Report 97-107

Silver Fern RM24

collision with pedestrian

Glen Innes

18 June 1997

Abstract

On 18 June 1997, at approximately 1150 hours, Silver Fern railcar RM24 running empty to depot on the down main collided with a pedestrian who had just disembarked from an up train and was using a pedestrian level crossing to gain access to Glen Innes shopping centre. The pedestrian was killed by the collision.

Safety issues identified were the rationale for determining the level of protection appropriate to particular pedestrian level crossing situations and the acceptability of subways as the only access to island station platforms.

Transport Accident Investigation Commission

Rail Accident Report 97-107

Train type and number:	Silver Fern railcar (running as an empty service) ex 300
Date and time:	18 June 1997, 1150 hours
Location:	Glen Innes, 672.68 km North Island Main Trunk
Type of occurrence:	Collision with pedestrian
Persons on board:	Crew: 1
Injuries:	Crew: Nil Others[1]: 1 fatal
Nature of damage:	Nil
Investigator-in-Charge:	R E Howe

[1] Passenger disembarked from Train 3238

1. Factual Information

1.1 Narrative

1.1.1 At about 1150 hours on Wednesday, 18 June 1997, a secondary school student detrained from Tranz Metro passenger service 3238 standing on the up main at Glen Innes station.

1.1.2 The student had an appointment with her doctor in Glen Innes. She was reported as having been ". . . a bit off colour" with loss of appetite. She had left college early to catch a train at Middlemore.

1.1.3 An elderly woman also detrained at Glen Innes. Reports indicated the student used the rear door of the leading half of the unit. The other passenger exited by the front door. Figure 1 shows a layout of the station, the position of Train 3238, and the relative detrainment points.

1.1.4 By coincidence the woman who detrained at Glen Innes had also been waiting for a train at Middlemore with the student. They were the only two passengers on the platform and the woman stated the student had asked her the time and asked if she knew what time the train was due. The woman recalled nothing unusual about the conversation or the student's behaviour.

1.1.5 After detraining at Glen Innes both passengers walked around the east side of the station shelter towards the pedestrian level crossing at the north end of the station. The crossing provided access over the down main to the station car park, the Glen Innes shopping centre and transport services.

1.1.6 The woman, who was walking slowly, stated the student must have passed her on the east side of the station shelter as the student was in front of her as she approached the crossing.

1.1.7 The woman continued to walk towards the crossing and when halfway between the station shelter and the crossing saw a train approaching on the down main from the north and heard the train whistle. At this point the woman stated she stopped walking.

1.1.8 The student was in front of the woman and continued to walk towards the crossing. The woman noticed the student's head was down ". . . as if she was deep in thought".

1.1.9 The woman heard the noise of the approaching down train ". . . very loud" although she stated her hearing was ". . . not the best".

1.1.10 The woman did not recall the student stopping at any stage. Her recollection was that the student continued to walk steadily towards the crossing with her head down, and give no indication that she had seen or heard the approaching train.

1.1.11 She stated she nearly called out to the student at this point but ". . . she wouldn't have heard me with the noise of the train". She saw the train hit the student and turned around to see that the impact had carried the student to the far end of the station shelter.

1.1.12 The down train which collided with the student was Silver Fern railcar RM24 returning to Westfield depot following completion of its service as Train 300, the Kaimai Express, from Tauranga to Auckland.

