



Australian Government  
Australian Transport Safety Bureau

# Proceed authority exceeded by train 2AD1

Tarcoola, South Australia | 21 August 2012



Investigation

**ATSB Transport Safety Report**  
Rail Occurrence Investigation  
RO-2012-009  
Final – 28 May 2014

Cover photo: Train 2AD1 at Pimba Source, reproduced with permission of Steve Molloy.

Released in accordance with section 25 of the *Transport Safety Investigation Act 2003*

#### **Publishing information**

**Published by:** Australian Transport Safety Bureau  
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#### **Addendum**

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# Safety summary

## What happened

On 21 August 2012, Genesee and Wyoming Australia (GWA) freight train 2AD1 was en route from Adelaide, South Australia, to Katherine, Northern Territory, when the train crew exceeded the limit of their train authority at Tarcoola, South Australia.

The train authority authorised the crew to travel to Northgate, which is located on the railway line branching to the north from Tarcoola. However, the crew did not take the line to Northgate and the train continued through Tarcoola, travelling west for about 2.6 km toward Perth before stopping.

View from 2AD1 departing Tarcoola Yard



Source: GWA

## What the ATSB found

The ATSB investigation found that the driver of train 2AD1 was a trainee who was unfamiliar with the route and had not completed the minimum competencies required by GWA to enable him to operate the train. The qualified supervising driver had allowed the trainee to take control of the train and had subsequently fallen asleep.

Following the occurrence, the supervising driver returned a positive test for amphetamine and methamphetamine, which he had consumed while off-duty. These drugs probably contributed to him falling asleep during the shift.

The ATSB found that the supervising driver's performance was being managed in accordance with GWA's drug and alcohol management program as a result of a previous positive drug test and that the company's drug and alcohol policy/processes were effective in managing drugs and alcohol in the workplace.

The ATSB further found that the company's safety management system procedures did not provide supervising and trainee drivers with sufficient guidance and direction in relation to their supervisory and permitted driving roles.

The report also notes that the actions of a crew member travelling in the crew van in alerting the locomotive crew and operating the emergency brake handle significantly reduced the distance that train 2AD1 travelled before it stopped.

## What's been done as a result

GWA has introduced a 'Category Card' to enhance the classification system for trainee locomotive drivers. The card specifies any operational restrictions placed on trainees and instructs the supervisor/mentor driver of the level of oversight that must be exercised for each classification level. GWA has notified all drivers of changes to the classification system and has taken steps to clarify the responsibilities of drivers supervising a trainee.

While GWA had a robust alcohol and drug-testing program in place, the organisation has taken further action by introducing screening en route and at off-train resting locations and increasing the frequency of random screening at existing locations.

## Safety message

This incident emphasises the need for rail transport operators to implement robust procedures that systematically manage the supervision, training and assessment of trainee drivers. It also highlights the risks associated with the use of amphetamines or methamphetamines and the impact that recreational drug use can have on safe rail operations.



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## The occurrence

At 2230<sup>1</sup> on 20 August 2012, train 2AD1 departed the Adelaide Freight Terminal on a scheduled Genesee and Wyoming Australia (GWA) freight service between Adelaide, South Australia, and Darwin, Northern Territory. On this occasion, the service was to terminate at Katherine due to a temporary closure of the Edith River rail bridge north of Katherine.

At about 0315 on 21 August, the train arrived at Port Augusta (Spencer Junction) where a crew change over occurred. The relief crew consisted of four drivers who had commenced duty at Spencer Junction at about 0300 that morning. The plan was for the drivers to work train 2AD1 in pairs, operating in rotating relay shifts through to Katherine. Each pair comprised a qualified driver and a trainee driver.

On joining the train, the rostered workout crew took control and commenced shunting train 2AD1 to change the lead locomotive and attach additional wagons. The second pair of drivers boarded the crew van to rest in preparation for their shift, which was to commence later that day when the train was near Tarcoola (Figure 1).

**Figure 1: Locations Port Augusta to Tarcoola**



Source: Geoscience Australia with annotations by ATSB

At 0450, the qualified driver of the workout crew received a Train Authority<sup>2</sup> (TA) from the Australian Rail Track Corporation (ARTC) network control officer (NCO) authorising train 2AD1 to travel to McLeay, where there would be a cross with an opposing train.

At about 0500, train 2AD1, with the qualified driver at the controls, departed from Spencer Junction under a signal indication. Once on the main line within the limits of the controlling signals, the TA authorising travel to McLeay came into effect. The qualified driver had not worked with the trainee driver previously and as they travelled toward McLeay enquired about the trainee's previous rail experience. Over the course of the journey, the qualified driver explained the

<sup>1</sup> The 24-hour clock is used in this report and is referenced from Central Standard Time (CST), UTC + 9.5 hours.

<sup>2</sup> An instruction in the prescribed format issued by the Network Control Officer in connection with the movement of a train.

safeworking and documentation carried in the locomotive and identified key features along the track.

As train 2AD1 approached McLeay, the qualified driver reported to the NCO and obtained the next TA authorising travel to Pimba, where the train would cross another opposing train. On approach to Pimba, the qualified driver repeated this process and the NCO issued a TA for train 2AD1 to travel through to Northgate, located on the line extending north from Tarcoola.

At about 0739, train 2AD1 departed Pimba. As there were no opposing trains through to Tarcoola, the qualified driver thought it would be a good opportunity for the trainee to gain experience in driving the train. The qualified driver was aware from his discussion with the trainee that he was unfamiliar with the route and had not yet completed the 'locomotive air brake' qualification.

The trainee driver was keen to gain experience and shortly after departing Pimba, took control of the train. The qualified driver, acting as the supervising driver, mentored the trainee by identifying the features along each section of track and explained driving techniques to achieve the target speeds required for those areas. To avoid information overload and confusion, the supervising driver only provided information relevant to the sections of track through to Ferguson, which was the last crossing location prior to Tarcoola.

As train 2AD1 progressed toward Ferguson, the communication between the supervising driver and trainee diminished.

At about 0920, shortly after passing through Kultanaby, the supervising driver fell asleep. The trainee was unfamiliar with the route ahead but continued to drive the train through Ferguson toward Tarcoola, ascertaining the location of the train from the documentation containing the speed restrictions and comparing this to the position of speed restriction signs and kilometre marker posts adjacent to the track. The trainee also completed the required administrative tasks which included updating the train running report form with the relevant times as train 2AD1 departed each track section.

