



Report 01-101

**passenger express Train 901 *Southerner* and
stock truck and trailer unit**

collision

**Makikihi Beach Road level crossing
between Timaru and Oamaru**

8 January 2001

Abstract

At about 1055 on Monday 8 January 2001, a collision occurred at Makikihi Beach Road level crossing between passenger express Train 901 *Southerner* and a loaded stock truck and trailer unit. The truck had cleared the level crossing but the trailer was only halfway across when the train collided with it and derailed. Two of the train crew and 3 passengers were seriously injured and 24 passengers suffered minor injuries as a result of the collision.

A factor contributing to the collision was the failure of the truck driver to give way to Train 901.

No safety deficiencies in the rail system were identified and no safety recommendations required.

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.

These reports may be reprinted in whole or in part without charge, providing acknowledgement is made to the Transport Accident Investigation Commission.

Contents

List of Abbreviations ii

Data Summary iii

1. Factual Information 1

 1.1 Narrative 1

 1.2 Site information 2

 1.3 Regulations governing level crossings..... 5

 1.4 Damage to passenger carriages 5

 1.5 Crashworthiness of Train 901 5

 1.6 Personnel..... 7

2. Analysis 7

3. Findings 9

Figures

Figure 1 Site plan of Makikihi Beach Road level crossing 2

Figure 2 View about 100 m from Makikihi Beach Road level crossing approaching from the east, the direction from which the truck and trailer unit approached..... 3

Figure 3 Signage and road markings at Makikihi Beach Road level crossing 3

Figure 4 A PW-61 Railway Level Crossing Intermediate Advance Warning sign, black characters on a yellow background 4

Figure 5 The leading passenger carriage as it came to rest (photograph courtesy NZ Police) 6

Figure 6 Damage sustained by the second passenger carriage..... 6

List of Abbreviations

km/h	kilometre(s) per hour
LE	locomotive engineer
m	metre(s)
manual	“Manual of Traffic Signs and Markings”, Part 1

Data Summary

Train type and number:	passenger express Train 901
Road vehicle:	stock truck and trailer unit
Date and time:	8 January 2001 at about 1055
Location:	Makikihi Beach Road level crossing between Timaru and Oamaru (Main South Line)
Type of occurrence:	level crossing collision
Persons on board:	train crew: 3 train passengers: 65 truck and trailer unit 1
Injuries:	train crew: 2 serious train passengers: 3 serious 24 minor road vehicle: nil
Damage:	extensive damage to the locomotive and 2 passenger carriages, and trailer unit of truck
Operator:	Tranz Rail Limited (Tranz Rail)
Investigator-in-charge:	D L Bevin