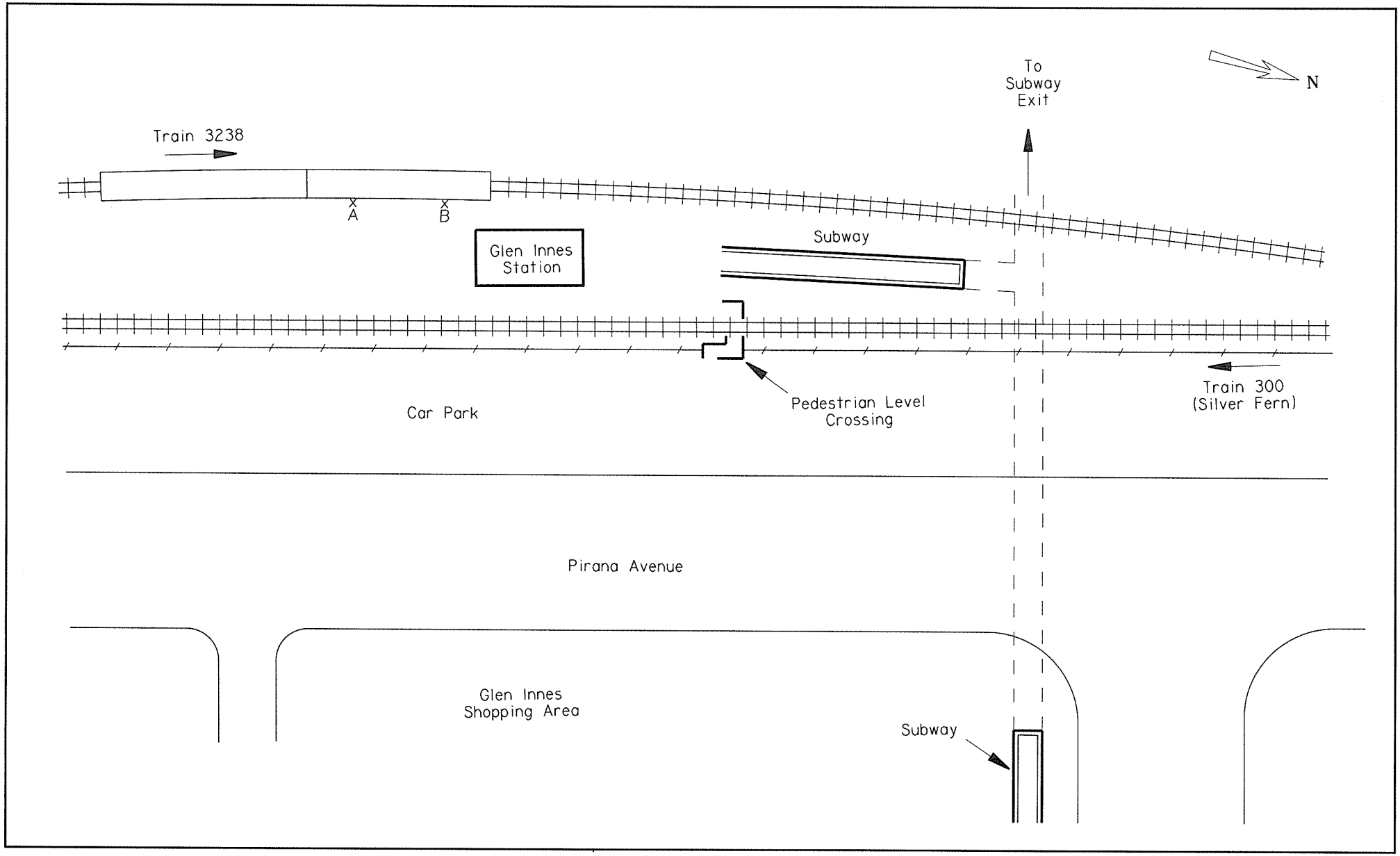

Figure 1
Site details (not to scale)

1.1.13 Train 300 had arrived at Auckland at about 1137 hours, two minutes after its scheduled time. After the passengers detrained the railcar left Auckland at approximately 1145 hours to run to Westfield as an unscheduled empty service crewed by a Locomotive Engineer (LE) and running as directed by Train Control. This was the normal practice for this service.

1.1.14 When the railcar exited tunnel 19 at 673.675 km North Island Main Trunk it traversed a 617 m right hand curve with an authorised speed of 85 km/h before entering the straight approach to Glen Innes Station which had an authorised speed of 100 km/h for railcars. The distance from the start of the straight to the pedestrian level crossing was approximately 340 m.

1.1.15 The LE stated there was no one at the pedestrian crossing as he was approaching the end of the curve and obtained his first view of the crossing some 380 m away but, ". . . there was a subby [suburban service], it was either just arriving or it had arrived at the station".

1.1.16 He stated he was always ". . . a bit cautious" when there was a suburban service on the other line at a station. When previously based at Westfied he said he had witnessed close calls when passengers had disembarked at suburban stations and jumped down on the opposite track to cross.

1.1.17 As he approached Glen Innes, and was about 200 m away from the crossing, he stated he saw two people walking towards the crossing and he sounded the train whistle. He said he noticed the person in front had her head down and did not look up. He recalled sounding the whistle again but the person continued walking. He said he saw no hesitation or sign of her stopping until the impact.

1.1.18 Requirements for locomotive whistle signals in such a situation were included in Rule 73 of the Signal Rules Section of Tranz Rail's Rules and Regulations which 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.

1.1.19 The LE stated his headlights had been on full but he could not recall whether he had put them ". . . on dip" for the suburban service as he exited the curve. The railcar was also equipped with forward facing ditch lights which flashed when the whistle was sounded.

1.1.20 The event recorder was extracted from RM24 following the accident. The event recorder log showed the railcar was travelling at 78 km/h with the throttle in notch 4 as it exited the curve prior to Glen Innes and 79 km/h in notch 4 when a full brake application was made which brought the railcar to a stop in 227 m at a point approximately 212 m past the point of impact (POI). The foot-activated whistle was still sounding when the railcar stopped.

1.1.21 Witnesses were quickly on the scene following the collision and found that no pulse was present in the student. This was confirmed by emergency services who attended a short time later.

1.2 Train 3238

1.2.1 Train 3238 was a scheduled Tranz Metro Diesel Multiple Unit (DMU) service comprising a single 40 m long unit, and was running to time.

1.2.2 The platform at Glen Innes Station to service DMUs is approximately 40 m long and therefore the position of Train 3238 on 18 June is known, as shown on Figure 1.

1.2.3 The guard was in the leading half of the unit and saw the two passengers alight. To the best of his recollection they both alighted from that leading half.

1.2.4 He stated that Train 3238 moved off very shortly after this as there were only two passengers detraining and there were no passengers boarding. He did not recall seeing the railcar on the down main.

1.2.5 The LE of Train 3238 did not see the passengers who alighted at Glen Innes. He did notice the approaching railcar on the down main and estimated it passed him cab to cab when his departing train was at the north end of the platform at Glen Innes, i.e. approximately 90 m north of the pedestrian crossing and 120 m north from the point of departure of Train 3238.

