Report 01-109

Electric Multiple Unit Train 8203

doors opened while train was moving

Tunnel No 2, North Island Main Trunk, near Wellington

16 July 2001

Abstract

On Monday, 16 July 2001, at about 0825 the passenger doors on the left side of Train 8203 electric multiple unit passenger service, opened uncommanded as the train travelled through Tunnel No 2 between Takapu Road and Wellington on the North Island Main Trunk. The locomotive engineer immediately stopped the train in the tunnel.

The doors opened due to an electrical short circuit that was caused by heat from an overworked resistor bank melting the insulation on the door control wires. The crew manually closed the doors and the train continued to Wellington.

There were no injuries to passengers or staff.

The safety issues identified included:

- the routing of an electrical cable conduit over a potential source of heat without suitable protection
- the non-compliance with a standard procedure for preventing an overload of resistor banks
- the unreliable radio communication between electric multiple unit passenger trains and train control while in Tunnels 1 and 2.

In view of safety actions taken by the operator to address these issues, no safety recommendations are included in this report.

Contents

Figures

Abbreviations

ATC	Alternative Train Crewing
DMU	diesel multiple unit
EMU	electric multiple unit
hr	hour(s)
km	kilometre(s)
km/h	kilometres per hour
LE	locomotive engineer
m	metre(s)
t	tonne(s)
Tranz Rail	Tranz Rail Limited
TC	train controller

Data Summary

Train type and number:	Electric Multiple Unit Train 8203
Date and time:	16 July 2001 at about 0825
Location:	Tunnel No 2, North Island Main Trunk, near Wellington
Persons on board:	crew: 4 passengers: about 40
Injuries:	crew: nil passengers: nil
Damage:	resistor bank burned out and electric cables damaged
Operator:	Tranz Rail Limited
Investigator-in-charge	D L Bevin

1. Factual Information

1.1 Narrative

1.1.1 On Monday, 16 July 200, Train 8203 which left Porirua at 0802 was a scheduled passenger service to Wellington. The train was an electric multiple unit (EMU) and consisted of 4 D Class non-powered passenger cars and 2 DM Class motor-powered passenger cars, DM153 and DM504, marshalled as follows:

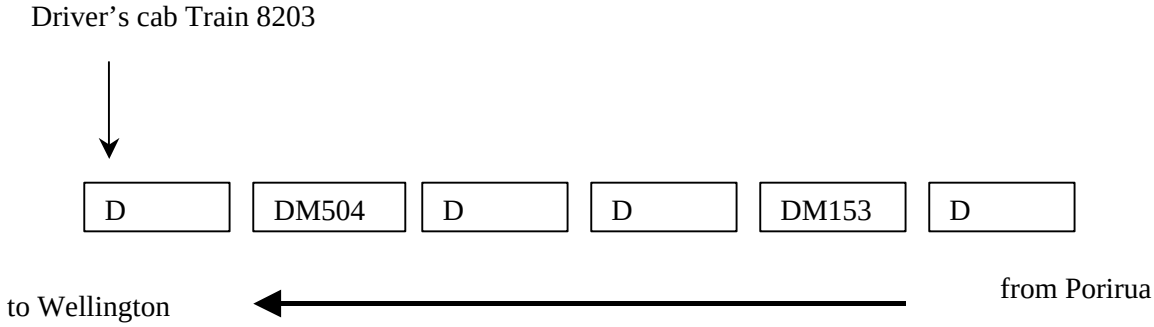

Figure 1
Marshal order of Train 8203

1.1.2 Train 8203 was crewed by a locomotive engineer (LE), a guard and 2 train assistants, who had earlier taken it to Porirua as Train 8202, a scheduled 0730 Wellington to Porirua non-stopping EMU service. Train 8202 had left Wellington about 4 minutes late and arrived in Porirua 10 minutes late, having lost time en route due to slow running.

1.1.3 As Train 8202 had climbed through Tunnel No 2 en route to Porirua (refer Figure 2) the LE felt that the train was sluggish and he had commented on this to the train guard.

1.1.4 When Train 8202 arrived at Porirua the LE had again spoken with the train guard, who had previously been a mechanical fitter on the EMUs. The guard told him that he thought that one of the traction motors might not be working.

