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ATSB TRANSPORT SAFETY INVESTIGATION REPORT
Rail Occurrence Investigation 2006008
Final



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# Collision Between Freight Train 6PM9 and a Track Mounted Excavator

## Summary

At about 1005[1] on Monday 25 September 2006 a Melbourne bound freight train, 6PM9, travelling from Perth to Melbourne, collided with a track mounted excavator conducting track-work near Inverleigh, Victoria. There were no injuries and only minor damage to both the train and the excavator as a result of the collision.

**Figure 1: The collision**


## Track

Inverleigh is located on the standard gauge Defined Interstate Rail Network (DIRN) between Melbourne and Adelaide. This section of the DIRN is leased to the Australian Rail Track Corporation (ARTC) which manages the line including maintenance.

At the time of the incident a Works Infrastructure[2] track maintenance gang were working on the track at the 101.900[3] km point.

In the section between the 104 km and 101 km posts the track is straight with a descending 1:100 grade, the maximum track speed is 115 km/h.

**Figure 2: Looking from the 104 km post in direction of travel towards the worksite**


The track gang were working on the line in accordance with safe-working rules known as *Track Force Protection – Country Region*. The protection required under these rules is that any on-track machine or obstruction on the running line be protected by placing an outer flag person with three Audible Track Warners (ATW[4]) on the line 10 metres apart not less than 2000 m and not more than 4000 m beyond the obstruction. The outer flag person must display a yellow flag to all approaching trains. In addition, an inner flag person displaying a red flag, must also be placed not less than 200 m from the obstruction.

On this occasion there was a tipper truck and a track mounted excavator working on the track. The supervisor at the worksite (responsible for track protection) had directed that the inner and

1 The 24-hour clock is used in this report to describe the local time of day, Eastern Standard Time (EST).

2 Works Infrastructure – Contracted by the ARTC to conduct track maintenance under the control of ARTC.

3 101.900 km point – distance from a zero kilometre reference point near Melbourne's Southern Cross Station.

4 ATWs are impact explosive devices secured on top of the rail of the track to be protected, to attract the attention of train crews.

outer flag persons be positioned immediately adjacent to the track, 200 m and 2000 m respectively, on both sides of the site.

The outer flag person at the 104 km post was displaying a yellow flag and had attached three ATWs appropriately to the track. He was positioned a safe distance to the left of the track (for a train heading towards Melbourne) where he was clearly visible to the crew of an approaching train.

## Train 6PM9

Train 6PM9 was 1068 m long, weighed 2255 tonnes and was hauled by three locomotives (V544, [G529 dead], 8160, and DL38). The train was owned and operated by SCT Logistics[5] and was crewed by two drivers. The primary driver operating the train at the time of the collision had three months experience in operating freight trains on this corridor. The secondary driver had 10 years experience as a driver, including some time spent as a driver trainer. The train crew had been advised by train control of the worksite at 0840 that morning when travelling between Ararat and Maroona.

## The incident

A little after 1000 on 25 September 2006, the flag person located at the 104 km post saw train 6PM9 approaching. He held the yellow flag steadily above his head until the train locomotives had passed.

The train crew had a clear view of the outer flag person and had expected to see him. Approaching the outer flag person (in throttle notch two) the driver acknowledged the yellow flag,

made a brake pipe reduction[6] of 50 kPa to 'setup' the brakes, and passed over the ATWs at about 111 km/h. Shortly after this the driver made a further brake pipe reduction of 20 kPa, followed closely by another reduction and then a full service application. At this point the drivers realised that the train might not stop before the inner flag person. The primary driver moved the brake handle into the emergency position to exhaust all air from the brake pipe. The secondary driver sounded the train whistle and used the train radio to alert the track gang.

The inner flag person displayed a red flag to the oncoming train. Realising it was not going to stop, the flag person moved to a safe place, also making sure the track gang were clear.

At about 1005 the leading locomotive of the train collided with the rear end of the excavator at a speed of 26 km/h. There were no injuries to either the train crew or the track maintenance workers. There was minor damage to the front cowling on the train's leading locomotive but it was able to resume the journey to Melbourne after minor repairs. The track excavator was also damaged and could not be used until repaired.

