Report 00-123

Diesel multiple units

Trains 3130 and 3134

collision

Ellerslie

28 December 2000

Abstract

At about 1150 on Thursday 28 December 2000, a diesel multiple unit Train 3134 collided head on with another diesel multiple unit Train 3130 on the up main line between Penrose and Ellerslie. Train 3130 had become disabled at Ellerslie and with the assistance of a relief diesel multiple unit was setting back to Penrose in a wrong line running movement on the up main line. Through a series of miscommunications the train controller unknowingly authorised the wrong line running, which resulted in Train 3134 and Train 3130 assisted by the coupled relief DMU, being in the same section of track while moving in opposing directions.

Two crew members and seven passengers suffered minor injuries.

The safety issues identified included:

- the inadequacy of verbal procedures to provide defences against human error
- the training and certification of new entrant train controllers on additional train control desks soon after their initial certification
- insufficient opportunity offered to train control trainees to view the various operating systems in use during their training
- the lack of a structured process for area familiarisation prior to or during certification on a train control desk
- the routine involvement of train controllers in “non-operational” work created by incidents
- the absence of clear communication between the locomotive engineers, maintenance staff and the train controller resulting in not everyone sharing the same concept of the plan to restore the train network
- the unreliable radio communications existing between the train controller and locomotive engineers at the time of the incident.

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

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

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Abbreviations

CRM	crew resource management
DMU	diesel multiple unit
ECMT	East Coast Main Trunk
km	kilometre(s)
LE1	locomotive engineer Train 3130
LE2	locomotive engineer relief DMU
LE3	locomotive engineer Train 3134
NAL	North Auckland Line
NCM	network control manager
NIMT	North Island Main Trunk
TC	train controller
Tranz Rail	Tranz Rail Limited

Data Summary

Trains:	Trains 3130 and 3134		
Type:	diesel multiple units		
Date and time:	28 December 2000 about 1150		
Location:	Ellerslie, 3.824 km North Auckland Line (NAL)		
Type of occurrence:	collision		
Persons on board:	Train 3130:	crew:	2
		maintenance staff:	3
	Train 3134	crew	3
		passengers:	about 30
Injuries:	Train 3134	crew:	1 (minor)
		other staff:	nil
	Train 3130	crew:	1 (minor)
		passengers:	7 (minor)
Damage:	minor to both diesel multiple units		
Operator:	Tranz Rail Limited (Tranz Rail)		
Investigator-in-charge:	D L Bevin		

1. Factual Information

1.1 Narrative

1.1.1 On Thursday 28 December 2000, Train 3130 was a scheduled Papakura to Auckland Tranz Metro[1] diesel multiple unit (DMU) passenger service and was crewed by a locomotive engineer (LE1), a guard and a train assistant, and conveyed 41 passengers.

1.1.2 At about 1048, as Train 3130 was about to depart from Ellerslie (refer Figure 1), LE1 noticed that the DMU air pressure gauge showed zero and that the park brake had automatically applied. He checked the compressor circuit breaker but could not find any fault so he detrained and went to physically check the compressor located on the side of the DMU chassis. He found a pipe had fractured and that the air from the compressor was escaping.

1.1.3 LE1 went back to his DMU cab and advised the train controller (TC) by radio that "3130 is disabled at Ellerslie, the main compressor has packed it in. We have got 41 passengers." The TC acknowledged his call and said that she would arrange with Tranz Metro staff in Auckland for taxis to go to Ellerslie station for the passengers.

1.1.4 The TC was aware that the next scheduled train through the area on the up main line was Train 3134, another Tranz Metro Papakura to Auckland DMU passenger service, which was due at Ellerslie at about 1148. The TC did not want to delay this service by returning Train 3130 to Penrose so she planned for it to be pushed through to Auckland via Newmarket. The TC discussed her plan with LE1 before she contacted Westfield[2] to arrange assistance for the disabled DMU to arrive from the south. She was not aware nor was she advised that a failed compressor could mean insufficient train braking to descend to Auckland.

1.1.5 LE1 later heard the LE of the relief DMU (LE2) asking the signalman at Otahuhu by radio for details regarding the location of the disabled DMU. He entered the conversation and told LE2 that "Train 3130 was disabled on the up main line at the platform at Ellerslie".

1.1.6 The relief DMU arrived and coupled to the south end of Train 3130. The coupled consist retained the identification as Train 3130. The relief DMU was accompanied by maintenance staff from the Westfield mechanical depot. They inspected Train 3130 when they arrived on site at about 1125 and determined the broken pipe could neither be repaired on site nor in Auckland, and that Train 3130 would need to go to Westfield to be repaired. The maintenance staff were concerned that there would be insufficient air from the compressor on the relief DMU to provide adequate braking for the coupled DMUs on the down grades between Remuera, Newmarket and Auckland if they went to Westfield by running via Auckland so LE2 decided they would request approval to return to Westfield by setting back via Penrose instead. LE1 was involved in this discussion, but the plan was not discussed with the TC.

1.1.7 At 1143, the TC attempted to contact Train 3130 by radio for a progress update but was unsuccessful. LE1 had been unable to contact the TC by radio from the north cab of Train 3130 to advise her that they were ready to go so he went with LE2 to the south cab of Train 3130 to try from that radio.

1.1.8 At 1146, LE2 established radio contact with the TC from that cab but the transmission kept breaking up. The contact was eventually stabilised. LE2 thought that he had asked the TC for permission to set back to Penrose and then cross over on to the down main line at Penrose and then proceed to Otahuhu. LE2 also thought the TC had replied "that's a roger, you're okay to set back to Penrose, cross over on to the down main line and then travel back to Otahuhu". Based on LE2's belief that was what he endeavoured to do.

[1] Tranz Metro is the group in Tranz Rail with responsibility for the operation of suburban train services in both Auckland and Wellington.
[2] The mechanical base for the DMU fleet.

1.1.9 LE1 confirmed with LE2 that the TC had given them permission to return to Penrose, after which both then left the cab, LE2 going to the south end cab of the relief DMU (facing Penrose) to drive while LE1 returned to the north end cab of Train 3130 (facing Newmarket).

1.1.10 The playback of the train control tape showed that LE2 had actually said to the TC "We are ready to proceed from Ellerslie back to Penrose. Have we your authority to go and then cross over on to the down main line?" The TC had responded saying "Yes. Roger that. We'll send you all the way round through to Westfield, Otahuhu, then you'll run 3138 from there". LE2 responded with "Roger. Thank you control, copy that."

1.1.11 LE2 recalled having only travelled about 100 to 150 metres at around 30 kilometres an hour when he noticed Train 3134, which was the DMU heading north on the up main line, coming toward his train around the curve ahead. LE2 applied the emergency brake and sounded the air horn at the same time. Train 3130 stopped and both he and the maintenance staff member who was riding with him jumped from the cab immediately before impact.