1. Factual Information

1.1 Narrative

- 1.1.1 On Monday 8 January 2001, Train 901 was the Christchurch to Invercargill *Southerner* passenger express and consisted of a DC class locomotive, 2 passenger carriages and a luggage van. The train was crewed by a locomotive engineer (LE), a train manager and a train assistant, and was carrying 65 passengers.
- 1.1.2 At about 1055 as Train 901 approached the Makikihi Beach Road level crossing from the north the LE noticed a stock truck and trailer unit appear from behind a row of trees which was situated about 50 m from the level crossing, on his left-hand side. The truck and trailer unit was travelling west along Makikihi Beach Road towards the level crossing and the LE estimated its speed to be about 60 km/h.
- 1.1.3 The LE realised that the truck was not going to give way and that it would not get across the level crossing before the train arrived, so he made an emergency brake application and briefly sounded the locomotive horn before he tried to get down on the floor of the locomotive cab for protection. The brakes had not had time to respond and he had not reached the floor before the impact.
- 1.1.4 The locomotive hit the three-axle stock trailer immediately behind the front axle and the trailer disintegrated on impact. The locomotive became airborne, turned 180 degrees to face the direction from which it had come and rolled 270 degrees, coming to rest without its bogies, on its right side and clear of the track about 60 m beyond the level crossing. The locomotive was extensively damaged but the LE, who sustained serious injuries, was able to climb out of the left-hand side of the cab.
- 1.1.5 As the locomotive left the rails the leading bogie had broken free and stopped close to the track about 60 m past the level crossing. The trailing bogie had initially remained attached to the locomotive body before it broke away and came to rest at right angles across the track, about 20 m further on. The 2 passenger carriages were derailed and extensively damaged but the baggage car at the end of the train remained upright on the tracks and undamaged.
- 1.1.6 The train assistant said that just before impact he had been talking to the train manager in the leading passenger carriage. He looked out the window on the left-hand side of the carriage and saw the truck and trailer unit travelling towards the level crossing. From its speed he knew that it was not going to stop before the level crossing and he called a warning to the train manager and braced himself against the carriage wall. Just before the impact he glanced out the right-hand side of the carriage and saw that the truck had cleared the level crossing but there was no sign of the trailer. There had not been time to issue a warning to the passengers before the impact.
- 1.1.7 Following the impact the train assistant was thrown across the carriage and out through a hole left by a window which had popped out. He finished up on the grass in the paddock beside the carriage and sustained serious injuries.
- 1.1.8 The LE thought that the speed of his train as he approached the level crossing was about 98 km/h. A subsequent download of data from the locomotive event recorder established the train speed as 90 km/h. The maximum permissible speed for the train in that area was 100 km/h. He estimated he was about 10 seconds from the level crossing when he saw the truck appear.
- 1.1.9 The truck and trailer unit was fully loaded with stock at the time of the collision.

- 1.1.10 Soon after the collision the truck driver recollected that he had not slowed his vehicle as he approached the level crossing and had not seen the train until he heard the locomotive horn sound briefly and saw the train about 20 m away as he crossed in front of it.
- 1.1.11 Another truck had stopped on the opposite side of the level crossing for the passage of the train but was not involved in the collision.
- 1.1.12 As well as the LE and the train assistant, 3 passengers received serious injuries and 24 other passengers received minor injuries. All injured staff and passengers were initially hospitalised, with 7 remaining overnight or longer.

1.2 Site information

- 1.2.1 Makikihi Beach Road level crossing was on the Canterbury Plains and offered good visibility for LEs, and for motorists within about 50 m of the level crossing. Both the rail and road approaches were straight and crossed at right angles. After crossing a bridge over the Makikihi River, about 200 m north of the level crossing, the track approached the crossing along an embankment, which lifted it above the paddocks on both sides.
- 1.2.2 The level crossing was not protected by warning lights, bells or barriers. It was protected by roadside signage, which included a St Andrews cross and a Give Way sign immediately before the crossing but did not include an Intermediate Advance Warning sign. There were markings on the road surface and a Level Crossing warning sign about 120 m back from the crossing on either side.

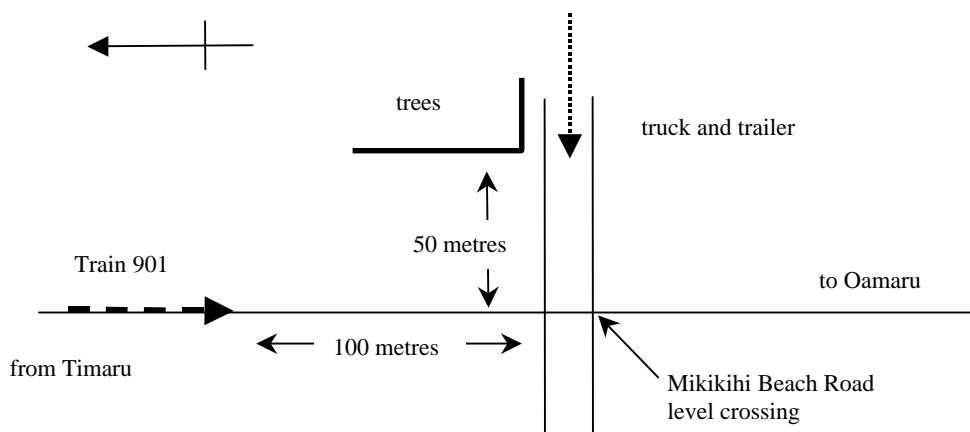


Figure 1
Site plan of Makikihi Beach Road level crossing
(not to scale)