1.2.6 Tranz Rail Limited (Tranz Rail) advised that an acceleration figure of 0.65 m/s^2 was appropriate for a single DMU departing from a platform.

1.3 Pedestrian level crossing

1.3.1 The pedestrian level crossing was installed by Tranz Rail in 1995. The installation was initiated by a joint working party site assessment carried out by Tranz Metro, the Auckland Regional Council and the Auckland City Council as part of stage one of a station upgrading program. The stage one program dealt with minor works to be funded by the Regional Council as part of the contract between the council and Tranz Metro for suburban rail services. Tranz Rail designed the crossing and arranged for construction by contract. The crossing is owned and maintained by Tranz Rail.

1.3.2 The decision to install a pedestrian level crossing at Glen Innes was prompted by persistent trespass over the down main due to passengers' aversion to using the subway and their desire to obtain direct access to the station car park at Glen Innes shopping area. The only other access to the island platform was by the subway which linked both sides of the track, (see Figure 1).

1.3.3 The joint working party survey resulted in the installation of two other pedestrian level crossings in the Auckland area similar in detail to that installed at Glen Innes. In all cases alternative access was available but trespass was common.

1.3.4 The student was a regular user of Glen Innes station when commuting to her college at Middlemore. Her brother was also a regular user, and in common with many Glen Innes patrons they both preferred to use the level crossing in preference to the subway to gain access to the east side of the station. Witnesses said this was because the subway had a history of users being subject to harassment, and it was known to be frequented by glue sniffers. In 1996 the west subway exit had been the scene of an assault which was linked to a homicide which occurred one month later.

1.3.5 The pedestrian crossing was situated adjacent to the subway entrance. A ramp exit had been cut through the station platform and a maze installed on the east side to ensure pedestrians' attention was directed to the approach of a train from the north. The pathway across the track was sealed and provided direct access to the carpark which was not served directly by the subway.

1.3.6 No maze had been erected on the west side of the crossing. All disembarking passengers intending to use the crossing were facing any oncoming traffic when they approached the crossing, (see Figure 3).

1.3.7 The LTSA guidelines, Clause 7.5.1 (e), referred to mazes or barriers ". . . to ensure that pedestrians make at least one 180° turn before crossing the tracks". This is a necessary requirement for pedestrian level crossings over tracks with two-way running where trains can approach from either direction and pedestrians' attention needs to be focused accordingly.

1.3.8 Clause 7.5.1 (e) continued "At multiple tracks the maze should orientate pedestrians so that they face oncoming trains before crossing the track". Nearly all multiple track crossings involve tracks where trains can only approach from one direction.

1.3.9 Glenn Innes was an example of a pedestrian level crossing over a single track which only allowed traffic in one direction. On the west side where the student entered the crossing there was fencing along the pedestrian approaches to direct pedestrians and clearly define the crossing point (Clause 7.5.1 (b) of the LTSA guidelines). Since all intended users of the crossing were facing oncoming rail traffic it was considered that there was no need for a maze and none was installed.

1.3.10 On the east side, where pedestrians approached at right angles to the track, a maze was installed which ensured pedestrians' attention was directed to trains approaching from the north.

1.3.11 The crossing was signposted on the east side with back-to-back notices bolted to the maze fencing. The signs read "WARNING, STOP-LOOK-LISTEN BEFORE CROSSING", (see Figure 2).

1.3.12 Tranz Rail was asked to advise what criteria they used when deciding whether to install active protection[2] at any particular pedestrian level crossing serving an island platform, and for the criteria used when deciding to install active protection at any pedestrian level crossing over Tranz Rail lines.

1.3.13 Tranz Rail included in its reply:

> The provision of pedestrian level crossings is not specifically referred to in any of Tranz Rail's own documented safety system or other procedures. Rather pedestrian level crossings are provided in a form the construction and layout of which is a subject of a draft guideline prepared in August 1995 by the Land Transport Safety Authority. The guideline is not mandatory, but it represents a distillation of professional and industry experience and good sense. Attached is a copy of the draft guideline, pages 23, 24 and 45, the last page being an illustration of the preferred layout for pedestrian crossings on the level. Active warning devices in the Auckland Metro area tend to be at sites that are used predominately by local residents accessing the area on the opposite side of the track from their homes, rather than accessing the Tranz Metro services i.e. Middlemore, Te Mahia both extend over both up and down main lines (note Middlemore is not an island platform).

The pages referred to are attached as Appendix 1.

[2] Active protection refers to devices such as walk/don't walk signs, flashing lights, gates or barriers, audible alarms or a combination of these where the device is activated prior to, and during, the passage of the train. Where such devices are not installed the protection is termed passive.

Figure 2
View of the pedestrian level crossing from the east side

Figure 3
View of the entrance to the pedestrian level crossing looking north from the island platform

1.3.14 Tranz Rail supplied details of pedestrian level crossings in the Wellington and Auckland commuter areas, including those serving island platforms and whether subway or overhead bridge access was available. This showed:

Auckland area

- six of 12 pedestrian crossings served island platforms,
- five island platform crossings were passively protected. Four of these locations had alternative access,
- one island platform crossing was actively protected and served a locality with no alternative access (Te Mahia), and
- of the six crossings not serving island platforms five were actively protected.

