



Report 97-110

Shunt M28

level crossing collision

near Morrinsville

4 September 1997

Abstract

At 1824 hours on Thursday 4 September 1997 Shunt M28 from Morrinsville to Te Rapa collided with an "A Train" milk tanker and trailer on a private level crossing, resulting in serious injury to the tanker driver. The safety issues identified were lack of stacking distance and proper signage on the road approaching the level crossing, the potential for inadequate safety provisions in historic deeds of grant for private level crossings, the tanker operator's lack of awareness of the hazards associated with private level crossings negotiated by their drivers and the factors affecting the detection of locomotives approaching level crossings at night.

Transport Accident Investigation Commission

Rail Accident Report 97-110

Train type and number:	Tranz Rail shunt, M28
Date and time:	4 September 1997, 1824 hours ¹
Location:	East Coast Main Trunk (ECMT), 24.8 km, near Morrinsville
Type of occurrence:	Level crossing collision
Persons on board:	Tranz Rail Crew: 2
Injuries:	Crew: Nil Other ² : 1 serious
Nature of damage:	Locomotive: substantial Tanker: beyond economical repair Trailer: substantial
Investigator-in-Charge:	R Chippindale

¹ All times in this report are in NZST (UTC + 12)

² Tanker driver

1. Factual Information

- 1.1 At 1819 hours on Thursday 4 September 1997 Tranz Rail Limited (Tranz Rail) shunt M28, hauled by DBR 1282, departed from Morrinsville where it had stopped on its trip from Waharoa to Te Rapa, to pick up additional tonnage. As the locomotive was travelling long hood leading, the locomotive engineer (LE) was seated on the left side of the cab and was assisted by a train operator seated on the right. The configuration of the locomotive required it to be double-manned.
- 1.2 At 1824 hours the shunt collided with the cab of an empty milk tanker as the tanker entered a private level crossing. The tanker was 19 m long and consisted of an articulated unit towing a three axle trailer, a configuration normally referred to as an “A” Train.
- 1.3 The crew of the train were uninjured. However because the right door of the locomotive cab had been jammed, as a result of local bending of the adjacent structure in the collision, the two occupants had to leave by the left door which although also jammed was able to be kicked open by the LE.
- 1.4 The driver of the tanker was thrown clear, through the right-hand doorway of his cab, and fractured his ankle in the accident.
- 1.5 At the time of the accident the sky was overcast, the weather fine and it was dark, as evening civil twilight was ending. Rain set in shortly after the accident.
- 1.6 The shunt was travelling west and the tanker eastward in an area where state highway (SH) 26 and Piako Road run parallel and close to the railway line for about 4.6 km. The level crossing was about 1 km from the Morrinsville end of the area in which the road and rail ran alongside each other (see Figure 1).
- 1.7 The LE and the train operator had 24 and 18 years experience respectively as qualified LEs. Each held a current operating certificate for the duties concerned. The LE had been on the midday shift starting at 1130 hours for the last three days and the train operator had a day off before the last two days on the midday shift. Both said they were well rested at the start of the latest shift.
- 1.8 The tanker driver’s last duty was on the previous day for a similar shift. On the day of the accident he reported half an hour early for his shift, which started at 1730 hours, and checked his vehicles prior to leaving Te Rapa. He left five minutes ahead of schedule for the 25 km drive to the farm from which he was to make his first pick up of milk for the day.
- 1.9 As was standard practice the tanker driver was issued with a load sheet before he left his depot. The load sheet included an occasional caution for entrances with special problems such as “steep grade”. The load sheet had no warning in relation to the driveway on which the accident occurred. The driver had been issued with a map (see Figure 2) which showed the existence of a railway between the state highway and the property. When looking at the map the driver had to deduce there would be a private level crossing involved when driving into the property as the driveway was not shown.
- 1.10 As the tanker was approaching the property, at which the driver was to make his first pick-up, it passed an intersection where Piako Road, on which the tanker was travelling, joins the state highway. The intersection is 256 m from the point at which the driver had to commence a right turn into the access driveway to the property.