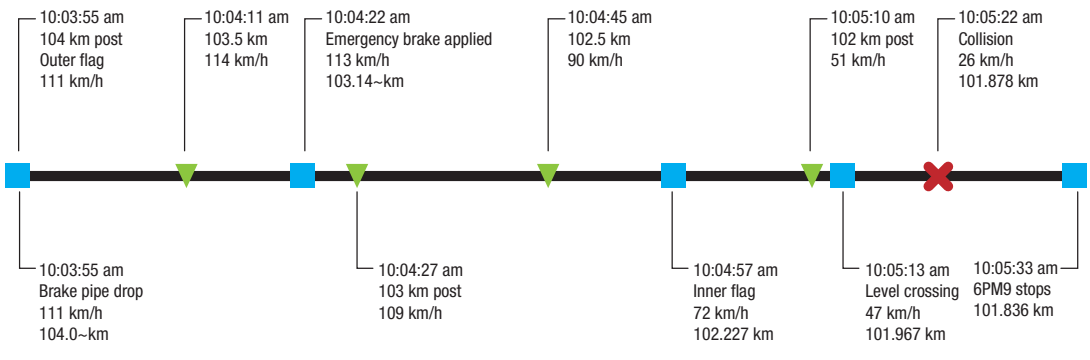
## Analysis

### Train handling

Based on the data logger from locomotive V544 (data summarised in Figure 3) train 6PM9 passed the outer flag person (104 km post) at 1003:55 travelling at 111 km/h. At about that time the brake pipe pressure started to reduce from running pressure.

Twenty seven seconds after this reduction (1004:22) an emergency brake application was made.

**Figure 3: Key events from data logger in locomotive V544**




Note: Scaled by time

5 Hook and pull contract with Pacific National locomotives and train crew.

6 The brake pipe runs throughout the train and is charged at 500 Kpa. When a driver reduces the brake pipe pressure the train's brakes apply, the greater the reduction the more braking is applied.

From this point the brake pipe exhausted rapidly and the train speed steadily decreased. The train passed the inner flag person's position at 1004:57 at 72 km/h, collided with the track mounted excavator at 1005:22 at 26 km/h and came to a stop at 1005:33. The data logger indicated that dynamic braking was not used. It should be noted that there is a slight time delay between the time the driver makes a brake application and when the brakes respond (and when it is recorded on the data logger).

The train crew had been advised of the location of the worksite, and that the track gang were working under their own protection, at 0840 that morning by train control. They were not advised that equipment was on-track. Although they approached the 104 km post expecting to see the outer flag person, the train's speed was not reduced in anticipation of the track works ahead. Once the train driver had sighted and acknowledged the outer flag person he made a minor brake application to set up the train's brake system. Shortly after this, more reductions were made before the emergency brake was applied to try to stop the train. By the time the emergency brake was applied the train was about 920 m from the inner flag person and only about 1260 m from the track mounted excavator. Given his prior knowledge of the location of the track work, his knowledge of the train's braking characteristics and experience on the route, the train driver should have reduced train speed well before it passed the outer flag person's position. The speed of the train approaching the outer flag person and the descending gradient meant that the train driver's initial brake applications were too little too late. By the time the emergency brake application was made at 1004:22 the collision with the track mounted excavator was almost inevitable.

*The Track Force Protection – Country Region* rules used in Victoria states that drivers of approaching trains must be prepared to stop the train and await further instruction from the inner flag person. It is not clear why the train crew had not adequately prepared the train to stop in anticipation of the track works on the line ahead. It is possible that they expected to be allowed past the inner flag person or that the driver just underestimated the amount of braking required to stop the train. Other factors which may have affected the driver's actions and decisions including fatigue and distraction were considered but could not be substantiated based on the available evidence.

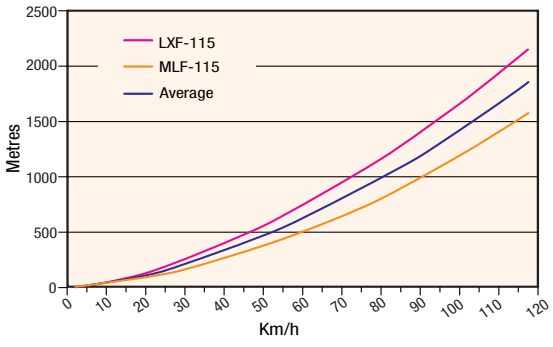
## Worksite protection

*The Track Force Protection – Country Region* safe-working rules specify minimum and maximum distances for flag persons protecting a track-work site. The rules make allowances for restrictive terrain that does not allow a good and/or distant view of the flag persons from an approaching train. In this instance, the position of the inner and outer flag persons allowed a good and distant view. However, the rules do not prescribe or provide guidance on when the outer flag person should be placed beyond 2000 m.