As train 2AD1 approached Tarcoola, the resting drivers were preparing for the impending crew change. The qualified driver of the resting crew expected to take over when the train stopped at Tarcoola, as there was a need to operate the locally controlled points from trackside in order to access the track to Northgate. He was aware that the train was close to entering the Tarcoola Yard and unsuccessfully attempted, on a couple of occasions, to contact the crew in the locomotive by radio to confirm the crew change location. As the train approached Tarcoola, he recognised that it was not slowing as would typically occur, but he still expected it to stop.

The trainee driver at the controls understood that the crew change would occur shortly after departing Tarcoola and rechecked the TA, noting that it authorised travel through to Northgate.

At about 1046, train 2AD1, travelling at 85 km/h, entered the eastern end of the Tarcoola Yard. The trainee was unfamiliar with the operation of the yard and as the TA authorised travel to a location past Tarcoola assumed that the points were set appropriately and that Northgate would be the next location.

As train 2AD1 passed through the Tarcoola Yard, the qualified driver in the crew van moved to the leading end of the van and looked out the window in the door.<sup>3</sup> He realised that the train would probably overrun Tarcoola and head along the wrong track, so he again attempted to contact the crew in the locomotive by radio. When there was no response, he went back through the crew van and operated the emergency brake handle to stop the train.

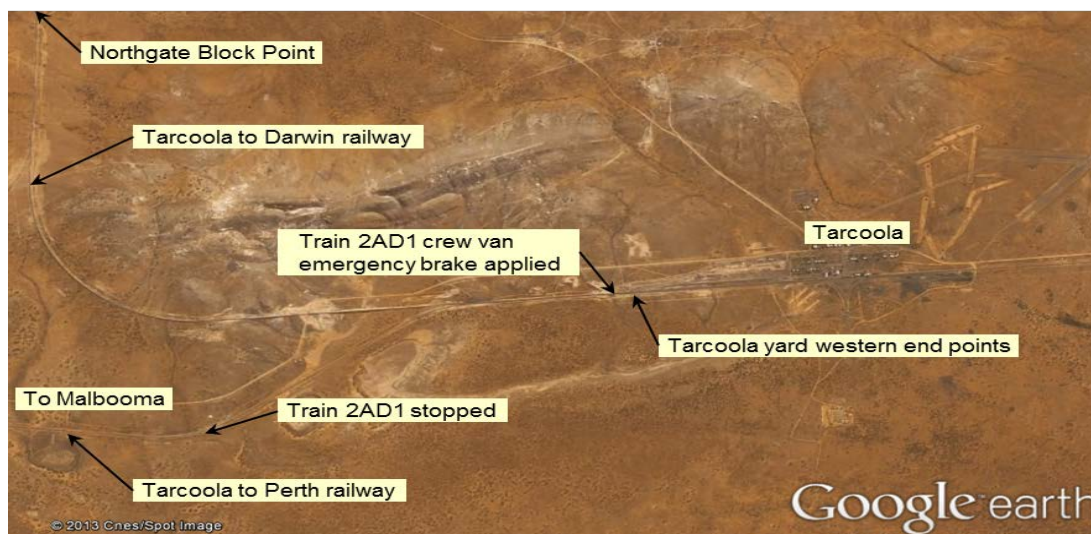
Meanwhile, the trainee driver at the controls heard the radio call and alerted the supervising driver that the resting driver was calling. The supervising driver awoke and attempted to respond to the radio call, but received no reply. It was at about this time that he realised that the train was on the wrong track.

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<sup>3</sup> All other windows in the crew van had the blinds drawn at that time.

Train 2AD1 came to a stop shortly after passing the Location Ahead sign<sup>4</sup> situated about 2.5 km from the Tarcoola Yard limit, in the Tarcoola to Malbooma section (Figure 2).

**Figure 2: Tarcoola Yard and path of train 2AD1**



Source: Google Earth with annotations by ATSB

## Post-occurrence events

After train 2AD1 stopped, the crew contacted the NCO responsible for the Tarcoola to Malbooma track to advise that the train had exceeded the authority limit and was in that track section. The NCO advised them that there were no train movements travelling east toward train 2AD1. The crews then changed over and the resting crew took control of the train. The supervising driver and trainee who were involved in the incident (incident crew) walked to the rear of the train in preparation for pushing it back to the Tarcoola Yard.

The western end of the Tarcoola Yard was the interface location between two NCOs who managed train movements to the east and west of Tarcoola.<sup>5</sup> As the train had passed through Tarcoola, the movement to return the train to Tarcoola required liaison between the two NCOs.

At about 1120, the west area NCO issued a TA which authorised train 2AD1 to return to Tarcoola and required the crew to report before entering the yard. At about 1125, the east area NCO issued a TA, cancelling the original TA for train 2AD1 to travel to Northgate.

At about 1210, train 2AD1 cleared the Tarcoola to Malbooma section into the Tarcoola Yard.

At about 1214, the east area NCO issued a new TA for train 2AD1 to travel to Northgate. At about 1235, the train departed Tarcoola for Northgate with the incident crew now resting in the crew van.

Train 2AD1 continued through Northgate toward Manguri (about 200 km north of Tarcoola) where the incident crew were relieved from duty by a replacement crew who had travelled by road from Port Augusta.

The incident crew subsequently underwent preliminary screening for the presence of alcohol and prescribed drugs. Both of the trainee driver's tests returned a negative result. While the supervising driver tested negative to the presence of alcohol, he returned a positive indication for amphetamine and methamphetamine, two substances declared as prescribed drugs.<sup>6</sup>

<sup>4</sup> A sign marking the approach to a location and the location's recognition by its designated name.

<sup>5</sup> Referred to in this report as the west area NCO and the east area NCO.

<sup>6</sup> Prescribed drug was defined as (a) Delta-9-tetrahydrocannabinol (b) Methylamphetamine (Methamphetamine), (c) 3, 4-methylenedioxymethamphetamine (MDMA) in South Australia's Rail Safety (Alcohol and Drug Testing) Regulations 2008 formed under the Rail Safety Act 2007, the legislation applicable to GWA's operations at the time of the occurrence.



# Context

## Location

Tarcoola is located about 725 track kilometres northwest of Adelaide. The Tarcoola Yard forms the junction between the railway to Darwin to the north, the Central Australian Railway (CAR), and the east-west railway that links Adelaide and Perth, the Trans-Australian Railway (TAR).

## Track information

At the time of the incident, the Australian Rail Track Corporation (ARTC) managed the east-west portion of the interstate rail network through Tarcoola together with a 6.4 km segment of track that veers north to Northgate (Figure 3). Northgate was the interface point between the ARTC managed railway and the remainder of the railway to Darwin, which was managed by Genesee and Wyoming Australia (GWA).

