Australian Government

Australian Transport Safety Bureau

ATSB TRANSPORT SAFETY INVESTIGATION REPORT
Rail Occurrence Investigation No. 2005/006
Final

Collision between

Shifted Freight Load on Freight Train 5MA5

and

Passenger Train 206A

Eden Hills, South Australia

30 September 2005

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Published by: Australian Transport Safety Bureau
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ISBN and formal report title: see 'Document retrieval information' on page v.

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DOCUMENT RETRIEVAL INFORMATION

Report No.	Publication date	No. of pages	ISBN
2005/006	September 2006	32	1 921164 03 4

Publication title

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Prepared by

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Acknowledgements

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Abstract

On Thursday 30 September 2005 at about 0800 hours (Central Standard Time) steel plate, part of a load that had shifted on Pacific National freight train 5MA5, struck a TransAdelaide passenger train 206A at Eden Hills railway station platform. There were no injuries and only minor damage to both trains and track infrastructure.

Eden Hills is located in the Adelaide Hills region approximately 14 km from Adelaide on the Belair railway line which forms part of the Defined Interstate Rail Network corridor. Within the railway corridor there is a standard gauge line managed by the Australian Rail Track Corporation (ARTC) and an adjacent broad gauge line managed by TransAdelaide.

The investigation concluded that the collision occurred as a result of the movement of inadequately secured metal plates on a Transi-flat container located approximately 1250 m from the front of train 5MA5. Based on available evidence, the shifted load had been out-of-gauge from Murray Bridge, 85 km from the point of collision. In addition, the ARTC track at Eden Hills station platform was up to 140 mm closer to the TransAdelaide track than the design clearance. Given the inadequate load securing methods, and the forces to which the load had been subjected during its carriage, there was a relatively high risk of a load shift resulting in an out-of-gauge collision.

THE AUSTRALIAN TRANSPORT SAFETY BUREAU

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The ATSB is responsible for investigating accidents and other transport safety matters involving civil aviation, marine and rail operations in Australia that fall within Commonwealth jurisdiction, as well as participating in overseas investigations involving Australian registered aircraft and ships. A primary concern is the safety of commercial transport, with particular regard to fare-paying passenger operations. Accordingly, the ATSB also conducts investigations and studies of the transport system to identify underlying factors and trends that have the potential to adversely affect safety.

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The ATSB does not have the resources to carry out a full cost-benefit analysis of each safety recommendation. The cost of a recommendation must be balanced against its benefits to safety, and transport safety involves the whole community. Such analysis is a matter for the body to which the recommendation is addressed (for example, the relevant regulatory authority in aviation, marine or rail in consultation with the industry).

EXECUTIVE SUMMARY

On Thursday 30 September 2005 at about 0800 (CST[1]) steel plate, part of a load that had shifted on a Pacific National freight train, struck a TransAdelaide passenger train at Eden Hills railway station platform. There were no injuries and only minor damage to both trains and the track infrastructure.

Eden Hills is located in the Adelaide Hills region of South Australia approximately 14 km from Adelaide city on the Belair railway line which forms part of the Defined Interstate Rail Network corridor. Within the railway corridor there is a standard gauge line managed by the Australian Railway Track Corporation (ARTC) and an adjacent broad gauge line managed by TransAdelaide.

The investigation focussed on the adequacy of freight loading and restraint on trains. The Australian Transport Safety Bureau issued a 'Safety Advisory Notice – Rail' to the railway industry on 26 October 2005. A copy of the advisory notice is at Appendix 6.3.

The investigation concluded that the collision occurred as a result of movement of steel plates on a Transi-flat container[2] due to non-compliance with the procedures contained in the Pacific National freight loading manual and the lack of inspections/audits to ensure compliance with this manual. Based on available evidence, the shifted load had been out-of-gauge[3] from at least Murray Bridge, 85 km from the point of collision. The investigation also found that the ARTC track at Eden Hills station platform was up to 140 mm closer to the TransAdelaide track than the design clearance.

Given the inadequate load securing methods, and the forces to which the load had been subjected during its carriage, there was a relatively high risk of a load shift resulting in an out-of-gauge collision.

A number of safety actions have been taken, or are underway through Atlas Speciality Metals (the steel plate manufacturer), Toll Express (the freight forwarder), Pacific National, and The Department for Transport, Energy & Infrastructure (the South Australian rail safety regulator). These safety actions include the use of steel tensile strapping for unitising steel plate loads.

The report makes a number of recommendations relating to the use and application of steel tensile strapping to ensure load security, and a review of acceptance and audit procedures to ensure compliance with the Pacific National Freight Loading Manual.

1 The 24-hour clock is used in this report to describe the local time of day, Central Standard Time (CST), as particular events occurred. Central Standard Time was Coordinated Universal Time (UTC) + 9.5 hours.

