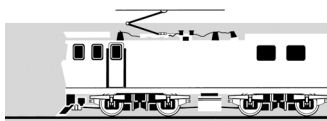
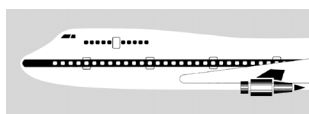


## RAILWAY OCCURRENCE REPORT

05-111

express freight Train 312, school bus struck by descending barrier arm, Norton Road level crossing, Hamilton

16 February 2005



The Transport Accident Investigation Commission is an independent Crown entity established to determine the circumstances and causes of accidents and incidents with a view to avoiding similar occurrences in the future. Accordingly it is inappropriate that reports should be used to assign fault or blame or determine liability, since neither the investigation nor the reporting process has been undertaken for that purpose.

The Commission may make recommendations to improve transport safety. The cost of implementing any recommendation must always be balanced against its benefits. Such analysis is a matter for the regulator and the industry.

These reports may be reprinted in whole or in part without charge, providing acknowledgement is made to the Transport Accident Investigation Commission.



## **Report 05-111**

### **express freight Train 312**

### **school bus struck by descending barrier arm Norton Road level crossing**

### **Hamilton**

**16 February 2005**

### **Abstract**

On Wednesday 9 February 2005 at about 1500, a descending barrier arm at Norton Road level crossing, Hamilton, struck a school bus conveying 16 passengers when the level crossing warning devices activated for the passage of express freight Train 312. The school bus could not clear the level crossing because of traffic banked up in front of and behind it.

Train 312 was stationary at the time and the locomotive engineer became aware of the school bus before he moved his train.

There were no injuries.

The safety issues identified included the signage, design, layout and alignment of the road approaches to, and exits from, the level crossing.

A joint safety recommendation covering these issues was made to the Chief Executives of ONTRACK<sup>1</sup> and Hamilton City Council.

Long-term use of the level crossing in its existing layout was considered but in view of the changes proposed by Hamilton City Council no safety recommendation was made

---

<sup>1</sup> ONTRACK is the trading name for New Zealand Railways Corporation, the rail access provider since 1 September 2004.



# Contents

- Abbreviations ..... ii
- Data Summary ..... iii
- 1 Factual Information ..... 1
  - 1.1 Narrative ..... 1
  - 1.2 Site and signalling information ..... 1
    - Level crossing protection ..... 3
    - Signalling ..... 6
    - The future of the level crossing ..... 6
  - 1.3 Locomotive event recorder ..... 6
  - 1.4 Personnel ..... 7
    - The locomotive engineer ..... 7
    - The school bus driver ..... 7
- 2 Analysis ..... 8
- 3 Findings ..... 9
- 4 Safety Recommendations ..... 10

# Figures

- Figure 1 Site plan of Norton Road level crossing (not to scale) ..... 1
- Figure 2 The eastern approach to the level crossing ..... 2
- Figure 3 The eastern side of the level crossing ..... 3
- Figure 4 The PW-57 sign on the western side of the crossing ..... 4
- Figure 5 The Norton Road/Lincoln Street intersection ..... 5
- Figure 6 An example of yellow hatching at a level crossing ..... 5
- Figure 7 The overhead warning signs on the eastern side of the crossing ..... 6

## Abbreviations

km/h	kilometre (s) per hour
m	metre (s)
t	tonne (s)
the manual	Manual of Traffic Signs and Markings
Toll Rail	Toll NZ Consolidated Limited
UTC	coordinated universal time

## Data Summary

<b>Train type and number:</b>	express freight Train 312
<b>Date and time:</b>	16 February 2005 at about 1500 <sup>2</sup>
<b>Location:</b>	Hamilton
<b>Persons on board:</b>	train: 1 bus: about 16
<b>Injuries:</b>	nil
<b>Damage:</b>	nil
<b>operators:</b>	train: Toll NZ Consolidated Limited (Toll Rail) bus: Pavlovich Coachlines limited
<b>Investigator-in-charge:</b>	D L Bevin

---

<sup>2</sup> Times in this report are New Zealand Daylight Saving Times (UTC+13) and are expressed in the 24-hour mode.



