taken by a participant. Otherwise the Commission may issue a recommendation to address the issue.

5.3. Two new safety issues were identified in this report:

Safety issue: Short staffing resulted in a track worker undertaking a task when they were not fully qualified to perform the role and were not familiar with the work area.

Safety issue: The use of incorrect procedures to establish protection and ineffective communication between the train controller and TW1 indicates that non-technical skills were not being adequately utilised during a safety-critical task.

5.4. In addition to the action being taken to address recommendation 009/21 (*see* para 2.69, KiwiRail carried out an internal investigation, which in part concluded:

> Cell phone use as method of communicating with Train Control circumvents safety assurance features such as call-capture, or the opportunity for improving safety awareness for other rail operators in the area, and therefore effectively compromises safe working conditions on the Rail Network.

5.5. KiwiRail is taking the following safety action to address this issue:

- working with relevant teams to update the Rail Operations Rules and Procedures to reflect that:
  - radios must be used for communication with train control
  - alternative methods are only to be used in the event of radio failure
  - train control will decline any track access request if radio communication is not attempted in the first instance
- conducting a review of the train control track occupancy authority matrix to ensure it aligns with the Mis 71 form and to investigate the practicability of developing a Train Control Rule 908 paper authority template. On 1 October 2023 KiwiRail advised the Commission that this review was pending completion with a targeted timeframe of December 2023.
- trialling a project to provide 'grab and go' bags for track workers, which include signals and interlocking diagrams, authorisation forms and other necessary equipment. On 10 October 2023 KiwiRail advised the Commission that it had completed an initial trial and the next phase was to roll out nationwide.
- Review and update the 155 callout priority allocation for logged jobs. On 10 October 2023 KiwiRail advised the Commission that this review was pending completion with a targeted timeframe of November 2023.

- Develop an incident management standard, including a guidance checklist for managers, for incident management activities. On 10 October 2023 KiwiRail advised the Commission that the draft standard was completed and waiting review and sign off. The next phase was to present the draft standard to all leadership teams dealing with occurrence management processes and introduce the guidance checklist as support.

5.6. In the Commission's view, these safety actions have addressed both safety issues. Therefore, the Commission has not made any recommendations.

6 Recommendations
Ngā tūtohutanga

General

6.1. The Commission issues recommendations to address safety issues found in its investigations. Recommendations may be addressed to organisations or people and can relate to safety issues found within an organisation or within the wider transport system that have the potential to contribute to future transport accidents and incidents.

6.2. In the interests of transport safety, it is important that recommendations are implemented without delay to help prevent similar accidents or incidents occurring in the future.

New recommendations

6.3. The Commission has issued no new recommendations.

7 Key lessons
Ngā akoranga matua

7.1. All personnel undertaking safety-critical roles should adhere to the principles underlying the application of non-technical skills to ensure that they share the same mental models and have a clear understanding of what is required of themselves and others to complete tasks safely.

7.2. The use of performance-impairing substances by persons carrying out safety-critical tasks in a transport environment is a significant risk.

8 Data summary
Whakarāpopoto raraunga

Vehicle particulars

Train type and number:	TDW9237
Classification:	Passenger
Operator:	Transdev Wellington Limited

Date and time	4 May 2023, 1248
Location	Tunnel 5, Johnsonville line
Operating crew	two trackworkers, one train controller, one train driver
Injuries	nil
Damage	nil

9 Conduct of the Inquiry
He tikanga rapunga

9.1. On 4 May 2023, Waka Kotahi NZ Transport Agency notified the Commission of the occurrence. The Commission subsequently opened an inquiry under section 13(1) of the Transport Accident Investigation Commission Act 1990 and appointed an Investigator-in-Charge.

9.2. The Commission obtained records and information from sources that included:

- interviews with two track workers, the train controller, the network control manager and the train driver
- written statement of the train controller
- CCTV and train performance data from the Transdev passenger train
- train control voice recordings
- train control graphs
- work rosters and timesheets of involved staff
- internal KiwiRail investigation report.