2 A Transi-flat container is a container base with removable caged sides.

3 Out-of-gauge is something on a rail vehicle outside of the permissible rollingstock outline.

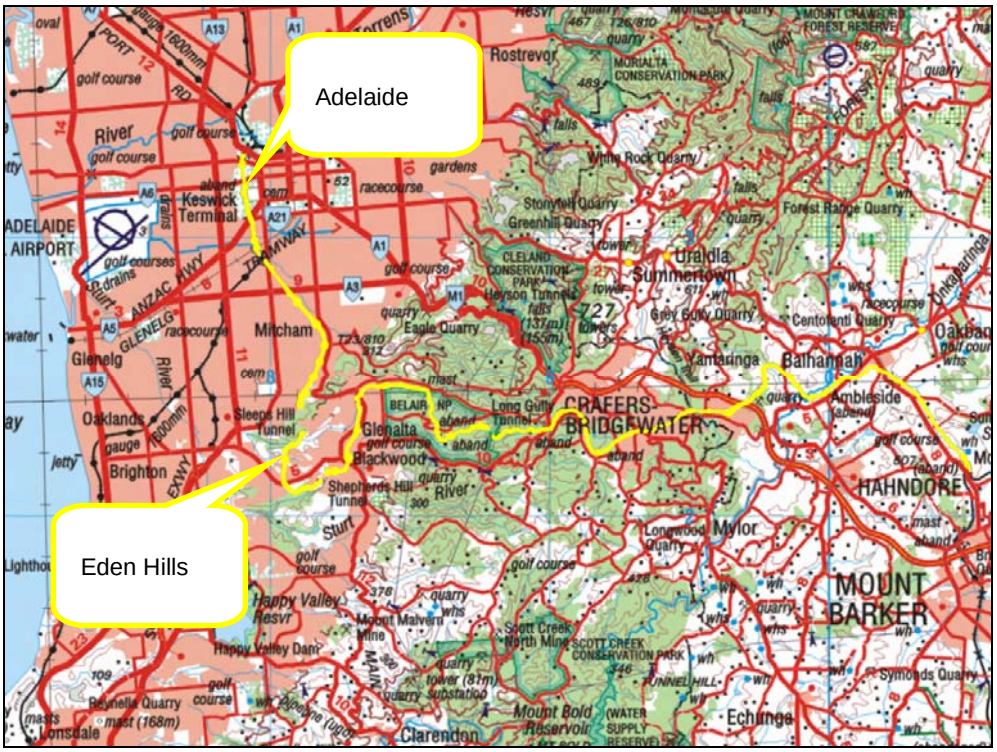
INTRODUCTION

At about 0800 on Thursday 30 September 2005 steel plate, part of a load that had shifted on Pacific National freight train 5MA5, struck TransAdelaide passenger train 206A at Eden Hills railway station platform. The load shift occurred at container position number two on the 35th wagon (ID number RQJY00020Y) in the consist, approximately 1250 m from the front of the train. Freight train 5MA5 was travelling from Melbourne to Adelaide on the standard gauge Defined Interstate Rail Network (DIRN). Passenger train 206A was travelling from Belair to Adelaide on the broad gauge intrastate passenger rail network.

There were no injuries but both trains and the track infrastructure received minor damage.

The Adelaide Hills railway corridor has a series of tight (less than 300 m radius) reverse curves on a 1 in 45 down grade towards Adelaide, and is considered to be one of the tightest and steepest main railway corridors in Australia, shown in Figure 1.

Figure 1: Map of the Adelaide Hills region



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1 FACTUAL INFORMATION

1.1 Location

The collision occurred at Eden Hills station platform, which is located on the Belair Line in the Adelaide Hills, approximately 14 km from Adelaide city. This railway corridor forms part of the Australian Rail Track Corporation DIRN, Melbourne to Adelaide rail line and the TransAdelaide broad gauge passenger line from Belair to Adelaide. The TransAdelaide and ARTC lines run adjacent to each other in this section of the corridor, shown in Figure 2.

Figure 2: Aerial photograph of Eden Hills station

(Department for Environment & Heritage, SA Copyright ©, taken October 2002)

1.2 Organisations Involved

Australian Rail Track Corporation (ARTC)

The ARTC is the accredited rail organisation responsible for controlling access to, and maintenance of, approximately 5860 km of standard gauge interstate track in South Australia, Victoria, Western Australia and New South Wales. This includes the section of DIRN between Melbourne and Adelaide over which freight train 5MA5 was travelling.

Pacific National

Pacific National is the largest accredited, and privately owned, rail operator in Australia. Its primary business is transportation of rail freight. Pacific National also provides locomotives and crews to other organisations including passenger rail. Pacific National was the owner and operator of freight train 5MA5.

TransAdelaide

TransAdelaide is an accredited rail organisation providing public rail transport services to Adelaide's metropolitan area. TransAdelaide is the owner, operator and manager of the passenger rail network which runs parallel to the ARTC network in the area where the collision occurred. TransAdelaide was the owner and operator of passenger train 206A.

1.3 Time Standardisation

A number of different time sources and variation were obtained from data recorded by train control centres and by train loggers. For the purposes of this report, the TransAdelaide track circuit signal log[4] has been used as the time base in this investigation. Time data from various other sources has been standardised to correlate with base time as listed below in Table 1.

Table 1: Time data standardisation

Source	Adjustment
TransAdelaide train 206A	
Car 3108	- 211 seconds
Car 3107	+ 24 seconds
TransAdelaide train control phone/radio	Nil
ARTC train control phone/radio	Nil
Pacific National train 5MA5 loco NR74	- 20 seconds

1.4 The Occurrence[5]

Freight train 5MA5 started its journey from Melbourne, departing at 2040 (Eastern Standard Time) on 29 September 2005, travelling through Kaniva at 0253 on 30 September 2005, arrived at Coonalpyn at 0420 CST, crossed another train, then departed at 0427. At 0432 the train passed through Coomandook, arrived at Tailem Bend at 0510 to attach bank engine[6] DL45 and departed at 0540. The train passed Monarto South at 0618, Belair at 0744, and Eden Hills platform at about 0759-0800. A roll-by inspection of the train was made by other train crews at Kaniva, Coonalpyn, and Coomandook. No irregularities with rollingstock or loading on the train were noted by the other crews.

Passenger train 206A departed Belair at 0745 heading towards Adelaide. The train arrived at Eden Hills station platform at 0759:58. A short time later, at 0800:12, the driver of the train noticed that

4 See Appendix 6.1 for TransAdelaide track circuit signal log graphic.

5 See appendix 6.2

6 A bank engine is used to provide locomotive assistance on steep gradients.

something was hanging foul[7] from a passing freight train and that it had struck the passenger train. The driver of the train immediately called TransAdelaide Train Control (0800:23), then checked his train for damage.

TransAdelaide train control called the freight train at 0801:25 and was advised by the driver that he was already stopping the train. Shortly after, the TransAdelaide train controller called the ARTC train controller about the collision.

The freight train stopped at 0802:42 near Lynton station platform at 10.9 km from Adelaide city. The rear portion of the train came to a stand still within the Sleeps Hill tunnel.

At 0803:34, after checking the train for damage and reporting to TransAdelaide train control, the driver of the passenger train departed Eden Hills station. At 0806:22 the driver of the train stopped within Sleeps Hills tunnel to inspect the shifted steel plate load on the freight train stopped on the adjacent line. The driver determined that the steel plate would not strike his train and then he contacted TransAdelaide train control and continued the journey towards Adelaide at 0806:58. At 0809:10 the driver of train stopped his train adjacent the cab of the freight train and spoke with the crew about the shifted steel plate load. The passenger train resumed the journey to Adelaide at 0810:10.

At about 0811 the driver of the freight train walked back about 1250 m to inspect the steel plate in the 35th wagon that was in the Sleeps Hill tunnel. Shortly before 0823 the driver found steel plate protruding from between the Transi-flat cage bars, he advised the co-driver of the condition of the load, which was then relayed to ARTC train control. Arrangements were made to inspect the track and signal infrastructure for damage, and to re-secure the steel plate.

During the incident, TransAdelaide suspended passenger train services on the Belair line until the freight train completed its journey to the Adelaide Freight Terminal.

A timeline of the occurrence is at appendix 6.2.

1.5 Injuries

There were no injuries.

1.6 Damage

1.6.1 TransAdelaide

No TransAdelaide track infrastructure was reported damaged as a result of the collision or out-of-gauge loading. There was minor damage to the outer carriage body of the TransAdelaide passenger train, shown in Figure 3.

7 Outside of the permissible rollingstock outline.

Figure 3: Photograph of damage to train 206A

A number of dents and scratches in the exterior finish were noted, including passenger hand rails that had been dislodged from their mounted position. The damage was minor and the train was able to continue its journey into Adelaide.

