



Report 97-104

Train 537

signal passed at danger

Ngaruawahia

15 April 1997

Abstract

On Tuesday, 15 April 1997, at approximately 2120 hours the locomotive engineer of Train 537, a southbound express freight, reported that the level crossing alarms at Ellery Street level crossing at Ngaruawahia had failed to operate for the passage of the train. Fortunately, no accident occurred. Tranz Rail Limited's initial investigation on the night of the incident revealed the signal controlling the approach over the crossing had both filaments blown on the stop indication bulb. The Commission's subsequent investigation concluded that the train had passed the signal at stop.

Safety issues identified were the need for locomotive engineers to be aware of the purpose and function of Approach Signals, and the need for timely notification of incidents to the Land Transport Safety Authority.

Transport Accident Investigation Commission

Rail Incident Report 97-104

Train type and number:	Express Freight, 537
Date and time:	15 April 1997, 2120 hours
Location:	Ngaruawahia, 558.74 km North Island Main Trunk
Type of occurrence:	Signal passed at danger
Persons on board:	Crew: 1
Injuries:	Crew: Nil Others: Nil
Nature of damage:	Nil
Investigator-in-Charge:	R E Howe

1. Factual Information

1.1 Narrative

- 1.1.1 On Tuesday, 15 April 1997, Train 537 was a scheduled southbound express freight service operated by Tranz Rail Limited (Tranz Rail) from Westfield to Te Rapa.
- 1.1.2 Train 537 consisted of DFT 7239 (leading), DX 5120 and a total train of 576 t and 302 m in length.
- 1.1.3 At approximately 2120 hours Train 537 was travelling through Ngaruawahia at slow speed after negotiating the crossover from the single line at the north end. The locomotive engineer (LE) stated he had been following Train 411, and running on yellow and green indications from the signals encountered.
- 1.1.4 As Train 537 approached Signal A11, the Down Approach from the Down Main¹, the LE observed the signal at red and slowed his train to a stop. He stated he was not aware that Signal A11 was a time-controlled signal operated by the approach of a train and understood it was controlled by Te Rapa signal box.
- 1.1.5 The LE stated he switched the headlights on the train from full to medium at this stage for the benefit of motorists on the road ahead. He could not recall whether he switched back to full before crossing Ellery Street.
- 1.1.6 When Signal A11 changed to a yellow indication the LE stated he moved slowly around the left hand curve towards Ellery Street level crossing. When interviewed some three weeks after the incident the LE's recollection was that Signal 11 displayed a yellow indication as the train approached it and he continued past it at slow speed.
- 1.1.7 Just after passing Signal 11, and with Train 537 entering Ellery Street level crossing some 20 m south of the signal, the LE saw "... a vehicle flash over in front of me very fast".
- 1.1.8 The LE looked out of his side window and saw the barrier arms protecting Ellery Street level crossing were vertical.
- 1.1.9 The LE stated he looked back when he was just over the crossing, and also when some 170 m past the crossing, and at no time saw signs of the barriers or flashing lights working. He could not recall whether this was by looking out of his rear cab window or by opening his side window and leaning out.
- 1.1.10 When the train was clear of the crossing the LE advised Te Rapa signal box that the level crossing alarms were not operating.

¹ Approach Signals are a standard part of the Tranz Rail signalling system. They are provided at places where it is necessary to control the speed of trains approaching junctions, points or other interlocked areas. An Approach Signal is a Stop and Stay signal placed before (in Tranz Rail terminology "in rear of") another Stop and Stay signal. Signal A11 was the Approach Signal for Signal 11. It was required due to the restricted approach view of Signal 11. If Signal 11 was at a red indication Signal A11 showed a red indication. Signal A11 was timed to change to a yellow indication 25 seconds after the passage of a train over an insulated joint approximately 250 m before Signal A11. This ensured a slow speed approach to Signal 11, which was 184 m south of Signal A11.