1.1.12 Train 3134 was a Papakura to Auckland Tranz Metro DMU passenger service and had departed from Papakura at its scheduled time of 1115. It was crewed by an LE (LE3 from Westfield), a guard and a train assistant and conveyed about 30 passengers.

1.1.13 LE3 said that when he arrived at Penrose there was a "caution proceed" (yellow) indication on the up starting signal, Signal 10RA, located at the north end of the Penrose platform. The indication on this signal authorised his train to enter the next section in advance. Tranz Rail's Rule 58(b) described the meaning of a "caution proceed" signal as:

> Proceed at normal speed, prepared to stop at next signal -
>
> Section is clear but signal in advance is at "stop" or is displaying a Low-speed indication.

1.1.14 LE3 received "right-of-way" from the guard and Train 3134 departed from Penrose. As the train rounded the last curve before the straight to Ellerslie, LE3 made a minimum brake application in preparation for stopping at the next signal in advance, Signal 392, which was about 50 m south of the Ellerslie platform. LE3 said that he thought he was following another train when he saw the "caution proceed" indication at Penrose and had expected Signal 392 to be at "Stop" (red).

1.1.15 LE3 estimated his speed was between 55 and 60 km/h when he entered the straight approaching Ellerslie and first became aware of the headlight of an approaching train. He realised it was on the same line as his train and immediately applied the emergency brakes and sounded the horn continuously until the impact. He estimated the speed at point of impact to have been between 10 and 20 km/h.

1.1.16 The TC said that she had not realised that Train 3130 was setting back to Penrose on the up main line until she had been advised of the collision by LE3.

1.1.17 Two crew and 7 passengers received minor injuries in the collision.

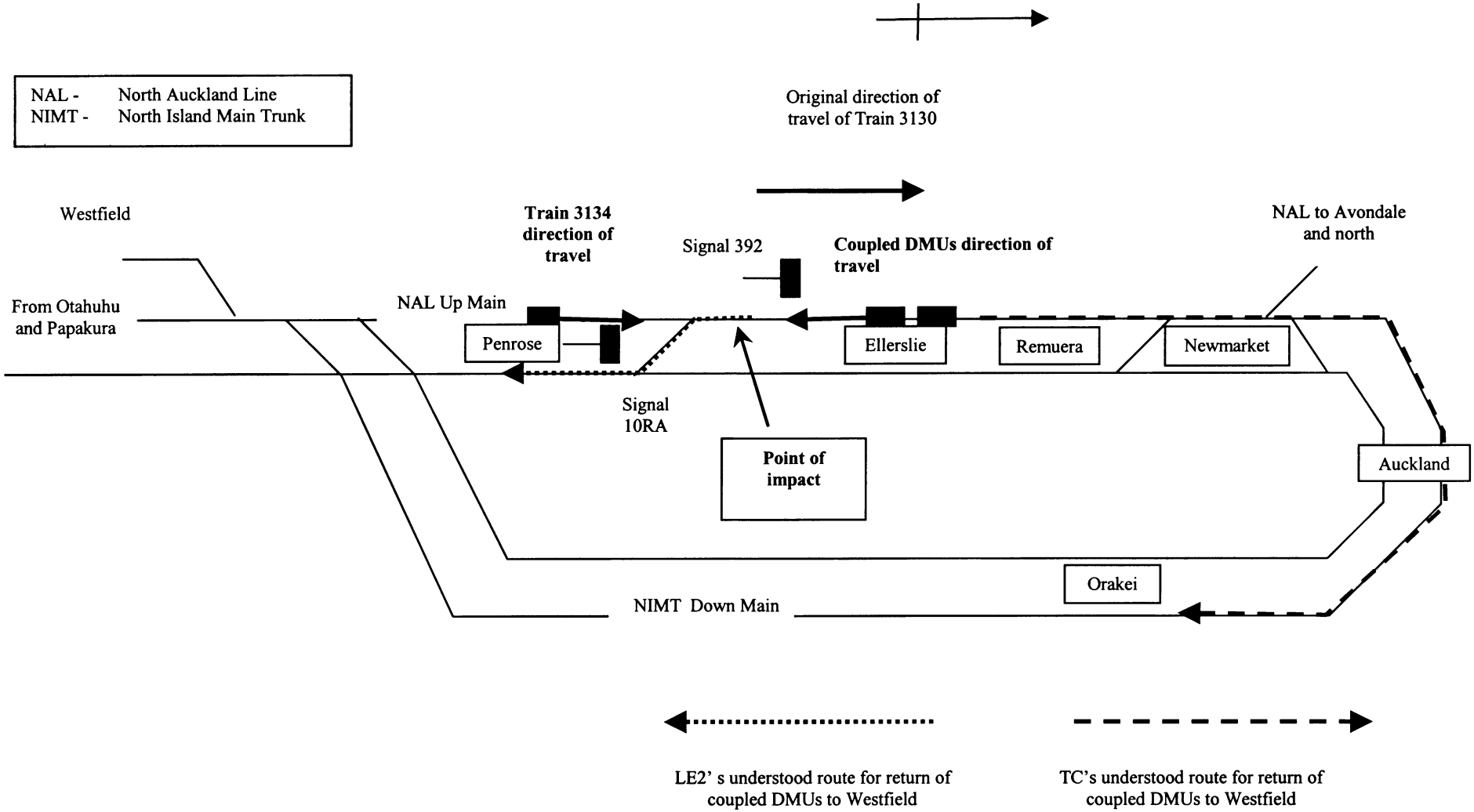

Figure 1
Track layout Westfield to Ellerslie
(not to scale)

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Figure 2
Approaching the final curve before Ellerslie on the up main line in the direction of travel of Train 3134

1.2 Site details and relevant procedures

1.2.1 The rail corridor between Westfield and Newmarket consisted of a down main line for trains running to Westfield and an up main line for trains for trains running to Newmarket. This was defined as Double Line Automatic Signalling.

1.2.2 Penrose was an interlocked station[3] situated about 1.1 km south of Ellerslie. The signalling for Penrose was automatic but could be manually operated by the TC from the train control centre in Wellington. At the time of the collision the signalling for Penrose was operating automatically.

1.2.3 Between Penrose and Ellerslie the up main line negotiated several curves which limited visibility and did not straighten until the point at which LE3 saw the approaching DMU some 190 m away. The section of track where the collision occurred was on a 1 in 47 up grade.

1.2.4 The up main line descended a 1 in 41 grade from Remuera to Newmarket and a nominal 1 in 45 grade from Newmarket to Auckland from where it continued around to Westfield via Orakei as the down main line of the North Island Main Trunk.

