



Report 00-106
shunt Y35
track warrant overrun
Mataura
4 May 2000

Abstract

At approximately 1010 hours on Thursday, 4 May 2000, Y35 shunt overran its track warrant limit at Mataura by 15 km. There was no opposing traffic.

Safety issues identified included:

- the need for better communication between train controllers and remote control operators when track warrants issued for main line shunts did not reflect work-between localities requested
- the need for more effective ways of communicating, and monitoring compliance with, amendments to rules and regulations to improve safety
- the need for formalised crew resource management training for Tranz Rail operational staff.

A safety action taken by Tranz Rail and 3 safety recommendations address these issues.

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 Shunting procedures at Maitara 3

 1.3 Train control procedures 3

 1.4 Procedural changes arising from the Waipahi collision (Report 99-122)..... 4

 1.5 Personnel..... 4

 1.6 Crew resource management 5

2. Analysis 6

 2.1 Track Warrant 59 6

 2.2 Failed defences..... 6

3. Findings 7

4. Safety Actions 7

5. Safety Recommendations 8

Figures

Figure 1 Simplified train control diagram 1

List of Abbreviations

CRM	crew resource management
km	kilometre(s)
LE	locomotive engineer
RCO	remote control operator
Tranz Rail	Tranz Rail Limited
TW	track warrant

Data Summary

Train type:	shunt Y35
Date and time:	4 May 2000, 1010 hours
Location:	Mataura, 550 km Main South Line
Type of occurrence:	track warrant (TW) overrun
Persons on board:	crew: 2
Injuries:	nil
Nature of damage:	nil
Operator	Tranz Rail Limited (Tranz Rail)
Investigator-in-charge:	R E Howe

1. Factual Information

1.1 Narrative

- 1.1.1 On Thursday, 4 May 2000, shunt Y35 based at Mataura was operating on the main line under TW control carrying out normal shunting duties in the vicinity of Mataura, within windows operating between scheduled main line train movements. The shunt was crewed by 2 remote control operators (RCOs), one driving manually from the cab (RCO 1) and one controlling ground movements (RCO 2).
- 1.1.2 Normally a shunting window was available between 0915 and 1030, dependent on the direction the shunt wished to travel and the actual train times and other track movements on the day.
- 1.1.3 Figure 1 is a simplified train control diagram for the day. Southbound Train 919 was running late and had crossed northbound Train 902 at Mataura. A track inspector using a hi-rail vehicle was following Train 902 north out of Mataura.