**Figure 3: Location of Tarcoola**

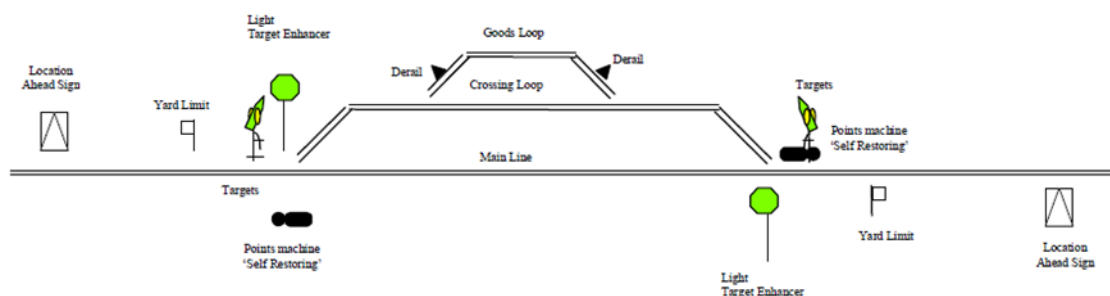


Source: Geoscience Australia with annotations by ATSB



The TAR through Tarcoola comprised a main line and crossing loop. The points connecting the main line and crossing loop were equipped with self-restoring point machines<sup>7</sup> operated remotely from the locomotive cab (if equipped) or from pushbutton controls located on a hut adjacent to the point machines. A reflectorised target point indicator and a light indicator (also called a target enhancer) displayed the status of the points to the locomotive crew. The reflectorised target and light indicators displayed a green arrow and green light respectively when the points were correctly set for the main line (a typical crossing loop layout is illustrated in Figure 4).

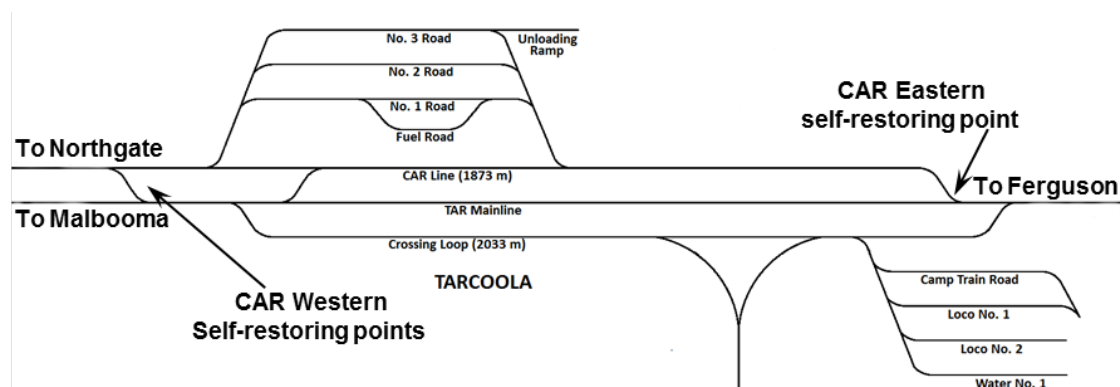
**Figure 4: Typical train order location with light indicators and self-restoring points**



Source: ARTC

Points located at either end of the Tarcoola Yard provided access from the TAR main line to the CAR. These points were also equipped with self-restoring electric point machines, which would normally be set for trains to travel on the TAR main line. To access the CAR, crews were required to stop the train and operate pushbutton controls located on a hut adjacent to the point machines to set the points for the required direction (Figure 5).

**Figure 5: Layout of Tarcoola Yard**



Source: ARTC with annotations by ATSB

Reflectorised target point indicators provided both day and night indication to the locomotive crew of the position of the points forming the turnouts to the CAR. The reflectorised target displayed a green arrow when the points were set for the main line, in this case the TAR, or a yellow dumbbell when the points were set to divert to another line/crossing loop, in this case the CAR line (Figure 6). These points were not equipped with a light target indicator.

<sup>7</sup> A qualified employee sets the self-restoring point machine to the required lie prior to the passage of a rail vehicle. The self-restoring point machine automatically returns to the default position following the passage of the rail vehicle.

**Figure 6: ARTC day/night reflectorised target point indicators**

### **GREEN ARROW**

Indicates the main line points are set for the main line.

The arrow points up and away from the line.



### **YELLOW DUMBBELL**

Indicates the main line points are set for the crossing loop.



Source: ARTC

## **Safeworking system**

The ARTC Network Control Centre, located at Mile End, Adelaide, provided the network control functions for the track through the Tarcoola area. Tarcoola was the interface location between two geographically defined areas of control. An ARTC network control officer (NCO) managed each control area to the east and west of Tarcoola. The NCO for the eastern area controlled train movements between Port Augusta (Spencer Junction) and Tarcoola, including the yard and track segment to Northgate. The NCO for the western area controlled train movements between the yard limit board at the western end of the Tarcoola Yard and Cook. Communication between the NCOs and train crews was via mobile telephone or dedicated ARTC two-way radio channels ultra-high frequency (UHF) 2 and UHF 5 for the east and west control areas respectively.

The ARTC managed the safe movement of trains on the TAR between Spencer Junction and Parkeston, Western Australia, and the CAR between Tarcoola and Northgate through a verbal communications based train order working system (TOW). The system required an NCO to issue an authority to the train crew, who then recorded the authority on a paper based Train Authority (TA) form. The crew validated the content by reading the TA back to the NCO. The TA, once validated, authorised the crew to proceed between specified locations in accordance with any applicable additional instructions. The train crews executing the TA were required to comply with instructions contained in the TA together with the applicable rules and procedures contained in the ARTC Code of Practice for the Interstate Rail Network (CoP).

At about 0716 on 21 August 2013, the NCO issued authority TA21 to the crew of train 2AD1 as they approached Pimba. This TA authorised the crew to 'After fulfilling TA19 proceed to Northgate' (TA19 was the previous authority authorising travel to Pimba). The authority TA21 did not contain any additional information in relation to which track, TAR mainline or CAR line (Figure 5), the train was to occupy in the Tarcoola Yard. The crew of 2AD1 were free to choose the route through Tarcoola and the access point for the line to Northgate.

### **Operation of points**

The CoP contained instructions for train crews operating point machines associated with crossing loops and procedures for crossing or passing other trains at those locations. The GWA training records indicate that the supervising and trainee drivers of train 2AD1 had attained competency in the CoP on 31 January 2011 and 23 April 2012 respectively.