Figure 2
View about 100 m from Makikihi Beach Road level crossing approaching from the east, the direction from which the truck and trailer unit approached



Figure 3
Signage and road markings at Makikihi Beach Road level crossing

- 1.2.3 There were no tyre skid marks on the approach to the level crossing. The only rubber tyre marks on the road ran parallel to the tracks on the west side from the point of impact.
- 1.2.4 Charts for calculating typical stopping sight distance requirements for passive control level crossings were included in Appendix 4A of the “Manual of Traffic Signs and Markings” Part 1 (the manual)¹. In determining sight distance requirements a speed of V85, that is the speed which is not exceeded by 85% of vehicles approaching the railway crossing, is used.
- 1.2.5 The manual allowed for the provision of a Railway Level Crossing Intermediate Advance Warning sign (refer Figure 6) in Clause PW-61(b) which stated:

PW-61 sign combinations should be erected on the left-hand side of the road on approaches to railway level crossings where:

- (b) STOP sign controls are not required but:
- sight distance in both directions along the railway line for an approaching driver is restricted by topography, development, vegetation, etc, to less than those specified in Table A4.2 APPENDIX A4 of the Manual of Traffic Signs and Markings, Part 1: Signs, and
 - it is not practical to improve sight distances, or
 - to install active level crossing controls ...

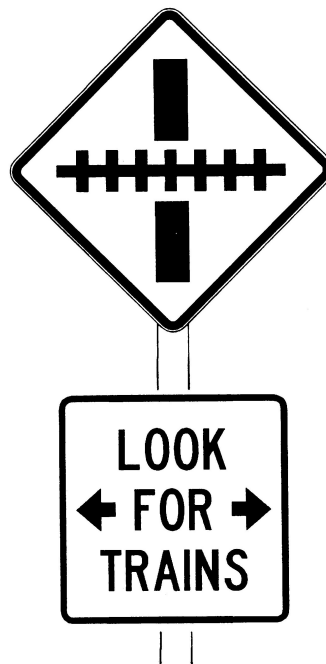


Figure 4
A PW-61 Railway Level Crossing Intermediate Advance Warning sign,
black characters on a yellow background

The level crossing did not qualify for a Stop sign but did meet the guidelines for a PW-61 combination sign.

¹ A manual jointly prepared and distributed by Transit New Zealand and the Land Transport Safety Authority which set out the policy and requirements for traffic signs and included guidance for the location and positioning of signs.

1.3 Regulations governing level crossings

1.3.1 Traffic Regulations 1976, Regulation 11 Railway Crossings Clause 1A stated that:

Every driver approaching any level crossing which is controlled by a give-way sign shall give way to any rail service vehicle which is approaching or crossing the level crossing.

1.3.2 The Railway Safety and Corridor Management Act 1992, Section 4(1) stated that:

It shall be the duty of every person when approaching or crossing a level crossing to keep a vigilant lookout for any approaching rail service vehicle using the railway line.

1.3.3 The Railway Safety and Corridor Management Act 1992, Section 4(3) stated that:

No person shall ride, drive or attempt to ride or drive any cycle, vehicle or animal on or across a level crossing or elsewhere on a railway line when there is any risk of that cycle, vehicle or animal being involved in a collision with any rail service vehicle using the railway line.

1.4 Damage to passenger carriages

1.4.1 Marks at the site showed that after impact the leading passenger carriage derailed and travelled at right angles to the main line for about 70 m with the front of the carriage and leading bogie travelling about 24 m through a trackside paddock. The carriage remained upright and stopped when the trailing end collided with the trailing bogie of the locomotive, which had separated from the locomotive and lay at right angles to the track.