9.3. On 25 October 2023 the Commission approved a draft report for circulation to seven interested parties for their comment.

9.4. Three interested parties provided a detailed submission and three interested parties replied that they had no comment. One interested party did not respond despite efforts to contact them. Any changes as a result of the submissions have been included in the final report.

9.5. On 21 February 2024, the Commission approved the final report for publication.

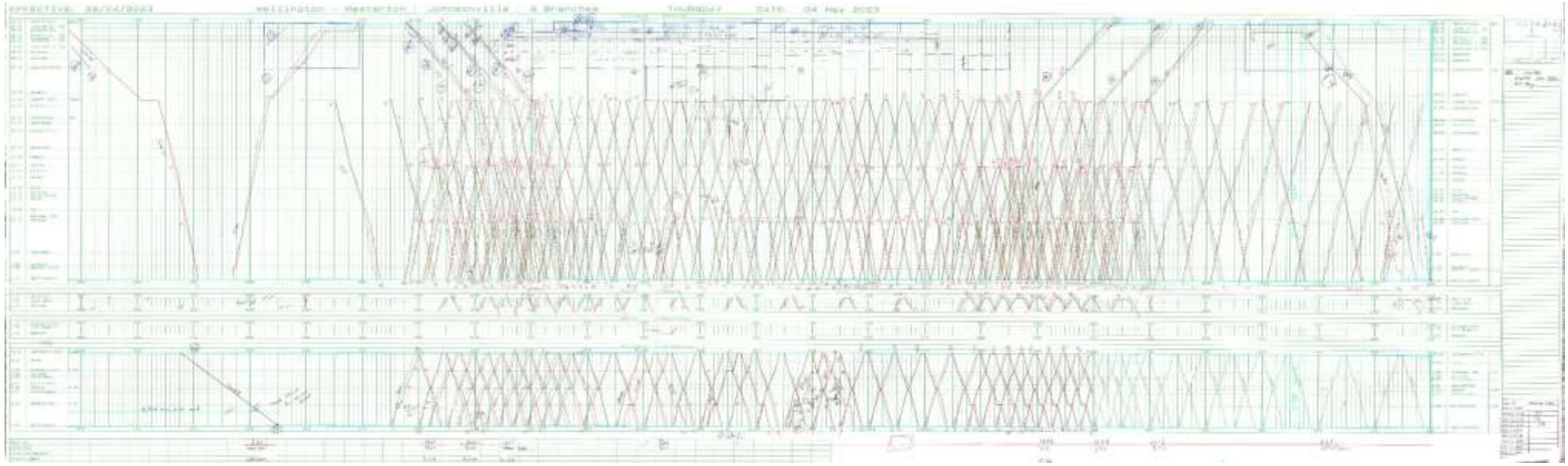
Abbreviations
Whakapotonga

ATSB	Australian Transport Safety Bureau
CCTV	closed-circuit television
ITD	individual train detection
JVL	Johnsonville line
km	kilometre
m	metre
NCM	Network Control Manager
OMS	operational management system
RAIB	Rail Accident Investigation Branch, United Kingdom
TC	the day-shift train controller
THC	tetrahydrocannabinol
TST	train stop trip
TW1	track worker 1
TW2	track worker 2

Glossary
Kuputaka

False association	When someone mistakenly believes that two events are related or connected. This often arises when there are superficial similarities or shared characteristics between the two events.
Kilometre mark	In railway terminology, the system of measuring track distance on the railway line. Rail workers use a kilometre mark to reference a specific location on the line.
Mimic screen	A visual display of the train control system by which the train controller commands the movement of points and the operation of signals.
Mis 71	Miscellaneous 71 – the form number allocated to KiwiRail track occupation cross check documentation.
Slip	In regions with hilly or mountainous terrain, a 'slip' refers to rockfalls or landslides that may endanger railway activities.
Train stop trip	A piece of equipment fitted to some passenger trains that activates emergency braking if the train passes certain signals at stop.
Train stop trip lever	The lever that activates the train stop trip

Appendix 1 Train control diagram



(Source: KiwiRail, edited for anonymity by TAIC)

Appendix 2 KiwiRail Rule 908–Blocking

908 Blocking

Protection by Blocking applies for track occupations within Automatic Signalling Areas and Interlocked Stations (including TWC interlocked stations).

