Report 08-101, express freight train 923, level crossing collision and resultant derailment, Orari, 14 March 2008

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.

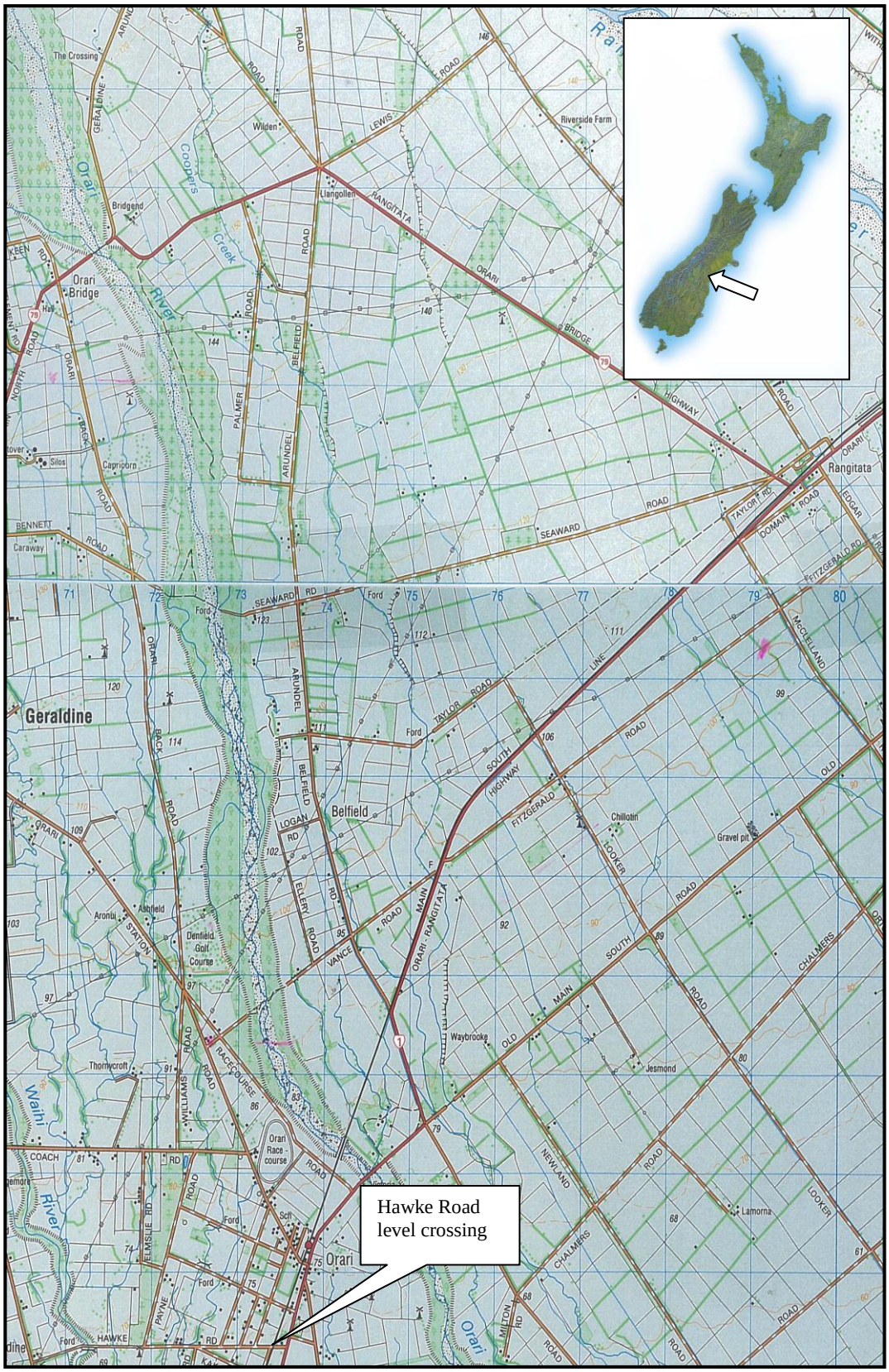
Final report 08-101

express freight Train 923

level crossing collision and resultant derailment

Orari

14 March 2008



Location of incident

Contents

Figures

Abbreviations

ALCAM	Australian Level Crossing Assessment Model
Ellesmere Transport	Ellesmere Transport Company Limited
GPS	global positioning system
hr	hour(s)
kg	kilogram(s)
km	kilometre(s)
km/h	kilometre(s) per hour
kPa	kilopascal(s)
m	metre(s)
MSL	Main South Line
t	tonne(s)
Toll Rail	Toll Rail NZ Consolidated Limited
UTC	universal coordinated time

Data Summary

Train type and number:	express freight Train 923	
Road vehicle:	Mercedes-Benz truck model 1827	
Date and time:	14 March 2008 at about 1149[1]	
Location:	Hawke Road level crossing, 141.77 kilometres (km) Main South Line (MSL), near Orari	
Persons on board:	train:	one
	truck:	one
Injuries:	locomotive engineer:	serious
	truck driver:	fatal
Damage:	major damage to locomotive, rolling stock, infrastructure and truck	
Operators:	train: Toll NZ Consolidated Limited (Toll Rail)	
	truck: Ellesmere Transport Company Limited (Ellesmere Transport)	
Investigator-in-charge:	P G Miskell	

[1] Times in this report are New Zealand Daylight Times (UTC + 13) and are expressed in the 24-hour mode.

Executive Summary

At about 1149 on Friday 14 March 2008, southbound express freight Train 923 collided with a truck on Hawke Road level crossing, Orari, between Rangitata and Temuka on the Main South Line, when the truck moved into the path of the approaching train. The level crossing had passive control[2] "Stop" signage. All signage and road markings were in place and in good condition.