Wellington area

- four of 11 pedestrian crossings served island platforms,
- all four were actively protected and two of the localities had alternative access, and
- of the seven crossings not serving island platforms five were actively protected.

Active protection was by flashing lights and bells, or flashing lights and warning signs, and bells.

1.3.15 As a result of inquiries overseas Queensland Rail supplied details of a draft risk assessment procedure which they are developing to prioritise pedestrian level crossings for upgrade, and to quantify criteria for the protection level to be supplied at newly installed, or upgraded crossings based on such factors as usage and location.

1.3.16 Similar details of pedestrian level crossings serving platforms supplied by Queensland Rail shows that in the Brisbane areas 22 platforms are served by pedestrian level crossings; of these 15 are combined with road crossings. Of the remaining seven platforms, five are currently, or soon will be, actively protected by automatic gates which open and shut based on activation by an approaching train. This is the highest level of protection provided for pedestrian level crossings by Queensland Rail. The remaining two crossings, on a comparatively lightly used single line passenger spur, have passive protection. Of the five gated crossings two have alternative access to the platform. Of the two passively protected crossings one has alternative access. Queensland Rail advised that the draft risk analysis criteria developed had been conservatively interpreted when the programme to update suburban crossings to automatic gates was implemented over the last three years. The position was different outside the Brisbane area where risk criteria was more directly applicable and only a small percentage of crossings was protected by automatic gates.