[3] Interlocked station - a station for which control of the points and fixed signals is centralised and arranged to prevent conflicting moves. The operation of the points and signals may be manually controlled in addition to being controlled by track circuits.

1.2.5 Tranz Rail's Bulletin Procedures dated April 1999 and in effect at the time related to Double Line Automatic Signalling Regulation 1 Trains Not to Set Back and stated in part:

> If a train is required to set back and there is no following movement in the affected section then Train Control may verbally authorise the setting back movement. Train Control must first ensure that the controlled signal at the entrance to the affected section is held at Stop before authorising the setting back movement. . .

1.3 Personnel

The LE of Train 3130 (LE1)

1.3.1 LE 1 was a senior locomotive engineer and had been driving DMUs for 7 years before the incident. He held a current operating certificate for his duties and his last theory examination for recertification had been on 25 November 2000. He was in good health and did not consider he was suffering from any work or home-related stress.

The LE of the relief DMU (LE2)

1.3.2 LE 2 had been employed by Tranz Rail for 40 years and had been driving DMUs for 7 years before the incident. He held a current operating certificate for his duties.

1.3.3 LE2 had successfully completed his most recent theory examination for recertification on 4 May 2000 and his last safety observation had been undertaken on 12 September 2000. He was in good health and did not consider he was suffering from any work or home-related stress.

The LE of Train 3134 (LE3)

1.3.4 LE 3 had been employed by Tranz Rail for 20 years and had been driving DMUs on a regular roster for 8 weeks although he had been certified to drive them since June 2000. He held a current operating certificate for his duties.

The train controller (TC)

1.3.5 The TC's employment with Tranz Rail started on 22 May 2000 when she commenced training in the train control school in Wellington.

1.3.6 On 19 June 2000, after 4 weeks at the train control school and having passed her interim and final examinations, the TC commenced on-the-job training on the East Coast Main Trunk (ECMT) train control desk. After 8 weeks of training with an experienced TC she was certified for solo operation on 9 August 2000. Her training and certification for the ECMT train control desk had not included an area familiarisation trip; instead, this was undertaken about 2 weeks later.

1.3.7 The TC said she thought that double line automatic signalling rules and regulations theory had been covered over 2 days during her training at the train control school. There was no double line operation associated with the ECMT train control desk and there had not been an opportunity during the initial training period for trainees to view a double line operation. The TC did not start to gain any practical experience of double line automatic signalling until she commenced on-the-job training on the Auckland train control desk on 13 November 2000.

1.3.8 Following 5 weeks training on the Auckland train control desk, the TC was certified to operate solo after completing a certification process which included examinations for double line automatic signalling rules and regulations and Auckland area knowledge as well as a practical observation by the train control manager.

1.3.9 The TC said that her training and certification for the Auckland train control desk had not included an area familiarisation trip to Auckland and that she was unfamiliar with the geographical features of the area, including the location of Ellerslie and the grades between Remuera, Newmarket and Auckland. The location of Ellerslie in relation to Penrose was shown on the train control diagram. Tranz Rail advised that:

> The Train Controller did not undertake any field visits in the Auckland desk area prior to the incident. There are no defined procedures for these visits. There is a view that more is achieved by undertaking these visits after a period of experience on a Train Control desk. The Train Controller subsequently visited the area between 12 and 14 February.

1.3.10 In response to a question relating to the length of time a new entrant train controller would operate on their first train control desk before starting training for a second desk, Tranz Rail included in their response:

> A review of certification records for new Train Controllers show the period between certification for an initial desk and commencing OJT for a subsequent desk does vary. Timeframes for four Train Controllers employed during previous intakes range from 13 weeks to 32 weeks.
>
> These variations are influenced by the need to train staff for additional desks. However, in all cases a key consideration is their level of performance on the initial desk.
>
> The Train Controller had 14 weeks experience on the initial desk before commencing OJT on the second desk. This is at the lower end of the range outlined above. The Train Control Manager was of the view the Train Controller had made adequate progress to take this step.

1.3.11 Although the TC had not felt under any pressure to be certified for the Auckland train control desk, she was aware that there was a "deadline", created in part by the upcoming Christmas leave program. She said that she had been confident with her preparation and training and felt that she had probably been ready for certification a week earlier. Her on-the-job training had been with a senior TC who had extensive experience on the Auckland train control desk and had proceeded largely without incident.

1.3.12 The TC had operated solo for 13 weeks on the ECMT train control desk and 2 weeks on the Auckland train control desk. The remaining 13 weeks of her train control career since graduating from the train control school had been spent in on-the-job training for the ECMT and Auckland train control desks. She was on her sixth rostered shift on the Auckland train control desk at the time of the incident.

1.3.13 Following the incident a report was not obtained from the TC by Tranz Rail who advised that:

> A report was not obtained from the Train Controller. The voice tape was played and due to the facts being clear, the contents of this were used as the basis for an interview.

1.3.14 The TC said that she had been aware of the existence of a site photograph book[4] on the Auckland train control desk and that it had been brought to her attention during her on-the-job training. A similar book was available to TCs on the ECMT desk also. She felt that such books were useful up to a point but did not know if they were on every desk although she had encountered them on both the desks she had worked. Tranz Rail advised that a similar site photograph book was also available on the train control desk responsible for train movements between Picton and Christchurch, but not on any of the other desks.

[4] The site photograph book contained photographs, access routes and other general information relating to significant locations.

1.3.15 The TC said that she had not taken the book with her on her area familiarisation trip as there was only one copy and it might have been required during her absence. She felt that the presence of the book would have been helpful during her trip to assist with retention of information.

1.3.16 During her training at the train control school the TC had been made aware of resources such as the site photograph book, street maps, topographical maps and the 0800 direct line[5] to emergency services. She had referred to the street map book during the incident because the site photograph book did not include details of Ellerslie.

1.4 Other events leading up to the collision

1.4.1 At about 1052, LE1 had advised the TC that Train 3130 was disabled at Ellerslie and that taxis were required to convey the 41 passengers on the train to their destinations. After confirming the train was immobilised the TC contacted Tranz Metro staff in Auckland and asked them to arrange for taxis to take the passengers from Ellerslie to their destinations.

1.4.2 During discussions with Tranz Metro staff the TC was advised that a spare DMU was available in Auckland to take up the running of the next service to Papakura, normally run by the DMU and crew from Train 3130, but because Train 3130 was still at Ellerslie there was no crew available. It was agreed that the TC would arrange for the crew to travel by taxi to Auckland to take up the running of the next service to Papakura using the available DMU.