The collision caused the locomotive to derail and roll before coming to rest 172 metres (m) past the level crossing. Twelve wagons directly behind the locomotive also derailed. The locomotive and 10 wagons were extensively damaged. The other two derailed wagons sustained moderate damage. The truck was extensively damaged.

The truck driver was fatally injured and the locomotive engineer suffered serious injury.

No safety deficiencies in the rail operating system were identified that contributed to the collision.

A safety recommendation was made to the Chief Executive of the NZ Transport Agency to address the issue of the capability of the locomotive event recorder to transmit in the event of an accident.

[2] Passive control is the control of vehicular or pedestrian traffic across a railway level crossing by signs and devices, none of which can be activated by the approach or passage of a train. Road users and pedestrians must detect the approach or presence of a train based solely on their own observations.

1 Factual Information

1.1 Narrative

1.1.1 On Friday 14 March 2008, Train 923 was a Christchurch-to-Dunedin express freight train consisting of locomotive DFT7008 hauling 23 wagons with a gross weight of 708 tonnes (t) and an overall length of 387 metres (m). There were no dangerous goods on the train.

1.1.2 At about 1140, Train 923 departed from the crossing loop at Rangitata, 133.64 km MSL, after a locomotive engineer changeover. The locomotive engineer was based in Timaru and this was the final leg of his shift that day.

1.1.3 The locomotive engineer said that when he approached Hawke Road level crossing, 141.77 km MSL, he had the locomotive in power notch 3 and the train was travelling at about 80 kilometres per hour (km/h), the maximum line speed for a freight train. He saw some movement through the trees from the eastern approach to the level crossing, so he sounded the locomotive horn, which changed the ditch lights mode on the locomotive from a steady light to the alternate flash mode. The locomotive engineer said that when the train was about 50 m from the crossing he saw a blue truck come in to view from behind the trees. He estimated the truck to be travelling at somewhere between 20 and 30 km/h.

1.1.4 The locomotive engineer realised that the truck was not going to stop at the crossing protected by "Stop" signage and that a collision was unavoidable. He said he moved the brake handle towards the emergency position, but thought he only achieved a full service brake application before he crouched behind the control stand.

1.1.5 The locomotive struck the deck on the driver's side midway between the headboard and the rear axle when the truck was a little more than halfway across the level crossing. The 2-axle Mercedes-Benz truck was transporting some stock from Leeston to a property further along Hawke Road.

1.1.6 Following the collision, the locomotive and the leading 12 wagons derailed. During the derailment sequence the locomotive turned through 180 degrees to face the direction from which it had come and rolled through 90 degrees onto its side, coming to rest some 171 m past the level crossing (see Figure 1). The locomotive engineer remained conscious while the locomotive rotated and the cab filled with dirt and dust. The locomotive cab became separated from the chassis mounting brackets during the derailment sequence and the cab dislocated forward and to the right. However, the cab integrity was maintained.

1.1.7 The truck broke up during the collision. The stock crate came to rest on the eastern side of the track about 30 m south of the level crossing. The other major truck components finished south of the level crossing on the western side of the level crossing, the truck cab at 10 m, the engine at 127 m and the chassis 171 m, still attached to the front of the locomotive.

1.1.8 At the time of the collision the weather was fine and sunny and the road was dry.

1.1.9 The driver of the truck was fatally injured. The locomotive engineer sustained moderate injuries.

Figure 1
DFT 7008 after the collision

1.2 Site information

General

1.2.1 Hawke Road level crossing was located at 141.77 km MSL, between Rangitata and Temuka. The level crossing was 162 m to the west of State Highway 1 (see Figure 2). Twelve trains and about 150 various road vehicles passed over the level crossing each day.

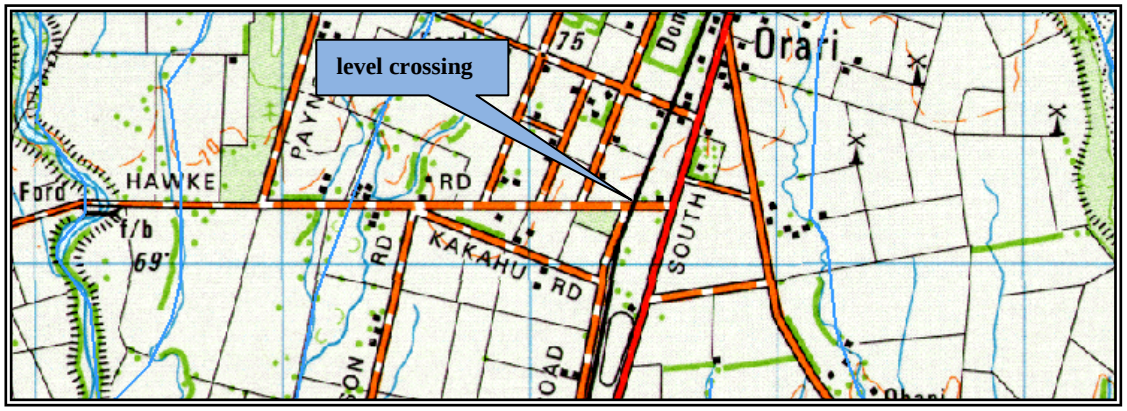


Figure 2
Location of Hawke Road level crossing

1.2.2 Hawke Road was a 2-lane, bitumen-sealed road. The road was 6.2 m wide at the level crossing, with each lane just over 3 m wide. A solid white centre line was painted on the approach to the level crossing. There was a 5.8 m wide mown grass verge on the northern side of the road and a 6 m wide mown grass verge on the southern side.

1.2.3 The road from State Highway 1 to the level crossing was on a slight rising gradient of 1 in 175. The road surface on the approach to the level crossing was slightly crowned to allow water to run off to the side of the road.

1.2.4 The railway track on the north side of Hawke Road level crossing, from where Train 923 approached, was straight for about 5 km and on a down gradient averaging about 1 in 200.