Instructions for operating other points located in a yard, such as those to access a line or a siding, were typically not included in the CoP, unless there were specific interface requirements that the crew must undertake. At Tarcoola, there were no specific requirements as the interface with the adjoining operator (GWA) occurred at Northgate. The respective NCOs coordinated this interface to ensure the safe separation of trains.

The CoP required the organisations that operated rolling stock on the ARTC network to implement systems for the development and maintenance of route or area specific competencies for their rail safety workers, in this case the locomotive crew. These competencies typically included the requirements for operating in the yard which were not covered in the CoP.

GWA had implemented the route-training packages, RSN04 ARTC: Port Augusta – Tarcoola and RSN06 Tarcoola – Alice Springs, as part of its competency management program to address this CoP requirement. GWA training records indicated that the supervising driver had attained these competencies on 21 April 2012. The trainee driver had not yet undertaken any assessment for competency in these route packages.

## Train crew

GWA typically staffed trains that utilised relay working with a crew comprised of fully qualified drivers. The organisation would occasionally vary this arrangement to address staffing shortfalls or to facilitate appropriately qualified trainee drivers attaining an additional qualification, such as route knowledge or in driving a locomotive. Trainee drivers who had not attained the required competencies to operate a locomotive could also be included on the roster as an additional member of a relay crew. A trainee driver rostered under this arrangement would typically function as a third person within the cab, to observe the operation of a locomotive and the route travelled.

The crew for the relay working of train 2AD1 included two trainee drivers. This staffing arrangement was in place because a number of the fully qualified drivers who would normally work that relay roster were undergoing training to prepare them for the introduction of new equipment. GWA included the trainee drivers in the roster with the expectation that they would only perform the functions of the second person.

GWA requires the second person to perform various ancillary functions for the driver, such as assisting in safeworking and completing administrative tasks. Additionally, the second person is in a position to intervene in an emergency, such as sudden incapacity of the driver, but only to the extent of bringing the train safely to stop.

The qualified (supervising) driver of the workout crew had 9 years of experience in the rail industry including 6 years as a locomotive driver, the last 18 months with GWA. At the time of the incident, he held the required qualification to operate trains on this route.

The trainee driver of the workout crew commenced employment with GWA in April 2012 and had no prior experience in the rail industry. He had completed the competency assessment for the role of second person on 1 July 2012. He had not undertaken training in locomotive engine systems or the driver's air brake, both of which were required before a trainee could operate a GWA locomotive.

An examination of the trainee and supervising driver's health assessment records established that they were current and that the individuals had satisfied the required standard, prescribed by the *National Standard for Health Assessment of Rail Safety Workers*.

The resting crew comprised a qualified driver who had 33 years of experience in the rail industry and a trainee driver who had also recently completed the competency assessment for the role of second person (12 July 2012). The resting trainee driver had also not completed the GWA mandatory requirements to drive a locomotive.

## Train 2AD1

At the time of the occurrence, train 2AD1 consisted of two locomotives (GWU 008 leading and ALF 23 trailing) hauling an inline fuel tanker, a crew van and 38 freight wagons. The train was 1,606 m in length and had a gross mass of 4,075 t. The crew van accommodated the off-duty crew during the rest cycle of the 8-hour rotating relay shift.

In addition to the ARTC In-Cab-Equipment (ICE) radio communication system, the lead locomotive and the crew van were each equipped with a UHF two-way radio. The channels available on this radio enabled communication with various parties including the ARTC Network Control Centre, other local UHF radios (train-to-train) and on board communication between the crews in the locomotive cab and the crew van.



The UHF radio in the locomotive cab was located adjacent to the driving position. An additional hand-held microphone for this radio was also located on the opposite side of the cab adjacent to the co-driver's position. The crew van was equipped with similar UHF radio equipment, located in the kitchen area. The channel selections on each of these radios were normally set to enable communication between the locomotive cab and crew van.

## Previous occurrences

In 2011, the ATSB investigated a Signal Passed at Danger (SPAD) incident that occurred at Dry Creek, South Australia, on 11 October 2011.<sup>8</sup> In this instance, Specialised Bulk Rail (SBR) train 1901S passed signal 13 at Dry Creek, which was displaying a stop (red) indication, and collided with an opposing GWA train (5132S).

The investigation identified a number of safety factors including the following;

- Specialised Bulk Rail's Safety Management System procedures did not provide the supervising drivers with sufficient direction as to the nature of their supervisory role.

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<sup>8</sup> ATSB investigation number RO-2011-016 – Collision between train 1901S and train 5132S at Dry Creek, South Australia, on 11 October 2011

# Safety analysis

## Train crew

### **Supervising driver**

#### **Toxicology**

As the supervising driver's preliminary screening test returned a positive indication to the presence of a drug, GWA sent a urine specimen to a NATA<sup>9</sup> accredited laboratory for confirmatory testing. This specimen tested positive<sup>10</sup> to the presence of amphetamine and methamphetamine. When interviewed, the supervising driver confirmed that he had used methamphetamine 'for recreational purposes' during the preceding off-duty period.

The use of stimulants such as methamphetamine is associated with a range of neurocognitive effects in humans. Methamphetamine has an elimination half-life ranging from 8 to 13 hours, and its effects typically last a similar amount of time.<sup>11</sup> Binge users often experience symptoms associated with heightened anxiety, paranoia and hallucinations, as well as irritability, insomnia and confusion. Furthermore, a withdrawal syndrome can occur at the termination of binge use and can include depression, irritability, anxiety, poor concentration, hypersomnia<sup>12</sup>, fatigue and paranoia, with these symptoms reducing in severity within a week following cessation of use.<sup>13</sup> Many of these effects, and after-effects, have the potential for a negative impact on human performance, especially with respect to the safe operation of machinery or vehicles.

The supervising driver's employee records document that about 16 months prior to this occurrence he had undergone a similar targeted screening test, which also returned a positive to methamphetamine. GWA managed this matter in accordance with the procedures outlined in its alcohol and other drugs policy, employment conditions and employee assistance scheme. In accordance with the policy, GWA stood down the supervising driver and demanded he undergo weekly screening tests and to comply with other GWA conditions until an Authorised Collection Centre had confirmed a negative test result.

Following his return to duty, GWA subjected the supervising driver to an ongoing program of random and targeted workplace screening tests. On two occasions, the screening test returned a result that required follow-up confirmatory testing. Both confirmatory tests returned a negative result. The last recorded confirmatory testing occurred about 2 weeks prior to the authority overrun at Tarcoola.

Throughout this period, GWA corresponded with the supervising driver to remind him of the previous positive result and to encourage him to take advantage of GWA's confidential counselling service and other services available through the company's employee assistance program. GWA also advised that a second positive confirmatory test result would result in GWA terminating his employment.