1.6.2 ARTC

No major damage was recorded by ARTC as a result of the collision or out-of-gauge loading. There was minor strike damage on the Sleeps Hill Tunnel wall, but would not interfere with safe train operations or tunnel integrity. Signal number 23 at Murray Bridge had damage to the access ladder at about the same height as the steel plate protruding from freight train 5MA5, as shown in Figure 4.

Figure 4: Photographs of damage to signal 23 at Murray Bridge

(Courtesy of the ARTC)

Murray Bridge is about 85 km east of Eden Hills. One other freight train, 3PW4, passed train 5MA5 within this area, at Monarto South about 70 km east of Eden Hills. A roll-by inspection of the side of train 5MA5, opposite to that of the shifted load, was performed and no irregularities with the train were reported.

There was no other infrastructure damage.

1.6.3 Pacific National

Pacific National had minor damage to the Transi-flat container side cage as a result of the shifted load within.

Figure 5: Photograph of shifted load

(Courtesy of Pacific National Pty Ltd)

There was no other damage.

1.7 Personnel Involved

The Pacific National driver, who was driving the train at the time of the incident, had extensive experience with 24 years of train driving. The other driver was sitting in the observer's position at

the time of the incident. He had 19 years of train driving experience. Both drivers were based at the Dimboola depot, working trains to Melbourne and Adelaide.

The TransAdelaide driver had 14 years experience driving passenger trains in the Adelaide Hills region. The driver was based at the Belair depot.

The train controller, employed by the ARTC, had several years experience as a train controller at the ARTC Train Control Centre.

The train controller, employed by TransAdelaide, had 15 years experience as a train controller at the TransAdelaide Train Control Centre.

The personnel involved signed on 'fit for duty' in accordance with the rules and procedures of their employer, they were up to date with their medical examinations and assessed as medically fit for duty. The working rosters of the staff involved were examined to determine the level of roster-induced fatigue, if any.

The medical condition, training status, toxicology, and fatigue levels of the personnel involved were not considered to be contributing factors to the incident.

1.8 Track Details

The TransAdelaide broad gauge track and the ARTC standard gauge tracks consists of continuously welded rail secured to steel sleepers and concrete sleepers respectively by resilient fasteners at a nominal gauge of 1600 mm (TransAdelaide) and 1435 mm (ARTC) supported on ballast. At Eden Hills the track has a 1 in 45 gradient. The broad gauge rail line is on a 278 m radius curve with a 50 km/h speed limit. The standard gauge rail line is on a 1006 m radius curve with a 60 km/h speed limit.

TransAdelaide and the ARTC are accredited by Transport South Australia as part of the accreditation and audit process. Both TransAdelaide and ARTC maintain the track in accordance with their respective codes of practice, both of which are based on the *National Code of Practice for the Defined Interstate Rail Network*, and both require a line inspection at intervals of not more than 72 hours.

Part 5 of TransAdelaide's code of practice addresses structural clearances. The design and rating of clearances applies to clearances between:

- rollingstock and structures; and,
- rollingstock on adjacent tracks.

The preferred track centre distance, for clearance between rollingstock on adjacent track, is four metres. The minimum track centre distance for clearance between rollingstock on adjacent track is derived from a clearance of not less than 300 mm between the maximum kinematic rollingstock outlines. The maximum kinematic rollingstock outline is also described by TransAdelaide's code of practice based on the *National Code of Practice for the Defined Interstate Rail Network*. Where permanent infringements of this clearance are allowable, it may be necessary to apply more stringent track geometry standards to compensate for reduced clearances.

After the collision, track clearance measurements were taken, the results are shown in Table 2 using the TransAdelaide platform as a datum point. Table 3 shows the track centre[8] variation through Eden Hills station platform. The measurements show that the ARTC track at Eden Hills station platform was up to 140 mm closer to the TransAdelaide track than the design clearance.