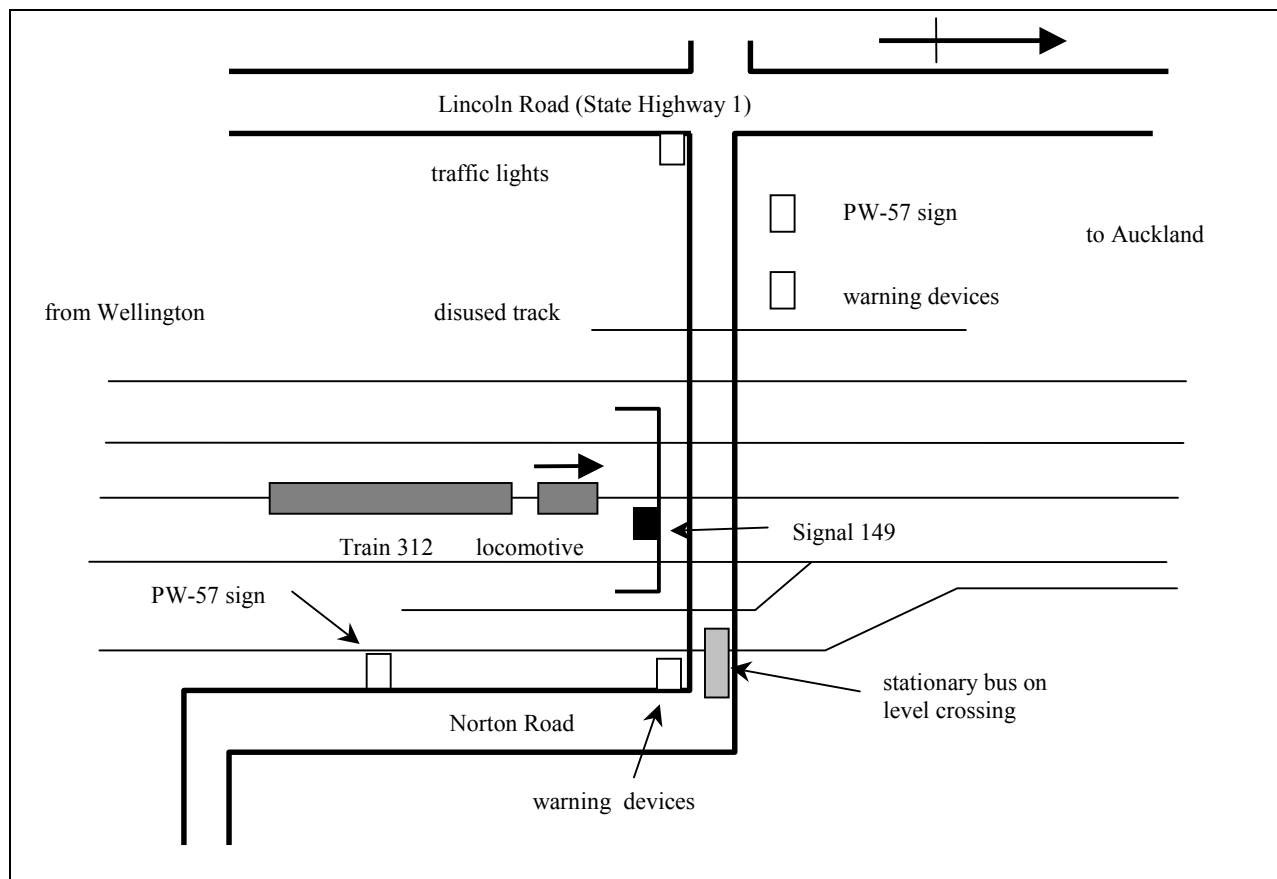


# 1 Factual Information

## 1.1 Narrative

- 1.1.1 On Wednesday 9 February 2005, Train 312 was a northbound express freight train travelling from Wellington to Mount Maunganui. The train consisted of an EF class electric locomotive and 28 wagons for a gross weight of 846 t and a total length of 465 m and was crewed by a locomotive engineer.
- 1.1.2 The locomotive engineer stopped Train 312 at Signal 149 on the south side of Norton Road level crossing in Hamilton, and left the cab to uncouple the locomotive from the wagons (see Figure 1). When he got back into the cab he called the signalman at Te Rapa signal box and requested a proceed indication on Signal 149 for his locomotive to travel to the locomotive depot.
- 1.1.3 The level crossing warning devices activated but the signal did not clear. The barrier arm at the level crossing had lowered until it struck and came to rest on the roof of a school bus that had entered the level crossing from the eastern side.
- 1.1.4 The locomotive engineer saw what had happened and advised the signalman, who then gave verbal authority for the locomotive engineer to pass Signal 149 at stop.
- 1.1.5 The school bus was not moving and the level crossing was clear of traffic as the locomotive passed Signal 149 and crossed Norton Road.

## 1.2 Site and signalling information



**Figure 1**  
**Site plan of Norton Road level crossing (not to scale)**

- 1.2.1 Norton Road level crossing was located at 543.23 km on the North Island Main Trunk. It was about 37 m wide and crossed 7 tracks, which included the main line, 2 loops and 3 sidings. The seventh track was disconnected and not used.