1.1.5 Train 8203 left Porirua and stopped at all stations from Kenepuru to Takapu Road. The LE said that he had contacted the train controller (TC) by radio from either Linden or Tawa and told him that his train was "sluggish and that he was going to try and nurse it back to town". Because of the late running of the service passenger numbers were light.

1.1.6 Train 8203 left Takapu Road and passed Signal 1157 which had displayed a yellow (caution proceed) indication[1]. The next signal, Signal 1081 was a stop and proceed signal[2] which displayed a red (stop) indication. The LE stopped his train at the signal before moving past it (refer Figure 3).

[1] 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.
[2] Stop and proceed signal - Stop, then proceed in accordance with the provisions of the Automatic Signalling Regulations. Section is occupied, or for some other reason it is required that the train should be stopped.

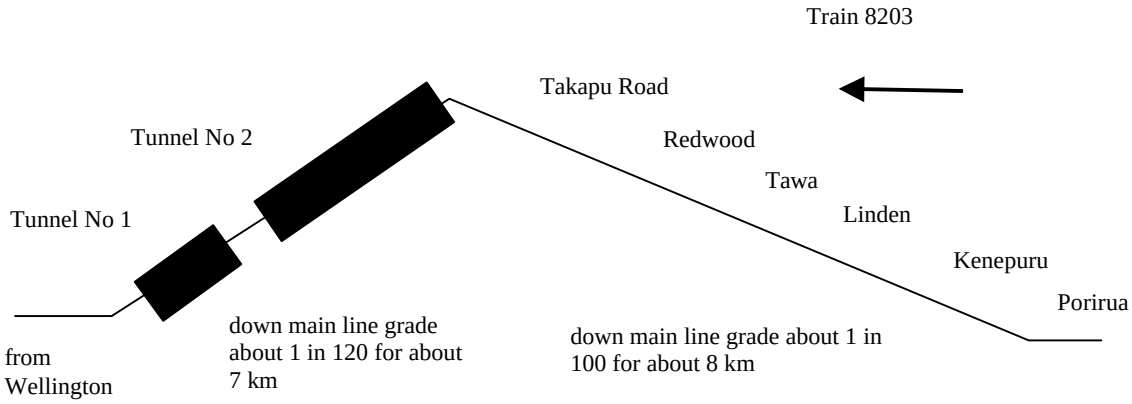

Figure 2
Gradient diagram Porirua to Wellington
(not to scale)

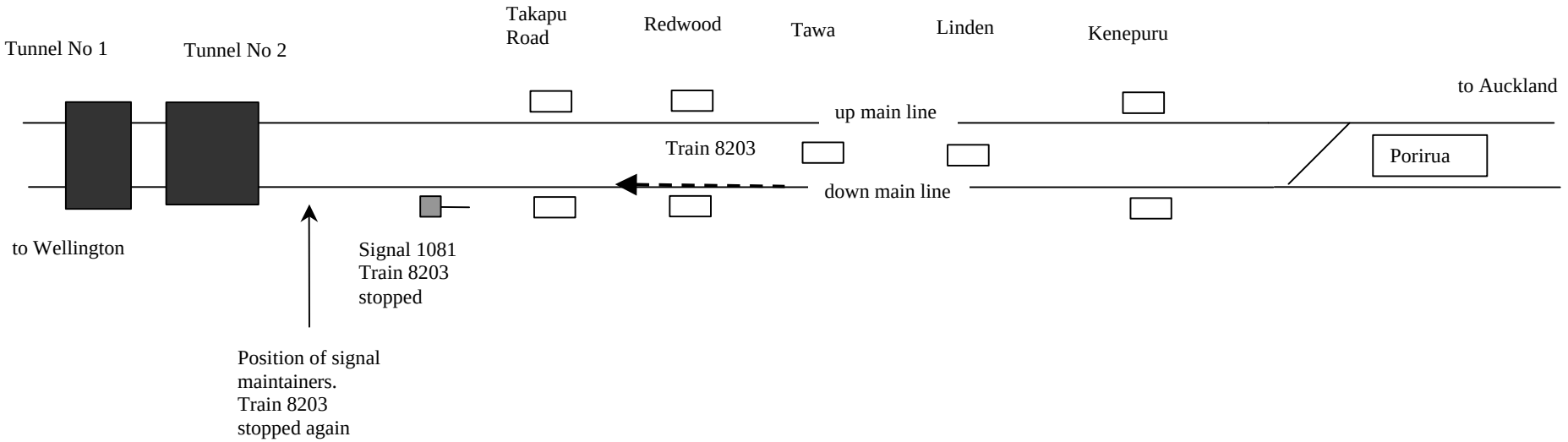

Figure 3
Route of Train 8203
(not to scale)