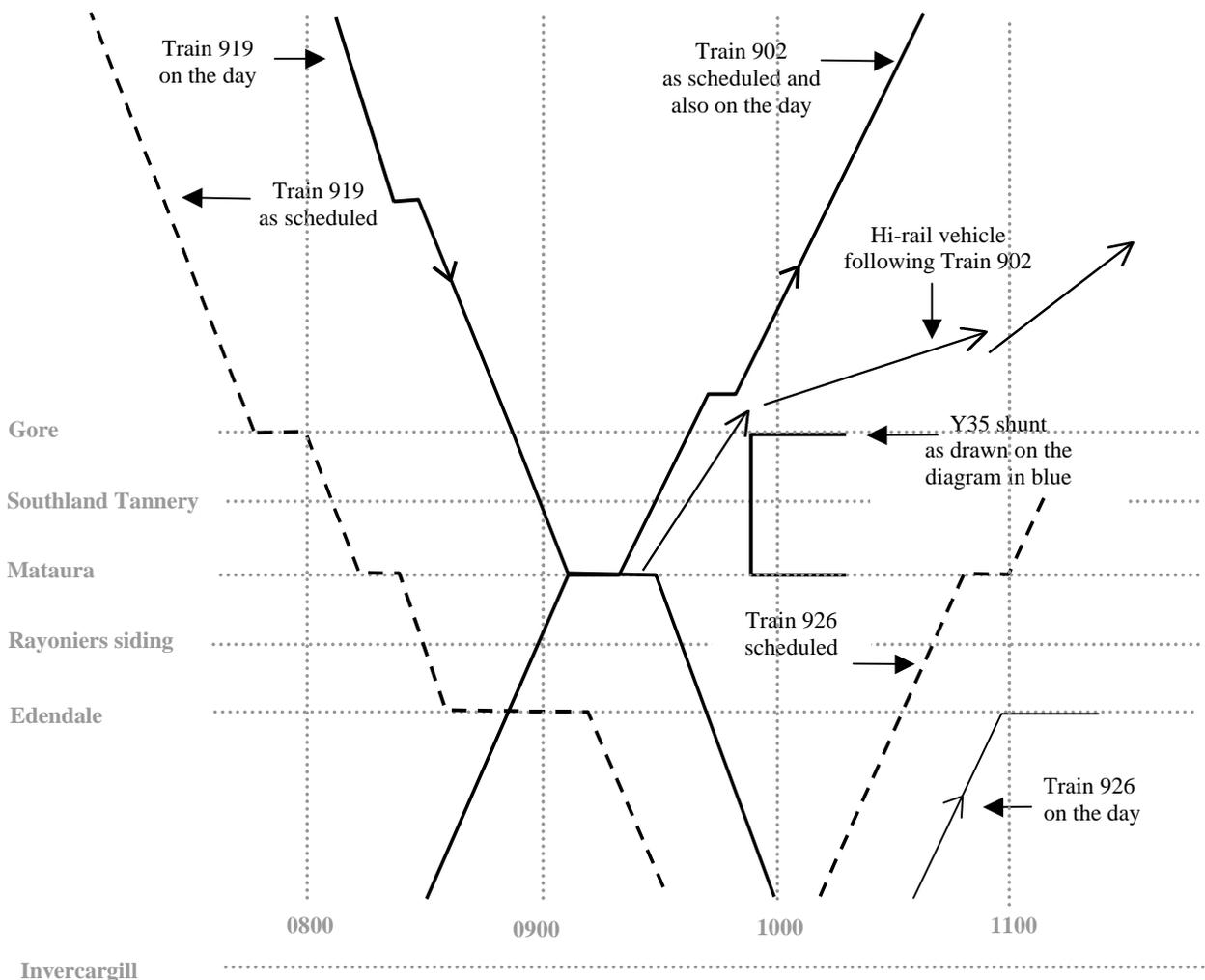


Figure 1
Simplified train control diagram

1.1.4 At 0917 hours RCO 1 called the train controller (TC) from Mataura to say Train 919 was pulling out of the loop, and requesting permission for the shunt to use the loop. This was granted. The following conversation then took place:

RCO 1 "I think we are just going to Rayoniers and Edendale first."

TC "Okay I've got him to call Edendale, so once he's cleared there we can get you up no problem."

RCO 1 "We have got a wagon here for Southland Tanneries, which they are looking for this morning."

TC "Okay."

RCO 1 "So we will have to shoot up there, as long as it's there before 11 o'clock."

TC "Before 11?"

RCO 1 "Yes."

TC "Okay."

RCO 1 "Yes, I am not sure what (RCO 2) plans are yet."

TC "All right, well you come back to us anyway. That will be fine, but you are okay to take the loop once that fellow is out of your road."

RCO 1 "That's good as gold."

TC "Okay."

RCO 1 "Thanks (TC)."

TC "Thanks (RCO 1)."

1.1.5 At 0939 hours RCO 1 again called the TC when the following conversation took place:

TC "Y35, control receiving."

RCO 1 "Y35 on the loop at Mataura. Our first move will be Southland Tanneries, then direct to Edendale, back to Rayonier and back to Mataura. Over."

TC "Um, Tanneries first? So you want to go to Tanneries first is it?"

RCO 1 "Roger, that is correct, over."

TC "Roger, come back to you shortly, I have got um 902 to clear at Gore first. Also I have got track inspector following him so I have got to make sure that both those 2 are clear, I'll come back."

RCO 1 "Very good."

1.1.6 After checking that Train 902 and the track inspector were clear of Gore the TC prepared a TW for Y35 shunt to work between Mataura and Gore. This was drawn in blue on the train control diagram (Figure 1). At 0945 hours he contacted Y35 shunt and TW 59 was correctly issued and repeated back correct at 0946 hours. The warrant later recovered from Y35 accurately reflected TW 59 as issued.

- 1.1.7 RCO 2 was on the front wagon of the shunt ready for the intended propelling movement north to Southland Tanneries. Although in radio contact with RCO 1 he could not hear communication between RCO 1 and the TC and did not hear TW 59 issued. RCO 2 said that RCO 1 told him a warrant had been obtained, and RCO 2 assumed it was for work between Gore and Edendale, based on the work they had ahead of them.
- 1.1.8 The shunt propelled to Southland Tanneries, with RCO 1 in the cab driving and RCO 2 on the leading end, and dropped off the required wagon. RCO 2 then joined RCO 1 in the cab, climbing in the non-driver's side and taking his seat. He said it was his normal practice to check warrants in such cases, but he did not look at the TW on this occasion.
- 1.1.9 There was no discussion of warrant limits as Y35 proceeded from Southland Tanneries siding to Mataura, passing the Mataura station warning board without any specific action by either of the RCOs. The shunt then proceeded through Mataura (the limit of its TW) approximately 15 km to Edendale and carried out some shunting. When RCO 2 rejoined the locomotive at approximately 1010 hours he checked the TW and discovered the overrun. The TC was advised and appropriate action initiated.
- 1.1.10 The first scheduled train through the Edendale-Mataura section was northbound Train 926 due through at approximately 1040 hours.