- 1.2.2 The level crossing was traversed by trains travelling to and from the East Coast Main Trunk, on the North Island Main Trunk and by shunt locomotives serving sidings on the south side of the crossing from Te Rapa, including the Hamilton container transfer site.
- 1.2.3 A vehicle count, taken between 1020 and 1050 several days after the incident, showed 263 motor vehicles had used the crossing during that time. This included cars, heavy trucks and buses. Two trains had also traversed the level crossing during that time.
- 1.2.4 On the western side of the railway, Norton Road connected to Lincoln Road<sup>3</sup> by means of an intersection controlled by traffic signals. The intersection was sited about 65 m from the level crossing.
- 1.2.5 Norton Road level crossing did not offer good visibility for road traffic, particularly when approaching the crossing from the east. This approach ran parallel to the railway corridor for about 100 m before it turned sharp left on to the crossing (see Figure 2).



**Figure 2**  
**The eastern approach to the level crossing**

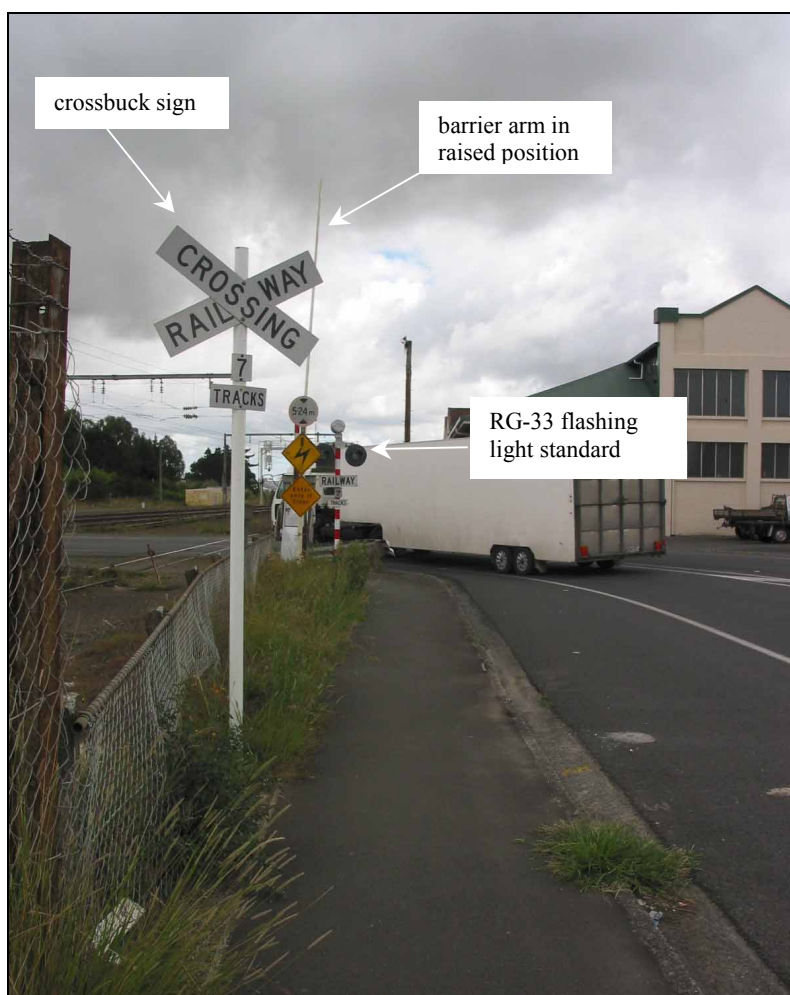
- 1.2.6 The level crossing offered good visibility for locomotive engineers approaching from either direction. Maximum train speeds were restricted to 50 km/h on the main line and 25 km/h on the remaining lines over the level crossing.
- 1.2.7 There was a road over rail bridge about 700 m south of the level crossing and a vehicle underpass about 400 m north.

