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ATSB rail safety investigation: key lessons learnt

Australian Transport Safety Bureau
PO Box 967, Civic Square ACT 2608
Australia
1800 621 372
www.atsb.gov.au

Abstract

With the creation of the ATSB in July 1999, followed by the enactment of the Transport Safety Investigation Act (TSI Act) in 2003, Australia had for the first time a national body with a mandate for professional and independent rail safety investigations.

In its relatively short existence, the ATSB's rail safety unit has had a significant influence on rail safety in Australia. In particular, it has been instrumental in fostering an approach that emphasises the importance of system safety, rather than just focusing on the mistakes of operational personnel.

Other notable achievements of the ATSB in rail investigations have included raising awareness within the rail industry of the importance of modern health and safety standards for operational personnel, and highlighting specific accident types. These include accidents due to poor communications, signalling difficulties, derailments such as through dynamic track and rolling stock interactions, fatigue, and level crossing collisions.

Early investigations

Soon after the ATSB was formed, it assisted with an investigation into a collision between two trains at Zanthus in Western Australia and found that systemic factors as well as human error contributed to the accident.

On 18 August 1999, just after 5 pm, the Indian Pacific passenger train travelling from Adelaide to Perth was inadvertently directed onto a loop line at Zanthus, where it collided with a stationary freight train. Seventeen passengers and four train crew required medical treatment, and there was significant damage to the locomotives and carriages.

Figure 1: Carriages damaged at Zanthus

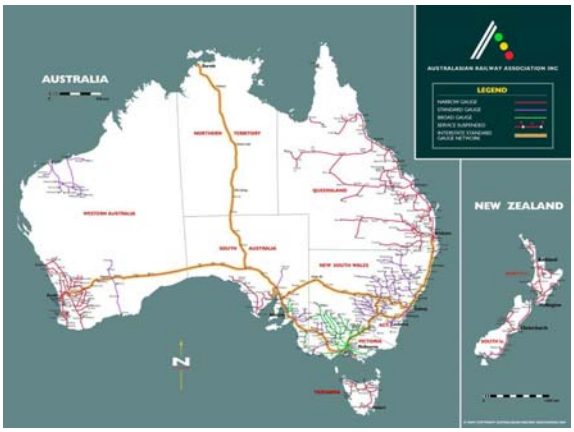
Three months later, on 26 November 1999, a similar accident occurred at Ararat in Victoria. A rail employee wrongly moved the points and diverted a grain train into the Ararat yard, where it collided with a stationary ballast train. Two train crew members were seriously injured. Given that it was possible to move the points in front of an oncoming train, the ATSB led investigation determined that the system in operation at Ararat was fragile in the face of human error.

Transport Safety Investigation Act 2003

Twelve other rail safety investigations were conducted under the relevant State legislation before commencement of the TSI Act on 1 July 2003. Since then, the ATSB's jurisdiction for rail occurrences under memoranda of understanding has been the Defined Interstate Rail Network (DIRN), the national standard gauge system that links Australia's major mainland cities and ports.

There was extensive consultation with the rail industry and State and Territory rail safety regulators prior to commencement of the TSI Act. Its advent was significant for the rail industry for a number of reasons. It marked the start of national, independent rail safety investigations that took a systemic and 'no blame' approach. It also mandated the public release of all reports.

Figure 2: Australasian railway network



Human performance and fitness for duty

A number of ATSB rail safety investigations found significant differences in the health standards for rail personnel between State and Territory jurisdictions, and when compared to health standards for safety critical workers in other modes of transport. Recommendations issued in ATSB rail safety investigation reports were a catalyst in formulating the National Standard for Health Assessment of Rail Safety Workers.

For example, on 5 June 2001, an empty suburban electric express train collided with the back of a suburban passenger train at Footscray station in Victoria. The passenger train had about 20 people on board. The driver of the empty train was injured, and two passengers were taken to hospital for observation.

Figure 3: Footscray, Victoria

There was strong evidence that the performance of the driver of the empty train was impaired by a medical condition that led to him being unable to recall the events in the minutes before the collision. The driver was taking a course of prescribed medication, which combined with an early start for work that day and a history of chronically disturbed sleep, may have resulted in him falling asleep for a short period while he was driving the train.

While there were safeguards in place to protect the safety of the system from such an eventuality, on this occasion they did not prevent the accident. A number of defences in the system were identified as being inadequate in terms of design or application. For example, one defence that was inadequate was the 'dead-man's handle' or vigilance device (in this case a foot pedal) designed to automatically apply the train brakes if there was any variation in applied pressure due to driver incapacitation. The ATSB's investigation found that in some circumstances the pressure on the foot pedal could be correctly maintained just by the weight of the driver's lower leg, regardless of whether or not he was incapacitated.

The alertness and fitness of drivers to perform their duties is also a defence against accidents. In the Footscray collision, the investigation found serious defects in the monitoring of the driver's health and fitness. It also found that the health standards used to assess driver fitness were deficient. As a result, although the driver was skilled and experienced, he was not medically fit to operate the train.

In some cases, the ATSB is requested to assist with rail investigations that would not otherwise fall within its area of responsibility.

On 31 January 2003, at 7:14 am, a four car Tangara suburban passenger train travelling from Sydney Central railway station to Port Kembla, left the track at high speed and overturned approximately 1.9 kilometres south of Waterfall railway station in New South Wales. The train driver and six passengers were killed. The train guard and the remaining 41 passengers suffered injuries ranging from minor to severe.