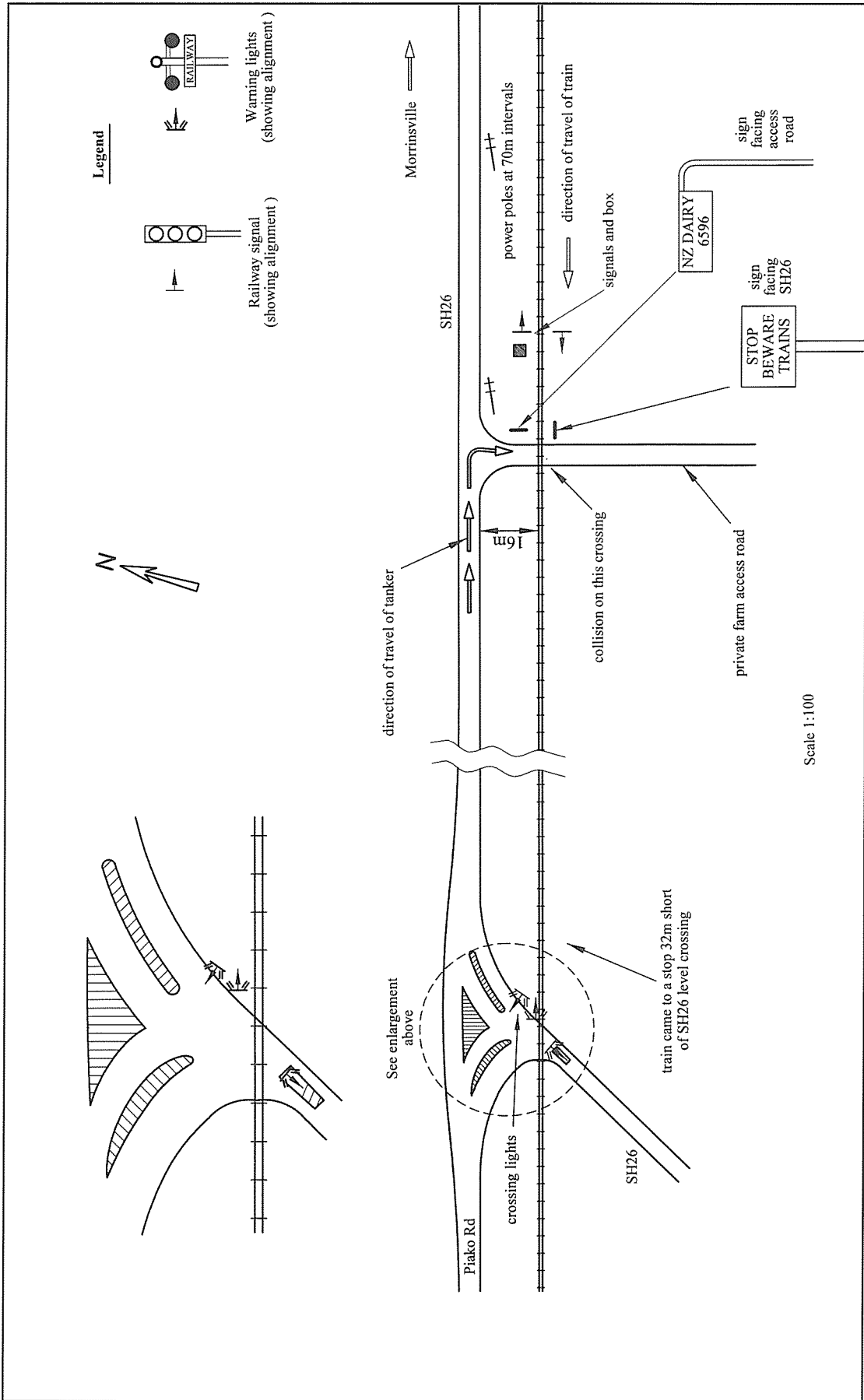


Figure 1
Collision of Shunt M25 with milk tanker near Morrinsville

- 1.11 Some 50 m to the right (south) of this intersection is the level crossing where SH 26 crosses the railway. For motorists travelling towards Morrinsville on Piako Road the lights on this crossing are designed to attract the attention of any who turn right off Piako Road into a slip lane before crossing the highway and entering the level crossing. A “seagull” patterned intersection guides the Piako Road traffic in an arc to the left then to merge straight ahead onto the state highway which joins from the right (see Figure 1).
- 1.12 The railway line crosses the farm driveway at right angles. The rail track is 19.6 m from the centre line of SH 26, a distance similar to the length of the “A Train” milk tanker.
- 1.13 The tanker driver stated that he slowed his vehicle as he approached the turn-in point but had plenty of time to turn in front of three approaching cars. The drivers of two cars which were following the tanker said the tanker actually stopped (one believed for about 20 seconds) and as soon as the approaching cars were clear it entered the drive. The tanker driver said he had no recollection of stopping at that point.
- 1.14 At the point on SH 26 from which the tanker driver had to make a right turn to enter the property the headlights of a westbound train would first come into view some 1030 m before it reached the private level crossing. Although the tanker driver’s view of an approaching westbound train was generally clear (see Figure 3) the driver’s line of sight, from his turn-in point on the road centreline was interrupted by 15 concrete poles supporting the conductors of a power line which paralleled the railway.
- 1.15 Prior to reaching the intersection between SH 26 and Piako Road the driver’s view of the railway ahead was blocked by the signage on the traffic islands associated with the intersection (see Figure 4).
- 1.16 The milk collection involved was the tanker driver’s second solo run after his familiarisation training, during which he had been accompanied by an experienced driver. He said he had not been into this property while under supervision but was aware that there was a railway crossing over the driveway as a result of his visit two days earlier.
- 1.17 After his previous visit the driver had made a note, on the map provided by the dairy company, for him to take particular care at the crossing. On that occasion, which was also at night, he said he had been surprised by the existence of the crossing because it did not have the normal “Stop” signs or St Andrews Crosses, and the home-made stop sign which was there was on the far side of the crossing.
- 1.18 The driver said that on the night of the accident although he had looked, he saw no train approaching from ahead of him as he made his decision to turn into the drive. He checked the road behind him because he knew three vehicles were following. He was aware that the stacking distance was less than the length of his vehicle as he said, that until he made a visit to the site subsequent to the accident, he thought the rail track was even closer to the road.
- 1.19 The tanker driver said that while he was in the drive, approaching the level crossing, he still saw nothing until “a dull light, similar to a candle light, appeared on [his] left then disappeared as fast as it appeared”. This prompted him to look to the crossing lights which were operating for the level crossing on SH 26 to his right. From this he realised that a train must be approaching which he had not seen. As he saw no train to his right he looked left and saw the “dimmed” headlights of the train almost upon him. He estimated he was less than 5 m from the crossing and “going very slowly” at the time as the driveway was rough.
- 1.20 He decided that he had no time to stop and select reverse to back out of the path of the train so he “. . . put [his] foot to the floor” and attempted to get his cab clear of the inevitable impact.