(a) Enquiries (applies to all areas)

Rail Personnel, who propose to occupy or obstruct the main line / crossing loop or other lines protected by interlocked signalling, **must** personally advise Train Control / Signaller of their:

- Identity
- Type of protection requested
- On tracking location * (at location)
- In Multi Line area, state lines being occupied or obstructed
- Occupation area including off tracking location *
- Time required for the work
- Nature of work.

*** Positively Identify Location**
When metrages are used the locations / station name / signals on either side are to be given to Train Control / Signaller to enable the **exact** location of the metrage to be positively identified.
e.g. 470 km between Te Kuiti and Puketutu;
76.32 km between 4R and 4LA signals at Chertsey

908 Blocking - continued

(b) Pre Authorisation Checks (applies to all areas)

i. **Train Control / Signaller** will ensure that the proposed occupancy will not conflict with rail movements (trains, Hi-Rail Vehicles, etc).

ii. **The location of conflicting rail movements** must be verified by Train Control / Signaller prior to the occupation being authorised.

iii. **Last train clear of on tracking location**

- Train Control / Signaller **must** verify that train's position to ensure that it has past the on tracking location, prior to authorising the occupation.

iv. **Details of the occupancy must be recorded on the:**

- Train Control diagram. or
- The form provided for this purpose in the local Signaller

v. **Before authorising the occupancy**
Train Control / Signaller will arrange for Blocking to be applied to prevent trains from entering the occupied area.

Once blocking is verified as being in place.

Establishing protection when signaller provides Blocking for Train Control
Where signals / points governing entry into an area controlled by Train Control are operated from a local Signaller, Train Control must receive confirmation from the local Signaller that Blocking is applied to protect the occupancy before authorising occupancy.

908 Blocking - continued

(c) Authorisation Process

i. **Train Control/Signaller will authorise occupation by stating:**

- Addressee
- Commencement time
- Clearance time
- 'At' location
- In Multi Line area state lines being occupied or obstructed
- Authority is either:
  - proceed from – to (locations) or
  - work (location)
  - work between (locations)
- Last train clear time of **on tracking** location
- Section of track verified Blocked.

ii. **Addressee obtaining Blocking will:**

Complete a Mis 71 Track Occupation Cross Check, with the instructions issued by Train Control/Signaller, including:

- Addressee
- Commencement time
- Clearance time
- 'At' location
- In Multi Line area tick box for lines being occupied or obstructed
- Authority is either:
  - proceed from – to (locations) or
  - work (location)
  - work between (locations)
- Last train clear time, of **on tracking** location
- Section of track blocked.

Read back the instructions to Train Control/Signaller.

iii. **Train Control/Signaller will then:**

Verify or correct the instructions.

908(c) Blocking / Authorisation Process - continued

WARNING:

- It is the responsibility of both Train Control / Signaller and the Addressee to ensure that confirmation of Blocking is included in the cross check.
- The Clear time will become the designated clearance time to be clear of the line.

(d) Clearance of Blocking applied for Track Occupancy

Train Control may request the addressee to make a call when clear of a specified location to enable either a train or other occupancy to occupy the section cleared.
Updated details of Blocking applied must be given to the addressee. This is to be entered on the Mis 71 and repeated back to Train Control.

The addressee must not again occupy the vacated area until further authority has been obtained.

WARNING: Blocked areas are not to be released to allow an opposing or following train to enter a section, or permission given for a train to enter onto the main line from a switch locked siding in that section, until advice has been received that the occupation is clear of the section.