---

<sup>3</sup> Lincoln Road was the designated State Highway 1 bypass for motor vehicles to avoid Hamilton central business district.

## Level crossing protection

- 1.2.8 Level crossing protection at Norton Road included flashing lights, bells, half-arm barriers and warning signage and the necessary road markings.
- 1.2.9 There was one RG-33 flashing light standard<sup>4</sup> on the western side of the crossing facing Lincoln Road intersection and one on the eastern side facing along Norton Road towards approaching traffic. There was also a crossbuck sign on the eastern side about 10 m from the crossing (see Figure 3) but there was no crossbuck sign on the western side of the crossing.



**Figure 3**  
**The eastern side of the level crossing**

- 1.2.10 There was a PW-57 sign 90 m from the level crossing on the eastern side. This was in accordance with the “Manual of Traffic Signs and Markings”<sup>5</sup> (the manual), which specified that such signs should be located on the left-hand side of the road at least 60 m from the crossing. The PW-57 sign on the western side was 57 m from the crossing (see Figure 4). This did not meet the guidelines specified in the manual, but physical limitations prevented it being further away. The manual also specified that where annual average daily traffic exceeded 2000 vehicles per day, a second PW-57 sign should be positioned on the right-hand side of the road. There were no PW-57 signs on the right-hand side of the road on either side of the crossing.

<sup>4</sup> An RG-33 flashing light standard consisted of a railway crossing flashing light signal head.

<sup>5</sup> A manual jointly prepared and distributed by Transit New Zealand and the Land Transport Safety Authority (now Land Transport New Zealand) that set out the policy and requirements for traffic signs and included guidance for the location and positioning of signs.



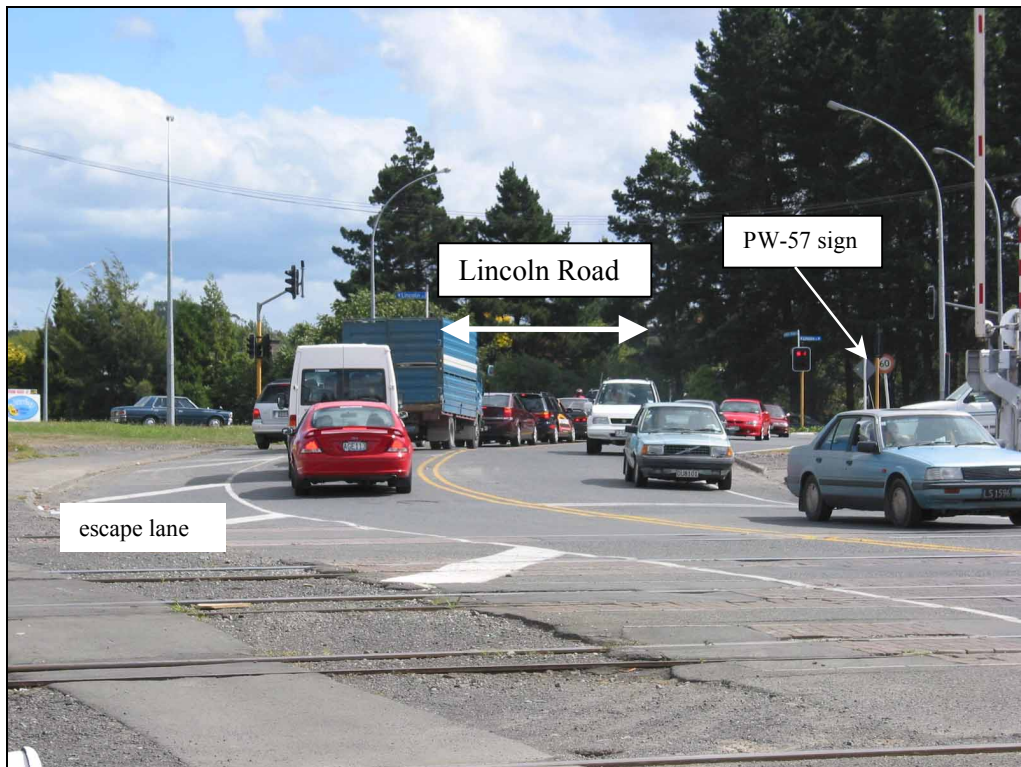
**Figure 4**  
**The PW-57 sign on the western side of the crossing**

