Report 07-103, passenger express Train 200, collision with stationary passenger express Train 201, National Park, 21 March 2007

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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.

Report 07-103

passenger express Train 200

collision with stationary passenger express Train 201

National Park

21 March 2007

Abstract

On Wednesday 21 March 2007, passenger express Train 200 collided with the rear of stationary passenger express Train 201 during a planned setback manoeuvre at National Park when radio communication failed.

One passenger travelling in the rear passenger carriage on Train 200 received a minor injury. The buffer at the rear of the train was damaged.

A safety issue identified was the reliance, during the setback movement, on a single line of communication between the locomotive engineer and the train manager piloting the train from the rear carriage. Safety actions have been taken to address the safety issue.

Figure 1
Location of incident

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Abbreviations

CTC	centralised traffic control
km/h	kilometre(s) per hour
m	metre(s)
Toll Rail	Toll NZ Consolidated Limited
UTC	co-ordinated universal time

Data Summary

Train type and number:	passenger express Train 200	
Date and time:	21 March 2007, at about 1300[1]	
Location:	National Park	
Persons on board:	Train 200 crew:	3
	passengers:	about 50
Injuries:	crew:	nil
	passengers:	one minor
Damage:	minor	
Operator:	Toll NZ Consolidated Limited (Toll Rail)	
Investigator-in-charge:	P G Miskell	

[1] Times in this report are New Zealand Standard Time (UTC + 12) and are expressed in the 24-hour mode.

1 Factual Information

1.1 Narrative

1.1.1 On Wednesday 21 March 2007, Train 200 was the Wellington to Auckland Overlander passenger express. The train departed from Wellington with a consist of a single diesel locomotive, one combined generator car/luggage van AG 49, and 4 passenger carriages AO123, AO48, ASO31 and AO215. The train was driven by a locomotive engineer and crewed by 2 train managers, one of whom carried out train attendant duties.

1.1.2 The train attendant became aware during the pre-departure check that there was no hand-held radio available for on-board staff. The platform manager then issued a replacement radio to the train attendant. The radio was checked to confirm that calls could be transmitted to and received from the locomotive engineer before the train departed at the scheduled time of 0730.

1.1.3 The train manager said that the radio reception was crackly at Paraparaumu when calling the locomotive engineer to confirm that the train was ready to depart. However, normal reception was restored after the radio was switched off then switched on again to repeat the confirmation.

1.1.4 At about 0935, Train 200 arrived at Palmerston North for a scheduled locomotive exchange and from where a replacement locomotive engineer took over driving duties. At about 0945, Train 200 departed with electric locomotive EF30094 on the head. The total length of the train was about 108 metres (m). The train manager said that the radio reception was again crackly when listening to the conversation between the locomotive engineer and the person in charge of a protected work site about 5 kilometres north of Palmerston North.

1.1.5 On the same day, Train 201 was the Auckland to Wellington Overlander passenger express. After a locomotive exchange at Hamilton, the train consist was single electric locomotive EF30232, one combined generator car/luggage van and 3 passenger carriages, with a total train length of about 90 m. The train was driven by a locomotive engineer and crewed by 2 train managers, one of whom carried out train attendant duties.

1.1.6 The Overlander timetable provided a 45-minute refreshment stop and a crew exchange for both trains when they crossed at National Park. Ontrack's[2] procedures specified that when 2 passenger trains crossed at National Park and it was necessary for both trains to berth at the platform, the first train to arrive berthed at the platform. The second train ran around it via the crossing loop and then set back to the platform while being piloted by the train manager from the rear carriage (lead carriage when setting back). Train 201 was scheduled to arrive at 1253 with Train 200 scheduled to arrive some 7 minutes later.

1.1.7 On 21 March 2007, Train 201 and Train 200 were both running a few minutes ahead of schedule approaching National Park. The train controller discussed berthing options with the respective locomotive engineers before determining that Train 201 would continue on the main line and berth at the platform. Train 200 would be routed around Train 201 via the crossing loop before setting back on the main line to the north end of the station platform. The locomotive engineer on Train 200 conveyed these berthing instructions by radio to the train manager.