- 1.1.11 The LE completed the journey to Te Rapa uneventfully with proceed indications on all signals. On arrival at Te Rapa he completed a report on the incident which included:
- After passing a yellow indication on the Down Starting signal at Ngaruawahia I proceeded towards the Ellery Street level crossing. As I almost got to the crossing a four wheel drive vehicle went straight over the crossing in front of the train. It was at this point I realised the alarms, arms and bells were not working.
- 1.1.12 The signalling staff member on call on 15 April 1997 spoke with the LE that night and recalled the LE telling him “The signal was at red, went to yellow, and a Pajero shot across”.
- 1.1.13 The Signal Field Engineer also spoke to the LE on the night by telephone and recalled being advised “The signal was at red, I slowed and almost stopped. It went to yellow and I proceeded.”
- 1.1.14 On 16 April 1997 the Signal Field Engineer again spoke by telephone with the LE to clarify what indication the LE had seen on each signal. He recalled the LE advising him Signal A11 was yellow, and Signal 11 “. . . would have to be at yellow”.
- 1.1.15 The Te Rapa signalperson recorded in his log that Train 411 had departed from Ngaruawahia at 2118 hours and Train 537 at 2122 hours. The recorded arrival times at Te Rapa were 2138 hours and 2140 hours respectively.

1.2 Alleged wrong side failure²

- 1.2.1 The LE’s verbal and written report indicated the crossing alarm system had failed to activate which constituted a wrong side failure. A 10 km/h speed restriction was immediately imposed and an investigation commenced by signalling staff.
- 1.2.2 Investigation on the night of 15 April found the red aspect on Signal 11 was blacked out due to failure of the two filaments of the bulb. Detailed testing on 15 and 16 April revealed no other faults in the signalling or protection system.
- 1.2.3 Blacked-out signals due to bulb failure are not uncommon. Tranz Rail advised approximately 70 bulb failures per month are reported for the approximate 15,000 bulbs within the signalling and level crossing asset base.
- 1.2.4 Tranz Rail’s operating procedures recognised this problem and included the following practices to minimise risk:
- bulbs are double filaments with staged life cycles, and a system exists for reporting dim indications when one filament fails,
 - blacked-out signals are defined as signals at danger and are required to be treated accordingly.

No reports of a dim indication, or of a bulb failure, at Signal 11 had been made prior to the incident.

² A wrong side failure occurs when a system or piece of equipment installed for safety reasons does not default to a safe condition on failure.

- 1.2.5 By 16 April local signalling staff, and the Signal Field Services Engineer in Wellington evaluating the test results, concluded a wrong side failure had not occurred and that the likely reason for the level crossing protection not operating was that Signal 11 had been passed at danger while blacked out.
- 1.2.6 After reviewing test results the 10 km/h speed restriction was lifted on 18 April.
- 1.2.7 On 29 April the Signal Field Services Engineer advised the Tranz Rail Quality and Safety office by memorandum of the conclusion reached regarding a signal passed at danger (SPAD). This resulted in notification of the incident to the Land Transport Safety Authority (LTSA) on 1 May 1997.

1.3 Site details

- 1.3.1 It was overcast with no rain on the night of 15 April 1997 and visibility was reported to be good.
- 1.3.2 Signal 11 was a Stop and Stay signal. The signal type was indicated by a red reflecting disk vertically below the upper lights.
- 1.3.3 Signalling staff who attended the incident on the night of 15 April 1997 found that both filaments of the stop indication bulb on Signal 11 were blown and the Signal was blacked out when required to display a red indication.
- 1.3.4 Tests were carried out to assess the visibility of Signal 11 when blacked out for a train at slow speed approaching around the left hand curve from Signal A11. Although the locomotive headlights were not directed at the signal due to the curvature the red disk stood out on high beam and was still clearly visible on dim.
- 1.3.5 The orientation of the barrier arms and lights at Ellery Street made it difficult for an LE looking back to see whether the protection was operating or not. Site tests showed that the flashing lights on the standards and barrier arms were visible when looking out of the side window of the locomotive but difficult to pick up when looking through the rear window.
- 1.3.6 Due to the late reporting of the incident no event recorder outputs covering 15 April 1997 were available for either Train 537 or Train 411.