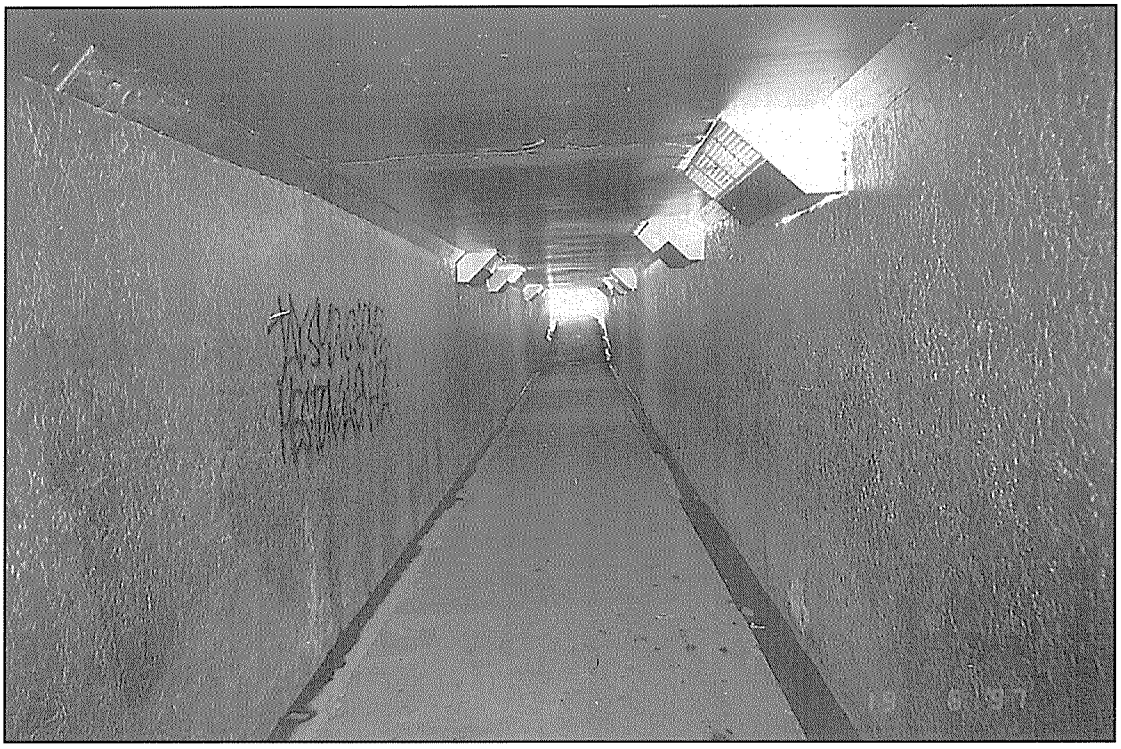

Figure 4
Pedestrian subway looking east to Glen Innes shopping centre exit

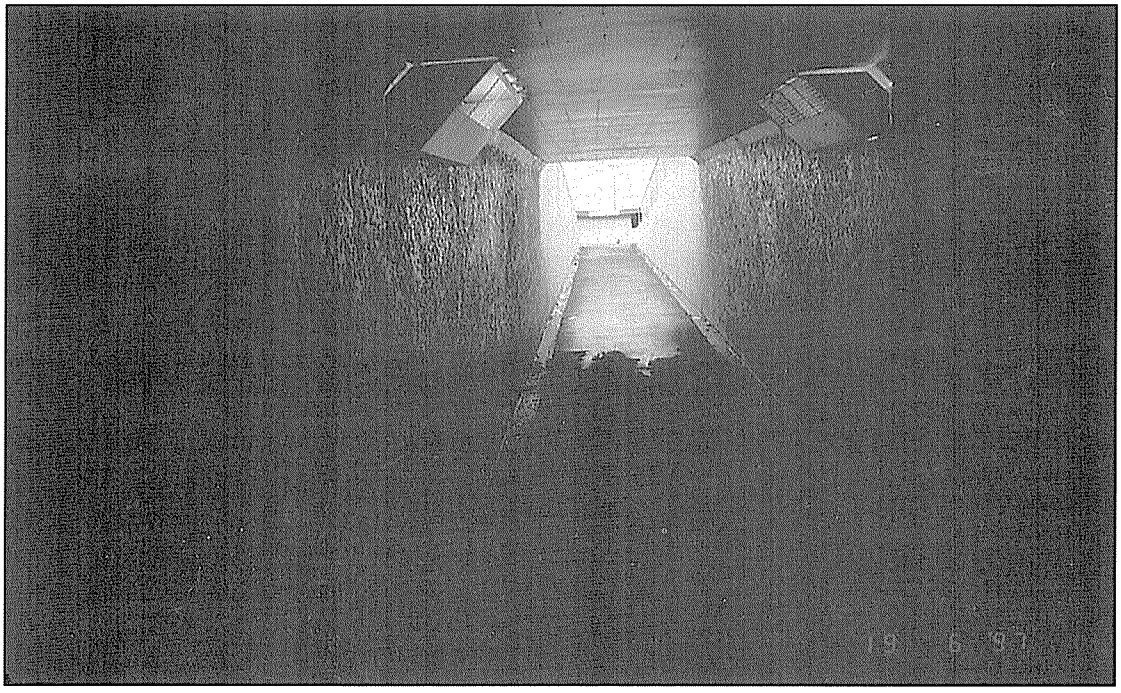

Figure 5
Pedestrian subway looking south to the island platform exit

1.4 Pedestrian subway

1.4.1 The pedestrian subway at Glen Innes is typical of many similar installations servicing stations in the Auckland and Wellington commuter areas. It is on land leased by Tranz Rail from the New Zealand Railways Corporation, although Tranz Rail advised repairs and general maintenance, including lighting, were the responsibility of the Auckland City Council. Tranz Rail advised that it had no record of a formal agreement or deed of grant covering the subway.

1.4.2 The subway was clean, dry and reasonably well lit when inspected following the accident (see Figures 4 and 5), although some lighting was inoperative due to vandalism.

1.4.3 Tranz Rail advised that Glen Innes Station was used by approximately 360 passengers per day, although Tranz Rail had no reliable information regarding how many of these used the pedestrian level crossing in preference to the subway to access the east side. The local Tranz Metro manager estimated that 200 passengers per day used the crossing and commented that, "Very few use the subway."

1.4.4 Site observation following the accident indicated:

- a general higher level of use of the station from the east side than the west, and
- a low level of use of the subway.

1.5 Weather

1.5.1 The weather was reported as being fine but overcast at the time of the accident, and visibility was good.

1.6 Human factors

1.6.1 The LE of the railcar had 32 years railway experience and held a current operating certificate for the duties involved. His health was good and he was not under medication.

1.6.2 On the day of the accident his shift had commenced at his home station, Hamilton, at 0850 hours. The previous day he had worked a six hour shift from 0930 hours to 1530 hours and he had been on leave during the preceding five days.

1.6.3 The student was reported as being in good health, apart from the symptoms which prompted the doctor's appointment she was to attend. She was also reported as doing excellently at school, displaying good spirits, and showing no sign of any worries or stress that may have affected her behaviour.

2. Analysis

2.1 The collision

2.1.1 The two witnesses to the accident were consistent in their recollection of the student's behaviour prior to the collision. This behaviour indicated that the student did not see or hear the train until impact. Factors which could have contributed to this were:

- The noise level in the vicinity of the pedestrian crossing, particularly as related to the departure of Train 3238
- The available view of the approaching railcar
- The possible preoccupation of the student.

2.1.2 From the reported detrainment points the student had approximately 48 m to walk to the crossing and the woman 40 m.

2.1.3 An assumed speed of walking of 1.11 m/s for the student and 0.76 m/s for the woman would have resulted in the student passing the woman at the south end of the station shelter, as remembered by the woman.

2.1.4 The woman had walked approximately 27 m to where she recalled stopping on hearing and seeing the railcar, which would have taken 35 seconds at her assumed walking pace. At this time the student would have walked approximately 39 m and would had been 4 m ahead of the woman and 9 m from the crossing, consistent with witness reports. The 9 m to the crossing would have taken the student approximately eight seconds to walk.

2.1.5 On these assumptions the railcar, travelling at approximately 22 m/s, would have been 176 m away from the crossing. This is consistent with the LE's recollection of where he first sounded the whistle after seeing two people walking towards the crossing when he was "approximately 200 m away".

2.1.6 The railcar and Train 3238 were reported as passing cab to cab, 90 m north of the crossing, i.e. some four seconds before impact. At this stage the rear of the departing DMU was 55 m north of the student. That would have required Train 3238 to have left the platform 20 seconds after the student alighted, based on the known acceleration characteristics of the unit. This would have been consistent with normal train departure timing.