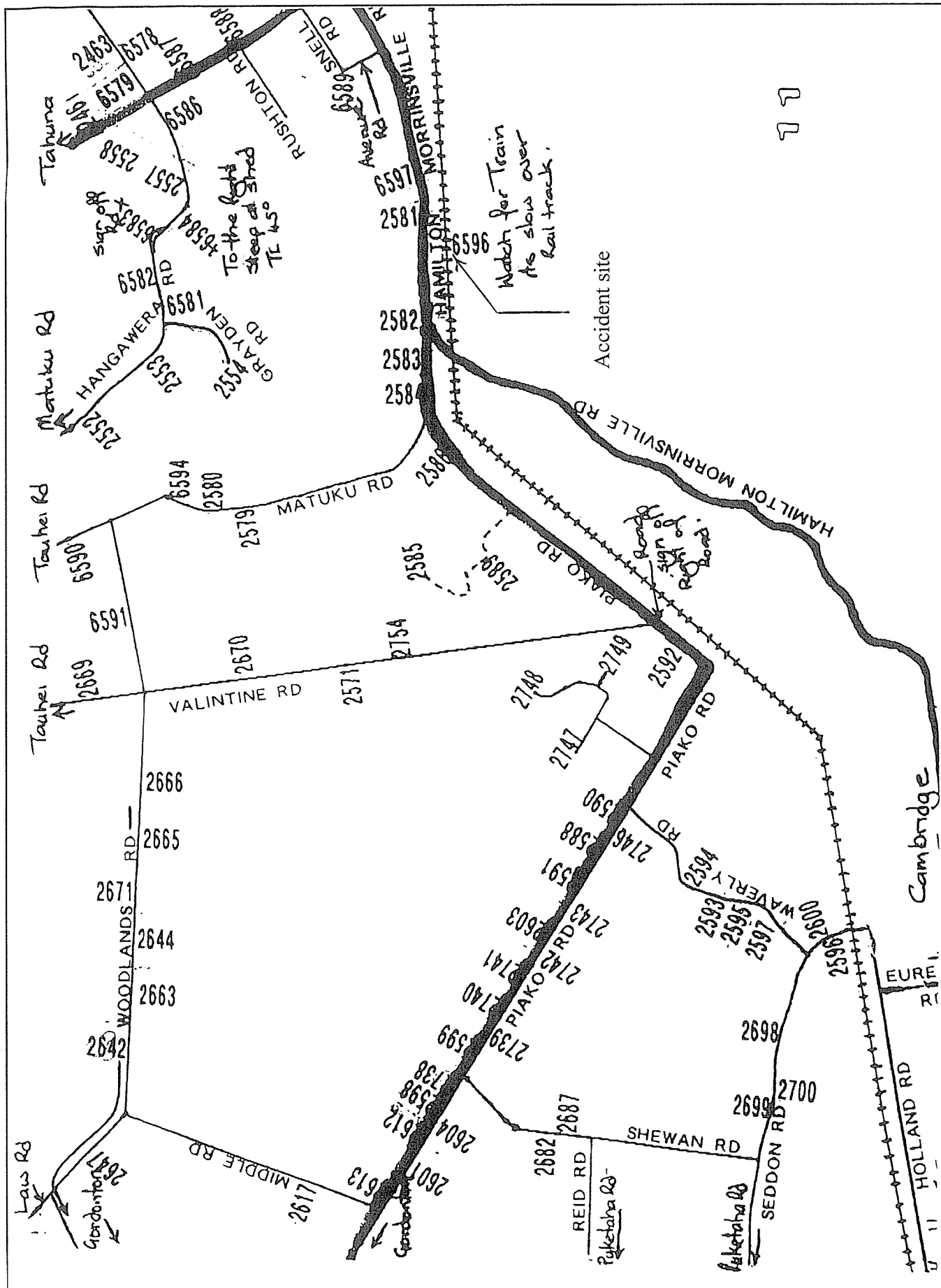


Figure 2
Tanker driver's sketch map

- 1.21 Timings made on the run subsequently indicated that it took 7 to 9 seconds to move a similar empty tanker from the centre of the road up to the railway after slowing normally then accelerating to just under 20 km/h.
- 1.22 The LE was not able to see the approaching tanker unit, due to the engine compartment of his locomotive. The train operator said that he saw the tanker turn in and, when it was obvious he was not going to stop, he blew the train whistle. While so doing he alerted the LE who said he applied the emergency brake of the train just as the collision occurred.
- 1.23 The forward coupling of the locomotive struck and ruptured the fuel tank of the tanker and tipped the cab forward springing the driver's door open in the process. The impact point on the tanker was some 1200 mm from the front of the vehicle. The diesel fuel from the tanker sprayed back over the locomotive and obscured its cab windows.
- 1.24 The only indication of the railway crossing on the farm driveway was an unlit black on white, 550 by 550 mm sign, facing the state highway but on the far side of the track 2.5 m from the railway centreline, which displayed:

STOP

BEWARE
TRAINS

There was no signage to warn drivers leaving the property of the level crossing.

- 1.25 After a left 600 m radius curve, the track on which the train approached the site of the accident was straight for 1030 m, the incline of the straight varied but averaged a 1 in 500 up gradient in the direction of travel. The variation in the gradient meant the train did not climb into full view, of a vehicle on SH 26, until a point about half way along the straight.
- 1.26 The LE stated that the locomotive headlights were turned on but could not be certain that they were on full (i.e. 24 volts rather than the 16 volt "dim" setting) as the shunt approached the accident site. He stated that it was a common practise for LEs to dim the headlights for approaching road traffic in situations such as this and he often did so himself. The train operator said the headlights were probably on full as he could see the track for some distance ahead.
- 1.27 The other forward facing lights on this locomotive were the four number plate lights, two on either side of the headlights, and the "ground light" which illuminates the locomotive coupling. All of these lights are controlled by the LE. The headlights can be on dim at both ends of the locomotive at the same time, as for shunting, but the full beam can only be selected to one end at a time i.e. either short or long hood. The ground lights are always left on as they are coupled with the locomotive instruments lights without which the LE cannot read his instruments. The number plate lights provide only back lighting and the ground lights are not designed to provide more than local illumination of the couplings for shunters.
- 1.28 The Signals Rules section of Tranz Rail Rules and Regulations included:

SIGNALS DISPLAYED BY TRAINS

69. Trains must display the following signals by day and by night . . .

- (b) **Head Lamp:** To show a White light forward displayed at the front of the train:
- (i) Head lamps must be illuminated by day and by night on all trains travelling on the main line and on all locomotives, . . . By day the light must be on "Full".



Figure 3
View from tanker cab of rail and road facing Morrinsville from turn point



Figure 4
View of SH 26/Piako Road intersection facing Morrinsville

- (ii) Head Lamps may be placed on “dim” by day and by night when closely approaching another locomotive, Railcar or Multiple Unit on the opposite running line provided that the Locomotive Engineer can see that the line ahead is clear, no level crossings intervene and the Locomotive Engineer considers it safe to do so. In addition they must be dimmed when trains are standing at a station and when approaching stations.
- (iii) Head lamps on locomotives employed exclusively on shunting must be on “Dim” at all times.
- (c) **Responsibility for train signals - Officers in Charge and Locomotive Engineers** must make certain that the proper signals are displayed by trains; Locomotive Engineers must also be satisfied that the lamps are in good order and that they are properly placed on the train. . . .

1.29 The tanker driver stated that he did not see the locomotive headlights until his cab was over the railway line and even then he believed they were on “dim”. A driver of one of the cars waiting behind the tanker, on SH 26 and facing the train said she did not see the locomotive lights at all, even though she could see the headlights of approaching cars, and doubted they were on.

1.30 A local member of the Police and another motorist, who used SH 26 frequently were adamant that it was easy to see the headlights of an approaching train when driving in the same direction as the tanker had been travelling. It was confirmed on site that if the headlights were on “full” they were easy to see.

1.31 Tests with a similar locomotive indicated that the headlights, which are located one above the other on the long hood end of the locomotive, are focused in a beam approximately 10° either side of the locomotive centreline and are not distinguishable as separate lights when on full. The tests also indicated that the headlights on “full” cannot be seen readily behind a position 20 m ahead of the locomotive when on a line 20 m to one side of it. When the headlights were on dim their intensity was less than that of approaching car headlights which were constantly passing the test area. In the area between the focused beam and the “no light” area the intensity of the locomotive headlight on “full” was similar to that of the approaching car headlights.

1.32 Several LEs were of the opinion that “about 90% of LEs” would dim their locomotive headlights at night for oncoming road traffic when the rail and road ran parallel for some distance.

1.33 Although this private level crossing was not so marked, the LE advised that mini St Andrews Cross signs were erected alongside the track prior to several private level crossings in the area. The purpose of this sign is to indicate the existence of a level crossing ahead but it is not a Whistle Board. However the Signals Rules section of Tranz Rail Rules and Regulations stated:

73. Locomotive Whistle Signals - The following are Locomotive whistle Signals:

(n) Warning of approaching train - When the Locomotive Engineer believes that the line may be obstructed or fouled by people or vehicles either at level crossings or elsewhere, he must sound the whistle at such a distance back from the obstruction or level crossing to give ample warning of the approach of the train. . . .

The sound of the whistle should be distinct, with intensity, duration, or repetition proportionate to the distance at which the warning is required to be heard, and the circumstances under which it is used.