1.4 Control of signals

- 1.4.1 Signal 11 was controlled by Te Rapa signal box. Te Rapa signal box has a route setting panel with entry and exit control. Once the signalperson had selected the route entry and exit points automatic route setting and signal clearance was initiated if the sections concerned were clear.
- 1.4.2 The signalperson had to reset the route after the passage of each train to initiate a proceed indication on Signal 11. When interviewed three weeks after the incident the signalperson could not recall whether he had reset the route for Train 537 or not prior to the incident occurring.
- 1.4.3 If the route had been reset for Train 537 following the passage of Train 411 Signal 11 would not have displayed a yellow proceed indication until Train 411 had passed Intermediate Signal 55629, some 2.4 km south of Signal 11.

1.5 Level crossing protection

- 1.5.1 The protection at Ellery Street level crossing for down trains could be activated in three ways dependent on the indication displayed by Signal 11:
- If Signal 11 was at green or yellow (with Signal A11 automatically at green) the protection was activated by an approaching train when 620 m north of Ellery Street level crossing.
 - If Signal 11 was at red (with Signal A11 automatically at red), and remained at red, the protection was not activated until an approaching train, having passed Signal A11 after it timed to yellow, was authorised to pass Signal 11 at stop. Normal practice in such circumstances was for a train to inch forward, activate the protection, and wait for the barriers to drop before proceeding. Once the protection was activated the barriers commenced lowering after 6.5 seconds and were fully lowered after a further 9.5 seconds.
 - If Signal 11 was at red, and as a result of Te Rapa signal box route setting was given a message to display a proceed indication after a train had passed the 620 m protection activation point, the proceed indication would not be displayed until the level crossing protection had been activated and the barriers were down or other delayed clearing conditions met. The restraint of the indication displayed on Signal A11 ensured a slow speed approach in these circumstances.

1.6 Personnel

- 1.6.1 The LE had joined New Zealand Railways in 1967 and had 20 years experience as a locomotive engineer. He held a current operating certificate for the duties concerned.
- 1.6.2 His work and recreational patterns were normal. His health was good and he had no requirements for any medication that might affect performance.

2. Analysis

2.1 Wrong side failure or SPAD?

- 2.1.1 The LE's prompt incident report on 15 April 1997 was based on his concern that the level crossing protection had failed to operate. His recollection of signal indications gave him no reason to believe a SPAD had occurred.
- 2.1.2 The detailed tests carried out by signalling staff found no fault with the operation of the signalling and integrated protection of Ellery Street level crossing except for the blown filaments on the stop indication on Signal 11. By 16 April 1997 local and head office signalling staff had concluded a wrong side failure had not occurred and that the likely reason for the failure of the protection to activate in time was that the train had passed the blacked-out stop indication on Signal 11.
- 2.1.3 Regrettably this conclusion was not immediately advised to the Tranz Rail Quality and Safety office to allow the incident to be notified to the LTSA at that time, and for an internal Tranz Rail investigation of a possible SPAD to be initiated.