1.2.5 The view line looking north when approaching the level crossing from State Highway 1 was restricted by a plantation of mature trees (see Figure 3). The effect of this was that when standing 7 m behind the limit line or 14 m from the track, a southbound train could not be seen until it was 73 m from the level crossing. Once stopped at the limit line, there was an unrestricted view along both directions of the railway.

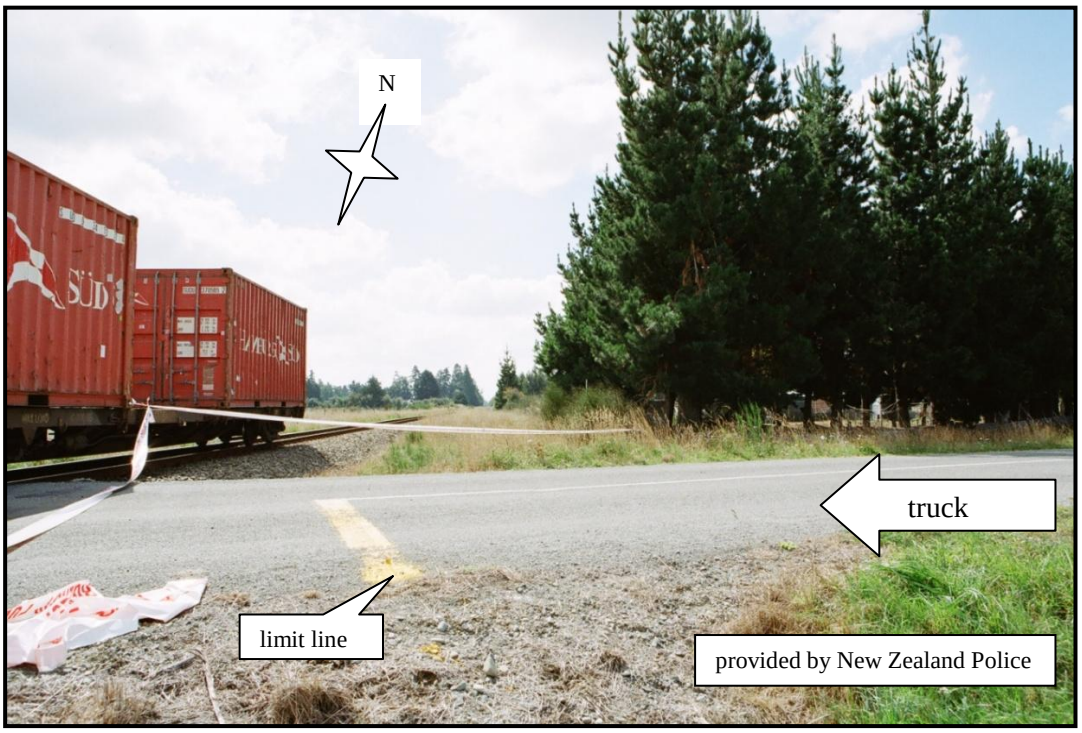


Figure 3
View from Hawke Road level crossing looking north

Level crossing protection

1.2.6 When approaching Hawke Road level crossing from State Highway 1, the crossing had passive protection in the form of "Stop" roadside signage and associated road markings.

1.2.7 The approach to the level crossing had the signs and markings that were required by Land Transport New Zealand[3] (Land Transport Safety Authority, 2000). This was an advanced level crossing ahead warning sign (PW-57), which was an outline of a train on a yellow background, on the left side of the road about 91 m before the level crossing. A "STOP" was painted with white lettering on the road ahead of the yellow limit line (see Figure 4). The limit line, which indicated the safe position for vehicles to stop, was 5 m from the nearest rail.

1.2.8 The railway level crossing "Stop" assembly (RG-32), consisting of a "Railway Crossing" sign, a "Stop" sign and a "Look for Trains" sign, was in place (see Figure 5).

1.2.9 All signage and road markings were in good condition.

[3] Land Transport Safety Authority was the predecessor of Land Transport New Zealand.

Figure 4
The approach to Hawke Road level crossing from State Highway 1

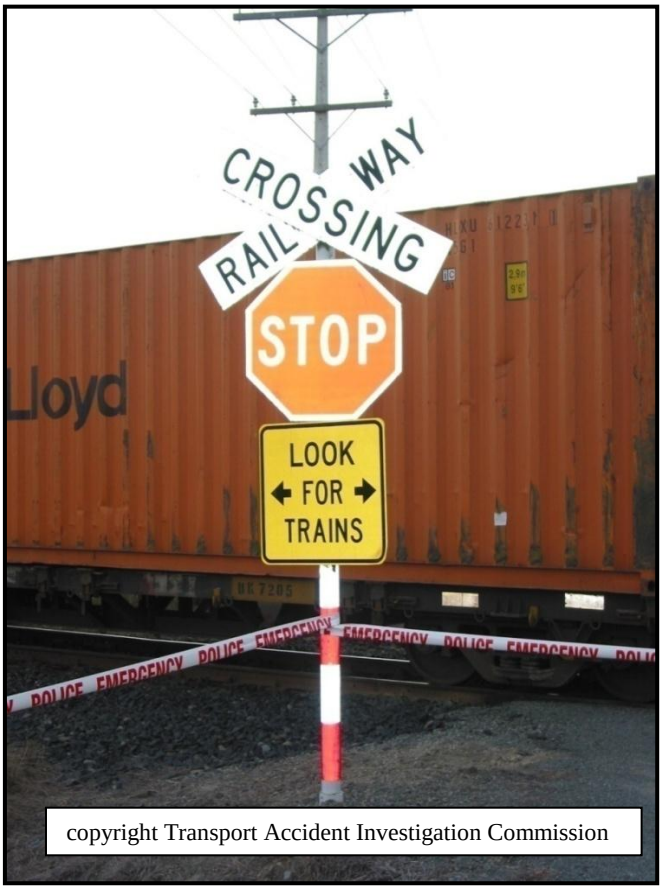


Figure 5
The warning signs in place at Hawke Road level crossing

1.3 Regulations governing level crossings

1.3.1 The definition of a level crossing, as described in the Railways Act 2005 section 4 (New Zealand Government, 2005), stated:

> (a) means any place where-
> (i) a railway line crosses a road on the same level, or
> (ii) the public is permitted to cross a railway line on the same level; and
> (b) includes a bridge used for both rail vehicles and road traffic on the same level; but
> (c) does not include a railway line on a road that is intended solely for the use of light rail vehicles.