- 1.34 There was one whistle (air horn) on either side on the locomotive. The whistle, which faces forward when the locomotive is travelling long hood, was on the side of the locomotive remote from the road in this case. The whistle on the near side of the train to the road, was aligned toward the rear of the train.
- 1.35 The tanker driver said he had the radio in the truck cab turned on but he had reduced its volume as he was expecting a call on his cellphone.
- 1.36 Both of the car drivers heard the train whistle immediately before the impact. They had not passed the rear of the tanker at that time. The tanker driver and another witness said the locomotive whistle continued to sound for some time after the train stopped. The train operator confirmed that he had used the train whistle handle as a support during the collision and the cock had broken in the impact allowing the whistle to sound continuously.
- 1.37 The locomotive event recorder log recorded the train as travelling at 55 km/h at the time the emergency brake application was made, having accelerated steadily after leaving Morrinsville. The speed limit for the shunt in this area was 80 km/h. In the last minute it had accelerated from 50 to 55 km/h and it took some 215 m to stop after the brakes were applied. A pile of sand on the outside of each rail, where the locomotive came to a stop, indicated the emergency braking had been used and the locomotive driving wheels had come to rest 214 m past the private level crossing on which the accident occurred.
- 1.38 The shunt operated every weekday but the timing of its departure from Morrinsville was dependent upon the nature of the load and the time taken to make up the consist and the number of stations involved. On this occasion the total train weight was 413 t and it was 188 m long. The consist was the DBR locomotive hauling six UK wagons with an average weight of 45 t and four empty ZA wagons weighing 20 t each.
- 1.39 A fatal accident had occurred on this crossing between a railcar and a truck three years earlier. On that occasion the truck and the railcar were both travelling westwards with the truck travelling ahead of the railcar. That accident occurred in daylight and the railcar involved was fitted with flashing ditch lights which came on for 20 seconds when the railcar whistle was sounded; as it was on three occasions. The Commission made no safety recommendations as a result of the investigation into that accident but did comment on the short stacking distance factor which it had addressed in previous investigations. (TAIC Railway Occurrence Report 94-123.)
- 1.40 The rail crossing is a granted private level crossing established under a deed granted in 1932. This deed required no signage or other warning that a rail crossing existed. It did however require:
2. THAT the Grantee will pay the Railway Department the cost of maintaining a proper level crossing over the railway-line and the cost also of all necessary forming and gravelling required for the use of the said right-of-way.
- 1.41 There was no definition, in the document, of what the maintenance of a “proper level crossing” involved but in the New Zealand Rail Ltd : Railnet Code Supplement; Subject Level Crossings dated 1 July 1992 and current at the time of the accident subjects addressed included:
- standards and maintenance of road/rail view distances
 - standards and maintenance of road surface and geometry, lane definition, crossing width, and carriageway separation
 - road warning signs
 - regular inspections of crossings, and
 - provision and maintenance of side fences, cattle-stops and drainage

- 1.42 A Deed of Grant issued by Tranz Rail in 1996 for existing private level crossings on another property in the area required the holder to erect RG5³ “STOP” signs or PW 15 “RAILWAY” signs⁴ on each road approach and to provide a minimum adjacent intersection distance of 23 m from railway track centre to road limit line of that adjacent road intersection.
- 1.43 In April 1995 in RTS 10⁵ titled “Road Signs and Markings for Railway Level Crossings” the Land Transport Safety Authority (LTSA) recognised that in level crossing accidents the relevant driver “errors” often include those which are associated with the presentation of information, the reception of information and the processing of information.
- 1.44 RTS 10 included the following information:

Presentation of the information.

The information should be presented as a stimulus, for if there is no stimulus, there can be no response. In relation to level crossings, information should be presented as a stimulus that will:

- give prior warning of an up-coming hazard.
- possess adequate intensity
- resolve uncertainty in an unambiguous manner
- not require mental translation, and
- identify the precise response required.

Reception of information

There is a range of human sensory perception. A stimulus should be designed to accommodate all, or nearly all, potential users. Specifically, the stimulus should be detectable by those road users with some form of visual or aural impairment. Similarly, the stimulus should take account of relevant modern vehicle features, e.g. car stereos and motor cycle helmets.

Processing of information

The three features that govern the processing of information are - reaction time, expectancy, and short term memory.

Reaction time not only includes the time taken to operate a control, but also the time to decide which control action should be taken. This rate of decision making varies directly with the number of possible control actions or responses to be considered. Each stimulus should, therefore, be presented in a way that either limits the number of responses or, preferably, identifies the required response.

Short term memory is highly susceptible to disruption, particularly if a great deal of information is being held in it. Prior warnings of level crossings will be less effective if there is an intervening road sign, or much less effective if heavy traffic conditions require a driver’s primary attention.

³ Transit New Zealand designation for standard road traffic “STOP” sign

⁴ Transit New Zealand former designation for standard road traffic “RAILWAY” sign

⁵ Reference for an LTSA draft code of practice.

Sight Impediments

Sight Restrictions. At passively controlled crossings⁶, despite a driver appreciating the need to look both ways and being prepared to give way, sight restrictions may be such that the necessary stopping sight distance is not available. In extreme cases RG5 "Stop" signs can be used. However, in the large number of in-between cases where the sight restriction is partial or only involves one or two of the sight quadrants, drivers tend to grossly overestimate a safe approach speed. . . .

1.45 In TAIC Railway Occurrence Report 93-105 it was recommended to Transit New Zealand that:

They develop a code of practice for the design of intersections with closely adjacent railway crossings, taking into account the combined risks of accidents that the two hazards represent (056/93); and

They develop a programme to review the adequacy of warnings to motorists at all intersections on State Highways which have railway crossings in close proximity. (057/93)

Transit New Zealand responded:

Recommendation 057/93 is being actioned through a working party involving Transit New Zealand, the Land Transport Safety Authority, New Zealand Rail and local authority representatives considering revisions to signing and road markings at rail crossings. This activity is also a first stage towards developing a code of practice as in recommendation 056/93.

1.46 In TAIC Railway Occurrence Report 96-106 the above recommendations were referred to and it was recommended to the Director of the LTSA that he:

Liaise with Transit New Zealand, Tranz Rail Limited and the appropriate local authorities to initiate a review to define all public level crossings where the stacking distance for long road vehicles is insufficient to ensure safe entry or exit from the crossing, and to ensure that appropriate action is taken, consistent with the frequency of use and the potential consequences of a collision. (064/96)

The Director, Land Transport Safety responded:

The Land Transport Safety Authority (LTSA) acknowledges the TAIC recommendation regarding the safety of railway level crossings for long vehicles and will liaise with Transit New Zealand, Tranz Rail Limited and other road controlling authorities appropriately. The LTSA will request road controlling authorities to identify all level crossings within their districts where stacking distances for long road vehicles are insufficient to ensure safe entry or exit from crossings, and develop and implement appropriate road or rail strategies to minimise risk of collision.