(e) Advising Track Clearance when protection is provided by Blocking

When the occupation is protected by blocking, the holder of the Mis 71 must advise Train Control or Signaller when they are clear of the line to enable blocking to be released.
The holder of the Mis 71 ***MUST*** *advise Train Controller / Signaller of the limits of the blocking that can be lifted as shown on their Mis 71, for example 8R Hinds and 2L Ashburton.*

908(e) Blocking / Advising Track Clearance - continued

The Train Controller / Signaller must:

- *Close off the blocking occupation on the graph or A Box Register*
- *Lift the blocking as advised*
- *Advise the holder of the Mis 71, the limits of blocking being lifted*
- *Advise the time the blocking is lifted.*

The holder of the Mis 71 will endorse the Mis 71 and repeat the limits of blocking lifted with the time.
A diagonal line is then to be drawn through the Mis 71.

(f) Completed Mis 71 forms

Completed Mis 71s are to be kept for a period of one month before being destroyed.

(g) Signalling failure – unable to provide Blocking

Should it not be possible to apply Blocking due to an Automatic Signalling or Signalling failure the following additional instructions will apply:

- Train Control / Signaller will advise the addressee of the occupation that blocking cannot be applied.
- The addressee of the occupation will enter this onto the Mis 71 in the space provided for "other information".
- Train Control / Signaller must ascertain that the occupancy is clear in the Safe Place/section concerned before authorising a train or MTMV to pass the signal governing entry into that section at 'Stop'.

908 Blocking - continued

(h) Additional track occupations within the authorised Blocked area

i. When additional users require to operate in the same block section as an existing occupancy with **no over lap** of areas required, the following requirements apply:

- The boundary shown on the Mis 71 forms will be either a km peg, tunnel portal, signal or switch-locked points.

IMPORTANT: Train Control / Signaller must apply double layer blocking (where available)

ii. When additional users require to operate in the same block section as an existing occupancy and overlapping or conflicting areas apply, the following requirements apply:

Refer also to:

- Rule 914 (e)
  Multiple activities with MTMV in Automatic Signalling Section
- Rule 915 (g)
  Hi Rail seeking authority to travel through a conflicting Track Occupation
- Rule 915 (h)
  Track Occupation request while conflicting Hi Rail Vehicle/Trolley

IMPORTANT: Train Control / Signaller must apply double layer Blocking (where available).

908 Blocking - continued

KiwiRail **Mis 71**

Track Occupation Cross Check

Name * _____ day _____ date _____

At _____ Line _____

Commence _____ hours **Clear by** _____ hours

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

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

⚠ **Warning** All adjacent running lines less than (4) metres from your work, must also be protected

☐ **Proceed from** **To**

☐ **Work at*/between*** **and**

Last Train No._____ cleared on tracking location *at _____hours/ *previous day

_____ (DM*/UM*) _____

☐ Blocking – ⚠ Blocking may vary from authorise limits

Blocking applied
Between and

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

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

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

Other Information

_____

_____

Partial Clearing of Limits

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

Blocking released _____ hrs

RPO use only	All locked off in Safe Place and Work Site clear at	hrs

☑ Tick box required * Delete Words not required 01/17

Figure 20

908 Blocking - continued

Mis 71 Metro is designed for use in suburban areas where occupancy time at one site is limited, requiring several requests to complete work at that one site.

KiwiRail **Track Occupation Cross Check** (Metro Areas only) **Mis 71 Metro**

This form applies to one fixed work site only. **A new form must be filled out for every new site.**

Name		day	/ / date
On Site at hrs	Nature of Work		
At		**Signal* /Points* / km***	
Working at */ between		**Signal* /Points* / km***	**Signal* /Points* / km***
		and	
Working at */ between		**Signal* /Points* / km***	**Signal* /Points* / km***
Additional Lines to be Protected			
Working at */ between		**Signal* /Points* / km***	**Signal* /Points* / km***
Working in multi track area (tick box(s))	Both up and Down Main Lines ☐	Up Main only ☐	Down Main only ☐ / Both Main Line and loop / Sidings ☐