1.4.3 The TC then contacted LE1 and asked him to travel with his crew to Auckland by taxi but LE1 advised her that he could not leave the disabled unit unattended before assistance arrived. LE1 asked the TC if she had a "sub shunt[6], a loco that can push us in to town?" to which the TC responded "They're organising a driver for that now".

1.4.4 At this point it had not been confirmed exactly what assistance was to be provided, so LE1 felt that he should stay with Train 3130 in case the LE from any assisting service was uncertified or unfamiliar with the DMU.

1.4.5 The TC had planned for Train 3130 to continue to Auckland via Remuera once assistance had arrived. The first reference made regarding the relief DMU with Train 3130 coupled setting back from Ellerslie to Penrose on the up main line was when LE2 requested permission to "proceed back to Penrose. . ." The TC later said that she had missed the word "back" when she authorised the movement and was under the impression that the relief DMU was going to push disabled Train 3130 forward to Auckland and then on to Westfield.

1.4.6 When LE2 spoke to the TC from the south cab of Train 3130, Train 3134 had not arrived in Penrose but by the time he had returned to the south cab of the relief DMU Train 3134 had departed from Penrose and was travelling towards Ellerslie. Until this time Train 3130 had been protected by Signal 392 (refer Figure 1) at the rear, but once LE2 moved the coupled DMUs back past Signal 392 towards Penrose it then occupied the same section of the up main line as Train 3134, which was travelling towards it.

1.4.7 Shortly after the TC had authorised Train 3130 to return to Penrose the following conversation, transcribed from the train control voice tape, took place between her and the signalman at Newmarket:

Signalman	Now that disabled job, has that been fixed up yet?
TC	It has. On it's way a couple of minutes ago.

[5] This number connected the TC to the Northern Communications Centre for the Police in Auckland.
[6] Locomotive hauled shunting services which operated to various sidings and terminals within the Auckland metropolitan area.

This was consistent with the TC believing that Train 3130 was being pushed through to Auckland via Remuera by the relief DMU, even though by that time she had unknowingly given authority for it to "proceed back to Penrose. . ."

1.4.8 The TC confirmed that she had not advised LE3 of the disabled train at Ellerslie because she expected he would have heard the radio transmissions between herself, LE1 and LE2, as he was in the immediate vicinity. She also knew that the disabled DMU was protected against following movements by Signal 392.

1.4.9 LE3 said that when he commenced his shift at Westfield he had heard discussions amongst staff regarding a disabled DMU but that he was not aware of its location. When he took over the running of Train 3134 his radio had been set in scan mode[7], but he had not heard any transmissions regarding the situation at Ellerslie.

1.5 Radio coverage

1.5.1 Tranz Rail advised that the radio channel covering the area of the incident was Channel 4, coverage of which extended from Waitakere to Bombay Hills.

1.5.2 The DMUs were equipped with MT1000 portable radios mounted in a motor vehicle adaptor in the cab. The TC said that because the radios were portable, train control staff did not know which radio unit was on which DMU service. They could not therefore base call specific DMU services unless the LE had called them first, which then allowed the TC to co-ordinate the radio to the train service and program the match into the radio computer. Unless this happened the only way the TC could attempt to contact the LE of a DMU was by voice-calling.

1.5.3 The following radio transmission between the TC and Train 3130 following its disablement was transcribed from the train control voice tape playback:

3130	Control, 3130 over. (repeated)
TC	3130. Go ahead.
	No response from 3130
TC	Subbie 3130 at Ellerslie. Go ahead.
3130	3130. Over
TC	3130, going to send you straight through to Westfield and pick up the next subbie at Otahuhu, to take back over the hill. 3138 at Otahuhu.
	No response from 3130
TC	3130. Did you copy that?
3130	3130, you copy? You're breaking up. We haven't received anything from you. Over.
TC	3131. 3130. I've got you there.

1.5.4 In an interview LE1 stated that:

> There was trouble in receiving radio contact with Train Control at this stage. The driver (LE2) then went outside and tried to radio from outside but to no avail. He then came into the disabled unit and used our radio, that was 3130 on the back cab, that is the cab nearest to Penrose and finally got through to Train Control and had a discussion. . .

[7] Scan mode allowed the LE to monitor all radio channels in his area without having to manually change channels.

1.5.5 In an interview LE2 stated that:

> . . .I contacted Train Control and it took a little bit of time to get through to her because the radios were a bit scratchy. . .

1.5.6 The TC said that:

> The next call I got was a base call from the driver of 3130, which was unusual, as they usually don't base call, they usually just call you on the radio. Previous to that I had had quite a few problems actually talking to him, I was trying to get an idea of what was happening and trying to get a hold of him to see if they were coupled up, if they were ready to go and this sort of thing. What I heard was emergency, but he got cut off half way through, and I thought that he had hit the emergency button in error as he didn't sound stressed. I tried to voice call but got no response . . .

1.5.7 The following radio transmission between Train 3130 and the TC relating to the reporting of the collision was transcribed from the train control voice tape playback:

TC	3130. Got your base call thanks.
3130	Emergency. . . (cut out)
TC	Cut out there. Was that you hit emergency in error?
	No response from 3130
TC	You hit that emergency in error. Is that correct?
	No response from 3130
3134	Auckland control (repeated)
TC	3134. Go ahead.
3134	Reporting a collision with a train setting back. . .

1.5.8 Tranz Rail advised that there had been no radio audits done on the Auckland radio network during the 12 months prior to this incident.

1.6 Train control workload

1.6.1 As well as dealing with Train 3130 at Ellerslie the TC was required to also control the movements of other trains and deal with other track user requests within her area of responsibility.

1.6.2 Some of the additional tasks associated with disabled Train 3130 were:

- attempting to arrange assistance for the disabled DMU
- arranging with Tranz Metro to provide taxis for passengers
- attempting to locate a spare DMU and crew for the next Tranz Metro service from Auckland to Papakura
- arranged alternative replacement transport for the next Tranz Metro service from Papakura

1.7 National train control centre

1.7.1 The national train control function was centralised to Wellington in 1998, where nationwide train control duties were carried out from 9 separate desks. The system comprised networked computers for signalling and a computer-based radio system that allowed TCs to communicate with LEs and other track users operating in their respective areas of control. Desks responsible for track warrant control working were also equipped with a computer for the preparation and issue of track warrants.

1.7.2 The computer-based systems were designed to allow train control areas to be transferred between desks within the train control centre to meet workload requirements. This system offered flexibility and allowed staff to be reduced during periods of low activity, particularly at weekends and quieter periods, when it was possible for several areas to be covered by one TC.

1.7.3 The Auckland train control desk was responsible for train movements between Waitakere, Auckland and Te Rapa (Hamilton) and was part of the Northern train control roster, together with the Central and East train control desks. TCs were rostered to work one, 2 or 3 of the desks, depending on their current certifications and the work load.