For the information of the Commission, the LTSA has received a copy of a Ministry of Transport document entitled "Road Management, Options for reform" submissions on which close on 31 July 1997. The LTSA plans to address the issue of responsibilities and accountabilities for road safety actions in our submission on the paper to the Ministry of Transport.

⁶ i.e. control of movement of vehicular or pedestrian traffic across a railway level crossing by signs and devices none of which are activated during the approach or passage of the train, and which rely on the road user detecting the approach or presence of a train by direct observation

- 1.47 The crossing involved was partially within the state highway road reserve with the remainder on railway land. Transit New Zealand had not delegated control of any part of the state highway to the Matamata Piako District Council.
- 1.48 Approaches were made to the Hamilton Offices of Transit New Zealand and the LTSA and the Matamata Piako District Council to establish if any of these authorities had the responsibility to have existing private rail level crossings upgraded to their current requirements for such crossings. Each indicated they had no responsibility for such action in this case. Transit New Zealand also advised, "It is not possible to sign private access on the state highway. The Traffic Regulations do not allow it to happen."
- 1.49 The private level crossing was used daily by an "A Train" milk tanker apart from during the two month "dry" season for the cows. The vehicles of the dairy company involved have to traverse 23 similar railway crossings in its area in which approximately 7100 clients are located.
- 1.50 The company had stringent requirements for the standard of the access driveways which it required customers to meet and maintain. These standards did not include any criteria for the approaches to railway level crossings.

2. Analysis

- 2.1 Although the issue of the use of public level crossings by long vehicles has been considered in earlier TAIC Railway Occurrence Reports it has not been raised specifically in relation to private level crossings.
- 2.2 The absence of sufficient stacking distance for long vehicles such as the "A Train" milk tanker was a significant feature in the environment of this accident for two reasons:
- There was nothing to draw the attention of the driver of a long vehicle to the short stacking distance available.
 - The difficulty of detecting the approach of a train at night requires a dedicated scan of the track in each direction from a stationary position, as close to the rail track as practicable, for the driver to be sure that he can cross the track safely with a long vehicle. Without the necessary stacking distance the driver had to make a decision on the safety of negotiating the level crossing and the opposing road traffic from the one point, a point remote from the crossing, at which he did not have a reasonable view of trains approaching from both directions.
- 2.3 The question of appropriate signage for advising the drivers of long vehicles of approaches to level crossings which do not have appropriate stacking distances has been raised by the Commission previously. However it is appropriate to recommend to the safety authorities and dairy companies that they extend their consideration of this subject to private level crossings particularly as Transit New Zealand advise that it is not permissible to erect such signs for private crossings under current legislation.
- 2.4 While the view lines to the west would have been more than adequate if a driver was positioned at right angles to the railway line they were not appropriate when the driver was positioned parallel to the railway line and some 20 m from it. In this position the driver would normally use the rear vision mirror of the vehicle to check for trains approaching from behind but the rear view mirror of the vehicle is oriented, as much as practicable to check traffic on the roadway behind it as the driver was doing on this occasion. In this case the signage at the SH 26/Piako Road intersection formed a barrier to sighting the train beyond that point so the

driver had to rely on sighting the warning lights at the crossing to alert him of an approaching train. On this occasion he did see the crossing lights but not until he had entered the driveway even though the timings indicate they would have been operating for some 26 seconds before he drove off SH 26. He did not look to his right as he had, “driven parallel to the railway line for several kilometres . . . so presumed there would not be a train coming from this direction”.

- 2.5 The inadequate stacking distance meant that if the driver had entered the driveway after a right turn off SH 26 and then stopped as close to the railway line as was safe the trailer of his “A Train” would have blocked the near side lane of SH 26 completely and would have had only the small side-lights on the vehicle as a warning of the obstruction which his vehicle formed in the dark.
- 2.6 This was a factor in the accident as although the driver believed there was no train approaching he did contemplate stopping and reversing as an option when he sighted the train. Had he decided to stop, let alone reverse, he would have obstructed SH 26 and any approaching motorists would have had only the small side-lights on the vehicle as a warning of the obstruction. Had he reversed the trailer may well have collided with the car which was waiting behind the tanker. When asked about the length of his vehicle he gave it accurately and he believed the railway was even closer to the road than was the case, but he had not considered these factors in evaluating his options when faced with an imminent collision.
- 2.7 Although the railway runs parallel to the road for a considerable distance the only view a driver, who intends to enter the driveway to this property from the west, can get of a train coming toward him is while he is travelling the 260 m from the intersection of SH 26 and Piako Road to the private driveway. Prior to that the signage at the intersection blocks the train from a driver’s view.
- 2.8 As the driver traverses this distance he must concentrate on the approaching road traffic to judge when he can turn into the driveway access safely. This is his first consideration before he makes the final check for an approaching train and turns right, across the opposing traffic lane.
- 2.9 The darkness precluded the tanker driver from seeing the train and tests showed his only certain visual warning of its approach was dependent upon the pair of headlights on the locomotive being switched on and operating on full beam. The remaining lights on the front of the locomotive were insignificant as a visual warning of its approach and if the headlights were on dim they would have been of less intensity than the approaching car headlights albeit on a parallel path at a higher level and being located close together, one above the other.
- 2.10 It could not be established if the locomotive headlights were on full or dim. The relevant Tranz Rail Rules and Regulations do not specifically require the headlights to be on full beam during the hours of darkness; by stating that the locomotive headlights must be on full during the day, they make the clear implication that they need not necessarily be so at night.
- 2.11 The Tranz Rail Rules and Regulations approved of the use of headlights on dim on the main line at night when another train was approaching and it was common, if unauthorised, practice for LEs to dim the headlights at night out of consideration for approaching motorists. While this action is considerate when the vehicles are passing it does deprive motorists approaching an unprotected crossing of their most effective warning of the approach of a train: its headlights on full beam. For this reason it is considered essential that the LE be aware of the value of the headlights full beam and have an aid to remind him when the headlight is not on full beam.