2.1.7 At the time of the collision the rear of Train 3238 was approximately 105 m north of the crossing.

2.1.8 Despite her hearing ". . . not being the best" and the distance of Train 3238 from the crossing the woman heard the whistle of the Silver Fern some eight seconds before the collision and the ". . . very loud" noise of the railcar. It is unlikely, therefore that the departing Train 3238 or any adjacent road traffic adversely affected the student's ability to hear the approaching railcar. It is possible that the student may have confused the initial warning whistle from the railcar with the departure of Train 3238 although it is unlikely that this confusion would have continued with regard to the second sounding of the whistle and the noise of the railcar's approach.

2.1.9 There is potential for confusion when two trains are passing at a passenger station. This potential for confusion should be taken into account when applying risk assessment techniques to assess protection requirements as recommended in Section 5 of this report.

2.1.10 The approaching railcar would have been visible from the crossing as it exited the curve some 360 m from the crossing. The departing Train 3238 did not restrict this view.

2.1.11 The length of time for which the railcar was visible would have given a theoretical maximum of 17 seconds warning to anyone intending to use the crossing who saw the train as soon as it was in their line of sight.

2.1.12 On reports and assumptions made the woman stopped walking when the railcar was approximately 176 m from the crossing. This was probably in response to the first sounding of the whistle, although her memory was that she saw the railcar ". . . coming around the curve" and this prompted her to stop. Although the railcar would have been visible 17 seconds before it reached the crossing it is likely that the woman did not see it until some 12 to 14 seconds before it reached the crossing.

2.1.13 The woman's ability to see the railcar clearly and the reported weather conditions at the time indicate it was unlikely that the sun adversely affected the student's view to the north.

2.1.14 Both witness reports referred to the student as walking with her head down. The LE referred to ". . . continuous walking, her head was down the whole time". The woman reported ". . . she had her head down as if she was deep in thought". It is likely that the reason for the student's failure to respond to the visual and aural warnings of the railcar's approach was some form of preoccupation.

2.1.15 Preoccupation is a recognised factor in injury accidents, although this would not normally cause total inattention to visible or audible safety indications. The elderly lady without the best of hearing had no difficulty in seeing and hearing the railcar.

2.2 The pedestrian level crossing

2.2.1 The decision to install a pedestrian level crossing in 1995 was based on an identified concern regarding the danger of uncontrolled trespass over the down main. By installing the crossing Tranz Rail was able to ensure a controlled approach which increased the safety of individual's access over the down main.

2.2.2 Once installed the crossing attracted some passengers who had previously used the subway. The quantified effect of installing the crossing is not known although it is likely that at least 70% of the passengers gaining access from the platform to the east side now use the crossing.

2.2.3 Although the position and wording of the signs did not comply exactly with the guidelines reportedly used by Tranz Rail the differences were not considered to be a factor in this accident.

2.2.4 No comprehensive comparison between the level of protection provided by Tranz Rail at pedestrian level crossings with that supplied by overseas rail systems was made. From the information available from Queensland Rail it is apparent there has been a recent development towards active protection by means of automatic gates in commuter areas. Factors such as train speed, available view and patronage would have a bearing on the perceived need for this. There is no available risk assessment information to indicate how these factors were assessed when deciding the level of protection to be supplied at Glen Innes.

2.2.5 The accident occurred at a pedestrian level crossing serving an island platform. Such platforms must have suitable specific pedestrian access over or under the rail tracks for Tranz Rail customers to use the services offered and this report addresses issues associated with alternative access in these circumstances. However, there are other situations involving specific pedestrian access over running tracks, e.g. access across the railway reserve to schools and shops, where risk analysis considerations are just as important. For this reason the recommendations made in Section 5 relate to all pedestrian level crossings[3].

2.3 Trespass

2.3.1 Trespass is an ongoing problem on Tranz Rail tracks, particularly in urban areas. The action taken in the Auckland area to address this issue at suburban stations by providing an authorised controlled crossing to regularise common usage is one practical way of dealing with this problem.

2.3.2 Trespass is also a problem in the Wellington suburban area. The local initiative in the Auckland area to provide authorised pedestrian access at specific localities where trespass is common may have application to specific localities in the Wellington area. In all cases any proposed installation should be subject to a risk assessment and protection provided in accordance with the safety recommendations made in Section 5 of this report.

2.4 Train braking

2.4.1 Due to their operating and braking characteristics trains have right of way at passively protected level crossings. Sounding the whistle, rather than braking, was the appropriate response by the LE when he saw people approaching the crossing.

3. Findings

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

3.1 The railcar and DMU were operated correctly.

3.2 The student was using the pedestrian level crossing installed by Tranz Rail for its intended purpose.

3.3 The student's actions indicated she did not see or hear the approaching railcar until impact.

3.4 The view available, and the manner of ensuring crossing users' attention was focused on approaching rail traffic, was appropriate for the direction and speed of the railcar.

3.5 The train whistle was operated in time to warn the student and was clearly audible above the noise of the departing DMU.

3.6 The student may have initially associated the railcar LE's first whistle warning with the departure of the DMU.

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[3] For the purpose of this report pedestrian access over or from a public road crossing is not included in the term "pedestrian level crossing". The system for prioritising protection for public road crossings takes account of pedestrian traffic in the method of ranking adopted and protection details are modified to suit pedestrian needs.