1.1.7 After the train had passed Signal 1081 it travelled slowly for about 1 km towards Tunnel No 2, where it came upon some signal maintainers working around the tracks, which required the train to stop. The LE was told that there was a signalling fault and that was why Signals 1157 and 1081 were displaying yellow and red indications respectively. As the LE applied power and Train 8203 started to move past the signal maintainers he noticed a further deterioration in the performance of the train. His estimated train speed was about 40 km/h as he entered Tunnel No 2 about one minute later.

1.1.8 As the last carriage passed the signal maintainer he noticed white cloudy smoke coming from the front bogey area of the last carriage. He assumed that one of the brakes had jammed on and notified train control immediately by cellphone.

1.1.9 A short time after Train 8203 entered Tunnel No 2 the LE noticed that the door light[3] was off. He mentioned this to one of the train assistants who was standing beside him and then turned around to look at the nearest door on the left-hand side of the carriage. The LE saw that the doors on that side of the carriage were open and immediately stopped the train.

1.1.10 The assistant went with his key to the nearest door control and closed the doors. He then proceeded through the train to check with the passengers to see if any other doors had opened. The passengers confirmed that all the doors on the left-hand side of all the cars had opened.

1.1.11 The check by train staff revealed that the two left hand doors of DM153 had not closed after the assistant had operated the door control and there was smoke in the passenger compartment. The source of the smoke could not be identified at that time. Because of the smoke and the defective doors the passengers in DM153 were evacuated to the passenger car in front. Before the train continued to Wellington, the doors in DM153 were manually closed using the door motors located under a seat adjacent to the doors.

Analysis 1

1. A detailed description of the train propulsion system and reason for the doors opening is given later in this report, but briefly, one of the resistor banks regulating the electric current to the traction motors on DM504 had burnt out leaving the traction motors on that car without power, which left DM153, the remaining motor car, to do all the work.

2. The resistor bank on the serviceable DM153 car heated to a point where the insulation encasing electric cables running through a conduit above the resistor bank melted, causing the conductors for the door control cables to short circuit, and opened the doors.

3. The smoke seen by the signal maintainer coming from the leading bogie of the last carriage was more than likely coming from the trailing bogie of DM153 immediately ahead, caused by the melting cable insulation. Some of this smoke probably infiltrated the carriage above once the LE had brought the train to a stop in the tunnel and there was no airflow to carry the smoke away from under the carriage.

1.2 Site information

1.2.1 The rail corridor between Porirua and Wellington consisted of a down main line for trains running to Wellington and an up main line for trains running to Porirua (refer Figure 3).

[3] The door light was a small light in the driving cab of the EMU and was illuminated while all doors on the service were closed.

1.2.2 The down main line ascended a grade of about 1 in 100 for nearly 8 km from Porirua to the northern entrance to Tunnel No 2 (refer Figure 2), and after entering the tunnel it descended a grade of about 1 in 120 for nearly 7 km through Tunnel No 2 and tunnel No 1 as it approached Wellington.

1.2.3 Signal 1018 was about 1 km south of Takapu Road and about 1 km from the northern entrance to Tunnel No 2 where the signal maintainer was working (see Figure 1).

1.3 Train information

1.3.1 The English Electric EMUs run with up to two trailer coaches (class D) to each motor coach (class DM). Trains of "red" [4] sets are made up in multiples of 3 cars.

1.3.2 DM153 was a motor-powered car EMU and was ordered from English Electric in 1946. This batch of English Electric EMUs entered service in Wellington between 1949 and 1954.

1.3.3 When operating Porirua EMU services the red sets typically consisted of 2 class DM motor powered cars with 4 class D trailer cars. Further 3 car sets were added when additional capacity was required.