- 2.12 While the train whistle is also an effective aid its value depends on the road vehicle driver's environment not obscuring the sound with such common features as radio telephones, cell phones and radio entertainment. In any event the current Tranz Rail Rules and Regulations require that the train whistle be sounded reactively rather than proactively. That is, it is only required to be sounded in response to a perceived hazard at a crossing not as a general warning for every crossing approached on the track.
- 2.13 The tanker driver was adamant that he checked for a headlight of a locomotive approaching from Morrinsville, but saw none before he decided to drive his tanker into the driveway. Because the purpose of the train headlights is to illuminate the track in front of the train they are focused for this purpose. Although the lights on full beam appear bright and even dazzling to motorists driving toward a train on an adjacent parallel road there is a point before a motorist passes the train at which the headlights go out of sight. This in turn means that the headlights of an approaching train are not visible to a driver on the road alongside the track while the locomotive travels a short distance before it reaches the crossing. There is a more significant distance at which the headlights have a similar intensity to motor vehicle headlights. However because of the long straight and parallel approach of the locomotive neither of these effects would explain why the tanker driver did not sight the lights before turning into the driveway if they were on full beam.
- 2.14 As the tanker driver approached this crossing after turning off the road there were several features which interrupted his view, the cab structure, a line of power poles and a NZ Dairy Client number sign. Nevertheless there were no significant obstructions to his view of the track towards Morrinsville, until he entered the driveway. As the tanker driver believed the locomotive headlights were on dim when he saw them at the last moment, neither of the train crew could be certain they were on full, other drivers attested to the ease of sighting an approaching train headlight on full beam while on the relevant section of SH 26 and a car driver behind the tanker who could see the approaching car lights did not sight the locomotive headlights the headlights may have been on dim on this occasion.
- 2.15 Assuming the tanker averaged 50 km/h between the intersection and the point from which he turned into the access driveway the total time available for him to sight the approaching train would have been no more than 14 seconds. Added to the 7 to 9 seconds it probably took the tanker to travel up the accessway to the private level crossing there would be 23 seconds while the train was approaching the level crossing after the tanker left the intersection between Piako Road and SH 26.
- 2.16 The insulated joint associated with the activation of the level crossing lights on SH 26 is 550 m to the east of the private level crossing so the locomotive would take some 36 seconds to travel to that crossing after activating the lights for the SH 26 level crossing. Thus the crossing lights on SH 26 would have been activated some 13 seconds before the tanker passed them unless the tanker stopped on the highway prior to turning into the drive as one motorists believed. Therefore it appears likely that the driver stopped for 15 to 20 seconds prior to turning into the private driveway. This would explain why the tanker driver did not see the crossing lights operating when he passed them.
- 2.17 As the LE was sitting on the left side of the locomotive he could not see the tanker as it approached the crossing. He stated that he was certain the locomotive headlights were switched on but he could not be sure they were on full. The last minute recognition of the impending collision conveyed to him by the train operator meant his brake application occurred almost simultaneously with the collision.

- 2.18 While the setting of the locomotive headlights could not be established the tanker driver did not detect them before he turned into the driveway. The possible reasons for this include an inadequate regard for his own safety by the driver, a preoccupation on the driver's part with ensuring he had sufficient space to turn the "A Train" across the oncoming road traffic, that the lights were not sufficiently unique to alert him to the hazard of the approaching train and that when he did look for them his view of the lights was obstructed. The explanation may be in any combination of these factors.
- 2.19 Putting to one side the possibility of the driver having insufficient regard for his own safety an improvement in the safety of such level crossings will be achieved if each of these factors is addressed by allowing the driver to concentrate on clearing the highway first, then alerting him to the presence of the level crossing and its restricted stacking distance, ensuring the visual warning of an approaching train is readily identified as such and finally ensuring that a driver can see an approaching train readily so that he can be sure if he does not see any lights (or other warning) he has time to move a heavy long vehicle clear of the track before any train arrives at the level crossing.
- 2.20 There is a potential to improve the visibility of locomotives by attaching a light, or lights, with different characteristics to those of the adjacent car headlights such as a strobe light, interrupted beam lights, lights of a distinctive colour or equipped with multifaceted lenses. It may also be of advantage to adapt the headlight circuitry so that an associated warning light is fitted to indicate to the LE if the locomotive is running without its headlight operating on full.
- 2.21 The combination of the location of the train whistles and the operation of the radio in his cab with the windows closed may explain why the tanker driver did not hear the warning train whistle before the collision. While the aural warning of the train whistle might not be heard above the noise of the in-cab radio it may alert a driver on occasion. The Tranz Rail Rules and Regulations did not require the locomotive crew to sound the whistle when approaching a private level crossing unless a hazard became evident to them. In this case the train operator says he sounded the whistle as soon as he realised the vehicle which was turning up the access driveway was not going to stop. Had the tanker driver heard the whistle this may have given him some five seconds warning of the impending collision which, given the reaction time required to evaluate the situation and decide to take action to stop the tanker and for that action to bring the vehicles to rest, may not have been sufficient to avoid the collision.
- 2.22 The tanker was approaching from the LE's right (i.e. obscured by the long hood of the locomotive) and until the train operator advised him the LE was unaware of the pending conflict with the tanker unit. The time taken for the train operator to recognise there was going to be a collision, to pass the message to the LE and for the LE to apply the emergency brakes meant that the braking was virtually coincident with the collision.
- 2.23 As the dairy company vehicles have to traverse 23 similar railway crossings to service its clients in the area it would be prudent for the company to evaluate the safety of these crossing for use by its tankers particularly after dark and/or where the stacking distance is insufficient.
- 2.24 There are many private railway crossings, of a similar type to the one involved in this accident, serving properties which by the nature of their activities attract service by truck and trailer combinations and other long vehicles. As heavy vehicles have the potential to derail trains and take a toll of life and property in a collision with a train it is in both the road and the rail operators' interests to minimise the risk of such collisions. In this respect the factors raised in the LTSA document RTS 10 which were related to this accident are relevant as follows:

2.24.1 Presentation of information

- It is accepted that there should be a stimulus to draw a road vehicle driver's attention to the existence of a railway crossing for if there is no stimulus, there can be no response. In relation to this level crossing the only information available to the driver was the hand painted unlit black and white sign facing the road but on the opposite of the railway line. This was non-standard, was incorrectly located and had no counterpart for traffic leaving the property.
- In the dark this sign did not give sufficient prior warning of the approaching hazard because the driver could not see it until he turned into the drive which in turn had insufficient stopping distance for him to stop clear of the railway line without endangering other drivers.
- The sign did not possess adequate intensity as it was unlit and not reflective. When it did come into view the sign required mental translation because it did not indicate where the driver should stop. If taken in the normal sense of a road traffic "Stop" sign, which is required to be at the point alongside which vehicles must stop, the sign was inappropriate as it was on the far side of the track. Consequently it did not identify the precise response required.
- The tanker driver had his radio turned on and said he did not hear the train whistle before the collision. Although not required by Tranz Rail Rules and Regulations the normal location for an LE to sound the whistle if required for traffic at the SH 26 crossing was at the mini St Andrews Cross located just after the locomotive has passed this private level crossing. On this occasion the train operator said he recognised the potential for a collision when the tanker turned off the state highway and sounded the whistle as soon as he realised the tanker was not going to stop. The short time taken for the tanker to travel to the collision point coupled with the time for the train operator to realise the potential and then act was probably insufficient for the tanker driver to react and avoid the collision even if he had heard the warning whistle.
- As he did not hear the whistle the only stimulus in the dark was the headlights of the approaching locomotive. The tanker driver said that he did not see the locomotive headlights prior to entering the drive even though he had checked for an approaching train. His first sighting of the locomotive headlights was when he turned his head, from looking at the crossing lights on the state highway level crossing to his right, to look in the opposite direction.
- Motorists were adamant that it was easy to see the headlights of an approaching train when driving along this stretch of road. The tanker driver had a clear view of the track for approximately 35 seconds prior to turning into the driveway so if the locomotive headlights were on full he should have seen them from his position in the centre of the road before he turned into the drive. Why he did not was not established. The possibilities are that he did not look properly, the approaching car headlights confused him or the locomotive headlights were not operating on full beam but for whatever reason there was insufficient visual stimulus to attract his attention to the threat to his life which the approaching train constituted.