The GWA processes to counsel and monitor the behaviour of the supervising driver did not prevent his further use of a prescribed drug. Therefore, following what was a second confirmatory test, his employment was terminated.

<sup>9</sup> National Association of Testing Authorities, Australia.

<sup>10</sup> Specimens in which the drug concentration is higher than both the screening and confirmatory thresholds are deemed positive.

<sup>11</sup> Scott, J.C., Woods, S.P., Matt, G.E., Meyer, R.A., Heaton, J., Atkinson, J.H. & Grant, I. (2007). Neurocognitive Effects of Methamphetamine: A Critical Review and Meta-analysis. *Neuropsychology Review*, 17, 275-279.

<sup>12</sup> Hypersomnia: greater sleepiness than is usual or desirable, including extended nocturnal sleep, unplanned daytime sleep, and an inability to remain awake or alert.

<sup>13</sup> Scott et al (2007).

## **Fatigue**

In the context of human performance, fatigue is a physical and psychological condition primarily caused by prolonged wakefulness and/or insufficient or disturbed sleep.<sup>14</sup> The National Transport Commission recognises five main factors contributing to fatigue impaired work performance, including:

- the duration of a duty period (time on task), and the rest breaks within and between shifts
- inadequate sleep (or sleep debt), which results from inadequate duration and quality of prior sleeps
- circadian effects, which involve working and sleeping against natural body rhythms that normally program people to sleep at night and be awake and work during the day
- the type or nature of the task being undertaken (workload)
- the work environment.

Fatigue can have a range of influences on performance, such as decreased short-term memory, slowed reaction time, decreased work efficiency, reduced motivational drive, increased variability in work performance, and increased errors of omission.<sup>15</sup> Fatigue impairment has been identified as a contributing factor in accidents and incidents such as Signals Passed at Danger.

The authority exceedence at Tarcoola occurred at about 1046, toward the end of the first 8-hour shift in the relay roster that had commenced at 0300 that day. This was the first shift worked by the trainee and supervising driver of the workout crew and each had returned to work following being rostered off-duty for a period of 84 hours and 75 hours respectively. The duration of the off-duty periods meant that there was opportunity available for the trainee and supervising driver to attain sufficient restorative sleep prior to commencing work. However it must also be recognised that such early shift start times are associated with increased safety risk attributable to fatigue effects, with some research suggesting approximately 15 minutes of sleep lost for every hour of start time prior to 0900.<sup>16</sup>

The trainee and supervising driver each advised that they had attained about 5 hours sleep immediately prior to commencing work at Spencer Junction on 21 August 2012. It is generally recognised that most people require a 7-8 hour sleep period in each 24 hours to maintain optimum performance, and a reduced sleep period in combination with an early shift start time has been shown to elevate the risk for a mild to moderate impairment in some tasks<sup>17</sup>. However, recent research indicates that 5 to 6 hours of sleep obtained in 24 hours may be a minimum threshold to manage significant fatigue impairment.<sup>18 19</sup>

In this case, the trainee driver indicated that he was not feeling tired during the shift, including at the time of the incident. However, the supervising driver did indicate that he began feeling tired at about 0900, and had consumed two cups of coffee in an endeavour to stay alert. He indicated that, in the past, when seated in the co-driver's position and working with another qualified driver, there had been opportunities to have a rest to improve alertness. Although the trainee driver was not qualified to be in charge of a train, the supervising driver still took the opportunity to pass driving duties to the trainee (after departing Pimba), and have a nap shortly after passing through Kultanaby, at about 0920.

<sup>14</sup> National Transport Commission (2008). *National Rail Safety Guideline. Management of Fatigue in Rail Safety Workers*. Available from: [http://www.ntc.gov.au/filemedia/Reports/NRSG\\_FatigueManagement\\_June2008.pdf](http://www.ntc.gov.au/filemedia/Reports/NRSG_FatigueManagement_June2008.pdf)

<sup>15</sup> Battelle Memorial Institute (1998). *An Overview of the scientific literature concerning fatigue, sleep, and the circadian cycle*. Report prepared for the Office of the Chief Scientific and Technical Advisor for Human Factors, US Federal Aviation Administration.

<sup>16</sup> Roach, G.D., Sargent, C., Darwent, D. & Dawson, D. (2012). Duty periods with early start times restrict the amount of sleep obtained by short-haul airline pilots. *Accident Analysis and Prevention*, 45S, 22-26.

<sup>17</sup> Roach, Sargent, Darwent & Dawson (2012).

<sup>18</sup> Dawson, D. & McCulloch, K. (2005). Managing fatigue: It's about sleep. *Sleep Medicine Reviews*, 9, 365-380.

<sup>19</sup> Thomas, M.J.W. and Ferguson, S.A. (2010). Prior sleep, prior wake, and crew performance during normal flight operations. *Aviation, Space and Environmental Medicine*, 81 (7), 665-670.



From the evidence available, there was no indication that the supervising driver's sleepiness was attributable to either time-on-task or nature of task (workload) demands. However, the use of methamphetamines has been shown to impact on sleep quality and duration and subsequent withdrawal is associated with hypersomnia and fatigue. Therefore, it is likely that drug use during his off-duty period contributed to his sleepiness during this shift.

### ***Trainee driver***

Between Spencer Junction and Tarcoola, there are 12 locations equipped with the reflectorised target and light indicators to show the status of the self-restoring points. Train 2AD1 travelled toward Tarcoola through each location along the main line, including the crossing of two opposing train movements at McLeay and Pimba. At each location, the crew of train 2AD1 would have seen green indications on the reflectorised target and light indicators. As they were authorised to take the main line through these previous locations, there was no requirement to operate the point machines.

When the trainee driver in control of train 2AD1 approached Tarcoola, the reflectorised target and light indicators ahead were all displaying green, meaning that the points were set for travel east-west on the main line (TAR). The trainee driver was unfamiliar with the layout and operation of the Tarcoola Yard and having previously checked the TA which authorised travel to a location past Tarcoola, expected the points in the Tarcoola Yard to be correctly set for Northgate. His expectation was probably reinforced by the green indications displayed at Tarcoola and having seen the same indications at 12 previous locations without any additional actions required. However, at this location the train crew had to stop the train and set the points toward Northgate.

The qualified driver in the crew van had tried to contact the crew in the locomotive as train 2AD1 approached Tarcoola, but received no reply. Despite the proximity of the radio equipment, the trainee driver only responded by alerting the qualified driver to the call from the crew van made immediately prior to the emergency application of the brakes.