1.8 Relief of train control staff involved in serious operating irregularities

1.8.1 Tranz Rail's policy regarding the relieving of TCs involved in serious operating incidents required the following :

- The Network Control Manager to immediately notify the Train Control Manager.
- The Train Control Manager to determine if the TC was implicated.
- The Train Control Manager to direct if the TC was to be relieved from duty.

It was not mandatory for a TC involved in a serious operating incident to be immediately relieved of duty.

1.8.2 The TC said that at about 1230 on the day of the incident the network control manager (NCM) had told her that LE2 had said she had given him permission to "set back". The NCM said that she would have to be relieved, but his attempts to arrange for either a relief TC or for the operation of the Auckland train control desk to be amalgamated with that of another train control desk were unsuccessful. The TC stayed on duty until she had completed her shift at 1500.

1.8.3 With regard to not relieving the TC following the incident, Tranz Rail advised:

> Both the Network Control Manager and Train Controller formed a view no authorisation had been given for the train to set back and therefore there had been no indiscretion on the part of the Train Controller. It was subsequently established the Locomotive Engineer was of the view he had obtained the appropriate authority. This was an error of judgement. The normal procedure is to relieve Train Controllers at the earliest opportunity unless it has been clearly established that they are not involved in the incident.

1.8.4 The issue of relief for TCs involved in serious operating incidents was addressed by the Commission in Railway Occurrence Report 00-116 hi-rail vehicle and train occupying same section of track, near Te Kauwhata and in Railway Occurrence Report 00-113 derailment of Train 378 at Te Maunga. The full safety recommendation made to the director of the Land Transport Safety Authority and his response are included in Appendix A.1 to this report.

1.9 Train control voice tapes

1.9.1 All train control communication channels, both radio and telephone, are recorded in the train control centre with the tape covering 24 hours of transmissions.

1.9.2 The 24 hour period for recording purposes ran from 1215 to 1215 the following day, at which time a new tape took over recording and the previous tape was replaced and stored for 14 days before going back in to service.

1.10 Advice to emergency services by TC

1.10.1 The TC said that immediately she was advised of the collision and the possibility of injuries she rang the 0800 emergency services line where she was put on hold by the operator without ascertaining the nature of her call. After holding for several seconds she hung up and dialled 111 and, having established that she was calling from train control in Wellington, was connected to the Wellington Free Ambulance service. A printout of telephone calls made from the train control desk showed that the TC had held on for 37 seconds after dialling the 0800 number before she hung up and rang 111. This was confirmed by a playback of the train control audiotape.

1.10.2 The TC said that she initially experienced difficulties as the dispatcher she spoke to at Wellington Free Ambulance did not have any local knowledge of the Auckland area and she had referred to the Auckland map book to give him information relating to streets bordering the Ellerslie station. The operator told the TC that he could not dispatch an ambulance from Wellington but would contact the Auckland St Johns Ambulance to respond. The TC also asked him to advise the police.

1.10.3 The procedure in place for TC's to follow when dealing with emergency services was detailed in Tranz Rail's Rail Operating Code Section 6 Operating Instructions for Train Control which stated that:

> 23.0 Contacting Emergency Services
>
> 23.1 Police Communications Centres
>
> In situations where accidents or emergencies occur and Train Control is notified or deems that the emergency services are required, the direct emergency number for the respective Police Communications Centre should be used to notify Police who will mobilise Fire and Ambulance resources. These numbers are confidential and for Train Control use only.
>
> 23.2 Directories
>
> A national set of Telecom directories is held in Train Control to cover the rail network.

1.10.4 Tranz Rail advised the following in regards to the training given to TCs in relation to advising and dealing with emergency services:

> Train Controllers are acquainted with the on-call register for emergency services during their OJT
>
> Reading of topographical maps is covered at the train control school
>
> There is no specific training on how to deal with emergency services, as the generic Train Control training essentially picks up the key elements of identifying location, extent of problem etc.

1.10.5 In regards to manuals available to TCs which described location, access etc, of various rail facilities to assist with directing emergency services Tranz Rail advised:

> Included in the Auckland Desk documents is an Auckland street directory that has had further details such as Tranz Metro station names, siding etc. added to it.
>
> Additionally there is a folder entitled Site Photographs Auckland Train Control Area, which includes station location and access routes, photographs of significant locations and other general information.

1.10.6 The issue of notifying emergency services was addressed by the Commission in Railway Occurrence Report 00-119. The full safety recommendations and responses from Tranz Rail are included in Appendix A.4 to this report.

2. Analysis

2.1 Introduction

2.1.1 This collision occurred primarily due to poor communication; equally missing was the intent to communicate and the ability to do so. The intent and ability to communicate were the defences in place to avoid misunderstandings under the verbal authorising of trains to set back in double line automatic signalling areas.

2.1.2 The TC was responsible for controlling the rail network in the area, yet she had a different concept of the LEs plan to clear the defective DMU from the section.

2.2 TC training and experience

2.2.1 The TC had 13 weeks of solo train control experience on the ECMT train control desk before she commenced on-the-job training for the Auckland train control desk. She had been employed as a train control trainee from outside Tranz Rail, so she had not had the benefit of a rail industry background and entered the train control school with only the rail industry knowledge she had attained through the train control correspondence course[8]. How she could have been considered ready for training and certification for a second train control desk when she had such limited experience in the rail industry and train control in particular is difficult to understand.

2.2.2 The TC's training at the train control school had not included an opportunity for her to see double line automatic signalling in operation, even though such an opportunity was readily available in Wellington, but her training had included a single line trip, probably in preparation for the single line operation on the ECMT train control desk which she would be joining on completion of the training course. Such an opportunity would have been beneficial to the TC, even if it had been undertaken in Wellington as part of her training for the Auckland train control desk.

2.2.3 The TC's inexperience in the rail industry and her unfamiliarity with the Auckland area meant that an area familiarisation trip either as part of her on-the-job training or as part of her certification process should have been mandatory prior to her commencing duty on the Auckland train control desk. This desk had the potential to be the busiest in the train control centre and although the TC would not have learned everything about the area from one trip she would have had an opportunity to travel on the Tranz Metro suburban trains and gain some understanding of that operation which generated a significant amount of the train control desk workload. Three safety recommendations covering staff training and experience have been made in section 5 of this report.

[8] Undertaken by prospective TCs before they enter the Train Control school for further training.

2.2.4 The TC had sat and passed 2 examinations as part of her certification, but these tested her theoretical knowledge only and would have been of more value had they been undertaken in conjunction with an area familiarisation trip rather than in isolation.