2.24.2 Reception of information

- The stimuli provided were not designed to accommodate the range of human sensory perception of most potential users of the private crossing.
- Specifically, as the LE was not required to sound the train whistle prior to any level crossing, there was no provision for an aural warning other than prior to a perceived hazard. In the closed cab, with the radio on, it is unlikely the tanker driver would have heard the train whistle had it been sounded earlier as he did not hear the whistle when it was sounded immediately prior to the accident.
- The train headlights are intended primarily to provide illumination of the track ahead for the train crew and although they are required to be turned on at all times, as a useful aid to detection, they are not designed specifically as warning lights, particularly when on dim.
- Although the driver had no visual or aural impairment the stimulus should take account of the potential for such handicaps in other drivers and for relevant modern vehicle features such as car stereos.

2.24.3 Processing of information

- The three features that govern the processing of information are; reaction time, expectancy, and short-term memory.

Reaction time

- Reaction time not only includes the time taken to operate a control, but also the time to decide which control should be operated. This rate of decision making was relevant to this accident because, as the tanker driver had not seen the train in the theoretical 35 seconds available for him to sight the headlights of the locomotive while there was road traffic approaching him, he had only 7 to 9 seconds in which to sight the train as he put the tanker into gear and drove it along the driveway to the railway track. Once he commenced the turn his view to the left was interrupted by the cab structure, the dairy company's client number sign, the power line poles, signal control box and the signal itself. Individually these items were of little significance but in combination they produced several successive blind spots of which the driver was not aware.
- He had to look in both directions as he was unaware of the direction from which any train might come. He had been facing Morrinsville prior to turning in, so he looked to his right first as that was the direction which he had only been able to check previously, by looking over his right shoulder and in his rear view mirror. Why he did not see the flashing lights on the state highway level crossing at that time is not known. The driver felt confident that there was no train approaching as he drove up to the level crossing until a light to his left caught his attention and subsequently he noticed the lights operating on the state highway level crossing to his right. His reaction was to look back in the opposite direction where he saw the approaching locomotive headlights. He then evaluated the choice of selecting reverse or getting himself clear of the track while sacrificing the rest of the

“A Train” and finally decided on the option of accelerating across in front of the approaching train.

- Having not seen the approaching train prior to turning into the drive it was a matter of chance if the driver would see it in time to stop his tanker clear of the tracks. If the locomotive headlights were not operating on full beam he had little chance of detecting the approach of the train earlier. It is unlikely that even if he heard the warning whistle, which he says he did not, the reaction time required for him to recognise its warning, to respond and for that response to take effect would have enabled him to avoid the accident.
- This consideration also applies to the train operator and in turn the LE as each had to recognise the need to act and then to respond appropriately. This affects the estimation of the extent of the seven to nine seconds which the tanker probably took to travel from the state highway to the railway which elapsed before the train operator blew the whistle and the LE responded to the train operator’s warning.

Expectation

- The tanker driver had driven into the property only once before and that was on the night prior to the accident. He had been surprised by the existence of the level crossing on that occasion so had made a note on his map to be careful and says he was therefore particularly looking for the approach of a train on this occasion. In view of this statement it is surprising that he did not see the flashing lights on the crossing over the state highway or the headlights of the approaching locomotive sooner.
- Expectation also applies to the train operator and in turn the LE. As each was familiar with “the road” they knew of the private level crossing which existed immediately prior to that over SH 26. This knowledge enabled the train operator to recognise the danger which confronted the tanker driver as soon as he saw him turn off SH 26 and enabled him to react promptly once he saw the vehicle was not going to stop. As the LE was “unsighted” he had no expectation of a problem and had to react to the train operator’s shouted warning.

Short-term memory

- Short-term memory may have been an important factor in the sequence of events for the tanker driver. While conscious of the private level crossing and the potential danger it presented, his first consideration was to establish when it was safe for him to turn off the state highway. This may have lessened his awareness of the proximate railway and led to his not looking for a train approaching from behind earlier and thus not detecting the flashing lights on the SH 26 level crossing sooner.

2.24.4 Sight impediments

- Apart from the train whistle, the only item which could have attracted his attention was the locomotive headlights. The headlights of the train are the only visual means by which an approaching train can be detected by a motor vehicle driver at night. There is no record of whether the locomotive headlights lights were switched on or on what setting. Therefore the setting of the locomotive headlight on this occasion could not be established. As it is not standard practice for trains to be operated with their headlights on full at all times and the LE stated that he dimmed the lights for approaching road traffic on occasion, it is possible the lights were not on full; however even if they were, the factors below may include the reason or reasons why the train was not sighted by the driver in time to avoid the accident.
- While the tanker was stopped in the middle of the state highway the glare from the headlights of oncoming cars might have interfered with the sighting of objects or made it difficult for the driver to notice the approaching locomotive headlights were advancing along a separate path even though the train was travelling on a track which was to the right of and above the level of the approaching cars.
- As the train approached this beam narrowed so if the tanker driver did not spot the lights as they first came into view his chances of doing so lessened until he was moving toward the track.
- The move toward the track was past various objects which continually aligned to interrupt the view of the approaching train particularly when the tanker was entering at the modest speed involved in accelerating from stationary to less than 20 km/h.
- As he was aware of the railway crossing but did not sight the train the approach of the train did not have the necessary stimulus to attract his attention.

2.24.5 Sight restrictions

- The level crossing involved in the accident is a private crossing. Apart from the unlit sign the only form of passive control was for a driver to be aware of the existence of the crossing and stop or slow as he approached the track to check in both directions for approaching trains. In the case of level crossings with inadequate view lines on public roads and some private roads, 'Stop' signs are used. In this case even though there were adequate view lines an inappropriately located home-made "Stop" sign had been erected. While the driver drove cautiously toward the crossing he did not allow himself time to stop before the crossing.
- In this case the driver could not enter the private driveway and stop clear but as close as practicable to the railway without creating a hazard for other road users as his trailer would have been stationary across one lane of the adjacent state highway. Equally a driver of a long vehicle leaving the property could not stop clear of SH 26 to give way to road traffic without part of his vehicle being foul of the railway track.

