Report 00-114

shunting service P28

signal passed at danger

Woodville

19 September 2000

Abstract

At about 1640 on Tuesday 19 September 2000, Train P28 Pahiatua – Palmerston North shunting service passed signal 4R at Danger and entered the main line at Woodville which was occupied by opposing Train 601 *Bay Express* passenger express. Train 601 had a Clear Proceed signalled route and was not expecting to stop. The conflict was soon realised and both trains were brought to a stop about 750 m apart. Train P28 derailed when its locomotive engineer tried to reverse off the main line through a set of points that had been "run through" when the signal had been passed at Danger.

The safety issues addressed in this report are:

- the site knowledge, training and certification of the rail operator
- the ability of the rail operator to identify and understand the indications of a low speed signal
- the lack of documented procedures for the advancing of trains which have stopped after overrunning a signal which reverted to Danger in front of the locomotive engineer
- the total reliance placed on locomotive engineers to follow signal indications to avoid conflicts.

Two safety recommendations have been made to the operator.

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.

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List of Abbreviations

km	kilometre(s)
km/h	kilometres per hour
LE	locomotive engineer
m	metre(s)
PNGL	Palmerston North – Gisborne Line
RO	rail operator
TC	train controller
VDU	visual display unit

Data Summary

Train type and number:	shunting service P28		
Date and time:	19 September 2000 at about 1640		
Location:	Woodville		
Type of occurrence:	signal passed at danger		
Persons on board:	P28 train	crew:	2
	Train 601	crew:	2
		passengers:	about 40
Injuries:	nil		
Damage:	No. 1 points run through		
Operator:	Tranz Rail Limited (Tranz Rail)		
Investigator-in-charge:	D L Bevin		

1. Factual Information

1.1 Narrative

1.1.1 On Tuesday 19 September 2000, Train 601 was the *Bay Express* Napier – Wellington passenger express and was crewed by a locomotive engineer (LE) and a train manager. At about 1616 the LE had advised the train controller (TC) by radio from Dannevirke that he had no passenger work at Woodville and the TC had cleared the necessary signals for the passage of Train 601 through Woodville on the Palmerston North – Gisborne Line (PNGL).

1.1.2 On Tuesday 19 September 2000, Train P28 was a Pahiatua to Palmerston North shunting service crewed by an LE and a rail operator (RO). The shunt was running long hood leading[1] on its journey from Pahiatua to Woodville on the Wairarapa Line.

1.1.3 At about 1618 the LE of Train P28 called the TC by radio from Pahiatua and advised that the shunt was ready to proceed to Woodville where they were to uplift tonnage before continuing to Palmerston North. He requested his train to be berthed in the yard via the balloon loop[2] for this purpose.

1.1.4 The TC cleared Signals A12L, 12L and 6L, which allowed Train P28 to travel around the balloon loop as far as Signal 4R (refer Figure 1) where he planned to hold it for the passage of Train 601 before signalling Train P28 across the main line and into the yard. The TC did not advise the LE of Train P28 of his intentions or of the presence of Train 601 in the area, nor was there a requirement for him to do so.

1.1.5 At about 1635 both trains appeared on the TC's centralised traffic control visual display unit (VDU) as they approached Woodville. The TC saw Train P28 enter the balloon loop from the Wairarapa Line at the same time Train 601 passed Signal 10L on the PNGL and approached Signal 8L on its approach to Woodville (refer Figure 1).

1.1.6 The TC then saw from the indications displayed on the VDU that the track circuit[3] covering No. 1 points from the balloon loop had illuminated, but he assumed that it was the result of a fault. The LE of Train 601 had called him by radio immediately after this track circuit had illuminated and said that Signal 8L had reverted to Danger (Red) "in his face" and that he had been unable to stop his train before overrunning it. Train 601 stopped following the overrun. The TC advised the LE of Train 601 that the route ahead was correctly set for the passage of his train and that he was authorised to continue to the next fixed signal in advance, Signal 4L, positioned immediately before Nos. 1 and 3 points at the western end of Woodville.