- 2.1.4 The subsequent late notification of the incident on 1 May 1997 meant that factual evidence, such as the event recorder logs to allow the position, speed and separation of Trains 411 and 537 to be analysed, was not available. In addition staff concerned were not able to be interviewed until three weeks after the incident and had understandable difficulty in recalling specific events and the order in which they occurred.
- 2.1.5 It is considered a SPAD occurred on 15 April 1997, and not a wrong side failure, for the following reasons:
- 2.1.5.1 Detailed tests failed to reveal any fault in the operation of the Ellery Street level crossing protection. While this did not rule out the chance of an intermittent failure allowing a yellow proceed indication on Signal 11 without activation of the protection at Ellery Street the chance of such a failure occurring was very low.
- 2.1.5.2 It was unlikely that the signalperson at Te Rapa had set a route for Train 537. Train 411 was logged in at four minutes ahead of Train 537 departing Ngaruawahia. The log timings showed Train 411 then took 20 minutes to travel 10.5 km to Te Rapa. Assuming an average speed over this distance Train 411 would have taken 4.5 minutes to reach Signal 55629. The lack of event recorder log details means this timing cannot be defined with accuracy. However it is considered likely that Train 411 either had not cleared Signal 55629, or had only just cleared Signal 55629, when Train 537 proceeded across Ellery Street level crossing. If a route had not been set for Train 537 Signal 11 would normally have been showing a red indication, although in the circumstances of the night this was almost certainly a blacked-out signal.
- 2.1.5.3 The LE stated he saw and responded to a red indication which turned to yellow as he approached Ellery Street level crossing. If, as is almost certain, this red was displayed on Signal A11, Signal 11 would normally have been displaying a red indication if the bulb filaments had not blown. This meant the route had not been set and cleared for Train 537.
- 2.1.5.4 The LE's written report on the night of the incident referred to "... passing a yellow indication on the Down Starting Signal" (i.e. Signal 11) and made no mention of Signal A11. It is considered very unlikely that Signal 11 could have displayed a yellow indication to Train 537 for the reasons outlined.
- 2.1.5.5 The LE may not have noticed that the Ellery Street protection had been activated when Train 537 passed Signal 11 because of:
- the designed delay in barrier operation,
 - the orientation of the barrier arms and flashing light standards,
 - the uncertainty regarding his method of looking back.
- 2.1.6 The LE may have unknowingly treated Signal A11 as the Starting Signal (he stated that he was not aware that A11 was a time-controlled signal and believed it was controlled by Te Rapa signal box) if he did not see Signal 11 some 184 m further on because the red aspect was blacked out. Although this does not totally fit his recollection of events when interviewed some three weeks later this is not surprising when considering the elapsed time.
- 2.1.7 Although this report finds a SPAD did occur the evidence supporting this is not conclusive, due mainly to late notification of the incident.

2.2 Incident notification

- 2.2.1 The late notification of this incident adversely affected the investigation. SPADs are a serious operating irregularity, particularly when the LE involved is unaware that a SPAD has occurred.
- 2.2.2 Tranz Rail's internal procedures failed to ensure that the early indication that a SPAD may have occurred was notified, and effectively followed up internally, in a timely manner.
- 2.2.3 Late reporting of incidents has been of concern to the Commission. As a result of Railway Occurrence Report 96-116, Opapa, the Commission recommended to Tranz Rail that they improve their incident reporting procedures. Tranz Rail are taking action as detailed in section 4, Safety Actions.

3. Findings

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

- 3.1 The Tranz Rail signalling system was operating as intended.
- 3.2 The red indication bulb on Signal 11 had failed in both filaments in all probability prior to the approach of Train 537 on 15 April 1997.
- 3.3 Adequate rules and procedures were in place to cover the possibility of bulb failure.
- 3.4 The Tranz Rail system to protect trains authorised to proceed across Ellery Street level crossing was operating as intended.
- 3.5 The LE of Train 537 was appropriately certified for the duties concerned.
- 3.6 The failure of the LE of Train 537 to observe and act on the indication of Signal 11 resulted in Signal 11 being passed at danger.
- 3.7 The speed of Train 537 precluded any warning to approaching road traffic on Ellery Street by means of the flashing lights and bells and barriers installed, and resulted in a near collision with a road vehicle.
- 3.8 The LE was unaware that he had passed Signal 11 at danger.
- 3.9 The close proximity of Approach Signal A11 to the blacked-out Signal 11, and the LE's belief that the Approach Signal was controlled by Te Rapa signal box, may have led him to act on the indication of Signal A11 as if it was the Starting Signal indication.
- 3.10 The late notification resulted in the unavailability of information which would have clarified the sequence of events which led to the incident.

4. Safety Actions

- 4.1 Following the incident Tranz Rail took action to remind locomotive engineers of the purpose and function of Approach Signals with particular respect to the automatic proceed indication received after a pre-arranged time delay.
- 4.2 As a result of a Commission safety recommendation arising from Railway Occurrence Report 96-116 Tranz Rail advised on 21 August 1997 that a review was underway to reinforce procedures then in place when an incident was required to be notified to the LTSA. Tranz Rail has confirmed that this review will include revised procedures to avoid the delay associated with the notification of this incident.

12 December 1997

Hon. W P Jeffries
Chief Commissioner