1.1.8 At 1250:23[3], Train 201 passed Down Home Signal 8L at National Park on its approach to the station platform. The train manager, who was positioned close to the observation window of the rear passenger car, maintained radio contact with the locomotive engineer and called him to stop clear of the designated stopping point marked on the 129 m long station platform (see Figure 2).

[2] Ontrack was the owner and access provider of the controlled rail network.
[3] Times were taken from Ontrack's centralised train control (CTC) data log.

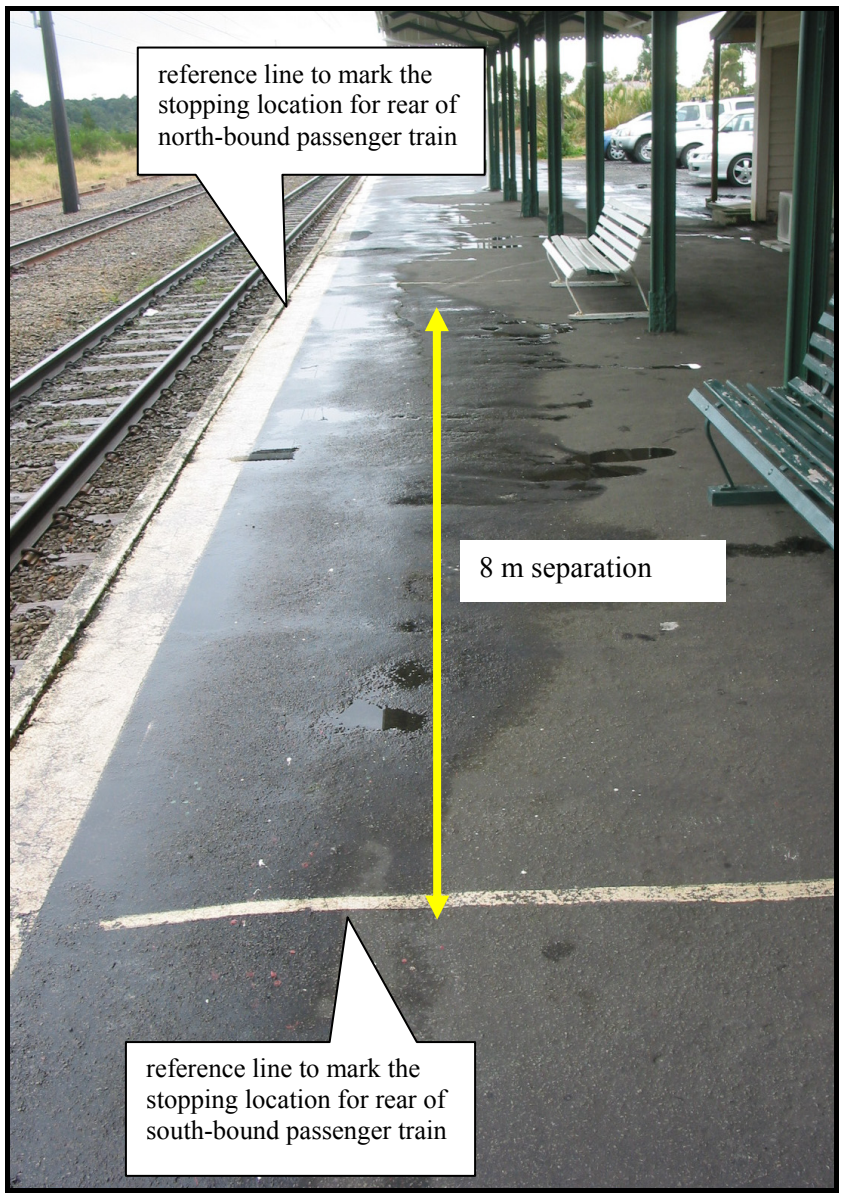

Figure 2
Designated stopping locations for passenger trains at National Park Station

1.1.9 At 1252:54, north-bound Train 200 entered the crossing loop at the south end of National Park, passed Train 201 and then crossed back to the main line at the north end. The locomotive engineer stopped the train when the train manager told him that the last carriage had cleared Signal 8L (see Figure 3). The north-end main line points were then restored to normal for the setback movement to the platform.

1.1.10 Before the setback movement started, the train attendant on Train 200 made a public address announcement instructing all passengers to return to their seats and remain seated until the train was berthed alongside the station platform.