1.1.7 After talking to the LE of Train 601 the TC noticed that M track, which had been illuminated to show the presence of Train P28 on the balloon loop as it approached Signal 4R, had extinguished, indicating to him that the track section which Train P28 had occupied as it approached Signal 4R was now unoccupied. He immediately realised that Train P28 had passed Signal 4R at Danger and entered the main line. He called by radio to the LEs to stop their trains. Train P28 was already stopped by this time, the LE having seen the headlight of Train 601, which had just begun to move again after receiving permission to do so from the TC following the overrun of Signal 8L. The 2 trains stopped about 750 m apart.

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[1] "long hood leading" meant that the locomotive was running in reverse with the cab at the rear end.

[2] There were 2 routes available to trains entering Woodville from the Wairarapa Line, the balloon loop and the "short way". Locomotive crews requested from TC whichever route best suited their work requirements at Woodville.

[3] Track circuits were illuminated in red on the VDU when the track section to which they referred was occupied by a train.

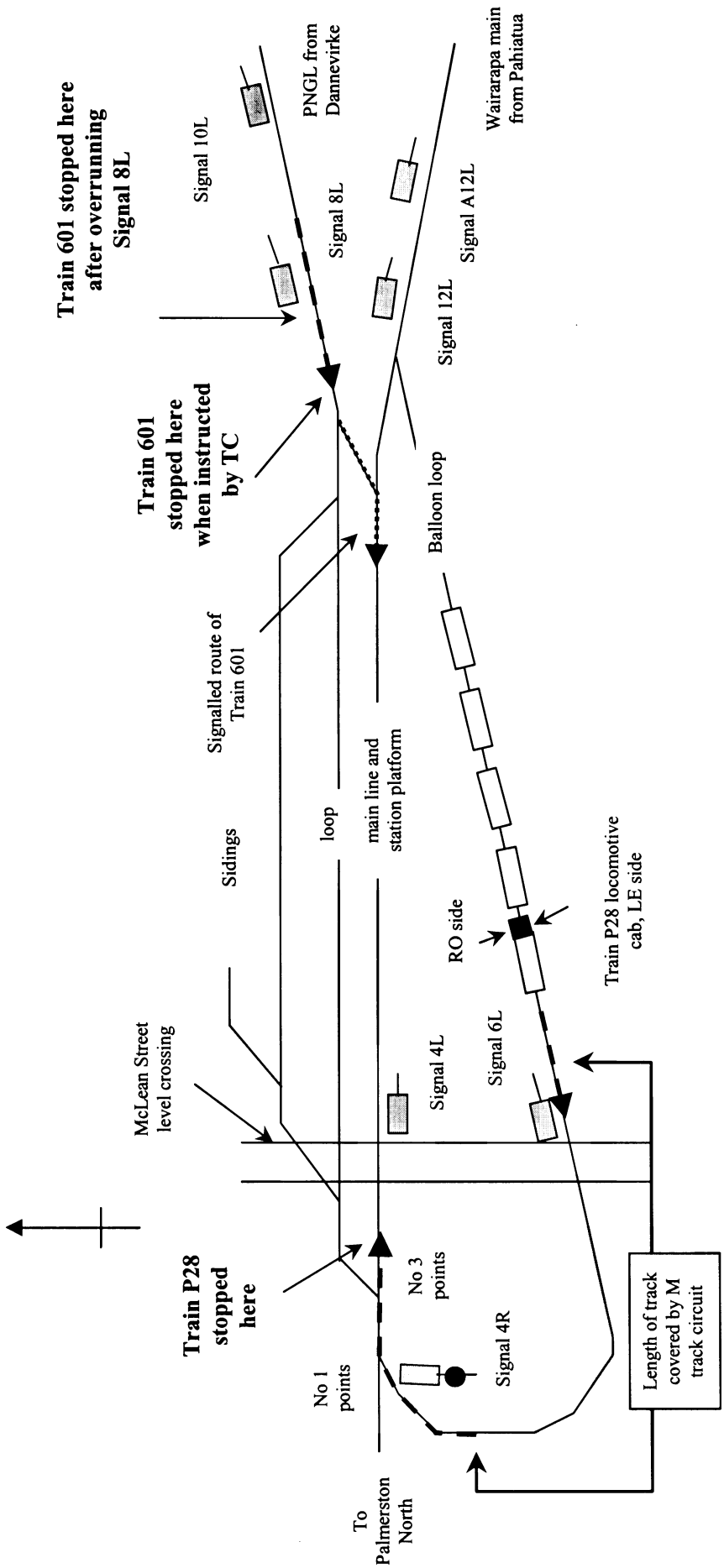

Figure 1
Woodville track layout
(not to scale)

1.1.8 Having seen the opposing train the LE of Train P28 attempted to vacate the main line by reversing his train back on to the balloon loop, an unauthorised movement, but in doing so the train derailed on No. 1 points. Train P28 had run through[4] and damaged these points after passing Signal 4R at Stop.

1.1.9 Tranz Rail's Centralised Traffic Control (C.T.C.) Regulation 1(b) Trains Not To Set Back stated that:

> Trains and shunting movements which are wholly within the Home or where provided Outer Home Signals at a station and are within the signalled area may not reverse direction except on the authority of the Signalman who must first satisfy himself that it is safe for the intended move.

1.1.10 As a result of the derailment of Train P28, and the run through of the points, Train 601 was unable to continue beyond Woodville, so the passengers were transferred to buses to continue their journey.

1.1.11 The LE and the RO of Train P28 were immediately relieved of duty pending an inquiry by Tranz Rail.

1.2 Train P28