- 1.2.11 The manual provided for a PW-13<sup>6</sup> sign to be erected on the main road approach to a side road junction where a railway level crossing was located on the side road immediately adjacent to the main road intersection. PW-13 signs were to be located where they were clearly visible to approaching drivers for a distance of at least 60 m on urban roads. There were no PW-13 signs on Lincoln Road advising traffic turning in to Norton Road.
- 1.2.12 An escape lane, identified by a painted area on the left-hand side of the road approaching the intersection, was provided for any vehicles caught on the level crossing by an approaching train because of traffic banked up at the traffic lights (see Figure 5).

---

<sup>6</sup> A side road junction symbol (arrow version with railway crossing on side road).





**Figure 5**  
**The Norton Road/Lincoln Street intersection**

- 1.2.13 The manual provided that where the departure of long vehicles or queues of traffic from a level crossing may be blocked by a nearby intersection or other traffic control devices, an escape lane or clear zone should be provided. Yellow cross hatch markings could be used to define a clear zone area that drivers should not enter when their departure from the level crossing was blocked. Figure 6 shows an example of a level crossing where yellow cross-hatching was in place.



**Figure 6**  
**An example of yellow cross-hatching at a level crossing**

- 1.2.14 There was a sign on each side of Norton Road level crossing warning approaching traffic of the presence and clearance height of the overhead catenary. An additional sign, which advised motorists to “enter only if clear”, was attached beneath the overhead warning signs on the eastern side (see Figure 7).



**Figure 7**  
**The overhead warning signs on the eastern side of the crossing**

- 1.2.15 The manual required that limit lines be marked on all sealed approaches to railway level crossings, to indicate the safe positions for vehicles to stop, if necessary, to avoid conflict with trains. Such lines should be marked 2 m in advance of a flashing light signal or lowered half-arm barrier. The limit lines on both sides of Norton Road level crossing met the criteria.

### **Signalling**

- 1.2.16 When a train was stopped at Signal 149 or any other signal adjacent to the level crossing, a command to clear any of the signals to proceed would not activate if the barrier arms were not in the fully down position.
- 1.2.17 There was an 8-second “pre-fall” period during which time the warning lights and bells began operating before the half-arm barriers started to descend.

### **The future of the level crossing**

- 1.2.18 On 4 August 2005 Hamilton City Council advised that in conjunction with Transit New Zealand a major roading project was planned for the intersection of Lincoln and Norton Roads. As part of that project Norton Road level crossing would be replaced with a realigned underpass beneath the railway tracks. The project was expected to commence in the 2005/2006 financial year and take about 2 years to complete.

## **1.3 Locomotive event recorder**

- 1.3.1 Locomotive event recorder data was not requested for analysis as Train 312 was stationary at the time of the incident.