1.2 Shunting procedures at Mataura

- 1.2.1 The 4 staff based at Mataura worked rostered early and late shifts. All 4 came from a shunting background and had been trained and certified in remote control locomotive operation. Training and certification also included manual locomotive operation commonly used when running main line to service the 30 km section of main line and associated sidings worked from Mataura. They were multi-skilled, able to carry out locomotive control or ground control duties, usually governed by a "first come first served" formula. RCO 1 preferred ground duties and commented "You had to be quick to claim the RT" (radio transmitter) required for ground duties. His preference for ground duties was based on his interface with customers and his perception of the "boring" and non-physical aspect of cab duties traditionally carried out by locomotive engineers (LEs).
- 1.2.2 The normal pattern for shunting around Mataura in the 1000 window was to shunt south. This was governed by resin tanks required at Rayonier siding. RCO 1 recalled the last time he shunted north first instead of south was some 5 weeks prior to the incident.
- 1.2.3 Shunt staff commented on the tight window available for shunting around 1000 hours because of the common late running of Train 919, and the restraint of Train 926 when running to time. The workload followed a pattern of a south shunt to drop off at Rayoniers, pick up at Edendale and pick up at Rayoniers before returning to Mataura in time to avoid a delay to Train 926. Any infrequent north shunt requirement, as occurred on the day of the incident, placed greater pressure to complete the work.

1.3 Train control procedures

- 1.3.1 Shunt movements were unlike main line train movements, where LEs called for a warrant without nominating a termination point and were given a termination point by the TC based on operating restraints. RCOs in charge of shunts outlined their work requirements, anticipating a work-between warrant to complete them. The TC confirmed he interpreted shunt work requirements as a request for a work-between warrant. However, TCs did not always issue warrants covering all the work requested. The TC said that although warrants he issued for shunt services usually reflected work requirements, this could not be guaranteed.

- 1.3.2 When interviewed following the incident the TC could not explain why he limited the work area to north of Mataura, because on reflection he considered a TW to work north and south was possible without conflicting with Train 926.

1.4 Procedural changes arising from the Waipahi collision (Report 99-122)

- 1.4.1 As a result of a review of TW procedures following the fatal Waipahi collision of 20 October 1999, Track Warrant Control Regulations were amended by Bulletin 183, issued on 29 March 2000, which included:

Commencing 1200 hours on FRIDAY 31 MARCH 2000 and continuing until further advised the following instructions will operate. The relative Track Warrant Regulations are modified accordingly.

TRACK WARRANT CONTROL REGULATIONS

* **Implement Mandatory Calling of Limits Held**

**2. Operating in Track Warrant Control Area
(additional new sub-clause)**

- (n) As a train approaches a station warning board or intermediate signal, the addressee must call on radio channel 1 advising the train number, location being approached and the terminating limit of the warrant held.

Track maintenance vehicles operating with a track warrant must also comply with this procedure, advising the vehicle identification number if not operating with a train number.

When calling on the radio make sure there are no other transmissions on channel 1 otherwise your transmission will not be heard correctly.

As detailed in Report 99-122, such a call on channel 1 was not intended to be received. The intent was to provide a specific process to refresh knowledge of the TW limit. Channel 1 was the local channel and could only be heard by train crews or other staff who happened to be in the near vicinity. It was a check procedure which Tranz Rail proposed to monitor by random listening equipment which is currently being progressively introduced.

- 1.4.2 None of the 4 staff at Mataura were aware that this instruction related to their main line shunt operations. While 2 could recall reading the Bulletin the other 2 had no such recollection. Mataura staff said they had no specific briefing on the change. The bulletin had been posted on the office board for a short time and then filed in a folder. No channel 1 calls had been made from Mataura shunts from introduction of the instruction until the day of the incident.
- 1.4.3 On 24 March 2000, Tranz Rail distributed a briefing paper for all staff operating in TW territory, covering the changes proposed in Bulletin 183. Local managers were required to provide all staff with a copy to enable them to clarify any matters they may be unsure about. Staff at Mataura did not recall receiving the briefing paper and had not requested any clarification.