8 Track centre is the measurement between the centre line of one track to the centre line of an adjacent track.

Table 2: Track infrastructure measurements

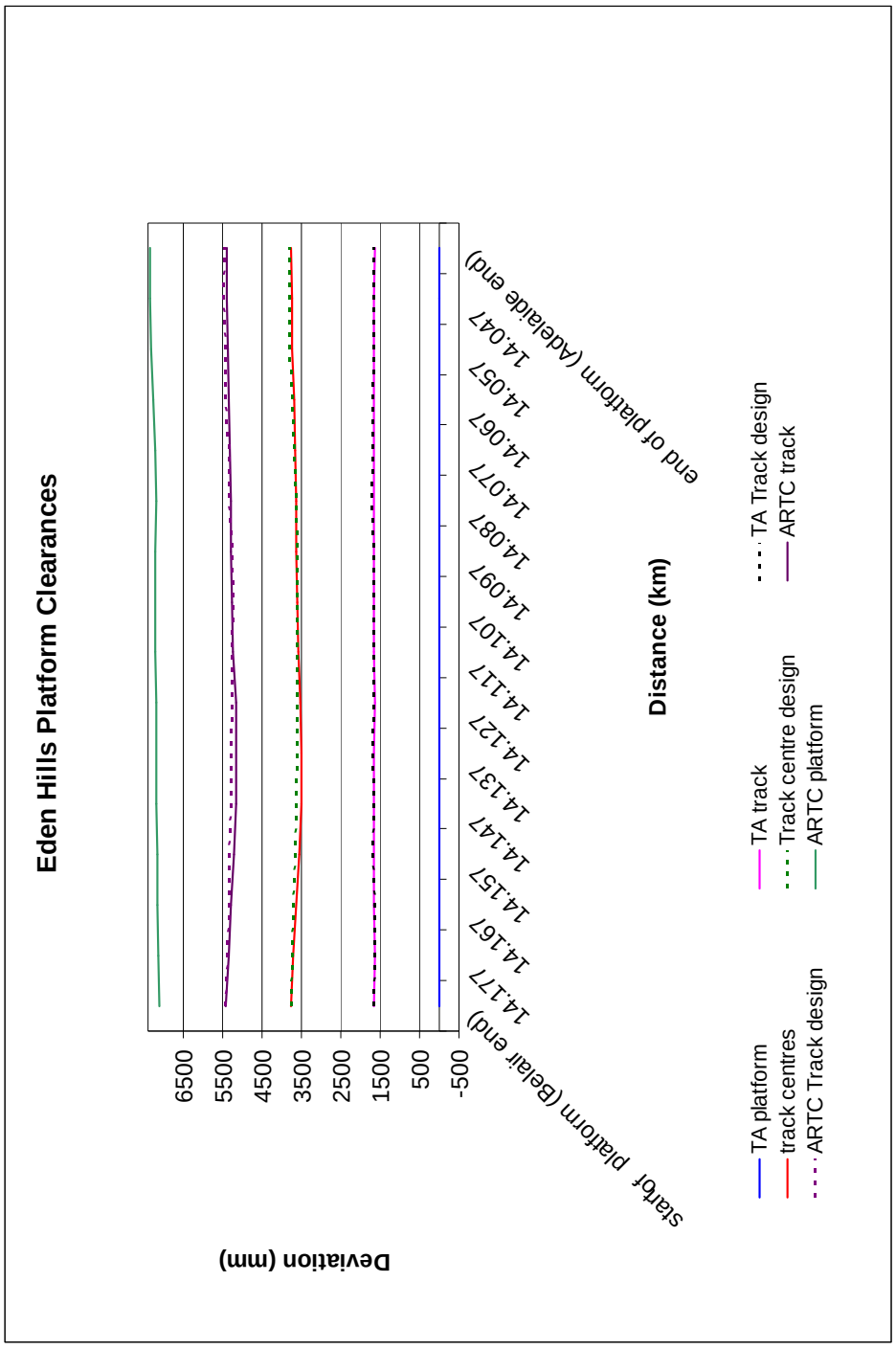


Table 3: Track centre measurements

Location (km)	Design (mm)	Actual (mm)	Variation (mm)	Variation on preferred (mm)
Start of platform (Belair end)	3754	3753	-1	-247
14.177	3739	3708	-31	-292
14.167	3707	3643	-64	-357
14.157	3666	3558	-108	-442
14.147	3638	3498	-140	-502
14.137	3620	3498	-122	-502
14.127	3611	3533	-78	-467
14.117	3606	3578	-28	-422
14.107	3603	3618	15	-382
14.097	3611	3638	27	-362
14.087	3635	3633	-2	-367
14.077	3684	3658	-26	-342
14.067	3739	3688	-51	-312
14.057	3780	3728	-52	-272
14.047	3796	3748	-48	-252
End of platform (Adelaide end)	3789	3763	-26	-237

Note: The preferred track centre is 4000 mm.

1.9 Train Details

1.9.1 Pacific National Train 5MA5

Freight train 5MA5 was operated by Pacific National. The train consisted of three diesel electric locomotives (NR74, 8118, DL45) and 36 freight wagons, with a length of 1483.35 m and weighing 2753.2 t.

The steel plate was carried on a Transi-flat container. The containers are fitted with removable caged sides, as shown in Figure 5 on page 6.

The load which shifted was made up of stainless steel plate cut into semicircular shapes of two different sizes stacked one on top of the other unitised onto a customised pallet, shown in Figure 7 on page 12.

Based on data retrieved from the locomotive data logger, train handling is not considered to be a contributing factor to the incident. Train loading issues are discussed further in section 2.1.

1.9.2 TransAdelaide Train 206A

Passenger train 206A was operated by TransAdelaide. The train consisted of two 3100 class diesel/electric multiple units (DMU 3107 and 3108) which could be driven from either end of the train. The net weight of the train was 92 t and it was 50 m long.

2 ANALYSIS

The movement of the steel plate load and the resultant collision with the passenger train was due to a number of factors relating to load restraint and inspection. The condition of the track infrastructure at the location of the collision also contributed.

There were no signs of excessive longitudinal forces throughout the freight train. Other loads on the train showed no signs of movement, but the strapping, both webbing and the individual unitising straps, showed signs of chafing and general wear.

The steel plate load had been out-of-gauge from Murray Bridge 85 km before the point of collision at Eden Hills station platform. No reports or indications had been received at the ARTC train control centre in Mile End to suggest a potential problem with the freight train. The shifted load was situated well back within the train consist such that the drivers could not see the shifted load. There were no reports or indications to the driver of the train that suggested a potential problem.

The Adelaide Hills rail corridor is relatively steep with a large number of curves. The gradient combined with the frequent changes in direction means that load securing systems are subjected to relatively high and alternating stress. These factors are more common in the Adelaide Hills rail corridor than on straighter rail corridors.

Given the history and consequences of these types of incidents, loads shifting en-route have been an ongoing problem in the Adelaide Hills region.

2.1 Load Securing System

The *Pacific National Freight Loading Manual* (PNFLM), dated 19 March 1998, documents the standard of load restraint applicable to Pacific National trains, and states;

> Freight must be sufficiently restrained to resist the dynamic forces generated by acceleration, deceleration, shunting and changes in train direction. … It is essential that the load is restrained to prevent movement in any direction relative to the wagon.

The PNFLM provides guidance on the performance criteria for load securing systems and lashing equipment on Pacific National trains. The criteria specifies minimum accelerations of 2 g for longitudinal acceleration and 1 g for vertical and lateral (side to side) acceleration (where g = acceleration due to gravity, 9.8 m/sec^2).

The load which shifted on the freight train was secured using two forms of load restraint. Firstly the load was unitised such that similar items were bound together to form a single unit. Secondly, the unitised load was secured by webbing straps within the caged sides of the Transi-flat. Both the webbing straps and the side cage, however, failed to contain the load within the unit.

Figure 6: The Steel Plate Load

2.1.1 Unitising the load

At the time of the incident the PNFLM stated that metallic strapping with a tensile strength of 900 MPa[9] was the minimum acceptable standard for unitising a load on Pacific National trains. The manual went further and stated that the majority of steel strapping grades were not suitable as the primary means of securing a load. The packaging manual of the steel plate manufacturer (Atlas Speciality Metals) also required that all steel plate loads were secured using steel strapping.

The Australian Standard for tensile strapping (AS2400, part 13) specifies the properties required for metallic and non-metallic strapping. The minimum tensile strength for extruded polyester is stated as 350-420 MPa with 5-20% elongation at break, while the minimum tensile strength for hot rolled metallic strapping is 530 MPa.

The load in question was not secured by metal straps but by three green polyester plastic straps, 15.9 mm by 0.9 mm. The tensile strength of the plastic strap used was 469 MPa, with 3% elongation at break.

Plastic straps were often used by the manufacturer in preference to steel strapping because they did not stain the steel product. The tensile strength of the strapping used in this instance exceeded the Australian standard, but the polyester PET straps did not meet the minimum restraint requirements contained in the PNFLM for such a load.