1.3.2 The Railways Act 2005 section 80 stated in part:

> **80 Rail vehicles have right of way**
> (1) Except as provided in subsection (2),-
> (a) any rail operator (and any person responsible for the driving or control of a rail vehicle) is entitled to assume, for the purposes of determining the speed at which it is reasonable for a rail service vehicle to travel past a station, level crossing, or elsewhere on a railway line, that all persons, animals, and vehicles not using the railway line will keep clear of the railway line; and
> (b) neither a rail operator nor any other person is to be regarded as negligent merely because that rail operator or person acts on that assumption for that purpose.

1.3.3 Traffic Regulations 1976, Regulation 11 (New Zealand Government, 1976) stated in part:

> Every driver approaching any level crossing controlled by a Stop sign shall stop for any rail service vehicle which is approaching or crossing the level crossing.

1.3.4 Traffic Regulations 1976, Regulation 131B (New Zealand Government, 1976) stated in part:

> **131B Combination of signs**
> The combination of signs specified in any one of the following paragraphs may be erected on the same pole:
> "(a) Where the pole is at a level crossing,-
> "(i) A 'Give Way' sign or a 'Stop' sign; and
> "(ii) A crossbuck sign; and
> "(iii) Where appropriate, a 'look for trains' sign or a 'more than 1 track' sign, or both

1.3.5 The Land Transport Safety Authority's Road Signs and Markings for Railway Level Crossings (Land Transport Safety Authority, 2000) stated in part;

> **3.3 Passive controls**
>
> Drivers must yield right-of-way to any rail vehicle approaching or passing a level crossing. Trains have a legal right of way at level crossings.
>
> Warning signs and markings are provided in advance and at the site of all crossings.
>
> **3.3.1 Passive "Stop" controls**
>
> Where active controls are not provided and sight distances along the railway from approaching road vehicles are restricted, all vehicles should be required to come to a complete stop.
>
> **3.5.2 Railway level crossing "Stop" sign assembly (RG-32)**
>
> The RG-32 sign assembly should be used at level crossings with a "Stop" control. The supplementary "No. of tracks" sign (PW-15) is added at all crossings with multiple tracks. The PW-59 "Look for Trains" supplementary

sign is optional for use in circumstances such as multiple tracks, infrequent use lines, or bad skew situations which make it desirable to add an additional prompt to drivers.

The assembly should be located on the left side of the road and where practicable the word "STOP" should be marked on the road surface.

3.6.1 Advance warning signs

3.6.1.1 Railway level crossing ahead (PW-57)

The PW-57 "Steam Train" sign is used to give advance warning of a railway level crossing. It is designed to be used as the first warning device encountered.

Where a single sign is adequate, the PW-57 sign should be placed on the left side of the carriageway.

4.2.1 Limit Lines

At all railway level crossings with sealed road approaches, limit lines should be marked on all approaches. These lines indicate safe positions for vehicles to stop, if necessary, to avoid conflict with a train.

Limit lines should be marked so that at passive control sites, no part of them is closer than 3 metres from the nearest rail. Limit lines for RG-32 assemblies should be in line with the sign (see Figure 6).

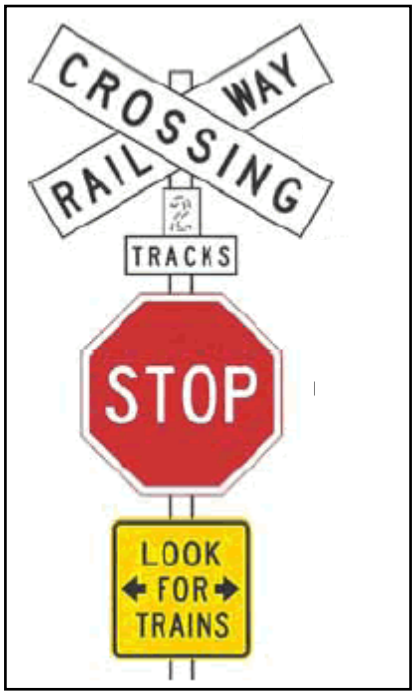


Figure 6
RG-32 railway level crossing "Stop" sign assembly

1.3.6 The current view line standards (Tranz Rail, 1997) at level crossings required that for a maximum authorised train approach speed of 100 km/h:

- the minimum view along the track at 5 m from track centre line is 222 m
- the desirable view along the track at 5 m from track centre line is 561 m
- the minimum view along the track at 30 m from track centre line is 163 m unless automatic warning devices or "Stop" signs have been installed.

1.4 Level crossing risk assessment

1.4.1 The Australian Level Crossing Assessment Model (ALCAM) (Australian Transport Council, 2003) is a safety assessment tool used to assist in the prioritisation of both road and pedestrian level crossings according to their comparative safety risk. ALCAM has been adopted by all Australian states and territories since 2003 and used in New Zealand since 2005.

1.4.2 The Model considered the physical properties (characteristics and controls) and the related common human behaviours to provide each level crossing with a comparative "risk score". This score was then multiplied by the site's "exposure rating" (a factor of vehicles, trains and consequence), which enabled the total risk exposure scores from various sites to be compared. The Model identified where specific risks existed, then determined proposed treatments to address the identified risk areas.

1.4.3 There are particular characteristics that have a greater influence on the overall risk profile at a specific site. These characteristics include limited sighting of trains (at passive sites), limited approach sighting, queuing and short stacking, proximity to shunt yards, high percentage of heavy vehicles and the approach gradient to the level crossing.