Given the task competence and workload of the trainee driver at that time, it is likely that he had focussed his attention to the task of driving the train. Human information processing is limited in that each person has finite mental resources available to attend to information or perform tasks at any particular time. In general, if a person is focussing on one particular task, then their performance on other tasks may be degraded.<sup>20</sup> This effect is increased where the task is novel, such as where the person's experience level is low. The increased workload associated with concentrating on the task of driving the train probably reduced the trainee driver's capacity to perceive or comprehend other cues, such as the previous two routine radio calls from the crew van.

## **Supervision of the trainee driver**

### ***Locomotive driver competency management***

GWA detailed the training and development requirements for the competency of a locomotive driver through a classification system specified in the Locomotive Stream of the Genesee and Wyoming Australia (SA/NT) Collective Agreement 2008. This classification system consisted of three stages (trainee locomotive driver, advanced trainee locomotive driver and assistant locomotive driver) which the trainee must complete sequentially to become a qualified locomotive driver. Each of the stages required the attainment of a set of prerequisite qualifications as well as 'off' and 'on' the job competencies. The qualifications in each level were linked to the competency modules contained in the certificate levels (I to IV) within the Transport and Logistics (Rail Operations) training package and the GWA internal training materials.

The classification system in the Locomotive Stream stipulated the GWA requirement for a trainee to progress to the stage of advanced trainee locomotive driver before the trainee could drive a

<sup>20</sup> Kahneman, D. (2011). *Thinking Fast and Slow*. Farrar, Straus & Giroux: New York.

locomotive under supervision. The trainee driver controlling train 2AD1 at the time of the exceedence of authority had not attained this classification level.

### ***Role of the supervising driver***

The GWA safety management system contained various procedures, checklists and registers detailing the required competencies and assessment criteria to support the qualification of locomotive drivers. The Genesee and Wyoming Australia (SA/NT) Collective Agreement 2008 defined the various competencies that a trainee must attain to complete each classification level to become a qualified locomotive driver. Driving a locomotive under supervision was defined as an 'on the job component' within the advanced trainee locomotive driver classification. GWA would issue the trainee with a driving record logbook to signify that the trainee had completed the mandatory parts of their training prior to permitting them to undertake a driving task.

GWA recognised the previous experience and driving qualifications of the qualified (supervising) driver of train 2AD1 at the commencement of his employment. This meant that he was not required to progress through the GWA trainee classifications system or have a driving record logbook issued. Furthermore, he had not supervised a trainee since commencing employment with GWA. Therefore, it is possible that he did not fully comprehend the significance of the driving record logbook when supervising a trainee driver.

Prior to commencing the trip, the GWA depot co-ordinator advised the qualified drivers of train 2AD1 that they would be working with trainees who were not yet qualified to drive a train. While the trainee driver of 2AD1 had later told the qualified driver that he had driven a GWA train on a couple of previous occasions north of Tarcoola, it was the understanding of the qualified driver that the trainee could not operate a train while undertaking safeworking functions such as a train cross. However, he considered that the trainee could operate a train at other times under supervision.

Through the course of the investigation, the ATSB found that other GWA drivers had a similar understanding and had allowed a trainee to drive in areas where the terrain and safeworking requirements for the operation of the train were less complex.

The GWA procedures did not contain sufficient guidance/instruction to inform a qualified driver that the issuance of the Driving Record Log book was required before the qualified driver could allow a trainee to drive a locomotive/train under their supervision. The procedures covering the mentoring of trainees by qualified drivers also did not adequately communicate the organisation's expectations in relation to the roles, responsibilities and accountability of each party when undertaking a training task. As a result, GWA qualified drivers were unlikely to be fully aware of the expectations of the organisation in relation to the supervision of its trainees.

## **Safety management system**

The organisational control and oversight of rail activities through the implementation of an effective safety management system (SMS) is fundamental in managing risks associated with railway operations. Organisations are required to implement programs to manage risks including alcohol and drug use, fatigue and competence to ensure rail safety workers<sup>21</sup> are fit for duty and have the skills necessary to perform critical tasks safely. In the case of train 2AD1 on 21 August 2012, the supervising driver was not fit for duty and handed over the driving duties to a trainee who was inexperienced and unqualified. This action contributed to an unsafe outcome when train 2AD1 exceeded the limit of its authority.

### ***GWA's drug and alcohol management program***

The South Australian *Rail Safety Act 2007* (in force at the time of the occurrence) and the *Rail Safety National Law (South Australia) 2012* that replaced it, contain a number of requirements in

<sup>21</sup> Rail safety worker means an individual who has carried out, is carrying out, or is about to carry out rail safety work such as operating a locomotive or supervising the operation of a locomotive.

relation to managing drugs and alcohol. As a result, organisations and their rail safety workers have responsibilities (a safety duty) in relation to managing drugs and alcohol in the work place.

Rail transport operators accredited in South Australia (like GWA) must prepare and implement a drug and alcohol management program for their rail safety workers. To satisfy the safety duty, the legislation states that an organisation must:

...ensure, so far as is reasonably practicable, that rail safety workers do not carry out rail safety work in relation to the operator's railway operations, and are not on duty, while the prescribed concentration of alcohol is present in their blood or while impaired by alcohol or a drug.

Similarly, for a rail safety worker to satisfy their safety duty they must not carry out, or attempt to carry out, rail safety work:

- (a) while there is present in his or her blood the prescribed concentration of alcohol; or
- (b) while a prescribed drug is present in his or her oral fluid or blood; or
- (c) while so much under the influence of alcohol or a drug as to be incapable of effectively discharging a function or duty of a rail safety worker.

GWA addressed this statutory requirement through the implementation of an alcohol and other drug policy. GWA's policy acknowledged the organisation's responsibilities under the rail safety law and detailed actions to support the management program. In addition to a pre-employment medical, which included screening for the presence of drugs or alcohol, GWA had implemented a testing program, both on a random basis and in response to specific events. GWA also delivered awareness/education programs to rail safety workers on the effects of alcohol and other drugs. In addition, GWA's general induction delivered to staff at the commencement of their employment contained information on the risks arising from the use of alcohol or a drug and their statutory safety duty.

GWA provided evidence of an ongoing program for both random and targeted<sup>22</sup> screening of rail safety workers for the presence of alcohol and drugs across its operations. Records of random screening tests at each of GWA's main depots indicate that from 1 January 2011 to the date of this occurrence (21 August 2012), GWA undertook about 749 tests, 5 of which returned positive results. During the same period, 142 targeted screening tests were conducted, 7 of which returned positive results to either alcohol or a prescribed drug.