1.2.1 The locomotive of Train P28 was running long hood leading, which meant that the LE, who normally sat on the right-hand side of the locomotive when running in the forward direction, was sitting on the left-hand side in the direction of travel. The seat on the opposite side of the cab was occupied by the RO. Train P28 consisted of a DC class locomotive and 4 wagons.

1.2.2 As Train P28 approached Woodville the LE had seen Clear Proceed indications (Greens) on Signals A12L and 12L, and a Caution Proceed indication (Yellow) on Signal 6L. The Caution Proceed indication on Signal 6L warned the LE that the next signal in advance, Signal 4R which controlled entry from the balloon loop to the main line via No. 1 points, was displaying either a Stop (Red) or a low speed indication.

1.2.3 Beyond Signal 6L the track curved to the right as it approached Signal 4R. The LE could not see Signal 4R because of trees, the right hand curve of the track and the length of locomotive hood in front of him so he relied on the RO to sight and relay signal indications to him. Once past the trees the RO had an unobstructed view of Signal 4R, but not the low speed unit, which was angled more in line with the track, making it visible in direct line of sight for about 200 m (refer Figure 2).

1.2.4 As Train P28 rounded the curve towards Signal 4R the LE told the RO that the next signal they would be looking for was "a low speed so we can enter the yard at Woodville."

1.2.5 The RO thought he had initially seen a low speed light and confirmed to the LE that a low speed indication was displayed. He later said that when the locomotive was nearly at the signal he thought the "low speed light started to blink then changed to Stop", so he had told the LE, but by then the locomotive had passed the signal.

[4] Trailing points are run through when they are set in one direction and a train from the other direction passes over them.

Figure 2
Signal 4R from about 200 m away.
The low speed light unit is arrowed.

1.2.6 The LE applied the brakes immediately to slow the train, but he had thought that what the RO had seen was the signal reverting to Stop after the front of the locomotive had gone past, the usual practice for colour light signals. He questioned the RO as to what he had seen to which the RO replied "I thought I caught out of the corner of my eye that it (the low speed light) might have changed colour."