1.4.4 ALCAM used intervention and installation limits to compare the levels of risk at level crossings, and determine if any improvements were required. The installation score was indicative of the risk score set for a newly constructed level crossing, so that if a level crossing assessment fell below that score, the crossing was likely to meet acceptable safety standards. If the level crossing assessment score were above the intervention level, some priority action was required to reduce the risks at that crossing.

1.4.5 In 2005, Hawke Road level crossing was surveyed using ALCAM. Land Transport New Zealand, the local road authority, Toll Rail, Ontrack[4] and a Queensland consultant jointly conducted the assessment.

1.4.6 At that time, the ALCAM survey assessed the risk score at Hawke Road level crossing as being 276, whereas the intervention level for the crossing was determined to be 390 (see 1.4.4). Although the assessed risk score was less than the intervention level, the suggested treatments or "proposals" included:

- install whistle boards on the Up and Down side of the crossing
- remove trees and vegetation in the northeast quadrant so as to achieve improved view lines.

1.4.7 In a letter to the Transport Accident Investigation Commission (the Commission) dated 28 March 2008, Land Transport New Zealand stated in part:

> Were a large number of crossings surveyed using ALCAM, this crossing would not be high on any list of crossings requiring significant remedial treatment.

1.5 Locomotive event recorder

1.5.1 At the time of the collision, locomotive DFT7008 was fitted with a "Tranzlog Lite" model event recorder.

1.5.2 On the day of the collision the locomotive Tranzlog global positioning system (GPS), which updated the internal clock at one-minute intervals, was working correctly but was recording New Zealand Standard Times. One hour must be added to the recorded times to align them with New Zealand Daylight Times.

1.5.3 Analysis showed that the radar speed was recording 8.1% slower than true speed (GPS speed) and the locomotive cab speedometer was reading 7.46% slower than true speed. In other words, when the locomotive cab gauge was showing 81 km/h, the true speed was 86 km/h.

[4] Ontrack was the network provider.

1.5.4 The state of controls at 1049:01 (New Zealand Standard Time) showed that the locomotive horn was operating. At that time both the front headlights and the ditch lights were switched on. The system message indicated that the locomotive speedometer gauge was reading 5 km/h slower than true speed. An interrogation of the event log confirmed that the horn was operated for 1.9 seconds.

1.5.5 Other key data extracted from the Tranzlog event recorder:

- at 1049:01, the throttle was in notch 3, the radar speed was 82 km/h, the true speed was 88 km/h and the brake pipe pressure was 558 kilopascals (kPa)
- at 1049:02, the throttle was in idle, the radar speed was 66 km/h, the brake pipe pressure was 278 kPa and the brake cylinder pressure was 39 kPa
- at 1049:05, the throttle was in idle, the radar speed was 24 km/h, the brake pipe pressure was 175 kPa and the brake cylinder pressure was 177 kPa. Tranzlog closed its selcall contacts to initiate an emergency radio call
- at 1049:10, the throttle was in idle, the radar speed was 5 km/h, the brake pipe pressure was 4 kPa and the brake cylinder pressure was 367 kPa. Tranzlog inputs switched off and Tranzlog shut down.

1.6 The road vehicle

1.6.1 The vehicle, a 2-axle Mercedes-Benz model 1827, registration CED483, had a tare weight of 7140 kilograms (kg) and was manufactured in 1995 (see Figure 7). The truck had a current Certificate of Fitness, issued on 7 February 2008. The check included a full brake test. Although the vehicle was rated as having a gross vehicle mass of 19 000 kg, New Zealand's legislation (Land Transport New Zealand, 2002) restricted the maximum legal gross weight of a 2-axle truck to 14 200 kg. The vehicle was not fitted with safety belts or airbags nor were they required to be fitted.

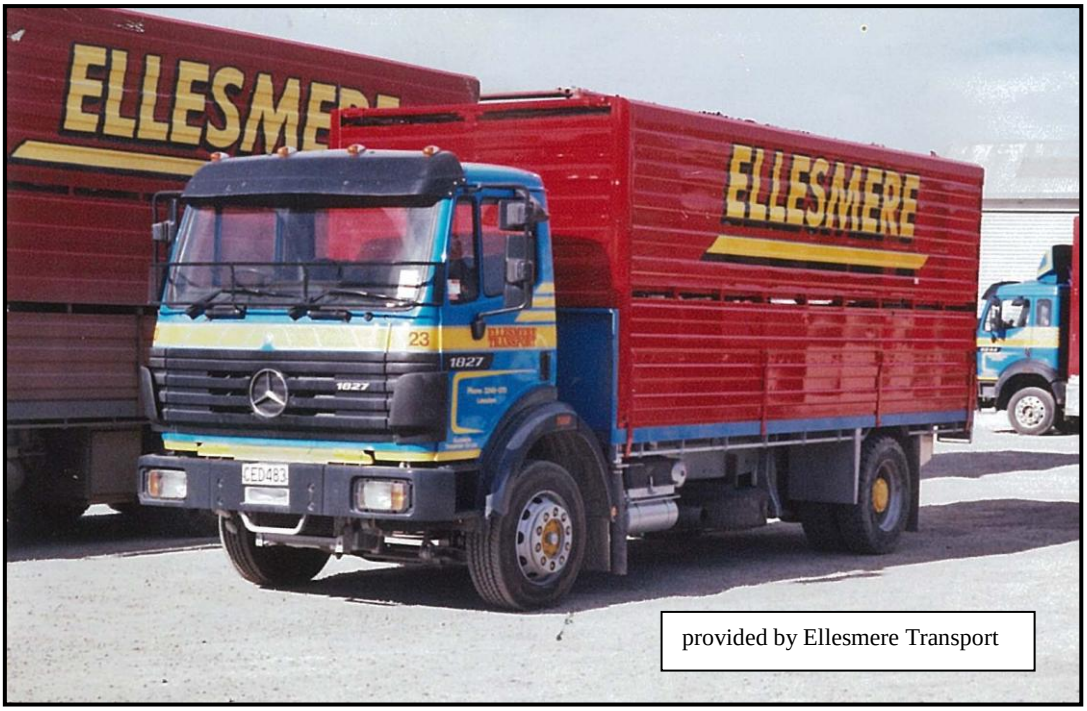


Figure 7
The Mercedes-Benz truck

1.6.2 The truck was fitted with a radio telephone system that enabled the driver to communicate with the depot and other drivers, but there was no evidence that it was being used at the time of the accident. There was no cell phone found in the cab following the collision.