It was evident that GWA had implemented a robust program for the management of drugs and alcohol in the workplace. Where an employee's random or targeted testing returned a positive result to either alcohol or a prescribed drug, GWA had implemented a system of counselling, education and ongoing monitoring through targeted testing to manage future compliance.

As mentioned previously, the supervising driver had tested positive to a drug test about 16 months earlier. GWA continued to monitor his performance throughout this period with repeat targeted testing, counselling and education. Upon the second confirmatory test (this incident), his employment was terminated.

As a proactive measure following this occurrence, GWA wrote to all of its rail safety workers, reinforcing the objectives of the GWA awareness and education program and the potential impact that alcohol or a drug can have on their performance in undertaking rail safety work. GWA also increased the frequency of random screening at existing locations (including Port Augusta) and expanded testing to include screening en route and at off-train resting locations to ensure their ongoing adequacy.

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<sup>22</sup> Targeted screening may also be undertaken and follows any rail safety incident, such as a collision, derailment, or an authority overrun, as occurred on this occasion, or where suspicion exists that an employee is unfit to perform work because of the use of alcohol and or other drugs.



## **GWA's fatigue management practices**

Modern fatigue risk management requires a number of elements and levels of risk control. Dawson and McCulloch<sup>23</sup> and the National Transport Commission<sup>24</sup> have both proposed the following levels of risk control:

- Level 1: Sleep Opportunity - Training, Scheduling Rules; Fatigue Modelling; Sleep / Medical Disorder Screening
- Level 2: Sleep Obtained - Training; Prior Sleep Wake Data; Sleep / Medical Disorder Screening
- Level 3: Behavioural Symptoms - Training; Symptom Checklists; Self Report Behavioural Scales; Physiological Monitoring
- Level 4: Fatigue Related Errors - Fatigue / Error Proofing Strategies; SMS Error Analysis System
- Level 5: Fatigue Related Occurrences - SMS Incident / Occurrence Analysis System.

GWA had a documented fatigue management policy as part of its safety management system. The policy was supported by a procedure for fatigue management<sup>25</sup> and a fatigue management training package. GWA utilised the FAID®<sup>26</sup> software as an indicator of the suitability of their master and operational rosters. Additionally, GWA had implemented a comprehensive set of rostering principles and fatigue proofing strategies to enable the practical management of identified fatigue risk. These principles and strategies incorporated risk controls up to and including Level 3 of the above-described model, and some elements of Level 4. This included provision of adequate sleep opportunity through scheduling rules and fatigue modelling, monitoring of sleep obtained through examination of prior sleep wake data, capacity to check on and report behavioural symptoms of fatigue impairment, and incorporated fatigue-proofing strategies where fatigue risk was elevated.

Relay working has been identified as a system of work which incorporates elevated fatigue risk due to the effects of a fast rearward rotating roster in combination with the difficulties that some drivers have in obtaining adequate restful sleep while on relay operations.<sup>27,28,29,30</sup> Like other Australian rail operators, GWA ensures that drivers are provided with an acceptable standard of accommodation in crew vans. GWA procedures also identify the risk for fatigue related errors within its various operations, including relay working of train crew, and incorporate controls through rostering principles and fatigue proofing strategies specific to those operations.

The GWA procedures and educational materials identified the shared responsibility of the organisation and the individual rail safety worker in implementing an effective fatigue management program to mitigate the risk of fatigue impairment of a rail safety worker. GWA policies promote a 'just culture' in relation to the management of staff who report/are detected as experiencing performance impairment due to the effects of fatigue. In the event a rail safety worker is fatigued and unfit for duty, GWA policies require the implementation of appropriate non-punitive control measures (such as providing additional rest opportunity) before the rail safety worker commences or recommences duties.

<sup>23</sup> Dawson & McCulloch (2005). Managing fatigue: It's about sleep. *Sleep Medicine Reviews*, 9, 365-380.

<sup>24</sup> National Transport Commission (2008). *National Rail Safety Guideline. Management of Fatigue in Rail Safety Workers*.

<sup>25</sup> Genesee & Wyoming Australia - Procedure for Fatigue Management, Document RS-PRC-030, Version 003, Dated 01/01/2012.

<sup>26</sup> Fatigue Audit InterDyne –biomathematical fatigue modelling software

<sup>27</sup> Thomas, G.R., Raslear, T.G., & Kuehn, G.I. (1997). *The effects of work schedule on train handling performance and sleep of locomotive engineers: a simulator study*. Federal Railroad Administration.

<sup>28</sup> Jay, S. M., Dawson, D. & Lamond, N. (2006). Train drivers' sleep quality and quantity during extended relay operations. *Chronobiology International*, 23 (6), 1241-1252.

<sup>29</sup> Darwent, D., Lamond, N. & Dawson, D. (2007). The sleep and performance of train drivers during an extended freight-haul operation. *Applied Ergonomics*, 39, 614-622.

<sup>30</sup> Lamond, N, Darwent, D. & Dawson, D. (2005). How well do train drivers sleep in relay vans? *Industrial Health*, 43, 98-104.

In train operations where two drivers are in the cab, the second person provides a risk control for the normal variability of human performance in that a single driver may miss critical driving cues whereas two drivers are less likely to do so. Additionally, the second driver assists in the provision of safeworking functions, the management of fatigue and mitigates risk arising from the sudden incapacity of a driver.

GWA's internal investigation of the authority exceedence by 2AD1 identified anecdotal evidence that, like the supervising driver in this incident, some train crew members take the opportunity to nap in the second person's seat when not required to participate in the management of the train. As an informal fatigue proofing strategy, napping can be beneficial to restore alertness. However, the practice is inconsistent with GWA's operational requirements, as it undermines the risk mitigation intended by the presence of a second person in the cab.

The safety actions identified by the GWA investigation included the development of mechanisms consistent with the organisation's just culture policies to establish the extent, if any, of this behaviour by train crews and the cause. GWA safety actions also included the evaluation of the adequacy of the higher-level fatigue-risk controls, and undertaking more detailed accident and incident investigation analysis, to better detect near misses and events that may be attributable to the effects of work related fatigue. GWA also has an opportunity to enhance fatigue management procedures through the inclusion of processes for collecting and analysing information on average sleep obtained during relay operations to support its fatigue risk assessments.

# Findings

From the evidence available, the following findings are made with respect to the exceedence of the limit of authority by Genesee and Wyoming Australia freight train 2AD1 at Tarcoola, South Australia, on 21 August 2012. These findings should not be read as apportioning blame or liability to any particular organisation or individual.