1.1.11 About a minute after Train 200 cleared Signal 8L, the signal was changed to a low-speed aspect. The train manager then radioed the locomotive engineer with the instruction that "we are now ready to set back". The locomotive engineer walked across to the off-side of the locomotive cab to satisfy himself that the low-speed light was displayed on Signal 8L, then he gave 2 blasts on the whistle before starting the setback movement. He said that he put the train brake on lightly to stop any surging and used the throttle to push back quietly.

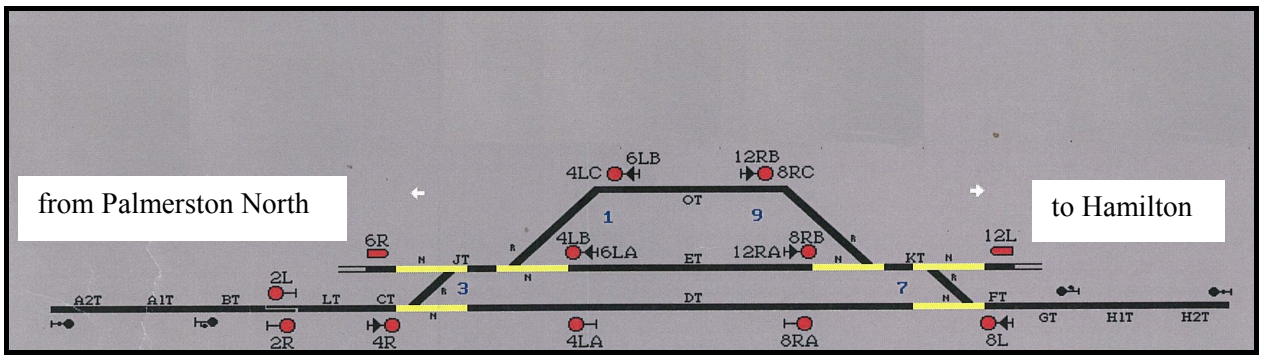

Figure 3
Signals layout at National Park (provided by Ontrack)

1.1.12 In spite of the instruction made over the public address system for passengers to be seated, some passengers stood next to the train manager at the rear of the carriage during the setback movement. One of the passengers, who was making a video recording at the time, recorded the conversation between passengers and the radio communication between the train manager and the locomotive engineer during the setback movement.

1.1.13 As the train got closer to the platform, the train manager was radioing to the locomotive engineer the distance to the marked stopping location. The train manager called 5 carriages to go, which was acknowledged by the locomotive engineer, then 4 carriages to go, but the train manager did not receive acknowledgement from the locomotive engineer. Just as the train manager started to call "3 carriages to go" the radio produced a loud "squealing" sound sometimes referred to as negative feedback. The "squealing" was continuous for 10 seconds.

1.1.14 Normal radio transmission resumed when the train manager called one-half a carriage length to go. No acknowledgement was received, so the train manager activated the emergency brake after the rear carriage had crossed the stopping location marked on the station platform. The locomotive engineer became aware of the emergency brake application just as he felt what he described as a minor bump.

1.1.15 The locomotive engineer from Train 201, standing at the north end of the platform, was observing Train 200 setting back. As the first passenger car went by, he heard that the train brake was on and saw that the brake cylinder pistons were extended. He thought initially that the train would stop short of Train 201 but then realised a collision was imminent, so he turned to face the approaching locomotive and gave the "Danger-Stop" hand signal by raising both arms above the level of his head.

1.1.16 One passenger sitting in the rear passenger car on Train 200 suffered a minor injury. There were no passengers on board Train 201 at the time of the collision.

1.1.17 On hearing the impact, the train attendant and locomotive engineer from Train 201 inspected the damaged couplings (see Figure 4) then went to the head of Train 200 to tell the locomotive engineer that there had been a collision. The locomotive engineer on board Train 200 radioed train control and reported the collision.