1.2.7 After passing Signal 4R Train P28 moved on around the curve and the LE asked the RO to check if the warning devices were operating at McLean Street level crossing about 200 m ahead. The LE felt that if they were operating it would confirm for him that the route from the balloon loop to the yard had been correctly set and signalled for his train to enter the yard. When the RO told him that the level crossing alarms were operating this satisfied the LE and he kept his train moving forward.

1.2.8 It was not until after the locomotive had passed over No.1 points and straightened up as it crossed No. 3 points on the main line that the LE realised his train was heading up the main line and not into the yard as he had expected. He became aware of Train 601 at the other end of Woodville at the same time as he stopped his train.

1.2.9 While the LE of Train P28 was trying to contact the TC on his mobile phone he decided that, as the end of his train was still on the balloon loop, he would set back and clear the main line for the passage of Train 601. He did not realise at this time that No. 1 points had been run through as he entered the main line. The locomotive hood in front of him had prevented him from seeing their setting as he approached around the curve and the RO had not made any call to him regarding their setting. When the TC answered the call he advised the LE that Signal 4L had not been displaying a low speed light. It was at this time that the LE became aware that his train had derailed as he was trying to reverse into the balloon loop.

1.3 Site details and signalling arrangements

1.3.1 Woodville was an interlocked junction station where the Wairarapa Line joined the PNGL (refer Figure 1) and was remotely signalled by centralised traffic control from a desk in the train control centre in Wellington.

1.3.2 Signal 4R controlled the movement of trains from the balloon loop to the main line, loop or sidings via Nos. 1 and 3 points. The balloon loop joined the main line via No. 1 trailing points[5] When Train P28 approached No. 1 points were set for the passage of Train 601 through Woodville on the main line.

1.3.3 Tranz Rail's Rule 56(b)(iv) described low speed lights as:

> …lights which display a short-range Yellow light when at "Proceed" but normally do not show any light.

1.3.4 Tranz Rail's Rule 57(a)(i) defined the speed indicated by a low speed signal as:

> Low speed. Displayed by a low speed light below two Red lights. Indicates that the points are in the proper position but not necessarily that the track is unoccupied. Locomotive Engineer must proceed cautiously at such a speed (not exceeding 25 km/h) as will enable him to stop clear of any obstruction.

1.3.5 A low speed light, when exhibited, remained illuminated with a yellow light until the whole of the train to which it applied had passed the signal. A low speed light was either lit or extinguished. A low speed light unit was always positioned on the signal mast beneath 2 red aspects, which remained at red while the low speed light was illuminated.

[5] Trailing points are those approached from the rear or "heel" end of the points.

1.3.6 The double unit aspects of Signal No.4R were angled to give direct line of sight of about 450 m across an open field before an approaching train entered the curve on the balloon loop. The low speed light unit was also angled but to a lesser degree making it visible from about 200 m back around the curve.

1.3.7 With reference to procedures for the advancing of trains that had overrun a signal, which had reverted to Danger in the face of the LE, Tranz Rail advised:

> Tranz Rail recognises that historically our rules have not specifically included procedures to be followed when a signal (other than a Departure Signal) has been passed at stop (including reversions). We are now reviewing this and intend clarifying this procedure.

1.4 Personnel

1.4.1. The LE of Train P28 was certified for the duties he was carrying out and was on his first shift back after one week off duty.

1.4.2 The RO had been certified for second person's duties (including RO duties) for stations from Levin to Marton on the North Island Main Trunk on 16 March 2000 and for Pahiatua, Oringi and Woodville on 14 September 2000, 5 days before the incident.

1.4.3 Tranz Rail advised that:

> Second persons do not require specific certification for the various signalling categories, but are trained to recognise the aspects of all signals (e.g. Green Bottom, Red top) and call these to a Locomotive Engineer.