1.4.2 The second passenger carriage was also derailed but remained upright, although leaning at about 25 degrees towards the right-hand side of the track. It was extensively gouged below window level (refer Figure 6) as it passed the stationary leading bogie of the locomotive.

1.5 Crashworthiness of Train 901

1.5.1 The Commission has investigated one other level crossing collision between a truck and a passenger train at Rolleston in 1993 (Rail Occurrence Report 93-112), which resulted in 3 fatalities and 7 seriously injured passengers. The gouging sustained by the carriages in that collision was at window level and, although 20 windows were broken in the 2 carriages and the occupants were showered with shattered glass, most of the fatalities and injuries sustained were from the direct intrusion of the truck body into the carriages and the effects of flying baggage and debris.

1.5.2 Tranz Rail advised that the structural design of the carriages involved in the Makikihi Beach Road level crossing incident was essentially the same as of those involved in the Rolleston incident. The car body frames consisted of hardwood uprights, bolted to steel brackets welded to the under-frame at the bottom, and bolted at the top to steel brackets connected to a timber rail that formed the edge of the plywood and timber roof diaphragm. Timber framing between the uprights and around the windows incorporated steel bracing against longitudinal forces. Transverse bracing was effected by the uprights themselves, and by the roof diaphragm and its connection to the steel end frames.



Figure 5
The leading passenger carriage as it came to rest (photograph courtesy NZ Police)



Figure 6
Damage sustained by the second passenger carriage

1.5.3 This type of car has been the mainstay of Tranz Rail's (and its predecessor's) express passenger fleet since the early 1940s, and with progressive modernisation and modification has continued to be so to the present day. Improvements to the basic carriages in recent years have included fixed seating as opposed to the earlier reversible seats and the replacement of the original laminated glass windows with tempered safety glass.

1.6 Personnel

1.6.1 All members of the train crew were certified for the duties they were carrying out.

1.6.2 The truck driver was appropriately licensed for operating the truck and trailer unit. He had been employed by the trucking company for over 5 years and regularly used Makikihi Beach Road in the course of his duties.

1.6.3 The truck driver said that he was aware of the existence of the level crossing on Makikihi Beach Road.

2. Analysis

2.1 The Commission has investigated this accident mainly from a rail perspective so the reasons why the truck driver did not give way as he approached the level crossing have not been established. The road signage and markings that were in place both approaching and at the level crossing were clearly visible and in good condition and met the guidelines included in the manual. There was adequate sighting distance for the truck driver to have seen the train and stopped had he approached the level crossing preparing to give way. It is clear from the road signage that Train 901 had the right of way through the level crossing.

2.2 Makikihi Beach Road was flat and straight as it approached the level crossing from the east and it was considered reasonable to assume that V85 (refer 1.2.4) equalled 90 km/h. Using this figure as a basis for calculations the following were identified:

- approaching the level crossing at 90 km/h a road vehicle would have required a line of sight of the approaching train when it was 312 m from the level crossing while the road vehicle was 209 m from the level crossing to allow it to stop in time
- the road vehicle would have needed to be travelling at a speed not exceeding 30 km/h when it cleared the hedgerow if it were to be able to stop in the 50 m available leading up to the level crossing.

2.3 If the level crossing was to fully meet the guidelines outlined in the manual, a PW-61 Railway Level Crossing Intermediate Advance Warning sign should have been placed 100 m from the level crossing, between the Railway Level Crossing Ahead sign (refer Figure 2) and the level crossing. To accommodate this, the Railway Level Crossing Ahead sign would have had to have been positioned 160 m from the level crossing in accordance with Clause PW-57 of the manual. The level crossing therefore did not meet the guidelines of the manual, however it is doubtful that the existence of a Railway Level Crossing Intermediate Advance Warning sign would have avoided this collision for the following reasons:

- the truck driver was familiar with the level crossing and was likely to have known that his view of an approaching train from the north was restricted by the hedgerow
- the road signage that was in place left no doubt to a road user as to the existence of the level crossing
- the truck was estimated to be travelling at 60 km/h, which was 30 km/h above the maximum speed at which it would have been able to stop in the available distance after clearing the hedgerow

- regardless of view lines, Traffic Regulation 11, Clause 1A required the truck to give way to trains, which implies that the truck needed to be driven at such a speed that it could be stopped clear of the level crossing to give way if required.