2.2.5 Tranz Rail's operating rules did not allow for motive power units to be left unattended outside locomotive depot points except in specific circumstances, which this incident did not meet. The TC's request for LE1 to leave Train 3130 unattended on the up main line at Ellerslie and travel to Auckland to take up the running of another service was probably based on her inexperience, but was undoubtedly made in the interests of customer service to get Tranz Metro services running back on time. LE1's decision to stay with Train 3130 was understandable and he offered a practical alternative, one that the TC appeared not to have thought of, when he suggested a "sub shunt, a loco that can push us in to town". Suburban shunts regularly travelled around the Auckland Tranz Rail network and LE1 thought that there might have been one in the vicinity which could have been utilised for this purpose. The TC's response that "they're organising a driver for that now" related to her attempts to find an LE for a relief DMU, not a "sub" (suburban) shunt locomotive, which LE1 had suggested. Her inexperience again possibly contributed to this misunderstanding. The words "that can push us into town" would have reinforced the TC's mental picture of Train 3130 being taken back to Westfield via Newmarket and not Penrose.

2.2.6 The mechanical failure of Train 3130 at Ellerslie brought with it 2 problems: the clearing of the disabled train from the section and the disruption to and recovery of other Tranz Metro services. While the clearing of Train 3130 from the section needed to be dealt with by the TC the disruption to the suburban passenger services was a Tranz Metro problem and the TC should have been able to hand it over to Tranz Metro staff to co-ordinate. When Tranz Metro services in Wellington were disrupted a Tranz Metro representative went to the train control office to co-ordinate issues such as alternative transport for passengers, alterations to train schedules, crewing requirements etc which then freed the TC to focus on the operational requirements of the situation. While it was not physically possible for a member of Tranz Metro staff from Auckland to be present in the train control office, a member of the Wellington staff should have been seconded to the train control centre to act as a liaison with the Auckland Tranz Metro staff. The TC's efforts in the interests of Tranz Metro and its customers took a lot of her time and attention and probably contributed to her lack of focus on the operational issues involved. A safety recommendation covering this issue has been made in section 5 of this report.

2.2.7 The TC's actions followed her plan that Train 3130 would proceed to Westfield via Auckland and reinforced that belief. She had also talked to staff in Otahuhu, Newmarket and Auckland signal boxes and Tranz Metro staff in Auckland and advised them of her expectation.

2.2.8 Although there was no requirement for the TC to have done so it would have been prudent for her to take manual control of the signalling at Penrose when she had been notified that Train 3130 was disabled. This would have allowed her to secure Signal 10RA at Penrose at "Stop" and would have prevented any following trains, including the relief DMU and Train 3134, from entering the up main line without her knowledge. The TC knew, however, that the relief DMU, with Train 3130 coupled, was protected against following movements by Signal 392, and she had no reason to believe they were going to move backwards away from the protection of that signal.

2.2.9 Although the TC was inexperienced in the practical operation of double line automatic signalling, she was aware of the procedures to be undertaken had she intended to return the coupled DMUs to Penrose on the up main line. The marks she had attained in her various examinations, culminating in her certification examinations, confirmed that she had a sound theoretical knowledge of double line automatic signalling rules, regulations and processes, and this was confirmed when she was interviewed following the incident.

2.2.10 When LE2 requested the TC's authority to "proceed back to Penrose" she heard the word "proceed" but missed the significance of the critical words "back to Penrose". It is probable that in her mind she perceived these words as "back to Westfield", following on as they did immediately after the word "proceed". The usual railroad terminology for describing the movement of a train reversing along a main line for whatever reason was "set back" or "setting back". Given that LE2 planned to travel in the wrong direction on the Up Main the term "set back' would have been more appropriate when referring to his intended movement. LE2 thought that he had asked the TC for permission to "set back to Penrose" but the actual words he used were "proceed back".

2.2.11 In responding the TC had said "we'll send you all the way round through to Westfield" but LE2 missed the significance of "all the way round", probably because he had requested and, he believed, received authority to return to Westfield via Penrose. This highlights the need for standard terminology to be used in such a safety critical communication system and the vulnerability of the verbal system of authorising setting back movements. A written authority would have been an effective defence against such a misunderstanding. Tranz Rail have since implemented a written authority process for setting back movements in double line automatic signalling areas (refer paragraph 4.1). In view of the action taken by Tranz Rail no safety recommendation covering setting-back procedures is included in this report.

2.2.12 Prior to centralisation the train control desks had traditionally been located in different parts of New Zealand and staffed by experienced TCs with an extensive knowledge of their individual operating areas. Once they had completed their training and certification the TCs usually only worked in these offices and because they were located within the TCs area of control they had the advantage of gaining local knowledge of their area while at the same time getting to know and develop working relationships with train crews. With the centralisation of the train control function to Wellington the experienced TCs from the respective desks were trained and certified on additional desks and their rosters were interspersed with both inexperienced new entrant TCs and experienced TCs who had been shifted from other areas. In each case these personnel brought with them no local knowledge and had little opportunity to gain any, except through area familiarisation visits. A safety recommendation covering this issue has been made in section 5 of this report.

2.2.13 Centralisation allowed staff levels in train control to be reduced with combined desk operations at such times as weekends when traffic was less dense. This was achieved through the rostering flexibility that resulted when all staff operating the roster were certified for each train control desk included in their respective roster. Until TCs had completed certification on all desks within their roster they could not be rostered for multiple desk shifts. Expectations from either Tranz Rail or a TC to commence training on another desk could create a situation where training commenced before a TC was adequately prepared. Although there was no evidence to suggest that such expectations were the case in this instance, it is doubtful that the TC was sufficiently experienced as a train controller to be considered ready for a move to learn a new desk which was potentially the busiest in the train control centre.

2.2.14 The difficulties experienced by the TC in firstly contacting then arranging for emergency services to attend the scene of the collision is of concern. The TC had correctly followed Tranz Rail's procedures when she rang the 0800 emergency number to the Police Northern Communications Centre in Auckland. Her action in hanging up after being "on hold" for more than 30 seconds and pursuing an alternative course of action demonstrated a certain initiative. A wait of that duration in a potentially life-threatening situation undoubtedly brought pressure on the TC to seek assistance from elsewhere. While it may have been prudent to have got someone else to hold the 0800 phone while she used another phone to dial 111 her actions overall were driven by her desire to get emergency services to the scene as quickly as possible.

2.2.15 When the TC dialled 111 she was connected to the ambulance dispatch office in Wellington where the operator, not surprisingly, neither had local knowledge of the Auckland area nor was able to dispatch an ambulance to the scene. The issue of notifying emergency services was raised in the Commission's Rail Occurrence Report 00-119. The recommendation and response from Tranz Rail has been included in Appendix A.4 to this report. A further safety recommendation covering the procedures relating to notifying emergency services has been made in section 5 of this report.