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

Blocking applied between		**Signal* /Points* / km***		**Signal* /Points* / km***

Work Area – Work sites Track Occupation crosscheck - continued

Previous Train Cleared Train No.		Blocking Applied	Clear Time	Safe Place	Blocking released	Previous Train Cleared Train No.		Blocking Applied	Clear Time	Safe Place	Blocking released
	hrs	hrs	hrs	hrs	hrs		hrs	hrs	hrs	hrs	hrs
	hrs	hrs	hrs	hrs	hrs		hrs	hrs	hrs	hrs	hrs
	hrs	hrs	hrs	hrs	hrs		hrs	hrs	hrs	hrs	hrs
	hrs	hrs	hrs	hrs	hrs		hrs	hrs	hrs	hrs	hrs
	hrs	hrs	hrs	hrs	hrs		hrs	hrs	hrs	hrs	hrs
	hrs	hrs	hrs	hrs	hrs		hrs	hrs	hrs	hrs	hrs
	hrs	hrs	hrs	hrs	hrs		hrs	hrs	hrs	hrs	hrs

Work Area Clearance at **hrs** **day** **date**

This form must not be used for Hi Rail Vehicle or Trolley (motorised) movements

Mis 71 Metro Version Two 05/15

Figure 20a

908 Blocking - continued

(i) Request for Change of Scope or Time Extension

When a change of scope or time extension is required for a track occupancy, a new track call and Mis 71 form must be completed. Except for when 908(d) applies.

Appendix 3 Rule 917 – Individual train detection

917 Individual Train Detection (ITD)

ITD is the minimum qualification required to move and work on the rail corridor **unsupervised**. If you do not hold a Licence to Operate you must arrange to be accompanied by a qualified person.

ITD is a method of protection to be used for occupancy of main lines, crossing loops and all lines within interlocked areas when:

- Moving on foot (e.g. inspections, investigations, site familiarisations).
- Making minor corrections (e.g. replacing a fish-plate bolt), which will not interfere with the safe running of trains.
- When crossing the line at a maintenance crossing.

Exception:
These provisions will not apply to Train Operating personnel engaged with train operational tasks or when working behind a substantial barrier in accordance with Rule 901(a).

WARNING:
The use of ITD is prohibited in

- Tunnels
- Protected Work Areas except when directed by RPO for Secondary Protection purposes

NOTE: Where provided in local site safety plans, Blocking Rule 908 must be used.

917 Individual Train Detection (ITD) – continued

(a) ITD Safety Check (Mis 70R)

A Mis 70R is a safety briefing check sheet that must be completed prior to occupancy of the track when no other means of protection is used.

When encroaching within two outstretched arm lengths of the edge of the rail on a main line, crossing loop or interlocked area, a Mis 70R **must** be completed unless other protection is being used.

EXCEPTION: Signals personnel carrying out routine inspection and testing of level crossing alarms which involves crossing the rail corridor over the formed roadway or formed pedestrian pathway are not required to complete a Mis 70R.

WARNING: Unless other protection is provided, a Mis 70R must be completed prior to track occupancy and must be produced when requested.
When one or more of the provisions on the Mis 70R cannot be complied with, Blocking / Foul Time must be requested **before** track occupancy.

(b) Individual Moving on Foot Alone

Individuals may protect themselves from trains and track vehicles when the following conditions are met:

- Able to visually detect the approach of a train moving at the maximum speed authorised for the locality and be able to move to and occupy a previously identified safe place at least 15 seconds before the train reaches them.
- Able to see and hear approaching trains and other track equipment which is not impaired by lights, fog, passing or standing trains or any other environmental condition.
- Will **not** occupy a position or engage in any activity that would interfere with their ability to maintain a vigilant lookout for, and detect the approach of, a train or track equipment moving in either direction.
- Confirms there are no power-operated tools or maintenance vehicles in use within hearing range.

917 Individual Train Detection (ITD) – continued

(c) Observer Appointed

An Observer may be appointed to protect another person or group that is occupying the track.