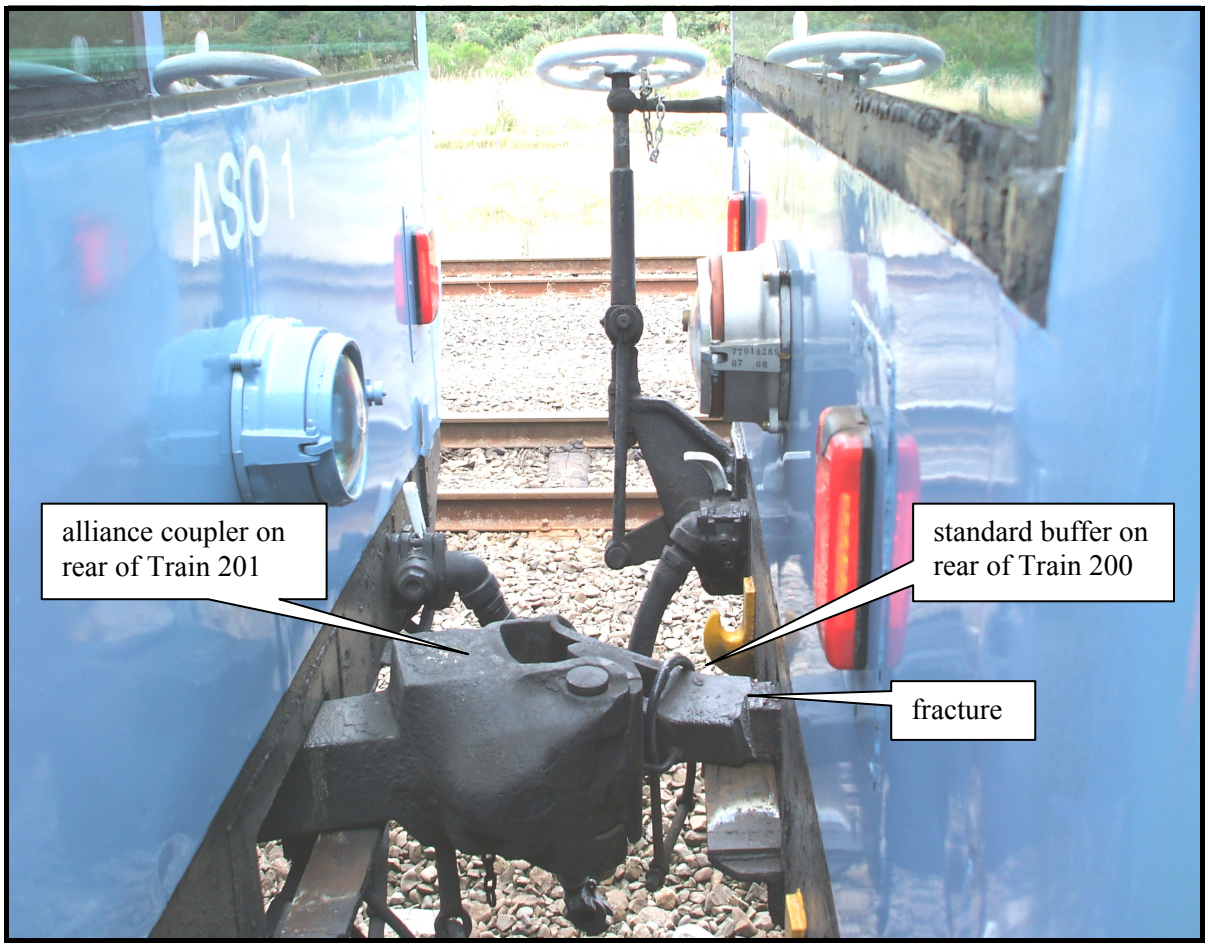

Figure 4
Impact damage to couplings (provided by Toll Rail)

1.2 Procedure for passenger trains crossing at National Park

1.2.1 The Ontrack Rail Operating Procedures section L3 stated in part:

> **6.11.2 Crossing of Passenger Trains**
>
> When two through passenger trains are to cross at National Park and it is necessary for both services to berth at the platform the following procedure will apply for the first train that is to berth at the platform.
>
> The first train to arrive is to berth at the platform, the second train will run via the loop on to the main line, and then set back to the platform. The setting back movement **must** be authorised by Train Control in accordance with CTC Regulation 1c and **must** be piloted by the Train Manager in accordance with Rule 124 c.