1.3.4 Tranz Rail advised that the resistor banks in class DM EMUs were cooled by normal under-car airflow created as the train moved along. There was no forced ventilation installed and there was no warning light in the LE's cab to warn of an overheating or defective resistor bank. On a single 3 car (single DM) set a defective resistor bank would have brought the train to a stop. On a train of more than one set the LE would have experienced reduced power.

1.3.5 The drive system consisted of 4 series-wound DC electric motors (2 sets of 2 motors in series) and a set of contactors that switch the 2 sets in series or parallel with each other. Each dual motor set had a resistance block and field winding connected in series. The contactors were arranged to gradually decrease the resistance in steps in order to accelerate the train. Initially the 2 motor sets were arranged in series so that each set would operate at a maximum of half the pantograph voltage, and then when more speed was commanded they were switched in parallel so that they could each operate at the full pantograph voltage. Finally the field windings were reduced to accelerate the train to maximum speed.

1.3.6 Series-wound DC motors had a very high starting torque and accelerated to a speed limited only by the load or series resistance. When the LE selected series, the 2 motor sets were switched in series and maximum resistance was selected for each set. As the high torque accelerated the train, the motor current started to drop until it reached a lower preset limit. At this point the automatic controls effectively changed setting and bypassed some of the series resistance, which allowed the motor current to increase beyond the lower limit and further accelerate the train. This sequence repeated itself until the maximum speed was reached for the series configuration, at which time the LE selected parallel if he required more train speed.

1.3.7 The LE selected one of 4 speed positions and the automatic controls accelerated the train up to the maximum speed possible for that selection, remaining there until the LE made a new selection. These 4 positions were Inch (I), Series (S), Parallel (P) and Field Tap (FT).

1.3.8 If for any reason the train could not accelerate to the maximum speed of the LE's selection, the control system would hold it in a lower setting and part of the resistance block would remain in circuit. A resistor that conducted an electric current produced heat proportional to the square of that current which meant that in this situation the resistance blocks continued to generate a considerable amount of heat.

[4] Local terminology to describe the English Electric EMU sets used on Porirua services.

1.3.9 The resistance banks on DM class EMUs were air cooled by normal under-carriage airflows across the radiation fins. There was no force ventilation as the resistors were normally only in the circuit for short periods which limited the amount of heat that needed to be dissipated. If an EMU was held too long in a throttle setting the resistors remained in the circuit longer than intended and the resistor was heated beyond its normal operating temperature.

1.3.10 According to Tranz Rail records, about 15 resistor banks failed per year in the English Electric EMU fleet. There was no way for an LE or maintenance staff to predict a resistor bank failure so most failures occurred while EMUs were in service.

1.3.11 Resistor banks failed as a result of repeated heat cycles and often occurred through instances where an EMU was held too long in a particular throttle setting. The LE had no indication of the motor current and had to judge from his own drive experience whether the acceleration rate was normal or abnormal.

1.3.12 The ability to repair a resistor bank depended on where the failure occurred. To be repairable the failure had to be in a location where it could be bridged without cutting out a significant portion of the bank; otherwise, the bank was replaced.

1.3.13 Resistor banks could not be isolated. They would either operate correctly or not at all and the effect on the EMU's performance was dependent on the particular bank that failed.

Analysis 2

1. It was likely that the resistor banks on DM504 failed while under load climbing through Tunnel No 2 towards Porirua on the first run of the day. The EMU set had completed its previous running on the Friday before and had been placed to the storage yard. On Monday it had been brought from the EMU storage yard to the Wellington platform before starting its journey as Train 8202 to Porirua. None of the other LEs who had driven the EMU prior to its departure on that day had reported any problems.

2. If a resistor bank had failed on DM504 before Train 8202 had departed from Wellington the LE should have noticed a reduction in performance straight away. The fact that he did not notice the reduced performance of the train until it was climbing through tunnel 2 suggests that the failure of the resistor banks probably occurred about that time.

3. Because of the failure DM153 was the only power car operating and its resistor banks would have heated up significantly during the climb through tunnel 2. After emerging from the northern portal of Tunnel No 2 however, it was a downhill grade to Porirua and although the train was not going as fast as normal it was running non-stop and this would probably have provided enough air moving across the resistor bank cooling fins to dissipate any built up heat and cool them before arrival at Porirua.