1.5 Personnel

- 1.5.1 RCO 1 had 19 years railway experience, mainly as a numbertaker/wagon recorder. He transferred to shunting about 1996, and to Mataura in early 1999, at which time he was trained and initially certified for remote control operations on 12 May 1999. Following his initial certification he had 3 on-the-job checks, the last on 16 September 1999, which was also his last formal safety observation. He felt that his training had been practical and suitable, and he felt confident to carry out rail operator duties following his certification.

- 1.5.2 His shift had started at 0400 hours and was due for completion at 1200 hours. It was his fourth day on early shift following time off over Easter. His health was good and he did not consider he was fatigued or under stress at the time of the incident.
- 1.5.3 RCO 2 had 20 years railway experience, mainly as a shunter. He had been an RCO at Mataura since remote control locomotives had been introduced in 1996. His last monitoring check was a formal safety observation made on 17 March 1999, some 14 months before the incident. His shift pattern was similar to that of RCO 1.
- 1.5.4 Tranz Rail safety observation procedures required formal observations 3 times within 24 months with a maximum of no more than 9 months between separate observations. Of these 3 assessments a minimum of one was required to be a Level A observation carried out by a person holding a licence to perform the tasks being evaluated. The monitoring of RCO 1 met this criteria but the monitoring of RCO 2 did not.
- 1.5.5 Both RCO 1 and RCO 2 held current certification for the duties concerned.
- 1.5.6 The TC had 28 years railway experience, 13 of which was in train control. He held current certification for the duties concerned.

1.6 Crew resource management

- 1.6.1 Crew resource management (CRM) is a general term covering crew management in highly operational situations: for example, on ships, in control rooms of power plants, in aircraft, and in medical operating theatres.
- 1.6.2 The way human beings interact, communicate and make decisions in such situations is quite similar. Equally, errors in such situations are also similar. Training in this area was developed in the airline industry as a result of research which showed that most aircraft accidents occur as a result of crew management errors rather than technical malfunction. The concept has since been adopted and formally adapted to suit the maritime industry.
- 1.6.3 Examples of common CRM failings are preoccupation with minor technical problems, failure to delegate the tasks and assign responsibilities, failure to set priorities, inadequate monitoring, failure to use available data, failure to communicate intent and plans, and failure to detect and challenge deviations from standard operating procedures. Failure to communicate and failure to challenge were key factors in this incident.
- 1.6.4 Although the principles of CRM have application to certain rail operating environments CRM training has not been adopted in the rail transport industry to the same extent as in the air and marine industries.
- 1.6.5 This was recognised by the Commission in Report 98-107, Train 411, wrong line running, Ngaruawahia, which included the following recommendation:

Introduce formalised crew resource management training for Train Control Operators, Signalmen and LEs based on the training available in the aviation and marine industries. (001/99)

Tranz Rail replied:

001/99

Service Delivery will review the crew resource management training available within New Zealand for the aviation and marine industry to assess its suitability to meet the requirements of our operation. If accepted such training would be linked into our current training requirements for Locomotive Engineers, Signalbox and Train Control staff.

2. Analysis

2.1 Track Warrant 59

- 2.1.1 TW 59 was a valid warrant, correctly issued and confirmed in accordance with the Tranz Rail procedures. The procedures associated with such an issue were meant to ensure those receiving the warrant clearly understood all conditions, particularly the warrant limit. This was not achieved, and RCO 1's misunderstanding of his TW limit caused the overrun.
- 2.1.2 RCO 1's experience and motivation probably contributed to him not registering his TW limit. His desire was to carry out a specific work function to achieve an end result by the end of his shift at 1200 hours. Although he heard, wrote down and repeated back the Mataura-Gore work limits, his memory of normal work patterns within the time block and the effect of a break in established pattern overrode the limit established by the TW procedures with the resulting overrun.
- 2.1.3 RCO 2 was unaware of the TW limit until arriving at Edendale. Although it was not required that he know the limit, or check it, his lack of knowledge did not allow CRM principles to be applied, which may have avoided the incident.
- 2.1.4 The TC was not required to bring to a shunt crew's attention any differences between the limits of work requested and TW limits granted, except by the formal issue of the warrant. An opportunity was therefore lost to reinforce the TW being issued to the recipient, a further example of not realising the benefits of CRM principles.
- 2.1.5 The general issue of CRM as an aid to minimising operational human error had been raised by the Commission previously (section 1.6.5). Although specific action has been taken to address issues raised in this report (section 4.1) more could be done in this area. A further recommendation has been made to the managing director of Tranz Rail to address this issue.