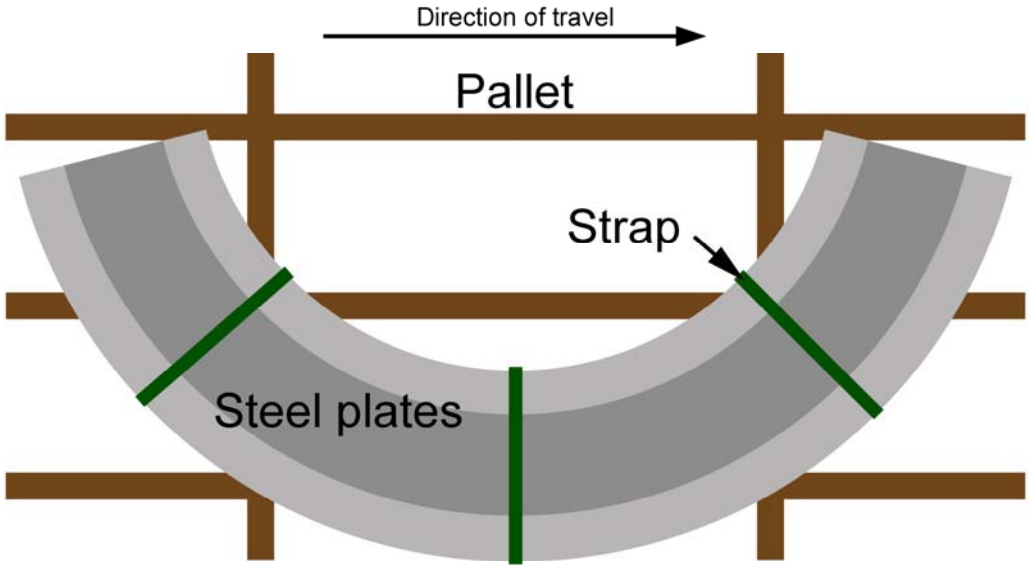
The load which shifted consisted of steel plates shaped in an arc and unitised using three polyester PET straps. The position of these straps, as shown in Figure 7, would allow two straps to provide limited longitudinal restraint and one strap to restrain lateral (sideways) movement. All three would restrain vertical movement. The load weighed 762 kg which equates to a potential force of 7.4 kN at 1 g acceleration and 14.8 kN at 2 g acceleration. However, the plastic strapping used to unitise this load was rated with a minimum tensile force of 6.7 kN per strap. The PNFLM states that:

> the minimum safe working load of each load securing component MUST NOT be exceeded when the above [longitudinal, lateral, and vertical] accelerations are applied to the load.

While three straps in combination may have exceeded the restraint criteria, based on the PNFLM it is likely that the straps were inadequate to conform to the longitudinal, vertical, and lateral criteria. By comparison, the lowest rated metallic strapping in the PNFLM is rated at 14.9 kN per strap. Three of these straps would have met the minimum restraint criteria.

9 MPa is Mega Pascal, a measurement unit of stress or pressure.

Figure 7: Unitising strap positions



Note: not to scale, Transi-flat webbing straps not shown

Two smooth clean stainless steel surfaces placed together have a relatively low coefficient of friction, and can easily slip with respect to each other. This movement may subject the unitising strapping to high levels of abrasion and/or shock loading. To limit this slippage, timber dunnage or load mats are commonly placed in between layers, or the tie down force may be increased. The steel plates which shifted on the freight train were stacked on top on each other with no dunnage or load mats between to increase friction.

It was also evident that the unitising straps were not protected from sharp corners. Consequently, any movement of the load would have led to abrasion of the plastic strapping, reducing its strength and increasing the risk of a strap failure. The load had been inspected by Atlas Speciality Metals prior to despatch and Toll Express inspected the load upon receipt. Toll Express used an acceptance checklist to verify that the load was secure; the correct weight and dimensions were declared on the consignment note; and, whether it was classified as dangerous goods. The checklist did not verify if the load had been packaged to the PNFLM requirements. Pacific National checked the load before the departure of the train. This inspection covered train condition and general load security, it did not ensure unitised loads met the PNFLM requirements.

2.1.2 Securing Unitised Loads

The unitised load was secured to the Transi-flat container using webbing straps. Investigators onsite soon after the incident noticed that the webbing straps were damaged, as shown in Figure 8. The PNFLM specifies that ‘whenever securing straps or ropes become frayed by more than 10% of their width (they) must be replaced’. However, it was not clear if this damage was pre-existing, or occurred as a result of the load shifting.

It was also evident that some webbing straps were not protected from sharp corners. As with the unitising straps, any movement of the load would have led to abrasion of the strapping, reducing its strength and increasing the risk of a strap failure.

Figure 8: Damaged webbing strap

2.1.3 Summary of Load Securing System

The use of plastic strapping did not meet the minimum securing standards required by Pacific National or by the manufacturer's own packaging manual. Both manuals specified metallic strapping as a minimum. The tensile strength of the plastic strapping used was well below that specified by Pacific National for unitising loads on Pacific National trains. It is also likely that the three plastic straps used to unitise the load were not sufficient to comply with the minimum criteria for restraining the load against longitudinal, lateral and vertical accelerations.

The PNFLM states 'correct securing of loading inside containers is the freight forwarders responsibility'. Once a load has been accepted by the freight forwarder it is loaded onto a train wagon with the objective of maximising unit weight and cubic utilisation. However, the freight forwarding transport company (Toll Express) did not detect the inappropriate use of the plastic strapping, nor did they have an acceptance procedure to verify that loads were secured using appropriate straps. Similarly, Pacific National did not check for compliance with their freight loading manual but relied on the freight forwarder securing the load in accordance with their requirements.

Given the inadequate securing methods, and the failure of several inspections to detect the deficiency, there was a relatively high risk of a load shift given the forces to which the load was subjected during its carriage. The use of a fully enclosed and secured container would have reduced the risk of the steel plate moving outside the static rollingstock outline of the vehicle and thus mitigating the risk of an out-of-gauge collision.