4. The LE did not specifically inspect the resistor banks on DM153 or DM504 on arrival at Porirua but he did not see any smoke when he walked along his train to the south end driving cab prior to departure from Porirua.

5. Because of the defective resistor banks on DM504, Train 8203 had only one power car operating and the LE was therefore unable to lift the speed of the train to where there was sufficient air passing over the resistor banks on DM153 to cool them.

6. The signalling malfunction meant that Train 8203 had to make 2 additional stops as well as travel slowly for nearly 1 km after passing Signal 1081 at "stop". These additional disruptions occurred while on the steepest part of the grade up to the northern portal of Tunnel No 2 and would have exacerbated the overheating of the resistor bank.

7. The overheating of the resistor banks in power car DM153 was caused by an extended period of traction motor overload that generated more heat than could be effectively dissipated.

8. As a result, a metal conduit which passed directly over the resistor bank also heated up and two door control wires which ran through the conduit fused together when the wire insulation melted. This shorted the conductors together and opened the doors.

9. The positioning of a non-insulated metal conduit conveying safety-critical wiring directly above a potential source of heat generation was an undesirable practice. Although overheating incidents of this type were rare there was an opportunity for this to occur in EMU consists of more than one DM motor car if a resistor bank failed.

1.4 Personnel

1.4.1 The LE had joined Tranz Rail in 1983 and had worked as a shunter and train examiner before entering the Tranz Metro Drivers Training School in 2001. He was on his first solo shift since being certified on 12 July 2001 to drive EMUs.

1.4.2 Prior to certification the LE had undertaken 4 weeks of rules and regulations training at an EMU driver's school, after which he sat and passed an examination. He then went to on-the-job training for a period of about 3 months during which time he was required to complete 216 hours of actual driving time while under tuition before receiving his final assessment.

1.4.3 The LE said that he was aware of the process of elimination method of determining which power car was defective. This procedure involved cutting out the power car that the LE thought was operating correctly and then attempting to move the train using just the remaining power car. If the train did not move it confirmed that the power car in question was defective.

1.4.5 Before the LE started on-the-job training he had to complete a test in fault finding. This was a practical test to ensure the participant could identify failure symptoms and action remedies. One relevant section was titled "Resistance grids burnt out".
A copy of the tick list is attached as Appendix 1 to this report.

1.4.6 Tranz Rail provided a copy of instructions from Rail Operating Code Supplement 4.15, Instructions 10.1 and 10.2, which detailed the blocking in of the no-volt relay to provide power if a defective resistance bank existed and is attached as Appendix 2 to this report. The LE advised that he was aware of this procedure and that it had been covered during his training.

1.4.7 Tranz Rail's Rail Operating Code, Code Supplement 4.15 Operating Instructions for D/DM Electric Multiple Units clause 7.2 stated in part:

> 7.2. Traction Motor Failure in Emergency Operation
>
> The following trains must not run:
>
> (ii) Trains with one motor coach cut out.
>
> 6 coach train - Tawa - No 2 tunnel, (north end)

This instruction was included in the training programme for trainee EMU LEs, and the LE confirmed that he was aware of it and that it had been covered during his training.

1.4.8 Emergency procedures for EMUs in Tunnel No 2 are included in Rail Operating Code, Code Supplement CSR 3.2 Duties of Tranz Metro Train Managers etc Instruction 4.6. which stated in part:

> If a fire is seen, or smoke is smelt, or if a passenger reports a fire, the following steps must be taken:
>
> 4.6.1 Passenger Trains / Multiple Units
>
> Relocate the passengers to an adjacent carriage / multiple unit...

There were no specific procedures relating to Tunnel No 2.

Analysis 3

1. The LE also knew of the procedures for identifying defective traction motors and for the blocking in of the no-volt relay in a defective resistance bank, yet he did not follow them. Instead, after consulting with the train guard, he chose to return to Wellington as scheduled.

2. When the LE spoke to the guard at Porirua he was probably calling on the guard's previous experience as an EMU fitter. When he was told that "one of the traction motors might not be working" and no other qualifying statement was made it was possible he took that as implicit approval that it was okay to return the set to Wellington in that condition. There was no requirement for a train guard to know the procedures for the running of EMUs with power cars cut out.