2.4 The LE estimated the speed of the truck at 60 km/h as it approached the level crossing. Working on an estimate of between 50 km/h and 60 km/h the truck would have taken about 4 seconds to travel the 50 m from the row of trees to the level crossing, while at 90 km/h the train would have travelled about 100 m in the same time. This suggests that the LE had about 100 m, or 4 seconds, to respond to the situation.

2.5 Analysis of the locomotive event recorder showed no changes to control settings until about one second before impact. At this point a significant reduction in air pressure in the brake pipe was evident, probably caused by either an emergency brake application by the LE or a burst hose as the locomotive derailed.

2.6 In the time available to the LE he:

- only had time to sound the locomotive horn briefly
- immediately applied the brakes, but they had not responded by the time of impact
- did not have time to warn the train manager by radio of the impending collision
- did not have time to get on the floor before the impact.

Under the circumstances there was little else the LE could have done to avoid or lessen the impact.

2.7 The train assistant became aware of the situation from his position in the front passenger carriage but there was insufficient time for him to take any action other than warn the train manager before bracing himself for the impact. His actions supported the fact that the train was very close to the level crossing when the truck entered it.

2.8 The full force of the collision was borne by the locomotive. The truck and trailer did not come in contact with the train again after the initial impact. The second trailer axle became wedged under the leading bogie of the locomotive and was probably the cause of the derailment of the locomotive. The third trailer axle finished up in a field, clear of the track and train. In the Rolleston collision the truck was struck by the locomotive and spun against the sides of the carriages by the impact.

2.9 The locomotive bogies remained close to the track after they had detached from the locomotive body, with the leading bogie stopping in such a position that it gouged the side of the second carriage as it passed. The trailing bogie was probably responsible for the majority of damage sustained by the leading carriage.

2.10 The fact that the derailed passenger carriages remained upright and did not tip over minimised injuries to passengers and crew.

2.11 Because the majority of structural damage to the carriages was sustained below window level there was little potential for injuries from shattered glass. In the circumstances of this accident the crashworthiness of the carriages met expectations.

2.12 The LE sustained serious injuries consistent with the force of the impact. In the circumstances of this accident the crashworthiness of the locomotive met expectations.

3. Findings

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

- 3.1 Train 901 was being operated correctly at the time of the collision.
- 3.2 The LE of Train 901 had about 4 seconds' warning of the impending collision and could not have taken any other action to avoid or lessen the impact of the collision.
- 3.3 The actions of the train crew leading up to and immediately following the collision were appropriate.
- 3.4 The crashworthiness of the locomotive and carriages was adequate.
- 3.5 The standard and condition of the existing level crossing signage and road markings were in accordance with guidelines published in the "Manual of Traffic Signs and Markings", Part 1, and they were clearly visible and in good condition.
- 3.6 Because a PW-61 Railway Level Crossing Intermediate Advance Warning sign was not erected the level crossing did not fully meet the guidelines specified in the "Manual of Traffic Signs and Markings", Part 1, but the presence of such a sign was unlikely to have avoided the collision.
- 3.7 View lines of the rail track from the road were adequate for motorists to stop in sufficient time, if travelling at a speed appropriate for approaching a level crossing controlled by Give Way signage.
- 3.8 The main factor contributing to the collision was the failure of the truck driver to give way to Train 901, as required by the road signage.

Approved for publication 11 July 2001

Hon. W P Jeffries
Chief Commissioner