1.2.2 Toll Rail's operating instructions for crossing the Overlanders at National Park were effective from 11 April 2005 and stated in part:

> **Train Operating Instructions**
>
> The National Park Station Canopy is equal to 2 carriage lengths.
>
> **200 On Time and 201 On Time**
>
> 201 will be berthed first on the Main Line at National Park with the last trailing carriage stopping close to the shelter of the canopy.
>
> The passenger work is to be completed, by inbound onboard service train crew.

During the piloting movement of Train 200 under the guidance of the Train Manager, onto the Main Line at National Park, Train 201 will maintain radio silence.

200 will run via the loop, out onto the Main Line at the North end of National Park, stopping clear of No 8L ABC signal.
The Train Manager acting as pilot will assist the driver.
After obtaining a low speed light (8LC") on the North side of "Fisher Road Level Crossing" Train 200 will be piloted backwards up the main line under the direction of the Train Manager using the hand held radio.
The Train Manager will stop the train short, clear by at least 1 carriage length from the rear of 201 service.

NB. Should at anytime the radio communication fail, Train 200 will remain stationary until the Train Manager and Locomotive Engineer have conferred and the train will be piloted under the direction of hand signals.

The setting back movement MUST be authorised by Train Control and MUST be piloted by the Train Manager in accordance with Rule 124 c.

201 Onboard Service staff will be responsible for ensuring the safety of all person/s remaining clear of the intending setting back movement of Train 200 at National Park Station.

The passenger work is to be completed, by inbound Onboard Service train crew.

1.3 Event recorder and radio tests

1.3.1 The event recorder on electric locomotive EF30094, Train 200, was downloaded for analysis. A total of 5 minutes 56 seconds of data at one-second intervals was extracted from the event recorder's short log. The setback movement resulting in the collision lasted 2 minutes 37 seconds.

1.3.2 Analysis of the short log data showed that:

- at the time of the incident the Locolog data recorder was working correctly
- there was a -10 kilopascal error on the brake pipe transducer so that the release pressure in the brake pipe was shown as 540 kilopascals instead of the standard 550 kilopascals
- at 66 seconds before logging ceased, a minimum reduction automatic brake application was made. The application was bled off on the locomotive so that the locomotive was pushing against a train with minimum braking already applied. The speed began to drop from 15 kilometres per hour (km/h) after the brake application was made
- at 12 seconds before logging ceased, the train was travelling at 5 km/h in notch 1 when an emergency brake application was made (by the train manager)
- at 11 seconds before logging ceased, the collision probably occurred while Train 200 was travelling at 5 km/h
- at 10 seconds before logging ceased, the movement was stopped and the locomotive throttle was off.

1.3.3 On 22 March 2007, the day after the collision at National Park, radio #36527 was bench tested in both transmitter and receiver modes. The radio performance met Ontrack's radio standards.

1.3.4 On the same day radio #10535 and portable radio #11352, fitted to electric locomotive EF30094, were both tested in transmitter and receiver modes. No deviation from Ontrack's standards was identified, so both radios were deemed fit for purpose.

1.4 Personnel

1.4.1 The locomotive engineer on Train 200 had been driving passenger trains for about 28 years and had been based at Palmerston North for most of his 44 years' driving experience.

1.4.2 He was qualified to operate electric locomotives, diesel locomotives and steam locomotives. His certification was current at the time of the collision.

1.4.3 He was familiar with the berthing arrangements at National Park but he said that it was probably about the third time only during the previous 5 years that he had arrived on Train 200 after Train 201, which required his train to run via the loop and then set back to the platform. He said that from his experience the Up Overlander had berthed on the main line ahead of the Down Overlander about 95% of the time.

1.4.4 The train manager on Train 200 had held a train manager qualification for about 20 years. The train manager's certification was current at the time of the collision.

1.4.5 On 24 February 2007, the train manager was observed "casually" while Train 200 was berthing at National Park. Both radio procedures and piloting position were reported as meeting requirements.

1.5 Other similar incidents reported at National Park

1.5.1 On 15 February 2006, a near collision was reported when Train 201 was setting back on the main line at National Park towards stationary Train 200. The train manager temporarily lost radio contact with the locomotive engineer. Train 201 stopped short of the rear carriage of Train 200.

1.5.2 On 6 March 2008, the New Zealand Transport Agency was advised that on the previous day Trains 200 and 201 had collided during a setback movement at National Park Station. The trains had resumed their respective journeys after the train crew inspected the carriages.