An Observer must:

- Hold a minimum of ITD
- Be in a position to give warning in sufficient time to enable each person to move to and occupy a previously identified safe place at least 15 seconds before the train reaches them.
- Devote their full attention to detecting approaching trains and other track equipment. This must not be impaired by lights, fog, passing or standing trains or any other environmental condition.
- Warn all individuals before an approaching train or on track equipment reaches the minimum required sight distance.
- Use a method to warn individuals of the approach of a train or track equipment that is:
  - Distinctive, clear and unquestionable.
  - Does not require individuals to be looking in any particular direction.
  - Can be detected by individuals regardless of noise or work distractions.
  - Is identified in the job safety briefing.

The Observer must be provided with either a whistle or an air horn.

Individuals who depend on an Observer for track safety must always remain in a position that allows them to receive warnings communicated by the Observer.

(d) Completed Mis 70R

Completed Mis 70R must be kept for a period of one month before being destroyed.

917 Individual Train Detection (ITD) – continued

A Mis 70R form is used by persons with a Licence to Operate in TPB or TPI

KiwiRail

Mis 70R

This form must be completed when working alone or with an Observer, when encroaching within two outstretched arm lengths of the edge of the rail.

Individual Train Detection Safety Check

(Rule 917 only)

Name _____

Date _____ **Time** _____

Location/km _____

Between _____ *(rail location)* **and** _____ *(rail location)*

You must be in your Safe Place 15 seconds before the arrival of rail vehicles

Maximum Authorized Speed for area in Km/h	Required Sight Distance in Metres		
	Alone	Tick box	Observer
10	40		60
25	100		140
40	170		220
50	200		280
60	250		340
70	300		380
80	350		440
90	400		500
100	450		560
110	500		620

Tick the appropriate box alongside the maximum speed which rail vehicles can run at this locality.

If you are unfamiliar with the maximum speed that applies at this locality then you must use the maximum line speed of 110km/h.

If in doubt, contact KiwiRail Area Infrastructure Office. (details on last page of book)

continued on page below.

Emergency - call 0800 808 400 **02/17**

Figure 36

917 Individual Train Detection (ITD) – continued

A Mis 70R form is used by persons with a Licence to Operate in TPB or TPI

KiwiRail

Mis 70R

Individual Train Detection Safety Check

1 I can continually see the track clearly in both directions for the required distance
☐ Yes ☐ No (tick yes if Observer(s) being used)

2. I can clearly hear approaching rail vehicles, at all times.
(no power-operated tools or maintenance vehicles in use within hearing range)
☐ Yes ☐ No (tick yes if Observer(s) being used)

Note: Observer(s) are used to ensure that vision/hearing requirements are complied with, when the task being carried out restricts vision/hearing.

Observer's name(s) .....

.....

3. I am using ITD to only carry out:
Inspections on foot **Or**
Using light tools **Or**
Crossing the railway track at a maintenance crossing, with a road vehicle
☐ Yes ☐ No

4. I have identified a **Safe Place to be in** 15 seconds before any rail vehicle arrives
☐ Yes ☐ No *(use greater sighting distance when obsever is being used)*

All the answers above are in the non-shaded boxes
☐ I can now use ITD – Rule 917
Or
If any of the answers above in a grey-shaded box,

Stop - I am unable to enter the Rail Corridor until either:

☐ A higher level of Rail Protection is being used
Or
☐ My Work Planner or Supervisor have put a higher level of protection in place

Warning,
Rail vehicles **may approach** from any direction, at any time.