1.6.3 Five days after the collision, a vehicle standards advisor approved by Land Transport New Zealand conducted a vehicle examination for the Commission. Because of the condition of the truck, it was not possible for the advisor to carry out any mobile tests. His visual inspection of the truck included the steering components, the suspension, the entire braking system, the engine and the drive train. The advisor found no condition with the truck that could have compromised its normal functioning. He concluded that the truck would have been up to the standard of a Certificate of Fitness before the collision.

1.7 Personnel

The locomotive engineer

1.7.1 The locomotive engineer on Train 923 had been driving trains for 37 years. He had been based at Timaru for the previous 5 years. His driving certification was current at the time of the collision.

1.7.2 On Friday 14 March 2008, the day of the collision, the locomotive engineer's rostered shift was from 0605 to 1355, a total of 7 hours 50 minutes. His work earlier in the week had included:

- Monday 10 March 2300 to Tuesday 0800 (maximum permitted 10 hours)
- Tuesday 11 March 2300 to Wednesday 0845 (maximum permitted 10 hours)
- Thursday 13 March 0605 to 1355 (maximum permitted 10.5 hours).

1.7.3 He had not worked during the weekend of 8 and 9 March. He was therefore rostered a total of 34 hours 25 minutes for the week commencing Monday 10 March 2008, which met Toll Rail's guidelines (Toll Rail, 2005).

The truck driver

1.7.4 The truck driver was 46 years old and had been employed by Ellesmere Transport at its Leeston depot since December 2006. His driver's licence was endorsed for Class 3 and 4 vehicles and he was therefore qualified to drive his assigned truck, the Mercedes-Benz 1827 truck. Most of his work was locally based in the Leeston-Christchurch area. Although the collision occurred outside his normal work area, his vehicle was suitable for the assignment.

1.7.5 Ellesmere Transport was a general carrier specialising in the transport of stock and fertiliser. The company had about 50 vehicles and employed about 70 staff split evenly between depots at Leeston and Dunsandel.

1.7.6 New employees were required, as part of the company employment policy, to identify any medical conditions. The truck driver had not identified any medical conditions apart from wearing glasses. His employer said that he always wore his glasses when driving and confirmed that his glasses were recovered from the accident site. He was described by his employer as being a quiet individual, a cautious driver and not prone to taking risks.

1.7.7 The truck driver's normal work hours were 0800 to 1800 Monday to Friday. However, the work hours could be changed depending on the workload at the time. The hours worked during the week commencing Monday 10 March 2008, taken from the driver's logbook, are shown in the table below:

Day	Hours of Duty	Rest Period	Total Hours Worked
Monday 10 March	0630-1930	1200-1230 1800-1830	12
Tuesday 11 March	0600-2000	1130-1200 1730-1800	13
Wednesday 12 March	0700-2200	1200-1230 1830-2000	13
Thursday 13 March	0800-2200	1330-1400 1700-1730	13
Friday 14 March	From 0800		

1.7.8 The NZ Transport Agency's *Work Time and Logbooks* factsheet 2, November 2007 (NZ Transport Agency, 2007) for driver working hours stated in part:

> **What are the work time and rest requirements?**
>
> In any period of work up to 24 hours (known as a 'cumulative work day'), you can work a maximum of 13 hours and then you must take a break of at least 10 hours (as well as the standard half-hour breaks every 5 ½ hours).

Pathology information

1.7.9 The body of the driver was taken to Timaru Hospital for a forensic autopsy, which was conducted on 17 March 2008. The autopsy report (Medlab, Timaru Hospital, 2008) noted a number of abrasions, lacerations and bruises on the head, chest and upper and lower limbs, consistent with severe blunt trauma. The heart appeared normal, with some mild atherosclerosis of the coronary arteries, but there was a small tear in the aorta at the junction of the thoracic and abdominal aortic segments. There were small amounts of blood in both chest cavities accompanied by fractures to the ribs on both sides, as well as fractures of the thoracic vertebrae and a complete fracture-dislocation between the cervical vertebrae C6 and C7. There was no significant brain injury, but the spinal cord was compressed in the area of C6 and C7 and almost completely severed in the thoracic region and T7.

1.7.10 Blood and urine samples were taken for toxicology testing. No abnormalities were detected that would suggest impairment by drugs or alcohol. Microscopic examination of the right coronary artery showed some bleeding into the area of atherosclerotic plaque. The Coroner's consulting pathologist reported:

> The finding of blood in the atherosclerosis in the right coronary artery raises a number of possibilities. This may be related to trauma to the chest at the time of the accident, or it could have immediately preceded the accident. Bleeding into the plaque of atherosclerosis in the right coronary artery is associated with sudden cardiac death, or with sudden but survivable heart attack. It is not possible at this examination to determine the exact timing of this haemorrhage as there were only minutes to separate the events.

1.7.11 As to the cause of death, the pathologist reported:

> The severe massive trauma caused compression in the spinal cord in the cervical region and severance of the spinal cord in the thoracic region. This is sufficient to cause very sudden death which may have decreased the amount of bleeding from the lacerated organs and fracture sites. The small amount of bleeding at the sites could also be explained if the death had already occurred due to a sudden cardiac failure. The possibility of death having preceded the accident cannot be proven, but there is a reasonable possibility that this is so.