3. According to Tranz Rail's Operating Code a 6 car set with one motor coach cut out was prohibited from running between Tawa and the northern portal of Tunnel No 2. The LE confirmed that he was aware of this instruction and that Train 8203 should not have departed from Porirua with one motor coach cut out. He could offer no reason as to why he had done so nor why he had not attempted to identify and rectify the problem as he had been taught during his training. The LE could also have contacted the EMU fitter at Wellington for advice if he was unsure of what action to take.

4. Train 8202 was already 10 minutes behind schedule when it arrived in Porirua. It is possible that because of his inexperience the LE accepted the guard's comments as approval to proceed, rather than delay the return of the service and further inconvenience passengers while he analysed and rectified the problem. He could also have decided that the defective EMU was better in Wellington where the fitters would have been able to examine it rather than at Porirua. Whatever the reason, his decision to return to Wellington without first identifying the defective traction motor and implementing the blocking in of the no-volt relay procedure was a result of his inexperience and was a major factor contributing to this incident.

5. Tranz Rail had provided adequate procedures for the identifying and rectifying of defective power cars when in service and since the incident has reinforced with EMU LEs the procedures for the running of EMUs with traction motors cut out (refer 3.1). The LE had been made aware of these procedures during his training but the reinforcement of these procedures with all LEs is seen as a positive action.

1.5 A later incident involving DM504

1.5.1 About one week after this incident power car DM504 was again part of scheduled EMU service Train 8202 from Wellington to Porirua with an experienced LE on board.

1.5.2 The train departed Wellington and the LE became aware that the service was sluggish. He had experienced similar problems before and on arrival at Porirua he followed the "process of elimination" and identified the defective power unit. He then closed the no-volt relay from a switch on the side of the defective resistor bank. This allowed the switches within the defective resistor bank to work and bypass the current around the damaged banks. This effectively meant that the train was dependent on only one traction motor until it reached a speed at which the damaged banks had been surpassed and the affected traction motor then became operational again.

1.5.3 The LE arranged for one of the train assistants to telephone the EMU fitter in Wellington and tell him what he had done. The fitter confirmed that the action taken by the LE was correct and the service returned to Wellington as Train 8203 with a combination of one and 2 power cars operating.

1.5.4 This was the second resistor bank failure for DM504 in two weeks. Tranz Rail advised that following its failure on Monday, 16 July, the defective resistor bank had been repaired but had been replaced after the second failure. The second failure was not related to the earlier failure nor to repairs made to the resistor bank at that time.

1.6 Radio communications

1.6.1 The TC said when he received the phone call from the signal maintainer he immediately attempted to make contact with the LE by radio but was unsuccessful. The TC then called out a communications technician to investigate the reason and noted in his occurrence log:

> No 8203 was a red set and LE had a handheld radio (longstanding problem with handheld radio in EMUs) - concern TCO could not establish reliable radio comms with this service while in the tunnel.

The portable radios were supplied by Tranz Rail as standard on English Electric class D and DM EMUs.

1.6.2 The LE had tried to contact the TC by his portable radio before moving off after the doors had been closed in Tunnel No 2 but was unsuccessful. He tried again between Tunnel No 2 and Tunnel No 1 and had made brief contact but that had been lost again when his train entered Tunnel No 1. After emerging from Tunnel No 1 he had re-established contact with the TC and advised him of the situation.

1.6.3 Tranz Rail advised that technical staff visited the Tunnel No 2 radio equipment site on 16 July 2001 and found a coaxial connector on the tunnel VHF system was loose. This caused about a 30 dB loss to the transceiver. The connector was cleaned and tightened and normal performance was restored and tested. EMU services can normally contact train control by portable radio while in Tunnels 1 and 2.

1.6.4 On 17 August, Tranz Rail advised that rodents had chewed through cable at or near Bridge No 3 which may also have affected the performance of the VHF radio system on 16 July 2001 although they were unable to confirm this with any certainty. However, once cable repairs were completed on 17 August the system was again fully tested.