Emergency - call 0800 808 400 02/17

Figure 36a

Kōwhaiwhai - Māori scroll designs

TAIC commissioned its four kōwhaiwhai, Māori scroll designs, from artist Sandy Rodgers (Ngāti Raukawa, Tūwharetoa, MacDougal). Sandy began from thinking of the Commission as a vehicle or vessel for seeking knowledge to understand transport accident tragedies and how to avoid them. A 'waka whai mārama' (i te ara haumaru) is 'a vessel/vehicle in pursuit of understanding'. Waka is a metaphor for the Commission. Mārama (from 'te ao mārama' – the world of light) is for the separation of Rangitāne (Sky Father) and Papatūānuku (Earth Mother) by their son Tāne Māhuta (god of man, forests and everything dwelling within), which brought light and thus awareness to the world. 'Te ara' is 'the path' and 'haumaru' is 'safe' or 'risk free'.

Corporate: Te Ara Haumaru - the safe and risk free path

The eye motif looks to the future, watching the path for obstructions. The encased double koru is the mother and child, symbolising protection, safety and guidance. The triple koru represents the three kete of knowledge that Tāne Māhuta collected from the highest of the heavens to pass their wisdom to humanity. The continual wave is the perpetual line of influence. The succession of humps represents the individual inquiries.

Sandy acknowledges Tāne Māhuta in the creation of this Kōwhaiwhai.

Aviation: Ngā hau e whā - the four winds

To Sandy, 'Ngā hau e whā' (the four winds), commonly used in Te Reo Māori to refer to people coming together from across Aotearoa, was also redolent of the aviation environment. The design represents the sky, cloud, and wind. There is a manu (bird) form representing the aircraft that move through Aotearoa's 'long white cloud'. The letter 'A' is present, standing for a 'Aviation'.

Sandy acknowledges Ranginui (Sky father) and Tāwhirimātea (God of wind) in the creation of this Kōwhaiwhai.

Maritime: Ara wai - waterways

The sections of waves flowing across the design represent the many different 'ara wai' (waterways) that ships sail across. The 'V' shape is a ship's prow and its wake. The letter 'M' is present, standing for 'Maritime.

Sandy acknowledges Tangaroa (God of the sea) in the creation of this Kōwhaiwhai.

Rail: rerewhenua - flowing across the land

The design represents the fluid movement of trains across Aotearoa. 'Rere' is to flow or fly. 'Whenua' is the land. The koru forms represent the earth, land and flora that trains pass over and through. The letter 'R' is present, standing for 'Rail'.

Sandy acknowledges Papatūānuku (Earth Mother) and Tāne Mahuta (God of man and forests and everything that dwells within) in the creation of this Kōwhaiwhai.

Transport Accident Investigation Commission

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

RO-2022-102	L71 Mainline Shunt, derailment and subsequent rollover, Tamaki, 1 June 2022
RO-2022-101	Passenger train, fire in auxiliary generator wagon, Palmerston North, 11 May 2022
RO-2022-103	KiwiRail W6 shunt and Metro (Go Bus) Route 60 bus, near miss at Selwyn Street level crossing, Christchurch, 8 August 2022
RO-2021-105	Unintended movement resulting in locomotive and wagon entering Picton Harbour, Picton, 1 September 2021
RO-2021-106	Derailment of Train 220, South of Hunterville, 13 December 2021
RO-2021-103	Te Huia passenger service, train parting, North Island main trunk line, Paerata, 19 July 2021
RO-2021-102	Freight Train 391, collision with light truck, Saunders Road, Marton, 13 May 2021
RO-2021-101	Serious injury during shunting operations on board the Aratere, Interislander ferry terminal, Wellington, 9 April 2021
RO-2020-101	Level crossing collision, Mulcocks Road, Flaxton, 10 February 2020
RO-2020-104	Safe working irregularity, East Coast Main Trunk Line, Hamilton – Eureka, 21 September 2020
RO-2020-103	Collision between bus and locomotive, Clevely Line level crossing, Bunnythorpe, 16 September 2020
RO-2019-108	Level crossing collision, Piako Road, Morrinsville, 7 December 2019
RO-2020-102	Express freight Train 932, strikes hi-rail vehicle, Limeworks Road, 24 April 2020
RO-2019-105	Express freight Train 268, derailment, Wellington, 2 July 2019
RO-2019-107	Passenger service SPAD and near collision, Wellington, 6 November 2019

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