3.7 The student's failure to link the aural warning of the railcar's approach with the need to check visually for approaching rail traffic before entering the pedestrian level crossing may have been due to preoccupation.

3.8 The details of the passive protection supplied at the level crossing were in general accord with the draft guideline prepared by the Land Transport Safety Authority (LTSA) and used by Tranz Rail when providing such facilities.

3.9 The position and wording of the signs was not a factor in the accident.

3.10 The draft guidelines for pedestrian level crossings did not include, and were not intended to include, the level of protection to be provided in particular circumstances.

3.11 Tranz Rail had no quantified risk-based system for assessing the appropriate level of protection for pedestrian level crossings.

3.12 The application of risk assessment techniques to assess pedestrian level crossing protection requirements is receiving increased attention and in Queensland has been partly responsible for an increased level of active protection in the Brisbane commuter area.

3.13 The local Auckland action to provide pedestrian level crossings where persistent trespass placed passengers at risk was a practicable response to an ongoing safety concern, and may be applied outside the Auckland area to advantage.

3.14 The suitability of the protection provided at pedestrian level crossings such as Glen Innes should be supported by a risk assessment to justify the protection level adopted.

4. Safety Actions

4.1 Following the accident the Auckland City Council repaired and improved the lighting in the Glen Innes subway and installed vandal-proof fixings.

4.2 Following the accident Tranz Rail installed warning signs at the end of the platform ramp approach to the crossing on the west side, similar in detail to the signs on the east side. In addition yellow lines were painted across the sealed pathway indicating a safe stopping point clear of the track.

5. Safety Recommendations

5.1 It was recommended to the Director, LTSA, that he:

5.1.1 Formalise the draft guidelines for protection at pedestrian level crossings and include the need for the use of a risk assessment technique to ensure appropriate protection is provided for new pedestrian crossing installations based on physical characteristics and usage and taking into account best international practice and industry experience, (093/97); and

5.1.2 Include in the guidelines that rail operators, as part of their safety system, review existing pedestrian level crossings against risk assessment criteria and implement a prioritised upgrading programme where the protection requirements for new crossings are not met. (094/97)

18 February 1998

Hon W P Jeffries
Chief Commissioner

7.0 APPLICATION TO COMPLEX SITUATIONS

7.1 Preceding Curve or at 'S' bends

Where a level crossing with a Give Way control is preceded by a curve requiring an advisory speed sign in accordance with the 'Guidelines for the Installation of Curve Warning and Advisory Speed Signs' in the 'Manual of Traffic Signs and Markings' (4) then the treatment shown in Figure 15, Appendix A shall be applied.

This Code of Practice allows for the use of sub-options (e.g. PW-17, PW-18, PW-20) of existing curve warning signs depicting a railway track relative to the curve(s).

7.2 Proximity to other Traffic Facilities

No pedestrian crossings, bus stops, or other traffic facilities should be located on a road within the safe stopping distance of a level crossing. Similarly, if a level crossing is located on an adjacent road within 30 metres of an intersection, no such facilities should be located within the safe stopping distance from the intersection. Details of safe stopping distances may be found in NAASRA (3.)

Roundabouts shall be located at least 30 metres from level crossings unless a road layout acceptable to both the road controlling authority and the rail operator can be achieved.

7.3 Dual Carriageways and Multi-lane Approaches

At multi-lane or dual carriageway approaches to level crossings the treatment shown in Figure 8, Appendix A shall be provided. Note that active controls must always be provided in these situations and that an RX-5 active control assembly shall be provided for each lane on the approach.

7.4 Background Definition

The RX-1, RX-2 or RX-5 assemblies may include an integral red, reflectorised target board as shown in Appendix C where increased conspicuity is required at any level crossing due to:

a) a visually complex or predominantly light coloured background, or

b) fog, mist or a low sun angle,

The target board shall be reflectorised using Class 1 reflective material or Class 1A reflective material if there is an excessively bright background to the assembly at night.

7.5 Pedestrian and Cycleway Treatments at Level Crossings

7.5.1 Pedestrian Facilities

Pedestrian facilities should be provided at locations where a significant number of pedestrians cross a railway line at grade. Similarly, provision should be made for cyclists where a significant number of cyclists cross a railway line at grade using a separate cycle facility.

For pedestrians, the following treatments can be considered in addition to a marked or well-defined footway which should always be provided:

a) *signs as specified in Figure 16, Appendix A to warn and/or direct pedestrians.*

b) *fencing along the pedestrian approaches to direct pedestrians and clearly define the crossing point.*

c) *limit lines at a minimum distance of 3 metres from the nearest rail to indicate a safe position for pedestrians to wait.*

d) *illumination of the crossing point where it is used at night time.*

e) *(at crossing points without active controls for pedestrians) pedestrian mazes or barriers to ensure that pedestrians make at least one 180 degree turn before crossing the tracks. At multiple tracks the maze should orientate pedestrians so that they face oncoming trains before crossing the tracks. A suitable design for a maze which will also allow access for prams and wheelchairs is shown in Figure 16, Appendix A.*

f) *audible signals, flashing lights, "Train Coming" indication lights, or barrier arms activated in conjunction with active devices for vehicular traffic where such devices are provided on an adjacent roadway or where visibility is restricted such that pedestrians would not have time to cross the track(s) before the arrival of a previously unseen train.*

All pedestrian facilities shall be located and constructed so as to provide pedestrians with visibility in both directions along the railway line from a position 4.5 metres away from the nearest track. This distance is the equivalent of 5 seconds walking time.