2.2 Track Clearances at Eden Hills Station

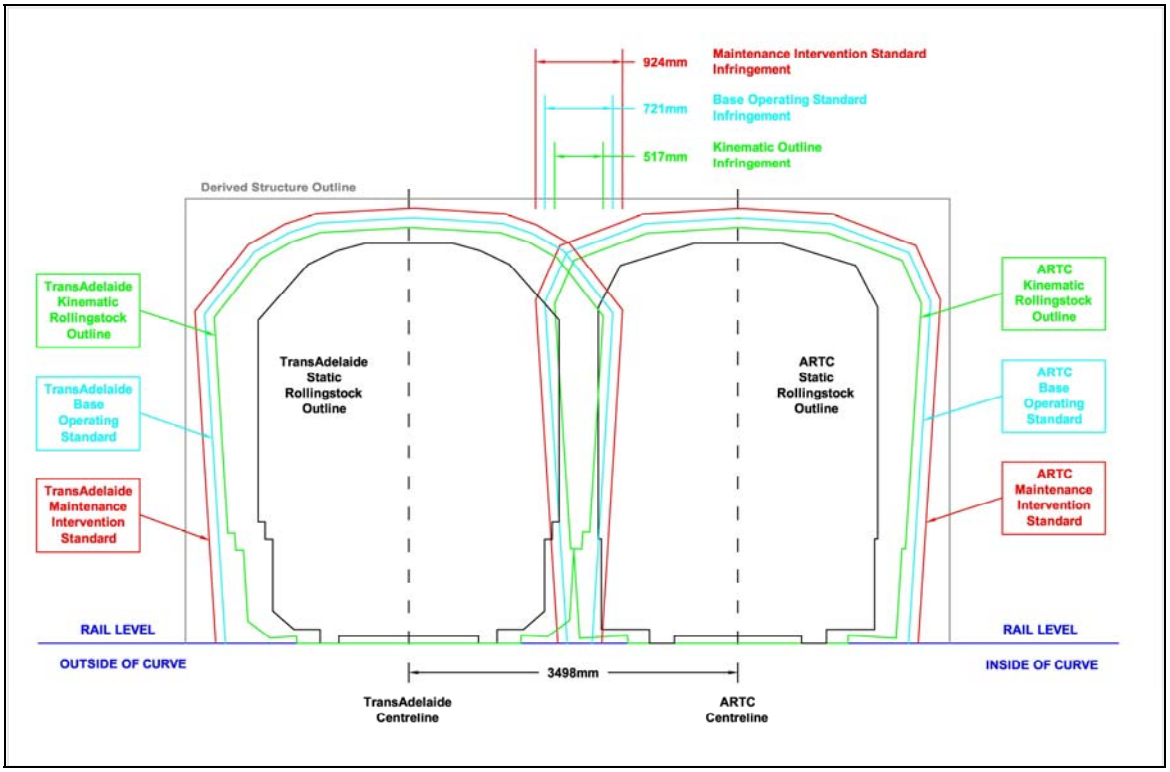
The measurements taken by ARTC and TransAdelaide of the track centres at Eden Hills station platform (Table 7) indicated that there was up to 140 mm deficiency when compared with its designed standard, and 502 mm deficiency when compared with the preferred standard for

rollingstock clearance. Had the ARTC track been in the design position, the risk of an out-of-gauge collision occurring at that location would have been reduced.

Both TransAdelaide and ARTC's track inspection standards refer to the measurement of adjacent line clearances. However, no records were produced to the investigation team to show that such measurements had been taken in the past.

Track clearance standards for both ARTC and TransAdelaide specify the minimum kinematic rollingstock outline, and how it is derived. Added to this are the base operating standard, the maintenance intervention standard, and the structure outline. Figure 9 shows the overlaps or infringements of the various standards between the TransAdelaide system and the ARTC network at Eden Hills station platform (14.147 km point).

Figure 9: Clearance outlines at Eden Hills railway station



In certain situations, such as within the confines of a station, preferred track centres may not be able to be physically achieved. Less clearance is allowable in these circumstances in conjunction with more stringent track geometry standards. In this case the ARTC allowable infringement had deviated 140 mm from the design standard without being detected by ARTC or TransAdelaide during routine track inspections. Without intervention, the infringement may have continued to grow, reducing the clearance between the adjacent rail lines and increasing the risk of a collision.

2.3 Shifting Load History

The investigation team reviewed seven reported load shift occurrence records from January 1997 until April 2006 on the Belair to Adelaide line. All resulted in the load being out-of-gauge or detached from the wagon. Indications were that inadequate load unitising/bundling and securing were the probable causes. In two instances, the load shifted within a fully enclosed container, forcing the doors open, causing it to be out-of-gauge. This demonstrates that the use of fully enclosed containers does not completely mitigate the risk associated with shifting loads. It is not known if appropriate tensile strapping was used in these incidents.

3 FINDINGS

3.1 Contributing factors to the incident

The following conclusions are made with respect to the collision between a shifted load on freight train 5MA5 and passenger train 206A at Eden Hills station platform at about 0800 on 30 September 2005. These conclusions identify the different factors that contributed to the incident and should not be read as apportioning blame or liability to any particular individual or organisation.

- The steel plate load was not secured adequately to prevent movement.
- The manufacturer (Atlas Specialty Metals) did not unitise the steel plate load using steel tensile strapping in accordance with:
  - the manufacturers packaging manual; and,
  - Pacific National's freight loading manual.
- The freight forwarder (Toll Express) did not ensure that the incoming consignment was packaged and secured in accordance with Pacific National's freight loading manual or detect the inappropriate use of plastic strapping.
- Pacific National did not check for compliance with their freight loading manual but relied on the freight forwarder securing the load in accordance with their requirements.
- The side cage of the Transi-flat did not adequately contain the shifted load.
- The steel plates were unitised one on top of the other, without intermediate high friction layers, resulting in low resistance to slippage between the layers.
- Some of the webbing straps used to restrain the load were damaged beyond their condemning limit.
- The ARTC track at Eden Hills station platform was closer by up to 140 mm to the TransAdelaide track than the design clearance.
- Neither the ARTC or TransAdelaide track inspections detected the track centres defect that had caused a rollingstock outline infringement.
- The Adelaide Hills rail corridor is relatively steep with a large number of curves. The gradient combined with the frequent changes in direction means that load securing systems are subjected to relatively high and alternating stress.

3.2 Other key findings

- Given the inadequate securing methods, and the failure of several inspections to detect the deficiency, there was a relatively high risk of a load shift given the forces to which the load was subjected during its carriage.
- The steel plate load was out-of-gauge from at least Murray Bridge, 85 km before Eden Hills.
- Loads shifting en-route have been an ongoing problem in the Adelaide Hills region.
- There was only minor damage to track infrastructure and rollingstock.
- The medical condition, training status, toxicology, and fatigue levels of all the personnel involved are not considered to be contributing factors to the incident.
- There were no injuries.

4 SAFETY ACTIONS

4.1 Recommended Safety Actions

As a result of its investigation, the ATSB makes the following recommendations 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.

4.1.1 Atlas Speciality Metals

RR20060035

The Australian Transport Safety Bureau recommends that Atlas Speciality Metals use appropriate tensile strapping to ensure load security during rail transit in accordance with the Pacific National Freight Loading Manual (or other applicable rail operator instructions).

4.1.2 Toll Express

RR20060036

The Australian Transport Safety Bureau recommends that Toll Express ensure that tensile strapping on incoming freight from customers is suitable and effective in ensuring load security during rail transit in accordance with the Pacific National Freight Loading Manual (or other applicable rail operator instructions).

RR20060037

The Australian Transport Safety Bureau recommends that Toll Express promulgate the minimum requirements for tensile strapping and load securing, in accordance with the rail operators' standards, and/or guidelines, to their customers.

RR20060038

The Australian Transport Safety Bureau recommends that Toll Express consider the use of containers or wagons which may help to reduce the potential for an out-of-gauge collision due to a load shift during rail transit.