- 2.25 The question of the safety of private level crossings such as this which have been approved by deed of grant is an important one. Meetings were held with a representative of both Transit New Zealand and the LTSA in Hamilton and the local District Council Planning Officer in an endeavour to establish if there was a protocol for ensuring existing private level crossings met current safety requirements. Their responses did not establish the existence of any provision to address this problem but elaborated on the provisions which are required for the establishment of new private level crossings.
- 2.26 Tranz Rail in the deed of grant which they inherited from their predecessors has provision for recovering the cost of maintaining a “proper” level crossing from the grantee. Their Railnet Code Supplement addresses the requirements for proper signage and stacking distances together with the design criteria for the road across the rail track. This may give potential for the improvement of such entranceways if a need and responsibility for such action is recognised.
- 2.27 In this case the accessway crosses the State Highway road reserve and then the railway property before entering the grantee’s property which appears to complicate the resolution of the matter further.
- 2.28 Rather than protract the investigation by delving further into these areas the Commission has made a series of safety recommendations as the most expeditious means of directing the attention of the relevant authorities to the problem of ensuring the safety of established private level crossings.

3. Findings

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

- 3.1 Although the sign intended to draw attention to the private level crossing was inappropriate and located in a potentially dangerous manner it was not a factor in this accident.
- 3.2 Appropriate signage on the state highway may have prevented this accident.
- 3.3 The driveway between the level crossing and the state highway had insufficient stacking distance for the “A Train” milk tanker or any other maximum length vehicle or vehicle combination.
- 3.4 The level crossing complied with the provisions of the deed of grant issued by New Zealand Railways in 1932.
- 3.5 The provisions in the deed of grant issued by New Zealand Railways in 1932 were obsolete in that they did not recognise current safety needs for such crossings.
- 3.6 The tanker driver was aware of the existence of the private level crossing as he approached the property.
- 3.7 Darkness was a factor in this accident.
- 3.8 The headlight beam of the locomotive, particularly if on dim, was not effective as a warning of the approach of the train to the tanker driver when his vehicle was stopped at the appropriate position to check for rail traffic before entering the private level crossing.

- 3.9 A potential remains for other serious accidents of this type at level crossings with passive protection where there is insufficient stacking room for a driver to stop and look in both directions immediately before crossing a railway line.
- 3.10 There is a need for deeds of grant for private railway level crossings to be reviewed periodically to ensure their requirements provide a reasonable degree of safety for the type of traffic likely to use the crossings and that the provisions therein are unambiguous.
- 3.11 Operators of truck and trailer combinations and long vehicles using private level crossings should make their drivers aware of the hazard created by a lack of stacking distance between the rail and the road limit line.
- 3.12 Operators of long vehicles which have to use private level crossings should be encouraged to make suitable provision for their drivers to negotiate such crossings safely.
- 3.13 It is practicable for Tranz Rail to make its locomotives more conspicuous to those negotiating level crossings in the dark.
- 3.14 Both truck operators and Tranz Rail would benefit if all private level crossings which do not have an adequate stacking distance for long vehicles were identified clearly by a standard sign on the appropriate road.
- 3.15 Both truck operators and Tranz Rail would benefit if all private level crossings which do not have adequate stacking distance for long vehicles were identified and upgraded to the standard required by recent grants for new private level crossings.
- 3.16 The dairy company could have done more to assist their drivers to negotiate the private level crossing safely.
- 3.17 The private level crossing involved in this accident was not safe for negotiation by a truck and trailer combination, the length of which approached the maximum permissible.

4. Safety Recommendations

- 4.1 It was recommended to the Director of Land Transport Safety that he:
- 4.1.1 Formulates a safety education programme for all operators of long vehicles using private level crossings with insufficient stacking distance from the nearest road intersection (095/97); and
 - 4.1.2 In conjunction with Tranz Rail implements a safety programme to ensure private level crossings held under deed of grant achieve signage consistent with the requirements for public level crossings (096/97); and
 - 4.1.3 In conjunction with Transit New Zealand, implements a safety programme to ensure that the grantees of private level crossings which are used by long vehicles and which do not have sufficient stacking distance from the nearest road intersection, display this information to drivers in such a position that it can be seen before they turn into the private road. (097/97)

- 4.2 It was recommended to the Managing Director of Tranz Rail that he:
- 4.2.1 Reviews all deeds of grant for private level crossings issued before the formation of Tranz Rail to ensure that the grantees either have their crossings upgraded to the present standards required by Tranz Rail or arrange alternate access to their property for vehicles that are at risk (098/97); and
 - 4.2.2 Accelerates the current five year programme to fit supplementary flashing ditch lights to locomotives with the aim of completing the programme by December 2000, and ensures procedures for their use enhance the conspicuity of locomotives approaching any passively controlled level crossing (099/97); and
 - 4.2.3 In conjunction with the Director of Land Transport Safety, implements a safety programme to ensure private level crossings held under deed of grant achieve signage consistent with the requirements for public level crossings (100/97); and
 - 4.2.4 Formulates a safety education programme to encourage the holders of statutory level crossings to achieve the safety standards proposed for private level crossings held under deed of grant (101/97); and
 - 4.2.5 Arranges to install a cab warning light to indicate whenever the locomotive headlight is not on full beam for any reason (102/97); and
 - 4.2.6 Amends the Tranz Rail Rules and Regulations on the setting of locomotive headlights by LEs to require the headlights to be on full beam when trains are approaching level crossings at night (115/97); and
 - 4.2.7 Considers amending the Tranz Rail Rules and Regulations to encourage the proactive use of train whistles when approaching level crossings at night. (116/97)
- 4.3 It was recommended to the Chief Executive of the New Zealand Dairy Board that he:
- 4.3.1 Advises the Chief Executives of each New Zealand Dairy Company to review each private railway level crossing used by their company and where there is insufficient stacking distance for a truck and trailer unit to; draw attention to this on the driver's load sheet and arrange for collection to be made from such properties in daylight hours only and preferably from a left turn off the adjacent public roadway. (103/97)
- 4.4 It was recommended to the General Manager of Transit New Zealand that he:
- 4.4.1 In conjunction with the Director of Land Transport Safety, implements a safety programme to ensure that existing private level crossings used by long vehicles, and which do not have sufficient stacking distance from the nearest road intersection, display this information to drivers in such a position that it can be seen before they turn into the private road (104/97); and
 - 4.4.2 In conjunction with the relevant local Councils, takes all practical steps to ensure sufficient stacking distance is provided on the approach to all existing private level crossings for the driver to stop any truck and trailer of maximum permissible length, clear of the rail track without creating a hazard to other road users. (105/97)