1.4.4 The RO had finished his previous shift at 0200 and his shift on which the incident occurred commenced at 1230 on the same day. He stated that he had gone to bed at 0330 and had been wakened about 0900 by a lawnmower operating in the vicinity. Although this had not been beneficial to his sleeping he was not sure that it had contributed to the incident. He did not consider himself to have been fatigued leading up to the incident as he had plenty of recreational time off and had also been off work because of a leg injury. His shifts immediately prior to the incident had mostly involved training for his certification and had not involved excessive hours. He said there were no external issues which could have contributed to stress prior to the incident.

1.4.5 Tranz Rail's Rail Operating Code Section 1 Instruction 5.6.5 which related to second person's duties stated that:

> This course prepares employees for Locomotive Engineer Assistants duties. The course will include some classroom study but will predominantly involve practical field based studies.
>
> Second Persons Safety Induction
>
> Second persons do not require the comprehensive road knowledge necessary for a Locomotive Engineer but do need detail familiarisation of signalling layouts at Terminals and stations where they are required to work.
>
> This familiarisation will be determined on a case by case basis by the M/STOP for the area concerned. This will also be recorded on the STF 23 issued by the M/STOP.
>
> When Second Persons are transferred into a new Terminal/Depot they must be given access to all S&I diagrams relating to the new area. They will also be

> given a field trip to selected station yards in the area by the M/STOP to cover in depth, the local and Working Timetable instructions.
>
> After receiving initial second person induction or if the running area is extended, the second person will be rostered as an additional crew member for familiarisation purposes over the area over which they will be required to operate as a second person.

The M/STOP was the designated staff training person.

1.4.6 The RO stated that this was the first day he had been rostered in the area since his certification. His training had included a trip through the area by road with a designated staff training person during which he had approached Signal 4R by foot from the balloon loop and had viewed it from the ground. In accordance with Tranz Rail's certification requirements this had been followed by on-the-job training which took the form of being rostered for one trip on Train P28 as a third member of the crew to gain further local knowledge. On this trip Train P28 had not used the balloon loop so the day of the incident was the first time he had been looking for and calling signals on that part of the route.

1.4.7 The RO had his field trip on a Thursday, his day on Train P28 with another RO the following day and was rostered as RO by himself on the following Tuesday. He said that while he was originally happy at the time to sign off as competent in local knowledge for the area he now felt the training time was too short and he should have asked for another couple of days of on-the-job training with another RO.

2. Analysis

2.1 Running of locomotives long hood leading on shunting services was a permitted practice and was regularly used where turning facilities for locomotives were not available, as was the case in Pahiatua. To counter the reduced visibility due to the locomotive hood it was Tranz Rail's policy that all such movements were required to have a two-person crew.

2.2 The use of the balloon loop by Train P28 when returning from Pahiatua was not uncommon. Not only did it provide alternative and often more convenient access to the Woodville yard but it also allowed the locomotive to be turned so that it could travel short hood or cab leading on the continuation of its journey to Palmerston North. The decision on whether to request the balloon loop or not was made by the crew of the shunting service.

2.3 The LE could not see the signal mast nor the aspects displayed by Signal 4R as Train P28 rounded the curve because of the locomotive hood in front of him so was totally dependent on the RO for signal sighting and calling signal indications.

2.4 The low speed light unit on the mast of Signal 4R was initially difficult to detect against a backdrop of dried grass and buildings, however the angle at which it was directed meant its visibility improved as the train approached Signal 4R from around the curve. The RO was sitting on the right-hand side of the locomotive as they approached Signal 4R and would have been able to see the double signal aspects, in this case showing 2 red lights, from about 450 m away. He would also have been able to see the low speed light unit from about 200 m away. If the low speed light had been illuminated it would have been easily visible at this point.

2.5 The LE had seen the Caution Proceed indication on Signal 6L, which indicated the next signal in advance, Signal 4R, was displaying either a Danger or a low speed indication. The LE had anticipated a low speed indication and was travelling at reduced speed when the low speed light unit became visible to the RO from about 200 m away and from where the LE had adequate time to respond to any instructions relayed to him by the RO.