RR20060039

The Australian Transport Safety Bureau recommends that Toll Express ensure that all securing equipment used such as webbing straps are fit for purpose and protected to ensure load security during rail transit.

4.1.3 Pacific National

RR20060040

The Australian Transport Safety Bureau recommends that Pacific National review their freight inspection procedures with a view to ensuring customers meet the minimum requirements for tensile strapping and load securing in accordance with the Pacific National Freight Loading Manual.

4.1.4 The Australian Rail Track Corporation

RR20060041

The Australian Transport Safety Bureau recommends that the ARTC review their standards and procedures to mitigate the risk of infringement of the design track centre clearance.

4.1.5 TransAdelaide

RR20060042

The Australian Transport Safety Bureau recommends that TransAdelaide review their standards and procedures to mitigate the risk of infringement of the design track centre clearance.

4.2 Safety Actions Already Initiated

As a result of this collision the Australian Transport Safety Bureau issued a 'Safety Advisory Notice – Rail' to the railway industry on 26 October 2005 to highlight the importance of adequate freight loading and restraint on trains. A copy of the advisory notice is at appendix 6.3.

4.2.1 Atlas Speciality Metals

Atlas Speciality Metals is now using steel tensile strapping for unitising steel product in accordance with their packaging manual.

4.2.2 ARTC

The ARTC in conjunction with TransAdelaide have taken corrective action at a number of locations in the Adelaide metropolitan area identified as having less than the design track centre clearance. The ARTC also advised that:

> Australian Rail Track Corporation has recently commissioned a road / rail vehicle equipped with the L Kopia laser measuring system.
>
> This equipment has the ability to measure the position of the standard gauge track relative to adjacent infrastructure (including the TransAdelaide track) with a high degree of accuracy and at preset intervals (10 metre increments are currently 'selected although this distance can be reduced if necessary).
>
> Regular application of this type of measuring technology will ensure that lateral track movement is detected and acted upon promptly.

4.2.3 TransAdelaide

TransAdelaide in conjunction with the ARTC have taken corrective action at a number of locations identified as having less than the design track centre clearance.

5 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:

a) Allowing the person to make submissions to the Executive Director about the draft; or,

b) Giving the person advance notice of the likely form of the published report.

The final draft of this report was provided for comment to the following directly involved parties:

a) Australian Rail Track Corporation;

b) TransAdelaide;

c) The Department of Transport, Energy & Infrastructure of South Australia;

d) Pacific National;

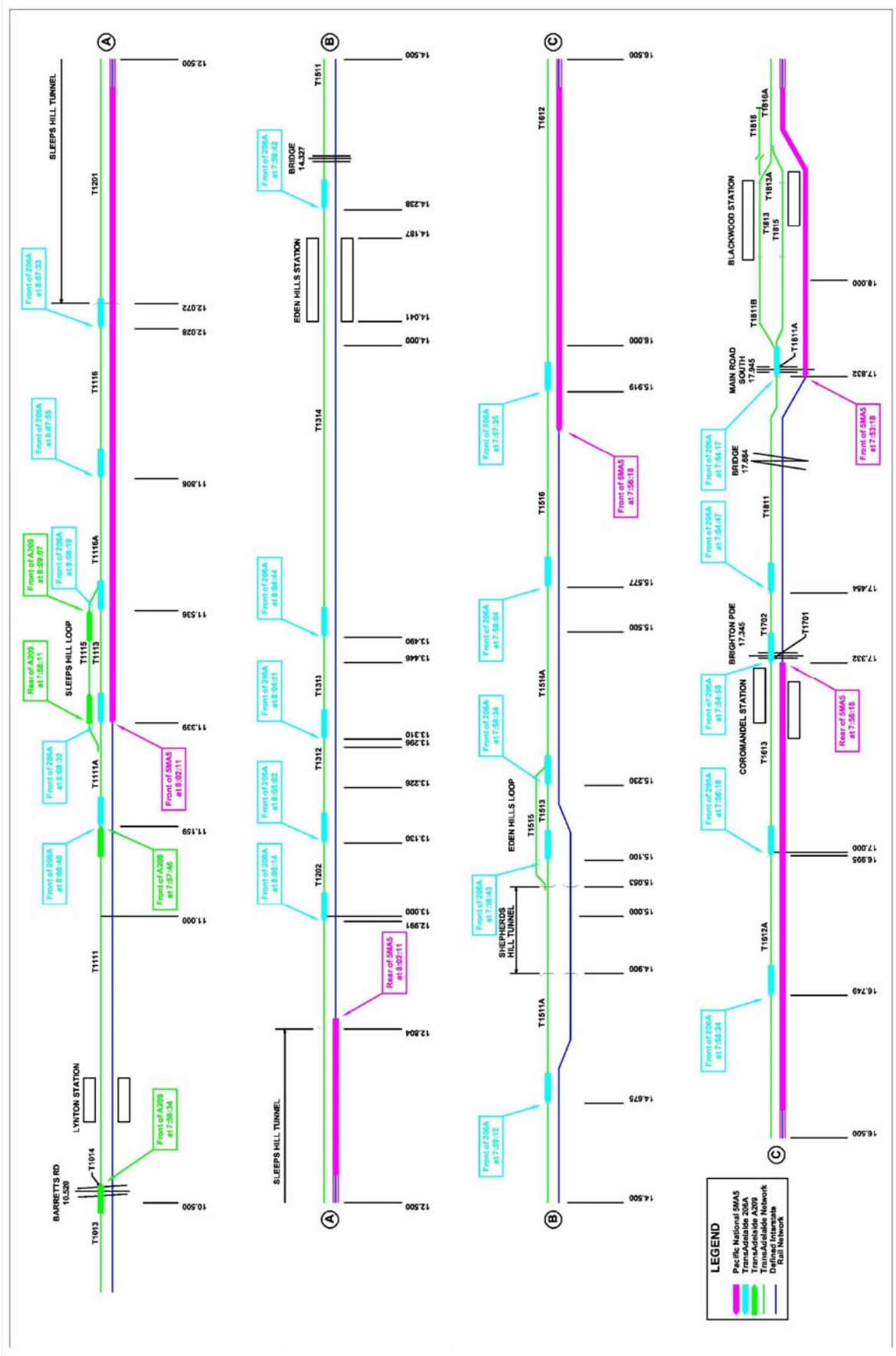
e) Toll Express;