The ATSB was asked to assist the Counsel Assisting the Special Commission of Inquiry into the Waterfall Rail Accident. ATSB investigators provided initial advice on the Commission's panel of experts about the conduct, structure and a systemic approach to the overall investigation.

The Waterfall Special Commission was critical that the ATSB's findings in the Footscray investigation had not been reviewed by NSW bodies and recommended that the ATSB should investigate

all serious accidents and incidents in NSW, not just those on the DIRN. In part, this was because of the ATSB's reputation and international links including as a member (and former chair) of the International Transportation Safety Association (ITSA). However, the NSW Government decided at that time to create a state-based investigator, the Office of Transport Safety Investigations (OTSI).

ATSB-led investigations in Queensland included the Cairns Tilt Train derailment on 15 November 2004. The train derailed at a speed of 112 km/h north of Berajondo on the Bundaberg to Gladstone line with 150 passengers, two drivers and five passenger service staff onboard. Some of the people on the train were severely injured but fortunately there were no fatalities.

Due to the serious nature of the derailment, the Queensland Government invited the ATSB to be the lead agency involved in undertaking a joint independent accident investigation in conjunction with Queensland Transport.

Figure 4: Derailed Cairns tilt Train

The principal cause of the derailment was excessive speed. From a systemic point of view, the accident was complex and although the principal causal factor related to 'human performance', better organisational controls may have prevented it.

Level crossing accidents

Level crossing accidents have been identified as a key risk to the safety of the rail industry. Since May 2006, the ATSB has investigated 14 significant level crossing accidents. Eleven involved a collision with a heavy road vehicle, and five of those collisions were with a passenger train. While the work of the ATSB's rail safety unit is centred on rail safety, the investigation of these level crossing accidents found, in most cases, that road user issues were the most significant contributing factors.

On 25 May 2006, a tipper truck and trailer carrying a load of 30 tonnes of citrus pulp collided with a freight train near Lismore in Victoria. The driver of the truck was fatally injured. Two locomotives and 41 of the train's 64 wagons derailed with the estimated direct cost of the collision upwards of $13.5 million.

Figure 5: Lismore, Victoria

At the time of the accident the area surrounding the level crossing was enveloped in very thick fog, with visibility less than 50 m. The investigation found that the truck was not being driven in accordance with these conditions, and that the performance of the truck driver may have been affected by fatigue. In addition, the level crossing approach signage and sighting distances were not in accordance with the relevant Australian standards.

On 12 December 2006, a double trailer road-train drove into the path of *The Ghan* passenger train at a level crossing near Ban Ban Springs in the Northern Territory. As a consequence, two locomotives, a wagon used for carrying passengers' vehicles and nine passenger carriages derailed. While there were no fatalities, the road-train driver and a female passenger were hospitalised and several other passengers and crew sustained minor injuries.

The investigation concluded that the truck was driven through the 'Stop' sign at the level crossing at a speed of about 50 km/h. The driver was very familiar with the crossing and had a habit of slowing rather than stopping at the crossing. He may have been influenced by the expectation that a train would not be present and by the

operational constraints of road-train vehicles. In addition, he may not have heard the warning of the train horn because of his severe hearing loss.

Figure 6: Ban Ban Springs, NT

Large heavy road vehicles can take a long time to stop and to get going again. As part of the ATSB investigation, trials were conducted at the Ban Ban Springs level crossing to see how long it would take a large road train to traverse the crossing under different conditions. The results showed, in certain circumstances, the time taken for the test vehicle to clear the level crossing from a standing start was longer than the standard time used to calculate sighting distances. The results of the ATSB's trials, detailed in the investigation report, have wider implications in relation to the adequacy of the current standards for sighting distances at level crossings.

Figure 7: Road-trains can take a long time to stop and get going again

Safety education

While the ATSB's work in rail safety investigation is relatively new (47 final reports on the ATSB website) compared with its decades long aviation and marine experience (1376 and 253 reports on the ATSB website respectively), the rail industry has enthusiastically embraced the concept of independent, systemic accident investigations.

Members of the ATSB's rail safety investigation team regularly participate in industry forums, make numerous presentations to the industry, conduct training, and participate and assist with various industry initiatives and workshops. A recent ATSB publication with industry input publicises lessons from level crossing investigations.

Expertise

New investigators bring extensive experience to the ATSB from careers in engineering, operations, human performance and failure analysis, to name just a few. Achievement of a Diploma of Transport Safety Investigation is the cornerstone of ongoing training and development for every ATSB investigator. Sharing of investigator expertise coupled with a rigorous approach to conducting investigations maximises the opportunity to determine factors contributing to each accident.

Safety Investigation Information Management System (SIIMS)

The Commonwealth has made a substantial investment in developing the ATSB's $6.1 million Safety Investigation Information Management System (SIIMS). SIIMS is integral to the investigation process and provides a systematic methodology for each investigation. An analysis framework ensures that every investigation carefully considers available evidence in order to determine contributing factors and then formulate safety recommendations to minimise the risk of recurrence.

Major accident preparedness

The ATSB regularly participates in major accident preparedness exercises. In the event of a major rail accident the Bureau is able to draw on over 40 fully trained investigators in addition to the rail safety investigation team including specialists in human performance, material failure and data recording, and 45 other ATSB professional staff. ATSB rail investigators are currently headquartered in Adelaide (where the Australian Rail Track Corporation is based) with other rail investigators in Brisbane and Canberra and a further ATSB office located in Perth.

The ATSB is regarded internationally as one of the premier multi-modal investigation bodies in the world and is constantly seeking to perform even better in the interests of future transport safety.