A Works Infrastructure procedure VRLIS005 *Track Protection Layouts & Signalling* provided additional guidance on the placement of flag persons. The document outlined special circumstances where the outer flag person must be positioned at a location beyond the 2000 m point but not beyond 4000 m. One special circumstance was on or near a steep descending gradient, or in any other circumstance that was likely to extend train braking distances.

At the time of the incident, Pacific National operated their trains based on the braking performance outlined in the *Draft Code of Practice for the DIRN – Volume 5: Rollingstock* standard, dated July 2002. Appendix A of the draft code listed minimum stopping distances for freight trains using a full service brake application held to the point of stop on level track, a graph of which is shown in Figure 4.

**Figure 4: Freight train stopping distances (full service braking)**




The graph shows a braking curve for a long express freight train weighing 3480 t (LXF - 115) and a medium freight train weighing 1500 t (MLF - 115). The average line closely represents train 6PM9 weighing 2255 t. Based on the graph, if travelling at 115 km/h train 6PM9 would have needed about 1800 m to stop on level track. On a 1 per cent downhill grade, it would have needed about 2800 m to stop.

Given the required braking distance of about 2800 m, the outer flag person was not positioned far enough away from the work site given the speed of the anticipated train traffic approaching on the descending gradient. The track speed of 115 km/h meant that the drivers of heavy trains would have real difficulty stopping their trains before the site if they were reliant on sighting and responding to the outer flag person alone. In these circumstances, there was an unacceptably high risk of a collision.

## Findings

These findings identify the various events and conditions that increased safety risk and contributed to the occurrence.

- The outer flag person was not positioned far enough away from the track-work site given the anticipated train traffic, the line speed and the descending gradient.
- The train driver had not adequately prepared the train to stop given his prior knowledge of the track work location, route experience and knowledge of the train's handling characteristics. His initial brake applications approaching the work site were too little too late.

## Safety actions

As a result of its investigation, the ATSB recognises safety actions already taken and recommends further safety actions with the intention of improving railway operational safety. Rather than provide prescriptive solutions, these recommendations are designed to guide interested parties on the issues that need to be considered. Recommendations are directed to those agencies that should be best placed to action the safety enhancements intended by the recommendations, and are not necessarily reflective of deficiencies within those agencies.

### RR20070001

The ARTC should review their policies and/or procedures to ensure that factors such as the type and speed of train traffic and the gradient of the line are adequately considered when placing outer flag persons to protect track-work sites.

### RR20070002

Pacific National review train handling practices and/or procedures to ensure drivers are prepared to stop in all circumstances when approaching anticipated track works.

## Submissions

Section 26, Division 2, and Part 4 of the *Transport Safety Investigation Act 2003*, requires that the Executive Director may provide a draft report, on a confidential basis, to any person whom the Executive Director considers appropriate, for the purposes of:

- Allowing the person to make submissions to the Executive Director about the draft; or,
- Giving the person advance notice of the likely form of the published report.

The final draft of this report was provided for comment to directly involved parties whose comments have been largely incorporated into the final report. The ARTC did note that:

> the Australian rules and procedures working group which has representation from all major track owners have identified the need to review the placement of advance warning signage/flag persons. A decision is in part dependent on finalisation of industry agreed braking performance curves.

## Media release

The Australian Transport Safety Bureau (ATSB) has found that insufficient train braking and inadequate warning distance contributed to a collision between a track mounted excavator and a freight train at Inverleigh, Victoria on 25 September 2006.

The ATSB investigation established that the collision occurred because the train driver's initial brake applications approaching the work site were too little too late and that the outer flag person protecting the worksite was not positioned far enough away from the site given the anticipated train traffic, the line speed and the descending gradient.

The ATSB concluded that 'in these circumstances there was an unacceptably high risk of a collision'.

The ATSB report makes recommendations to the train operator and the track manager with the aim of protecting track-work sites from similar accidents.

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