f) Atlas Specialty Metals

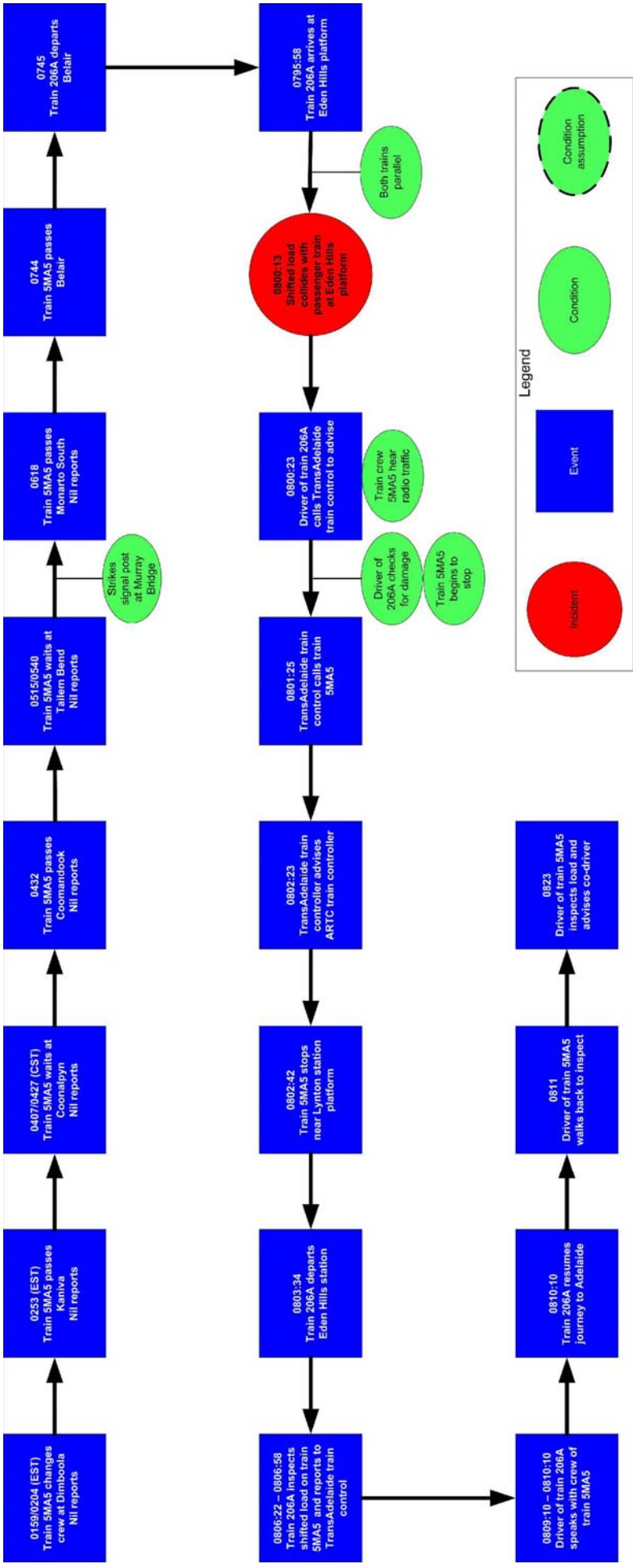
Submissions on the draft report were received from Australian Rail Track Corporation; TransAdelaide; The Department of Transport, Energy & Infrastructure of South Australia; and, Pacific National. Their submissions have been considered by the ATSB investigation team and have been incorporated into the report where appropriate.

6 APPENDICES

6.1 TransAdelaide Track Circuit Signal Log Graphic



6.2 Timeline Diagram



6.3 ATSB Safety Advisory Notice - Rail

Australian Government
Australian Transport Safety Bureau

SAFETY ADVISORY NOTICE - RAIL

RSAN2005/0001

26 October 2005

The following Safety Advisory Notice is presented for your information and action that you consider appropriate. There is no requirement to formally respond to this advisory notice; however, feedback on any actions taken would be appreciated. This notice is released as a preliminary investigation report under section 25(2) of the Transport Safety Investigation Act 2003.

Readers are advised that the Australian Transport Safety Bureau (ATSB) investigates for the sole purpose of enhancing transport safety. Consequently, Bureau reports are confined to matters of safety significance and may be misleading if used for other purposes.

Investigations commenced after 1 July 2003, including the publication of reports as a result of those investigations, are authorised by the Executive Director of the Bureau in accordance with the Transport Safety Investigation Act 2003 (TSI Act). Reports released under the TSI Act are not admissible as evidence in any civil or criminal proceedings.

The Australian Transport Safety Bureau advises the Australian rail transport industry to consider the adequacy of freight loading and restraint on trains. Particular attention should be paid to freight loads that have been pre-packaged by customers of the rail transport industry.

Introduction

As a result of a current ATSB rail safety investigation into a freight load that had shifted en route, becoming out-of-gauge, the ATSB has issued this Safety Advisory Notice to the rail industry to highlight the importance of suitably secured freight loads in wagons.

Overview

At about 0758 Central Standard Time on Tuesday 30 September 2005 an out-of-gauge freight load on train 5MA5, travelling from Melbourne to Adelaide, struck a stationary passenger train 206A at Eden Hills railway station platform, South Australia. Eden Hills railway station is located on the Belair line in the Adelaide Hills railway corridor. The corridor has a series of tight (less than 300 metre radius) reverse curves on a 1 in 45 down grade towards Adelaide.

Observations

At this preliminary stage, the investigation has made a number of observations regarding the adequacy of freight loading and restraint in wagons. In this instance, steel plates had been secured by an engineering company, then delivered to a freight logistics company based in Brisbane where they were loaded and secured into a caged container. This container was then delivered to a rail operator and loaded onto a rail vehicle. In this container plastic straps were observed by investigation staff to have been used to secure the steel plate freight load to a timber base frame. These plastic straps appear to have failed, allowing the freight load to shift.

Caution should be exercised in properly securing all loads, particularly those with sharp edges that could damage straps and restraint systems.

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7 MEDIA RELEASE

Freight train load shift led to collision with passenger train

An ATSB has found that inadequate load securing methods, combined with reduced track clearances, lead to a collision between a steel plate freight load and a passenger train at Eden Hills station platform on 30 September 2005.

The freight load had been protruding from the side of the freight train for at least 85 km before the collision occurred.

Eden Hills is located about 14 km south of Adelaide in the Adelaide Hills region. Both trains were heading towards Adelaide when the collision occurred.

There were no injuries and only minor damage to track and rollingstock infrastructure.

The Australian Transport Safety Bureau investigation determined that the minor collision occurred as a result of movement of an inadequately secured metal plate load and reduced clearance between both tracks. Given the inadequate load securing methods, the risk of a load shift and strap failure, a collision became likely irrespective of track clearances.

As part of the investigation, the ATSB issued a safety advisory notice on 26 October 2005 to encourage better load security.

In the interest of future rail safety, the ATSB has now made further recommendations regarding the use and application of tensile strapping to ensure load security, reviewing acceptance and audit procedures to ensure load security, and reviewing standards and procedures to mitigate against reduced track clearances.