2.6 The RO thought he had seen a low speed indication on Signal 4R, but as the train got closer the low speed unit became more clearly identified and it should have been obvious to him that there was no low speed indication displayed. The RO appeared to have been unsure of exactly what indication he was looking for initially and where exactly Signal 4R was. He was probably grateful for the guidance from the LE about expecting a low speed indication and was probably influenced by it. Because of his uncertainty he should have called the signal as Stop until he had satisfied himself as to whether or not the low speed light was illuminated. While the train was stopped he could have sought the LE's advice if he was still unsure. This would also have provided an opportunity for the LE to check the signal indications for himself.

2.7 The LE offering the RO his expectation that Signal 4L would be displaying a low speed indication appears to have been his recognition of the RO's relative inexperience in the area. There would have been a degree of authority gradient between the LE and the RO. An RO with limited experience in an area is less likely to question the expectation of an LE, who not only had ultimate responsibility for the running of the train, but was also more experienced in the area. Add to this the probability that the RO's familiarisation training was not adequate, it was not surprising that he told the LE what he thought he wanted to hear, that a low speed indication was being displayed.

2.8 The RO had not previously entered Woodville by locomotive via the balloon loop and his only previous experience with Signal 4R had been during his visit with the staff training person at which time he had only approached and viewed it from ground level. A locomotive ride around the balloon loop as part of his training would have significantly improved his situational awareness in regards Signal 4R and its low speed light unit. Tranz Rail have addressed this shortcoming in their on-the-job training procedures so no safety recommendation regarding this issue has been made in this report; however, the RO's training did not require him to have an intimate knowledge of the signalling arrangements and what they signified. A better understanding of the low speed light indication, how it worked and what it meant would have been beneficial, considering that the RO was acting as the LE's eyes. A safety recommendation covering this issue has been made in section 5 of this report.

2.9 Low speed lights do not extinguish once the front of a train had passed as was the case with automatic colour light signals; instead they remained illuminated until the whole of the train to which they applied had passed at which point they automatically extinguished. The RO's confusion as Train P28 approached Signal 4R was probably due to his only seeing the two red lights as he got closer and, thinking he had seen a low speed indication earlier which he could not now see, led him to believe that the signal had reverted to Stop by the extinguishing of the low speed indication for whatever reason.

2.10 The TC had cleared signals for Train P28 to travel as far around the balloon loop as Signal 4R where he planned to hold it until after Train 601 had cleared. Train 601 was a passenger express and, because the TC was aware that there was no passenger work required at Woodville, he had given it priority and had cleared signals for its passage through Woodville. He had seen both trains on the VDU before him as they had approached Woodville and was satisfied that the signals and points were correctly set for the intended moves.

2.11 When the TC was advised by the LE of Train 601 that Signal 8L had reverted to Danger in front of him, he originally thought that it was the result of a faulty track circuit because he had noticed that the track circuit was illuminated over No. 1 points and No. 3 points at the opposite end of the main line from where Train 601 had stopped. Although there was no requirement for the TC to do so, it would have been prudent for him to have confirmed that Train P28 had stopped at Signal 4R before he authorised Train 601 to continue, considering he knew that Train P28 was in that area.

2.12 The LE of Train P28 was on the off side of the locomotive as the train approached No. 1 points from around the right-hand curve so he could not have seen their setting. He was, however, satisfied that Train P28 had a low speed indication on Signal 4R, confirmed he believed by the fact that the alarms at McLean Street level crossing were operating, and was therefore unaware that his train had run through No. 1 points as it entered the main line.

2.13 Although the warning devices were operating at the level crossing this had nothing to do with the setting of the route for Train P28. They were activated by Train P28 passing Signal 4R and occupying the next track circuit. No. 1 points were set for the main line at the time the signal was overrun which was further evidence that the route was not set for the passage of Train P28 from the balloon loop to the yard. The distance from Signal 4R to No. 1 points was about 50 m and had the LE instructed the RO to check the setting of the points as they approached them rather than the level crossing alarms it is probable that, although the signal overrun had occurred, the run through of No. 1 points and the resulting potential collision situation would have been avoided.