2.2.16 The documentation available to TCs on the Auckland train control desk for use in emergencies could have been improved by incorporating the information from the street guide into the site photography book to make one reference book for use in emergencies. The site photography book contained essential information on most, but not all of the locations around the Auckland train control area. Ellerslie was amongst those not listed. Only 3 of the 9 train control desks had a site photography book available. A safety recommendation covering this issue has been made in section 5 of this report.

2.3 Relief of TCs

2.3.1 Tranz Rail's stated policy of relieving "Train Controllers at the earliest opportunity unless it has been clearly established that they are not involved in the incident" was not supported by available resources. This was the second incident in 10 weeks where a TC involved in a serious operating irregularity had not been immediately relieved once their involvement had been established. In the first incident, which had involved a hi-rail vehicle and a train occupying the same section of track (Railway Occurrence Report 00-116), the TC remained on duty with his immediate manager sitting alongside him for a further 3 hours after the incident until the end of his rostered shift. In this investigation it was found that the TC remained on duty by herself for another two-and-a-half hours following the incident until the end of her rostered shift. In both cases relief was not available.

2.3.2 In a letter dated 12 June 2001 referring to the Te Kauwhata incident, Tranz Rail suggested that the use of the TC's immediate manager to sit with him when relief couldn't be arranged "would have been of significant value given the circumstances." It is therefore surprising that Tranz Rail did not consider that "significant value" about 10 weeks later for the TC involved in this incident, who was on only her sixth rostered shift at the time. The Commission was of the opinion that the TC involved in the Te Kauwhata incident should have been relieved of duty following the incident as should the TC involved in this incident and a finding in the report reflected that. A recommendation to the director of the Land Transport Safety Authority was made in relation to both Rail Occurrence Reports 00-113 and 00-116. The recommendation and response from the director is included in Appendix A.1 to this report.

2.3.3 The inability of Tranz Rail to provide relief for the TC is viewed with concern, as she had been involved in an operating incident with potentially serious outcomes and should reasonably have expected to be removed from the train control environment at the earliest opportunity, once her possible involvement had been determined, to compose herself and thus remove the potential for another incident as a result of stress.

2.4 Crew resource management

2.4.1 Crew Resource Management (CRM) is a general term covering crew management in highly operational situations; for example, on ships, in control rooms of power plants, in aircraft and in medical operating theatres.

2.4.2 The way human beings interact, communicate and make decisions in such situations is quite similar. Equally, errors in such circumstances are also similar. Training in this area was developed in the airline industry as a result of research showing that most aircraft incidents occurred as a result of management errors rather than technical malfunction. The concept has since been adopted and formally adapted to suit the maritime industry.

2.4.3 Examples of common CRM failings are preoccupation with minor technical problems, failure to delegate the tasks and assign responsibilities, failure to communicate intent and plans, and failure to detect and challenge deviations from standard operating procedures. Failure to communicate intent and plan was a key factor in this incident. The principles of CRM extend to other people in the system such as in this case, train controllers. To include others remote from the prime operating vehicle requires good reliable communication. The TC had discussed her plan with LE1. LE1 subsequently took part in discussions with LE2 and maintenance staff, where a different plan was agreed on, yet no one thought to include the TC in the decision-making process, even though the TC was the person responsible for controlling trains on the track.

2.4.4 Although the principles of CRM have application to certain rail operating environments it has not been adopted in the rail transport industry to the same extent as in the air and marine industries.

2.4.5 This was recognised by the Commission in Railway Occurrence Reports 98-107, Train 411, wrong line running, Ngaruawahia, and Report 00-106, track warrant overrun, Mataura. The recommendations and responses from Tranz Rail have been included in Appendix A.2 and A.3 of this report.

In view of these responses no safety recommendations covering CRM have been made in this report.

2.5 Radio performance

2.5.1 The ongoing poor performance of the portable radios in the DMUs was well known by Tranz Rail and the continued difficulties experienced by the TC, LE1 and LE2 probably discouraged communication between them. This not only increased the risk of errors being made but did not encourage the application of CRM. Access by staff to reliable radio communications is crucial, particularly when involved in operating incidents. Although Tranz Rail has taken some action towards replacing the mobile radios currently in the DMUs (refer Safety Action 4.2) a safety recommendation covering radio performance has been made in section 5 of this report

3. Findings

Findings and safety recommendations are listed in order of development and not in order of priority.

3.1 Train 3134 collided head on with the relief DMU and Train 3130 when the TC unknowingly authorised Train 3130 to set back along the up main line into the path of Train 3134, a scheduled passenger service.

3.2 The unintentional authorisation for the coupled DMUs to set back to Penrose resulted from poor communication, which resulted in the train controller not having the same mental concept of the recovery plan as the LEs. The effective use of crew resource management could have prevented the collision.

3.3 The radio equipment installed on DMUs operated by Tranz Metro did not allow for reliable communication between train control and other trains during routine operations, and probably contributed to the confusion between train control and on-site staff as to which direction the relief DMU with Train 3130 coupled was going to move.

3.4 The train controller was not sufficiently experienced in train control duties to have been certified for a second desk. This was not a reflection on the train controller's potential ability, but when combined with having had no field familiarisation trips, meant that she had probably not been sufficiently prepared to take charge of a second train control desk so soon.

3.5 The train controller was probably overloaded with tasks that should have been routinely handled by Tranz Metro staff, which probably distracted her from the task of the removal of Train 3130 from the section.

3.6 The train controller not being removed from the desk following this serious operating incident created the potential for other incidents to occur as a result of attention diversion and stress. This incident, together with previous incidents investigated by the Commission where train controllers should have been relieved following serious operating incidents, indicates that train control does not have sufficient resources to fulfil its policy of relieving train controllers when they have been implicated in serious operating incidents.

3.7 There were inadequate defences in the verbal authority procedure to protect against lack of, or poor communication, between locomotive engineers and train controllers.

4. Safety Actions

4.1 On 8 June 2001 Tranz Rail advised that it had:

> . . . reviewed the procedures for authorising trains to set back on the wrong line Double Line Automatic Signalling territory. The procedures in place at the time of the incident permitted verbal authority. As a result of the review this was changed to a requirement for a Mis 60 Authority. This change came in to effect on Sunday 4 February 2001.
>
> Additionally, Locomotive Engineers were briefed of the need to clearly explain any change of pre-established plans when requesting specific authorities.

In view of the action taken by Tranz Rail regarding the authorising of trains to set back in double line automatic signalling areas no safety recommendation covering this issue has been made in this report.