1.7.12 Because of the uncertainty over whether the truck driver's cause of death, specifically, whether he had suffered a heart attack before the collision with the train, a second opinion was sought from the Chief Forensic Pathologist. His conclusion were as follows:

> "Traumatic damage to coronary arteries in blunt force trauma is uncommon but well recognised with case reports dating back as far as 1958."
>
> "Sudden Death from cardiac arrhythmia or disabling symptoms from the onset of infarction (even though they do not kill the driver outright) could manifest as the pathology findings found here. There is currently no feasible mechanism for reliably identifying onset of infarction within the short time course between onset and death of the person which [hypothetically] could occur in this case. The absence of changes in myocardium sampled provides no grounds to believe that early infarction has occurred in this case, but neither does the absence of pathological findings prove that it has not occurred for the reasons outlined above."
>
> "There were other traumatic (non-cardiac) injuries found which explain his death, which were of unassailable severity and interpretation."

1.8 Notification of accident to Ontrack

1.8.1 Train control did not receive an emergency vigilance alarm selcall from the derailed locomotive. The Fire Service was the first party to advise Ontrack of the collision.

1.9 History of level crossing accidents

1.9.1 Ontrack confirmed that there had been only one previous level crossing accident at Hawke Road; a non-injury accident in October 1986.

1.9.2 Ontrack advised that of the 275 level crossing accidents throughout New Zealand since 1 January 2000, 5 (including this accident) resulted in a derailment and in each case a heavy motor vehicle was involved. Four of the 5 derailments occurred on level crossings with "passive" control. In each case, the driver had failed to comply with the road signage.

2 Analysis

2.1 The interface between public road transport and rail operations can be hazardous at level crossings, where safe operation is primarily reliant upon the road user complying with the controls in place, because it is impossible for a train to stop in a short distance. For example, a fully laden freight train travelling at 80 km/h can take up to 800 m to stop. This is one of the reasons why the Railways Act 2005 determined that any person driving a rail vehicle was entitled to assume that the track in front was clear.

2.2 In this accident the evidence showed that the truck continued along Hawke Road and crossed the railway line directly in front of the approaching Train 923 without stopping at the limit line, thus bringing about the collision.

2.3 Hawke Road had a straight approach from State Highway 1 to the level crossing and had had only one, non-injury, accident more than 20 years earlier. The level crossing warning signage ahead of the crossing and the road signage and markings at the level crossing were all in place and in good condition and met the guidelines in the Road Signs and Markings for Railway Level Crossings manual. At the time of the accident, the weather was fine and the truck driver had a clear, unobstructed view of the signage telling him to stop before proceeding across the railway line. Why the driver did not stop and check that the railway was clear before proceeding could not be determined, but had he done so he could have seen the approaching train and waited for it to pass.

2.4 Some factors that need to be considered, such as the mechanical condition of the truck, the health of the truck driver, driver distraction and tiredness, the direction of the sun and the operation of the train are discussed in the following paragraphs.

2.5 From the examination of the truck, there was no evidence of mechanical defects found, such as with its braking system, that could have prevented it stopping. The statement from the locomotive engineer together with the absence of braking marks on the road surface suggested that no braking or insufficient braking was applied to stop the truck before the limit line.

2.6 While the first pathologist felt that there was a reasonable possibility that sudden cardiac arrest preceded the truck driver's death from the severe trauma of the accident, he reached that conclusion without having access to evidence from the accident site. The second pathologist was less conclusive about the possibility of cardiac arrest, but considered it still a possibility in the absence of clear proof. After examining all the evidence, including the site evidence, the Commission considers that the possibility of sudden cardiac arrest contributing to the accident was more unlikely than not for the reasons given in the paragraphs below.

2.7 The history of the accident indicated that the driver was operating the truck normally leading up to the accident, having made the appropriate steering and gear changes required to slow the truck down and turn off State Highway 1 to make the approach to the level crossing. The

observed speed of the truck just prior to impact was consistent with it accelerating normally away from State Highway 1 without necessarily preparing to stop at the level crossing. The truck was following the direction of the road and was on the correct side of the road at impact. It would be unusual for the truck to follow this path in such a controlled manner had the driver collapsed suddenly or become acutely incapacitated or impaired by coronary artery disease. The circumstances of the accident therefore made it unlikely that sudden cardiac arrest preceded the impact, as it appeared that the driver was operating the truck normally right up until the time that it was struck by the train.

2.8 Taking the above into consideration, the Commission's view is that the driver was operating the truck normally and his failure to stop at the level crossing was due to human performance considerations such as distraction, preoccupation, potential tiredness and mis-operation due to a slip or lapse in his driving-related decision-making. The evidence from the scene examination did not support medical incapacitation as a factor contributing to the collision.

2.9 Some tiredness leading to a lack of truck driver concentration might have been a factor in the accident because he had worked 51 hours during the preceding 4 days. However, while the daily work hours had been long, they had not exceeded the maximum permitted and his driving log recorded a 10-hour rest period between shifts, which was compliant with the driving regulations.

2.10 Apart from the radio telephone, no other equipment was found in the truck cab, such as a cell phone, that the driver could have been using at the time he was approaching the level crossing and thus distracted him. However, it could not be ruled out that some other form of distraction occurred. At the time of the accident the sun was high from a northerly direction, almost at right angles to the direction in which the truck was travelling. Therefore, the potential for sun strike has been discounted as a contributory factor.

2.11 Analysis of the Tranzlog event recorder data showed that the locomotive engineer had the train under control and travelling at the correct speed when approaching the level crossing. There were no changes to the control settings until about one second before impact when the locomotive horn sounded. The locomotive engineer had a few seconds only from the time he first saw the truck until the collision, so it was not possible for him to stop the train before the level crossing. By crouching down behind the control stand, the locomotive engineer took the appropriate action to reduce the risk of personal injury.