1.6.5 In each case following repairs the radio system in Tunnel No 2 was restored to the standard required for the correct operation of Alternative Train Crewing (ATC)[5] radio equipment.

1.6.6 The ATC radio system was required to provide the following functions:

- voice contact between LEs and Train Control at all times
- the ability for Train Control to selectively call a particular locomotive radio
- the ability for a locomotive to register a call on the train control radio computer
- the ability for a locomotive to send an emergency call to the train control radio computer
- the ability for a locomotive to send a vigilance call to the train control radio computer
- the provision of a portable radio to provide voice contact between an LE and train control in case the LE had to leave his cab.

1.6.7 EMU services were not designated as ATC services as they had 2 train crew members however, radio equipment that enabled voice contact between EMUs and train control was provided in the form of portable radios.

1.6.8 The Commission recently investigated another occurrence where the poor performance of portable radios was found a factor contributing to a collision between 2 diesel multiple unit (DMU) services at Ellerslie (Rail Occurrence Report 00-123). In that report Tranz Rail advised that it was aware of the wider issue of radio communication difficulties involving DMUs and was in the process of replacing portable radios with fixed radios in all DMU cabs. The Commission made a safety recommendation covering radio performance in the report (Safety Recommendation 047/01).

1.6.9 Tranz Rail advised that a programme was currently underway to equip the English Electric EMUs with fixed in-cab radios which will:

- eliminate potential battery and antenna damage
- provide an improved antenna set-up
- increase the radio transmission power.

Analysis 4

1. The note made by the TC when logging the communication fault suggested that EMU portable radio difficulties within the tunnels were not uncommon. This was confirmed by the inability of the LE to maintain radio communication with the TC once his train entered Tunnel No 1.

2. The actions of the train crew in moving passengers to the next forward carriage was appropriate and conformed to documented procedures. In this case the train was able to continue to Wellington without further event. However, if the train had been immobilised in the tunnel for some reason, the absence of effective radio communication with train control could have seriously delayed any emergency response and placed the passengers at greater risk.

[5] single person crewing

3. The upgrade from portable to cab-mounted radio sets in English Electric EMUs by Tranz Rail as defined in Safety Action 3.3 should improve the quality of radio communications. This system will match the reliability of the ATC system but will not have all the features which, because the EMUs always run with a minimum crew of 2 when on the main line, are not required.

2. Findings

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

2.1 The uncommanded opening of the doors on Train 8203 in Tunnel No 2 was the result of an electrical short circuit in the door control system. The short circuit was caused by 2 electric cables fusing together when the conduit in which they lay was heated from below by a resistor bank.

2.2 The resistor bank overheated for 2 reasons:

- the 2 traction motors it was regulating became overloaded as the train ascended the grade to Tunnel No 2 because the other power car in the train was not operating due to its resistor bank burning out.
- the slow speed of the train as it climbed the grade, combined with the frequent stops and enforced slow running did not allow sufficient natural air flow required to cool the resistor bank.

2.3 The routing of non-insulated conduit carrying safety-critical electrical cables above a potential source of heat was a latent weakness in the original design that contributed to the incident.

2.4 The LE's training had covered how to detect, fault-find and rectify for a burned out resistor bank, and the Tranz Rail procedures prohibited Train 8203 from continuing with the service until this had been done. The reason for the LE continuing with the service was not established, but was likely due to his inexperience and his desire to provide the travelling public a timely service.

2.5 The faulty radio communication system and the use of portable radios in Tunnels 1 and 2 had the potential to delay any emergency response and increased the risk to crew and passengers.

2.6 The actions of the train crew in response to the doors opening in the tunnel and the indications of fire were appropriate and conformed to Tranz Rail procedures.

3. Safety Actions

3.1 On 24 August 2001, Tranz Rail advised that:

The incident was extremely rare and was the product of a number of combined factors, creating the particular set of circumstances. No similar event can be recalled in recent times.

The following steps are being taken to further reduce the chance of a recurrence:

1. Employees are being reminded of Rail Operating Code procedures for running EMU's with motors cut out.

2. Questions on Rail Operating Code procedures for running EMUs' with motors cut out will be included in CAT (Computer-Aided Training) tests in the future

> 3. The feasibility of insulating the wiring conduit in situ is being investigated. Assuming suitable material can be found it will be progressively installed while the DM's are lifted for heavy repairs.