4.2 On 8 June 2001 Tranz Rail advised that it:

> . . . is aware of the wider issue of radio communication difficulties involving DMUs and is in the process of replacing portable radios with fixed radios in all DMU cabs.

4.3 On 14 November 2001 Tranz Rail advised that it had:

> completed the installation of new fixed radio equipment in all ADL/ADC and ADK/ADB class DMU's on 11 October 2001.

5. Safety Recommendations

5.1 On 29 October 2001 it was recommended to the managing director of Tranz Rail that he:

5.1.1 ensure that following initial training and certification, new entrant train controllers do not commence training on another train control desk until they have completed at least 12 months duty on their first train control desk (043/01)

5.1.2 include an area familiarisation trip with an experienced train controller or similarly qualified person as part of the training and certification for any train control desk together with an unaccompanied field trip scheduled within an acceptable timeframe following certification as a follow up (044/01)

5.1.3 ensure that trainee train controllers view the operations of the various signalling systems on the Tranz Rail network during their initial training at the train control school (045/01)

5.1.4 increase the amount of information available in the existing site photography book to include street maps etc so that it becomes the major reference manual for train controllers in emergency situations and ensure that such books are made available on all train control desks (046/01)

5.1.5 conduct a full audit of the Auckland train control radio system to ensure it meets required standards for communication between train controllers and locomotive engineers, including Tranz Metro services (047/01)

5.1.6 ensure that staff are available in the train control centre to assist the train controller by liasing with Tranz Metro when suburban train services are disrupted (048/01)

5.1.7 liaise with emergency services to ensure that existing contact procedures are adequate and that the training and ongoing certification of train controllers reinforces such procedures. (049/01)

5.2 On 22 November 2001 the managing director of Tranz Rail replied:

5.2.1 043/01 – Tranz Rail do not accept this recommendation in its present form. The report provides no basis for arriving at a minimum period of twelve months for a new Train Controller on their initial desk. However, as suggested in our response to the preliminary safety recommendation, Tranz Rail intends to gather information from overseas railway organisations with similar Train Control systems regarding their approach to this matter with a view of establishing a minimum period based on industry practice.

5.2.2 044/01 – Tranz Rail do not accept this recommendation. A recommendation that changed "…with an experienced train controller or similarly qualified person …" to "… with experienced operating and/or maintenance personnel …" would be acceptable. This suggested change is prompted by Tranz Rail's firm belief that Train Controllers are best to have field visits with experienced field practitioners.

5.2.3 045/01 – Tranz Rail accept this recommendation. It is consistent with the revised induction process implemented for trainees who commenced training on Monday 24 September 2001.

5.2.4 046/01 – Tranz Rail accept this recommendation. Tranz Rail reiterates previous concerns advised to the Commission regarding the absence of comment in the report on the ability of emergency services to pin point the location of Ellerslie station. Suburban stations are local facilities frequently used by the public. Tranz Rail would expect local emergency services to be familiar with access routes.

It is suggested that the Commission further consider a recommendation directed towards the emergency services.

5.2.5 047/01 – Tranz Rail accept this recommendation.

5.2.6 048/01 – Tranz Rail accept this recommendation. However, it is contended that at the time of the incident this was not an issue. Replays of the train control voice tapes indicate that when the Train Controller was dealing with the breakdown the number of calls was not excessive. In fact it was noted that the Train Controller had time to pro-actively seek information not associated with the breakdown.

Additionally, assistance was provided by the Train Controller on the adjacent desk. This support remained available throughout this period.

049/01 – Tranz Rail accept this recommendation.

Approved for publication 31 October 2001

Hon. W P Jeffries
Chief Commissioner

Appendix A

A.1 Arising from the Commission's Railway Occurrence Railway Occurrence Reports 00-113 and 00-116 the Commission recommended to the director of the Land Transport Safety Authority that he:

> Carry out an LTSA investigation, or initiate a specific audit, of Train Control operations, such investigation or audit to include:
>
> the resources available to meet the workload demand
>
> the suitability of the roster system
>
> the maximum shift desirable
>
> the adequacy of arrangements for meals and other breaks during shifts
>
> the adequacy of the current training system
>
> the suitability of staff trained under any other system
>
> the effectiveness of the safety observation and compliance monitoring system
>
> the suitability and control of the work environment
>
> the ability to immediately relieve any train controller involved in a serious operating incident
>
> and initiate action necessary to address any deficiencies found.

On 6 June the director of the Land Transport Safety Authority replied:

> We have considered your recommendation for the Land Transport Safety Authority (LTSA) to conduct a Review of Tranz Rail Ltd (TRL) Train Control Operations. Although we consider that our proposed course of action will allow for appropriate monitoring of TRL actions on the issues regarding train control we acknowledge that there may be some benefit in commissioning the recommended independent review. On this basis we will accept your recommendation.
>
> As we consider that the proposed review will divert technical expertise within TRL we will discuss with them the most effective means of meeting the terms of the review at that time.
>
> We have drafted a Terms of Reference for this Review and we are actively considering appropriate reviewers noting the potential for conflict of interest where any of the main rail consultancies are also involved in bidding for aspects of TRL business.
>
> We look forward to receiving the final draft of the above TAIC Report.

A.2 Railway Occurrence Report 98-107, Train 411, wrong line running, included the following safety recommendation and response from Tranz Rail:

> Introduce formalised crew resource management training for Train Control Operators, Signalmen and LE's based in the training available in the aviation and marine industries. (001/99)

Tranz Rail replied:

> 001/99
> Service Delivery will review the crew resource management training available within New Zealand for the aviation and marine industry to assess its suitability to meet the requirements of our operation. If accepted such training would be linked into our current training requirements for Locomotive Engineers, Signalbox and Train Control staff.

A.3 Railway Occurrence Report 00-106, track warrant overrun, Mataura, included the following safety recommendation and response from Tranz Rail:

> Introduce the formalised crew resource management procedures recommended in safety recommendation number 001/99 and ensure that such procedures include remote control operators operating main line shunts. (006/01)

Tranz Rail replied:

> Tranz Rail accept this recommendation. This is presently being evaluated to determine the best way to facilitate these principles to staff. Tranz Rail expect to complete this evaluation by end of June 2001.

In view of these responses no safety recommendation covering CRM has been made in this report.

A.4 Railway Occurrence Report 00-119, Train 281, fall from cab, Owhango, included the following safety recommendation and response from Tranz Rail:

> Review the effectiveness of the Tranz Rail emergency plan to respond to such accidents to ensure it includes guidelines to TCOs and network control managers to minimise the initial delay in notifying emergency services and ensure timely information regarding access to accident and incident sites (023/00)

Tranz Rail replied:

> 023/00: Appropriate information for emergency responses is available and procedures are already in place. These will be reviewed and reinforced.