2.12 At impact the rapid reduction in brake pipe pressure caused by the locomotive brake cock being ripped off should have initiated a Tranzlog emergency selcall to train control. The emergency radio call was not transmitted because the wiring powering Tranzlog became disconnected when the locomotive cab separated from the chassis. This raised the issue of whether the installation of the devices was sufficiently robust to ensure that a timely transmission was sent to train control in the event of an accident, and is an area the operator should examine. However, had the locomotive engineer had time to apply full emergency braking, the resulting drop in brake pipe pressure should have activated, automatically, an emergency selcall to train control.

2.13 During the past 10 years there have been 5 accidents at public level crossings, including this event, that resulted in a train derailment and each case involved a heavy motor vehicle. All but one derailment occurred at a level crossing with passive controls, and in each occurrence the truck driver had not complied with the road regulations even though appropriate signage was in place. Because the safety issues dealing with the potential hazards of road vehicles negotiating level crossings have been well documented in the public arena, no safety recommendation, relevant to the rail industry, was considered necessary.

3 Findings

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

3.1 The collision between the truck and Train 923 at Hawke Road level crossing was brought about because the truck driver did not come to a stop as required by the road signage and continued moving into the path of the approaching train.

3.2 No mechanical issues were found with either the truck or the locomotive that could have contributed to the collision.

3.3 The road signage and markings were in good condition and clearly visible and met the specified protection criteria for the level crossing.

3.4 No mechanical or environmental issues were identified that could have prevented or distracted the truck driver from seeing the road signage and markings and stopping the truck at the limit line, clear of the railway.

3.5 Although it was possible that the truck driver suffered a cardiac event such as a heart attack prior to the collision, this is considered unlikely given the controlled manner in which he was driving immediately prior to the truck reaching the level crossing.

3.6 A contributing factor may have been some tiredness for the truck driver because he had worked up to the maximum number of hours permitted each day for the 4 days before the accident.

3.7 The locomotive engineer was operating the train correctly and could not have taken any other action to avoid or lessen the impact of the collision.

3.8 Because the locomotive Tranzlog cabling was disrupted during the accident, an automatic emergency radio selcall was not sent to train control.

3.9 This accident highlighted the need for vigilance at level crossings to prevent collisions and the potential for a heavy road vehicle to derail a train should there be a collision.

4 Safety Recommendation

4.1 On 20 May 2010, the Commission recommended to the Chief Executive of the NZ Transport Agency that he address the following safety issue:

> that the integrity of locomotive event recorders and radios during a train collision, derailment or rollover be strengthened to an extent that the capability be maintained to transmit an emergency radio selcall to train control. (007/10)

4.2 On 28 May 2010, the Rail Safety Manager, NZ Transport Agency replied in part:

> We intend to work closely with KiwiRail with an aim to implementing and closing this recommendation as soon as practicable.

Approved on 20 May 2010 for Publication

Mr John Marshall QC
Chief Commissioner

Works Cited

Australian Transport Council. (2003). *The Australian Level Crossing Assessment Model*. Australia.
Land Transport New Zealand. (2002). *Vehicle Dimensions and Mass*. Wellington, New Zealand.
Land Transport Safety Authority. (2000). *Road Signs and Markings for Railway Level Crossings.* Wellington: Land Transort Safety Authority.
Medlab, Timaru Hospital. (2008). *Autopsy Report to the Coroner*. Timaru: Medlab.
New Zealand Government. (1976). Traffic Regulations 1976. Wellington, New Zealand.
New Zealand Government. (2005). Railways Act 2005. Wellington, New Zealand: Brookers.
NZ Transport Agency. (2007). *Work Time and Logbooks.* Wellington, New Zealand.
Toll Rail NZ Consolidated Limited. (2005). *Rail Operating Manual, Section 3, Rostering locomotive running*. New Zealand.
Tranz Rail. (1997, 12 18). *Infrastructure Code Supplement Issue 2*. Wellington, New Zealand.

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

08-113	Report 08-113, empty push/pull passenger Train 5250, collision with platform-end stop block, Britomart station, Auckland, 19 December 2008
08-103	Report 08-108, express freight Train 845, track warrant overrun, Reefton – Cronadun, 13 August 2008
07-103	Report 07-103, passenger express Train 200, collision with stationary passenger express Train 201, National Park, 21 March 2007
07-115	Report 07-115, express freight Train 533, derailment, 103.848 kilometres, near Tokirima, Stratford – Okahukura Line, 7 November 2007
06-106	Report 06-106, express freight Train 826, signalling irregularity, Cora Lynn, 31 July 2006
07-108	express freight Train 720, track warrant overrun at Seddon, Main North Line, 12 May 2007
07-113	express freight Train 239, wagons left in section at 514.9km, between Te Awamutu and Te Kawa, 22 September 2007
07-110	collision, express freight Train MP2 and Work Train 22, Ohinewai, 19 June 2007
06-110	passenger train 4045, uncontrolled movement, between Britomart and Quay Park Junction, 9 October 2006
06-108	EMU Passenger Train 9268, struck slip and derailed, between Wellington and Wadestown, 26 August 2006
07-101	express freight Train 736, derailment, 309.643 km, near Vernon, 5 January 2007
05-123	empty passenger Train 4356, overran conditional stop board without authority following an automatic air brake irregularity, Meadowbank, 6 October 2005
05-116	collapse of Bridge 256 over Nuhaka River, Palmerston North-Gisborne Line, 6 May 2005
05-124	express freight Trains 834 and 841, collision, Cora Lynn, 20 October 2005
06-112	loss of airbrakes and collision, Tram 244, Christchurch, 21 November 2006
06-102	SA/SD passenger Train 4306, braking irregularity, between Westfield and Otahuhu, 31 March 2006

Price $22.00 ISSN 1178-4164