2 Analysis

2.1 The collision at National Park between Train 200 and Train 201 was essentially a low-consequence event. The crossing manoeuvre was normally conducted with one train stationary and the other train setting back at low speed. While the potential for injuries to passengers on board each train was there, as in this case, they were unlikely to be serious. On the other hand, the potential frequency for this type of accident was high as the crossing manoeuvre was carried out on most days that the Overlander passenger trains operated. Radio communication had failed on at least one other reported occasion before this accident and failed again about 12 months later. Radios can fail for a number of reasons, ranging from technical faults in the equipment from something as simple as a flat battery to operator error or interference from other sources. For this reason the Transport Accident Investigation Commission does not address how or why the radio communication failed on this occasion, but more the effect of that failure and how the hazard could be mitigated.

2.2 While the berthing of Train 200 and Train 201 on the main line at National Park was a routine event, what was unusual on this occasion was that south-bound Train 201 arrived ahead of north-bound Train 200. Train crews indicated that during the 3 years preceding this collision Train 200 had arrived at National Park ahead of Train 201 about 90% of the time. Nevertheless, the setback movement was not difficult and should have been successful provided the procedure was robust and it was being followed.

2.3 The train manager was correctly positioned near the observation window of the rear passenger carriage while north-bound Train 200 was routed via the crossing loop and through the north-end turnout back on to the main line clear of Signal 8L. After the train manager had given right-away to the locomotive engineer for the setback movement, the locomotive engineer demonstrated caution by re-checking the signal aspect being displayed before he started the setback movement. The locomotive engineer had his train under control in power notch 1 while gradually increasing speed to a maximum of 15 km/h after 90 seconds, when he made a minimum automatic brake application. The rear carriage was about 134 m short of the designated stopping point when the minimum brake pipe pressure reduction was made.

2.4 The train speed slowed to 12 km/h when the train manager radioed "5 carriages to go" and the locomotive engineer confirmed. The radio "squeal" on the train manager's radio started as the rear passenger carriage was passing the northern end of the station platform at about 10 km/h. The train travelled about 27 m or one and a half carriage lengths during the 10 seconds of radio "squeal". By the time the train manager had composed herself and made the next radio transmission, the train had slowed to 7 km/h but was only one-half a carriage length from the designated stopping point. The train manager knew then that the train was not going to stop in time, so terminated the radio transmission and went as directly as was possible, between passengers standing, to activate the emergency brake.

2.5 Because the train manager was not positioned beside the emergency brake, vital time was lost while negotiating her way from beside the rear observation window to and activating the emergency brake. In addition to the passengers standing and being "in the way", the presence of the passenger recording the setback movement and idle chatter had the potential to distract the train manager performing critical pilot duties. Had all the passengers been seated, as instructed, the train manager would have had a more direct route to the emergency brake and could have activated the emergency brake earlier and possibly stopped the train before its impact with stationary Train 201.

2.6 The risk of a radio failure during the piloting movement at National Park had been recognised by Toll Rail and its procedures required that should the radio communication fail, the train would remain stationary until the train manager and locomotive engineer conferred. The berthing movement would then be completed by being piloted under the direction of hand signals.

2.7 The fact that a near hit had occurred before this accident and another collision followed it, both due to a similar failure of a single line of communication, indicated that Toll Rail's internal investigation and remedial action taken for continuous improvement of procedures required further refinement.

2.8 The safety actions taken by KiwiRail[4] have removed the risk of failure of the single line of communication by changing the procedures and subsequently amending the Overlander train schedule to eliminate the need for the setback manoeuvre at National Park.

[4] KiwiRail assumed responsibility for the operation of the Overlander passenger services on 1 July 2008.

3 Findings

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

3.1 The crew on passenger express Train 200 was qualified to conduct the setback manoeuvre at National Park and was following all procedures associated with it.

3.2 The collision occurred when the single line of communication between the train manager piloting the train from the rear carriage and the locomotive engineer at the head of the train failed.

3.3 The final opportunity to prevent the collision was the train manager engaging the emergency stop, but possibly distraction from passengers standing in the carriage delayed this action, and the same passengers may have extended the time it took the train manager to reach the emergency stop.