2.14 The total reliance the Tranz Rail system placed on locomotive crews seeing and correctly interpreting signals to avoid conflicts has been raised in several other Commission reports on signals passed at Danger. Such a system does not recognise the known tendency for humans to be poor monitors and occasionally fail at this task. It is paramount that any transport system includes defences against the inevitable human failure. In this case the TC had been in radio contact with the LE of both trains shortly before the incident occurred. Although there was no requirement for the TC to do so had he communicated to the LE of Train P28 his intention to hold his train at Signal 4R until after the passage of Train 601 this incident would probably not have occurred. Tranz Rail needs to review its policy and training of TCs to incorporate the principles of crew resource management to reduce the likelihood of this type of occurrence in future. A safety recommendation covering crew resource management has been made in Rail Occurrence Report 00-106, so no further safety recommendation covering this issue is included in this report.

3. Findings

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

3.1 All staff concerned were certified for the duties undertaken.

3.2 The RO had not received sufficient training to effectively assist the LE of Train P28 on the route.

3.3 Train P28 passed Signal 4R at Danger and entered the main line in conflict with Train 601 when the RO misread Signal 4R to the LE, who could not see the signal indications displayed due to long hood running.

3.4 The RO probably misread Signal 4R for the following reasons:

- the RO was not sufficiently familiar with the area and its signalling characteristics
- the LE had told him he expected the signal to be displaying a low speed indication, which it was not
- an authority gradient existed between the LE and RO which would have made the RO reluctant to read the signal different from the LE's expectation.

3.5 There was no requirement for the RO to be certified for the various signalling categories.

3.6 Neither the LE of Train P28 or Train 601 was informed of the others whereabouts, which prevented them from having shared concept of the situation with the TC.

3.7 Tranz Rail's policy of relying only on locomotive crews seeing and interpreting signals to avoid conflict did not provide adequate defence against one-person errors.

3.8 There were no procedures in place for the TC to follow before authorising trains to move that had stopped because of a signal that had reverted to Danger in the LE's face.

4. Safety Action

4.1 Following the incident Tranz Rail advised that its internal inquiry had identified a shortcoming in the on-the-job training process in that it did not take account of the need for a trainee RO to experience a long hood run entering Woodville via the balloon loop. This requirement was included in the staff training and certification process from 1 December 2000.

4.2 In view of the safety action taken no safety recommendation regarding this issue is necessary.

5. Safety Recommendations

5.1 On 3 May 2001 the Commission recommended to the managing director of Tranz Rail that he:

5.1.1 introduce check procedures for staff involved with the signalling of trains before authorising a train to continue after it has overrun a signal which reverted to Danger as it approached (010/01)

5.1.2 introduce a signals qualification into the certification process for second persons to assist with the identifying and understanding of signal indications, particularly when acting as the eyes of the LE in long hood running situations. (011/01)

5.2 On 5 June 2001 the managing director of Tranz Rail replied:

5.2.1 Safety Recommendations 010/01 and 011/01

010/01
Tranz Rail accept this recommendation.

011/01
Tranz Rail accept this recommendation. Tranz Rail are currently reviewing the operating rules. Please note following additional comment:

Tranz Rails' existing certification process includes training in identifying a signal and describing the indications viewed to the Locomotive Engineer. It does not include describing the meaning to the Locomotive Engineer. It is assumed this is what the recommendation means.

Tranz Rail will refer this matter to the Locomotive Engineers' Council to review to determine if users consider this process will add value. This Council consists of Locomotive Engineer representatives and some Managers with considerable locomotive driving experience.

Approved for publication 16 May 2001

Hon. W P Jeffries
Chief Commissioner