## **1.4 Personnel**

### **The locomotive engineer**

- 1.4.1 The locomotive engineer had been involved in locomotive running duties since 1978 and had attained his grade 1 certification in 1989. His certification for the duties he was undertaking was current.
- 1.4.2 The locomotive engineer said that at about 1500 he had stopped Train 312 about 20 m short of Signal 149 and left the locomotive cab to detach the locomotive<sup>7</sup> from the train. This was a common practice and allowed the locomotive to travel directly to the locomotive depot.
- 1.4.3 After uncoupling the locomotive, he returned to the locomotive cab and made a radio call to the signalman and requested a proceed signal indication on Signal 149 across Norton Road.
- 1.4.4 While he was waiting for the signal to change, he began packing his gear into his bag. As he did so, he heard the level crossing alarm bells start ringing. He looked up and saw a bus on the eastern side of the level crossing with the barrier arm resting on the side and roof of the bus.
- 1.4.5 He saw the passengers move to the back of the bus and that the bus was prevented from reversing off the level crossing because of the traffic banked up behind it. The locomotive engineer called the signalman again and asked if he was having difficulty getting a proceed indication on Signal 149. When the signalman confirmed that he was, the locomotive engineer advised him of the situation.
- 1.4.6 The signalman then gave the locomotive engineer verbal authority to pass Signal 149 at stop. After satisfying himself that it was safe to do so, the locomotive engineer proceeded over the level crossing.
- 1.4.7 The locomotive engineer said he had not seen how the bus got caught in that position.

### **The school bus driver**

- 1.4.8 The school bus driver had been driving buses for most of his working life and school buses for about 10 years.
- 1.4.9 He said he had followed a line of traffic towards the eastern entrance to the level crossing and had turned left to enter the crossing. His bus had just entered the level crossing and was on the first track when the crossing alarm bells started ringing.
- 1.4.10 The cars in front of him cleared the level crossing when the alarms started to ring but he stopped where he was. He could not reverse off the crossing because of the traffic banked up behind him.
- 1.4.11 As the barrier came down he checked where the train was and was satisfied that the bus was safe, although he was concerned that a train may come from the opposite direction, where his visibility was not so good. He decided that the passengers were safer if they stayed on the bus so he moved them to the back, rather than have them alight on to the rails.
- 1.4.12 After the locomotive had cleared the crossing, the half-arm barrier returned to its upright position. The driver drove the bus clear of the crossing on the western side.
- 1.4.13 The driver said he thought the track he had stopped over was a disused siding because the lines were rusty. However, despite its appearance, the siding was regularly used as an entry to/exit from the Hamilton container transfer depot.

---

<sup>7</sup> The electric locomotive on Train 312 was to be replaced with a diesel locomotive for the continuation of the journey east.

## 2 Analysis

- 2.1 Norton Road was a principal route through the western part of Hamilton city for motor vehicles connecting with Lincoln Road. Because Lincoln Road was also the State Highway 1 bypass, it had a high traffic count and this, together with the traffic from Norton Road, made the intersection extremely busy. Delays to traffic on Norton Road at the intersection frequently resulted in traffic queuing back across the level crossing.
- 2.2 The warning devices in place, together with the escape lane and the speed restrictions in effect for trains, meant that the possibility of a collision occurring as a result of traffic queuing over the level crossing was probably remote. However, a potentially serious situation was created each time this occurred. The integrity and appropriateness of the level crossing were considered during the investigation but in view of the alterations planned by Hamilton City Council, no safety recommendation regarding the continued use or future of the level crossing has been made.
- 2.3 The road signage and markings that were in place, both approaching and at the level crossing, were clearly visible and in good condition and met the guidelines included in the manual, except for the non-existent PW-13 sign and the incorrectly positioned PW-57 on the eastern side. The alignment of the intersection turn into Norton Road meant that it was not possible for the PW-57 to be positioned the required 60 m from the crossing but the siting of the sign did not contribute to the incident.
- 2.4 With a traffic count of 263 vehicles in 30 minutes, the 24-hour traffic density was about 12600 vehicles per day. If the crossing was to fully meet the guidelines in the manual an extra PW-57 sign should have been placed on the right-hand side of the road, adjacent the existing PW-57 signs, and PW-13 signs should have been placed on either side of Lincoln Road, about 60 m from the intersection with Norton Road. However the main defences, namely the warning devices at the level crossing, met the guidelines and the absence of the additional signage did not contribute to the incident.
- 2.5 The sign, which advised drivers to “enter only if clear” was attached, with other signs, to the standard which warned of the presence of the overhead catenary. There were several signs and standards on the eastern side of the crossing, which created a clutter and this, together with the small size of the sign, would have made it difficult for motorists to see, especially as they were concentrating on approaching and entering the crossing. The issue of signage at the level crossing has been included in a joint safety recommendation to the Chief Executives of ONTRACK and Hamilton City Council.
- 2.6 The bright colour of cross-hatching to indicate “enter only if clear” however, is highly visible to motorists and, together with appropriate signage, would probably have provided a more positive defence by discouraging cars from entering the level crossing, rather than relying on an escape route, when the exit was blocked. The issue of road markings at the level crossing has been included in a joint safety recommendation to the Chief Executives of ONTRACK and Hamilton City Council and no separate recommendation covering cross-hatching has been made. However, despite the compromises and possible minor improvements to signs and road markings, the crossing may be as safe for road traffic as it can be made at costs consistent with the benefits that might result from more substantial interim improvements.
- 2.7 The traffic signals at the intersection with Lincoln Road influenced traffic patterns for east-to- west motor vehicle traffic flows across the level crossing. If the signals were at stop, traffic often banked back and blocked the exit from the crossing. When approaching from the eastern side, motorists had a restricted view of traffic movements on the western side until they had completely entered the level crossing, by which time following traffic prevented them reversing and so committed them to continuing across.