4 Safety Actions

4.1 In July 2007, Toll Rail's Manager, Palmerston North issued a local instruction for the safe berthing of Overlander passenger trains on the main line at National Park.

> **SCOPE:**
>
> This Local Instruction provides for the safe berthing of Overlander passenger Trains 200 and 201 on the mainline at National Park.
>
> **SIGNAGE & MARKINGS:**
>
> Two "yellow" lines on the station platform marking the stopping locations of the rear of each train.
>
> A sign at either end that when obscured from OIC view marks the point where there are *ten carriage lengths* to the stopping location of the rear of the second train [sic].
>
> **RADIO COMMUNICATION:**
>
> The following additional radio procedures will apply:
>
> All personnel involved in berthing trains must use *Channel 1 with scan disabled*.
>
> The OIC must call every *ten seconds* after the reversing movement is commenced until the *ten carriage lengths* sign is reached.
>
> Beyond the *ten carriage lengths* sign calls must be made *10 – 8 – 6 – 4 – 3 –2 – 1 – ½ - Stop.* From the *3 lengths* call the PTT must be activated *continuously*.
>
> To provide a secondary level of protection the Train Manager will be required to apply the emergency brake if communication is lost with the Officer in Charge.
>
> *Channel 1* is a general use channel. Should any radio transmissions not associated with the berthing movement be heard the movement must be *stopped*. Other radio users are then to be requested to maintain radio silence until confirmation the movement has been completed *before* the movement re-commences.

RESPONSIBILITIES:

The Train Manager of the first train to arrive will be responsible for positioning the first train to arrive.

The Locomotive Engineer of the first train will become the OIC and will be responsible for calling the reversing movement of the second train after confirmation of a *proceed* indication on the Home signal.

The Train Manager of the second train will be responsible for:

Confirming to the locomotive engineer and OIC that the Home signal is at *proceed* for the reversing movement.

Monitoring radio communication from the OIC.

Standing immediately adjacent to the carriage emergency brake facility and activating this if an *emergency stop signal* is exhibited by the OIC or should a *communication break* occur.

BERTHING SEQUENCE:

Any freight trains crossing both Overlander passenger trains are to be berthed in No.1 road to allow the Officer in Charge (OIC) to control reversing movements from the vicinity of the crossing loop.

Should both trains arrive at National Park at or about the same time Train 201 is to be berthed on the mainline first.

BERTHING PROCEDURE:

The first train berthed on the mainline is to be pulled forward to a point clear of the furthest mark on the platform in direction of travel.

After the second train has pulled through the loop towards the Home signal at the opposite end the OIC must position at the designated safe position in the vicinity of the loop to avoid distraction from passengers.

When the Home signal has a proceed indication the Train Manager will inform the Locomotive Engineer and OIC.

The OIC will then call the reversing movement as described above.

The rear of the train is to be stopped adjacent to the nearest platform marker in direction of travel.

DOCUMENT CONTROL:

This is a controlled document.

Toll Rail Manager, Palmerston North is responsible for document control.

Copies of this document are to be distributed to:

Toll Rail Manager, Palmerston North
Toll Rail Manager, Te Rapa
Service Operations Manager, Rail Passenger, Wellington
Operations Manager, Ontrack, Wellington.

The above are responsible for ensuring rail personnel are trained and fully understand these procedures.

4.2 Following the collision at National Park on 5 March 2008, the Toll Rail Manager, Palmerston North, issued later that month an amended local instruction for the Overlander passenger trains berthing on the main line at National Park. The changes included:

- the portable radio must be obtained from the owner of the café and returned after use
- the train manager of the second train will be responsible for confirming with the officer in charge that they are standing beside the carriage emergency brake facility of the rear car before the setting back movement starts.

4.3 On 5 December 2008, a revised Overlander train schedule was introduced that eliminated the need for both trains to berth on the main line at National Park. Passengers on Train 200 had a scheduled 35-minute refreshment break at Ohakune, while passengers on Train 201 took their scheduled refreshment break at National Park. The subsequent crew change occurred when the trains crossed between Ohakune and National Park, usually at Makatote crossing station.

Approved on 17 September 2009 for publication

Hon W P Jeffries
Chief Commissioner

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