2.2 Failed defences

- 2.2.1 Bulletin 183 recognised the reliance of the TW system on human input and was introduced to provide an additional safeguard against the chance of human error causing an overrun. The new requirements had not been effectively introduced to the RCOs at Mataura, thus removing a potential defence to the overrun which occurred.
- 2.2.2 There had been no formal safety observations of RCO 2 for 13 months, some 4 months past requirements. Although RCO 1 had received frequent visits for tuition and checking up until September 1999, a gap of almost 8 months followed. While such a gap was within code requirements the combination of his relative inexperience and the new rule requirements introduced in April 2000 should have alerted local management to the need to ensure the changes were introduced with particular care to ensure understanding and compliance.
- 2.2.3 Operating staff from a shunting background who do main line running in control of shunts are more vulnerable than LEs to human error because of the potential conflicting requirements of shunt demands to suit customers and safe main line operating procedures. The training and supervision of such staff, and the defences in place to minimise such errors, need to take specific account of this vulnerability.

3. Findings

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

- 3.1 Y35 shunt was operating under a valid TW, correctly issued in accordance with Tranz Rail requirements.
- 3.2 RCO 1's overrun of the TW was caused by a combination of factors including:
 - his preoccupation with customer requirements
 - the departure from standard pattern associated with the northbound shunt
 - his lack of knowledge of recent regulation changes meant to avoid such errors
 - the limited CRM support available due to RCO 2's lack of knowledge of the TW limit
 - the limited CRM support available due to the lack of explanation from the TC regarding the difference between work-between requirements and warrant limits granted.
- 3.3 Matura staff were not familiar with the amended regulations intended as a defence to TW overrun, due to the failure of local management to ensure effective introduction of the amendments.
- 3.4 The monitoring of RCO 2 did not meet Tranz Rail code requirements with regard to formal safety observations.
- 3.5 While monitoring of RCO 1 did meet Tranz Rail code requirements with regard to formal safety observations, the combination of his relative inexperience, the introduction of the amended rules and the 7.5 months since his last formal observation indicated a particular need for an April safety observation following the regulation amendments.

4. Safety Actions

- 4.1 On 16 June 2000 Tranz Rail issued Train Control Safety Briefing No. 4 which included:

Issue of track warrants: When issuing a Track warrant to a Locomotive Engineer, that in your view does not fit the normal pattern for that train/area/time of day etc, then would you please offer an explanation to the LE so he gains an understanding of the reasons for the issue of this particular Warrant. This also applies to situations where, because of conflicting movements, requests for Track Warrants by an LE or Remote Control Operator on a Shunt have to be curtailed short of the location requested, then please inform the LE/RCO of the reasons why.

5. Safety Recommendations

5.1 On 30 April 2001 the Commission recommended to the managing director of Tranz Rail that he:

- 5.1.1 introduce the formalised crew resource management procedures recommended in safety recommendation number 001/99, and ensure that such procedures include remote-control operators operating main line shunts (006/01)
- 5.1.2 change the procedures for introducing rule and regulation amendments to ensure staff are fully conversant with such changes prior to introduction, and that effective introduction is monitored (007/01)
- 5.1.3 audit safety observation procedures to ensure defined frequencies are achieved, and ensure particular attention is given to newly certified staff. (008/01)

5.2 On 15 May 2001 the managing director of Tranz Rail replied:

Safety Recommendation 006/01

Tranz Rail accept this recommendation. This is presently being evaluated to determine the best way to facilitate these principles to staff. Tranz Rail expect to complete this evaluation by end of June 2001.

Safety Recommendation 007/01

Tranz Rail accept this recommendation.

Tranz Rail has reinforced the need for Managers to follow procedures when briefings relating to significant operating changes are promulgated. The need for effective monitoring following implementation will be included on future briefings.

Safety Recommendation 008/01

Tranz Rail accept this recommendation.

The safety observation system includes a facility for Managers to monitor the currency of safety observations, and in particular identify those that have fallen overdue. Procedures already exist for Managers to ensure defined frequencies are achieved.

Additionally, Tranz Rail has reviewed its procedures for safety observations for newly certified staff and expect this process to be completed by the end of June 2001.

Approved for publication 16 May 2001

Hon. W P Jeffries
Chief Commissioner