- 2.8 The time delay between the half-arm barriers being activated by an approaching train and its subsequent arrival at the crossing was appropriate for the width of the crossing and gave vehicles adequate time to vacate, by either traffic signal phasing or the emergency lane. The presence of the escape lane on the approach to the intersection suggested that it was not uncommon for traffic wishing to vacate the crossing to take evasive action when the usual exit was blocked by queuing traffic.
- 2.9 With the possibility that an approaching train could be on any one of the 6 tracks, it was understandable that motorists would not delay exiting the crossing once the warning devices activated. However, the visibility available to locomotive engineers as they approached the crossing, as well as the reduced maximum speeds in effect, meant that even in situations where cars were caught on the crossing, a collision was unlikely. This would not necessarily be the case where a motor vehicle had deliberately entered the crossing after the warning devices had activated.
- 2.10 The warning devices were not operating when the bus initially entered the level crossing. The tight left-hand curved entry meant that it was not possible for the driver to approach and enter the crossing straight on. As a result, the bus was still turning on to the crossing, and by the time it had straightened up sufficiently for the driver to see straight ahead it was already under the barrier arm as it started to lower. If the bus driver had followed the traffic over the crossing he would have cleared it safely because the locomotive of Train 312 was stationary at the time. However, although he was aware of the presence of that particular train, his concern was that there might be another train approaching and his action in stopping his bus as soon as he became aware that the warning devices had activated was justified, particularly as he could not then reverse off the crossing.
- 2.11 The locomotive of Train 312 was stationary at the time of the incident. The locomotive engineer was aware of the presence of the bus and only moved his locomotive once he had received permission to do and was satisfied that to do so would not create a danger to the bus or its occupants. As a result there was no chance of his locomotive colliding with the school bus. The distance from the locomotive that the school bus had stopped reinforced this.
- 2.12 The signalling system provided a defence in that the bus had prevented the barrier arm attaining the down position for any signals to clear. The bus driver would not have been aware of this defence built in to the signalling system. However, if the bus had been further on to the level crossing, the barrier arm would not have been prevented from coming fully down, the signals would have cleared and a moving train could have approached the level crossing with a proceed indication on the appropriate signal.

### **3 Findings**

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

- 3.1 Train 312 was operated correctly and the actions of the locomotive engineer did not contribute to the incident.
- 3.2 There was no possibility of a collision as the locomotive and the bus were stopped about 20 m apart and the locomotive engineer was aware of the presence of the bus.
- 3.3 The main contributing factor to the incident was the inability of the bus driver to reverse off the crossing when the level crossing warning devices activated. The bus driver's action in stopping the bus at this point rather than attempting to continue forward was justified.
- 3.4 With the exception of the absence of PW-57 and PW-13 signs, the level crossing signage and road markings were in accordance with guidelines published in the manual, Part 1. All signage and road markings were in good condition and, with the exception of the sign on the overhead power warning standard, were clearly visible.