7.5.2 Cycle Facilities

Where a cycle facility crosses a railway line at grade and separate from a vehicle carriageway speed control barriers and signs to warn and/or direct cyclists must be provided. Where there are multiple railway tracks the barriers should orientate cyclists so that they face oncoming trains. Suitable barrier designs are shown in the National Roads Board/Urban Transport Council "Guide to Cycle Facilities" (5).

In addition to this, consideration should be given to providing the following:

a) *fencing on the cycle approaches to direct cyclists and confine the crossing point.*

b) *illumination of the crossing point where it is used at night time.*

c) *audible signals, flashing lights or barrier arms activated in conjunction with such devices for vehicular traffic where such devices are provided on an adjacent roadway or where visibility is restricted such that cyclists would not have time to cross the track(s) before the arrival of a previously unseen train.*

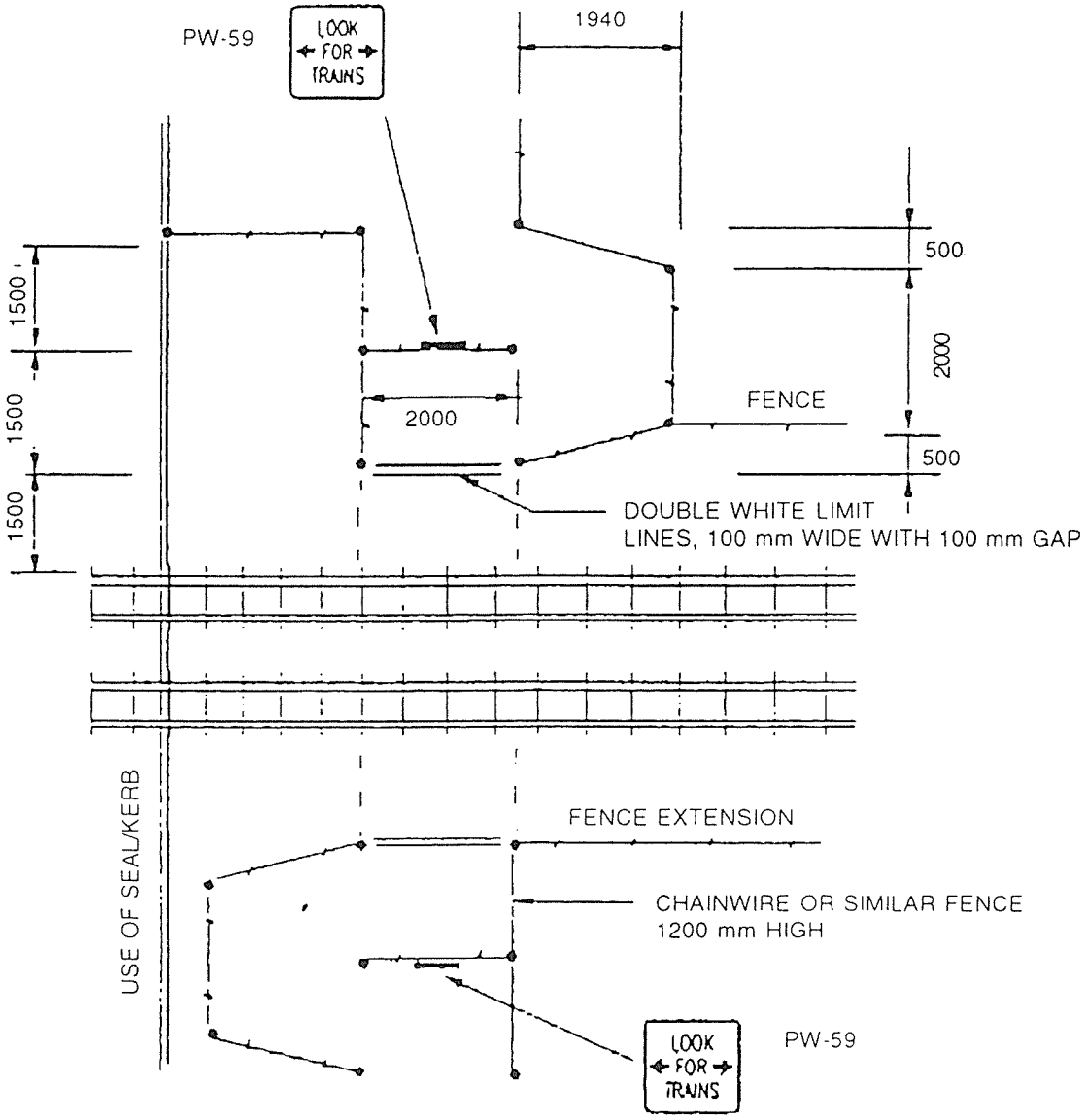

Figure 16: Pedestrian Maze for At-grade Pedestrian Crossings