On 8 November 2001, Tranz Rail advised:

> An insulating material has been applied to one unit while it was lifted for heavy repairs. Insulating material will be progressively installed across the fleet.

On 23 November 2001, Tranz Rail advised that this work was due to be completed by March 2002 in conjunction with the installation of fixed in-cab radios.

3.2 In view of the safety actions taken, no safety recommendations regarding staff training or the insulating of the wiring conduit are necessary.

3.3 On 8 November 2001, Tranz Rail advised that they:

> ... have a programme to install fixed in cab radios. This is taking place as each EMU visits Hutt workshops for maintenance.

On 23 November 2001, Tranz Rail advised that this work was being undertaken in conjunction with the insulating of the wiring conduits and was due to be completed by March 2002.

3.4 In view of the safety action taken, no safety recommendation regarding the improving of the radio communications between English Electric EMUs and train control is necessary.

Approved for publication 05 February 2002

Hon. W P Jeffries
Chief Commissioner

Appendix 1

L. Carry out fault finding D/Dm EMU Set - will not move Master Controller "Dead"/"Alive"

TASK	ACTIONS	ASSESSOR	
		Date	Initials
Will not move Master Controller dead			
Reverser not in direction of travel	Place in direction of travel		
Control switch turned off	Turn on Control switch		
Control fuse blown	Replace with tested fuse		
Brake valve isolating cock not cut in correctly	Cut in correctly		
Trip valve isolating cock closed	Open trip valve isolating cock		
Control Circuit Governor contacts open	Restore brake pipe pressure		
Control Circuit Governor defective	Use the by pass (ask questions)		
Jumper-out-loose-defective	Check or change jumper		
Isolator selector switch off	Turn on		
Main low tension fuse blown	Replace with a tested fuse		
Motor generator fuse blown	Assistance required. More than on DM. insert emergency fuse links		
Master Controller alive			
Air or hand brake applied	Release brakes		
Over load relay tripped	Reset (ask questions)		
Train line contractor fuse blown	Replace with a tested fuse		
Control cut out "cut out"	Cut in		
Yellow Jumper out-loose-defective	Check or change		
Resistance grids burnt out	Block in the no volt relay advance controller to series		

Appendix 2

10.0 Fault Location

10.1 Trainset will not move - Master Controller Dead

If the trainset will not move and the master controller is dead, i.e. the low voltage electrical circuit is not complete, check the following causes and remedy.

* Reverser not in direction of travel - rectify.
* Control switch turned off - turn on (CB's B1 and B2 on Johnsonville sets)
* Control fuse blown - replace with a tested fuse
* Trip valve isolating cock closed - open.
* CCG defective - use the bypass.
* Brake valve isolating cock not cut in correctly - rectify.
* Isolator selector switch turned off - turn on.
* Main low tension fuse blown - replace with tested fuse (not on Johnsonville sets).
* Motor generator high voltage fuse blown - arrange for assistance. If more than one DM in consist - insert emergency fuse links
* White jumper out, loose, defective, if driving from a trailer - check or change. (Only as a last resort, usually at a Depot).
* If more than one DM in consist - insert emergency fuse links.

10.2 Trainset will not move - Master Controller Alive

If the trainset will not move and the master controller is alive, check the following causes and remedy.

* Air or hand brakes applied - release brakes.
* Overload relay tripped - reset.
* Train line contactor fuse blown - replace with tested fuse (not on Johnsonville sets).
* Control cut out - cut in.
* Yellow jumper out, loose, defective - check or change.
* Resistance grid burnt out - block in the no volt relay and advance the master controller to series to gain traction motor power.

The knob for manual control of the no volt relay is located on the frame between numbers 3 and 4 panel on A side and is blocked in by one of the flags. The flags are located in the bottom of the electrical cabinet in the luggage compartment. The handgrips on the covers are designed so that when the no volt relay is blocked in by the flag, the flag handle is locked in place by the handgrips. With the no volt relay blocked in, it is then by-passed allowing the master controller to be moved to series. The start off will be quite rough in comparison to normal operating. When the no volt relay is being blocked in there is no need to lower the pantographs as no side covers are removed.