- 3.5 View lines of the railway track for motorists approaching, and at the level crossing, were not good, although visibility for locomotive engineers was excellent.
- 3.6 Although collisions between trains and motor vehicles on Norton Road level crossing under existing conditions are unlikely, the continued long-term use of the crossing in its existing alignment is untenable.

## **4 Safety Recommendations**

- 4.1 On 4 May 2005 the Commission recommended to the Chief Executive of ONTRACK that he:

participate with Hamilton City Council in a review of Norton Road level crossing in Hamilton to include, but not limited to, the design, layout, signage, road markings, warning devices and the alignment of the road approaches and exits to ensure these are appropriate and take steps to rectify any shortcomings identified (032/05).

- 4.2 On 27 May 2005 the Chief Operating Officer of ONTRACK responded in part:

ONTRACK intends to implement this recommendation.

Due to the need for participation with another party, we cannot give a formal date when this will be implemented.

- 4.3 On 19 April 2005 the Commission recommended to the Chief Executive of Hamilton City Council that he:

participate with New Zealand Railways Corporation in a review of Norton Road level crossing in Hamilton to include, but not limited to, the design, layout, signage, road markings, warning devices and the alignment of the road approaches and exits to ensure these are appropriate and take steps to rectify any shortcomings identified (033/05)

- 4.4 On 14 September 2005 the Chief Executive of Hamilton City Council responded in part:

Your findings suggest that a number of minor changes be made to the road markings and signage at the rail crossing, and on the approaches to it.

Whilst the required modifications may not have contributed to the incident, staff are reviewing the signage and road marking at this rail crossing and all other crossings in the city. This will be done in conjunction with Transfield rail staff. It is expected that any changes identified as being necessary will be in place by 30 October 2005.



**Recent railway occurrence reports published by  
the Transport Accident Investigation Commission  
(most recent at top of list)**

- 05-111 express freight Train 312, school bus struck by descending barrier arm, Norton Road level crossing, Hamilton, 16 February 2005
- 04-103 shunting service Train P40, derailment, 43.55 km near Oringi, 16 February 2004
- 04-116 passenger express Train 1605, fire in generator car, Carterton, 28 June 2004
- 04-127 express freight Train 952 and stock truck and trailer, collision, Browns Road level crossing, Dunsandel, 19 October 2004
- 04-125 Collision between an over-dimensioned road load and rail over road bridge No.98 on Opaki-Kaiparoro Road, between Eketahuna and Mangamahoe, 2 October 2004.
- 04-123 Electric multiple unit traction motor fires, Wellington Suburban Network, 7 May 2004 – 30 September 2004
- 04-121 Locomotive DBR1199, derailment, Auckland, 24 August 2004
- 04-120 Express freight Train 726, collision with runaway locomotive, Pines, 18 August 2004
- 04-119 Diesel multiple unit passenger Train 3358, signal passed at Stop and wrong line running irregularity, between Tamaki & Auckland, 28 July 2004.
- 04-118 Express freight Train 725, track occupation irregularity leading to a near collision, Tormore-Scargill, 20 July 2004
- 04-112 Diesel multiple unit passenger Train 2146, fire in auxiliary engine, Boston road, 16 April 2004
- 04-111 Express freight Train 736, track occupation irregularity involving a near collision, Christchurch, 14 April 2004
- 04-110 Shunt L9, run away wagon, Owen's Siding Onehunga, 5 April 2004
- 03-114 Express freight Train 220, derailment, Shannon, 21 November 2003
- 04-113 Express freight Train 220, and empty truck and trailer, collision, farm access level crossing, 162.56 km between Maewa and Rangitawa, 27 April 2004

Transport Accident Investigation Commission  
P O Box 10-323, Wellington, New Zealand  
Phone +64 4 473 3112 Fax +64 4 499 1510  
E-mail: [reports@taic.org.nz](mailto:reports@taic.org.nz) Website: [www.taic.org.nz](http://www.taic.org.nz)

Price \$20.00

ISSN 1172-8280