**Safety issues, or system problems, are highlighted in bold to emphasise their importance.**

A safety issue is an event or condition that increases safety risk and (a) can reasonably be regarded as having the potential to adversely affect the safety of future operations, and (b) is a characteristic of an organisation or a system, rather than a characteristic of a specific individual, or characteristic of an operating environment at a specific point in time.

## Contributing factors

- The supervising driver relinquished control of train 2AD1 to a trainee driver who had not attained the requisite competencies to drive a locomotive under supervision.
- The supervising driver fell asleep and did not maintain an adequate level of supervision of the trainee driver as train 2AD1 approached Tarcoola.
- The supervising driver's use of methamphetamines during his period off-duty prior to the shift probably contributed to his sleepiness.
- The trainee driver accepted control of train 2AD1 without having attained the requisite competencies to drive a locomotive under supervision.
- The trainee driver's lack of route knowledge combined with the perception that the route through Tarcoola was correctly set probably influenced his expectation that Northgate would be the next location ahead.
- **The Genesee and Wyoming Australia safety management system procedures did not provide supervising and trainee drivers with sufficient guidance or direction as to the extent of their supervisory or permitted driving roles. [Safety issue]**

## Other factors that increased risk

- Anecdotal evidence indicates that some GWA train crew members may occasionally nap in the second person's seat when not actively involved in the management of the train.

## Other findings

- The decisive action taken by the qualified driver of the resting crew in operating the emergency brake handle located in the crew van limited the extent of the exceedence of authority by train 2AD1 at Tarcoola.



# Safety issues and actions

The safety issues identified during this investigation are listed in the Findings and Safety issues and actions sections of this report. The Australian Transport Safety Bureau (ATSB) expects that all safety issues identified by the investigation should be addressed by the relevant organisation(s). In addressing those issues, the ATSB prefers to encourage relevant organisation(s) to proactively initiate safety action, rather than to issue formal safety recommendations or safety advisory notices.

All of the directly involved parties were provided with a draft report and invited to provide submissions. As part of that process, each organisation was asked to communicate what safety actions, if any, they had carried out or were planning to carry out in relation to each safety issue relevant to their organisation.

## Supervision of trainee drivers

Number:	RO-2012-009-SI-01
Issue owner:	Genesee and Wyoming Australia
Operation affected:	<i>Rail: Freight</i>
Who it affects:	All rolling stock operators

### **Safety issue description:**

The Genesee and Wyoming Australia safety management system procedures did not provide supervising and trainee drivers with sufficient guidance or direction as to the extent of their supervisory or permitted driving roles.

### **Proactive safety action taken by: Genesee and Wyoming Australia**

Genesee and Wyoming Australia has advised the ATSB that:

A system of ranking trainees has been implemented – each level in the three-tier system correlating to the trainee's progression towards being able to assume control of a main line train or locomotive. Under this system, a card is issued to each trainee, which details their ranking and any associated limitations that apply to their role relative to the operation of the locomotive/train. Under the supporting protocol, the trainee is required to present their card to the Driver in Charge [supervising driver] prior the commencement of the service.

A locomotive driver memo was drafted and sent to the home address of all drivers and operators in GWA, reminding them of the three category restrictions that apply to all grades of trainee.

Category A: Trainee locomotive drivers without their air brake and locomotive engine qualifications are NOT permitted to drive under any circumstances.

Category B: Advanced trainee locomotive drivers are permitted to operate locomotives/trains under very clear and strict supervision.

Category C: Assistant drivers are able to operate locomotives/trains with some autonomy while under the supervision of a qualified driver.

Personal briefs were held with every driver/operator in each location detailing the incident, the possible ramifications and the consequences of allowing inexperienced and untrained drivers to operate locomotives and trains. These briefing sessions expanded on the safety theme and allowed for two way conversations with staff that were beneficial in many respects. The underlying focus of the briefings involved gaining an unconditional commitment from every driver that they understood the consequences that could have been realised and that they would apply all safeworking rules and protocols.

### **ATSB comment:**

The ATSB is satisfied that the action taken by Genesee and Wyoming Australia should adequately address the safety issue.

***Current status of the safety issue:***

Issue status: Adequately addressed

Justification: The actions undertaken by Genesee and Wyoming Australia should adequately address the safety issue.

# General details

## Occurrence details

Date and time:	21 August 2012 – 1046 Central Standard Time (CST)	
Occurrence category:	Incident	
Primary occurrence type:	Proceed Authority Exceed	
Location:	Near Tarcoola, South Australia	
	Latitude: 30° 42.63' S	Longitude: 134° 34.077' E

## Train details

Train operator:	Genesee and Wyoming Australia	
Registration:	2AD1	
Type of operation:	Intermodal	
Persons on board:	Crew – 4	Passengers – 0
Injuries:	Crew – 0	Passengers – 0
Damage:	None	

# Sources and submissions

## Sources of information

The sources of information during the investigation included:

- Australian Rail Track Corporation
- Genesee and Wyoming Australia
- The crew of train 2AD1

## References

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South Australia's Rail Safety (Alcohol and Drug Testing) Regulations 2008 formed under the Rail Safety Act 2007



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Thomas, M.J.W. and Ferguson, S.A. (2010). Prior Sleep, Prior Wake, and Crew Performance During Normal Flight Operations. *Aviation, Space and Environmental Medicine*, 81 (7), 665-670.

## Submissions

Under Part 4, Division 2 (Investigation Reports), Section 26 of the *Transport Safety Investigation Act 2003*, the ATSB may provide a draft report, on a confidential basis, to any person whom the ATSB considers appropriate. Section 26 (1) (a) of the Act allows a person receiving a draft report to make submissions to the ATSB about the draft report.

A draft of this report was provided to the Australian Rail Track Corporation, Genesee and Wyoming Australia, the Office of the National Rail Safety Regulator and the crew of train 2AD1.

Submissions were received from the Australian Rail Track Corporation, Genesee and Wyoming Australia, the Office of the National Rail Safety Regulator and the crew of train 2AD1. The submissions were reviewed and where considered appropriate, the text of the report was amended accordingly.

# Australian Transport Safety Bureau

The Australian Transport Safety Bureau (ATSB) is an independent Commonwealth Government statutory agency. The ATSB is governed by a Commission and is entirely separate from transport regulators, policy makers and service providers. The ATSB's function is to improve safety and public confidence in the aviation, marine and rail modes of transport through excellence in: independent investigation of transport accidents and other safety occurrences; safety data recording, analysis and research; fostering safety awareness, knowledge and action.

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.

The ATSB performs its functions in accordance with the provisions of the *Transport Safety Investigation Act 2003* and Regulations and, where applicable, relevant international agreements.

## Purpose of safety investigations

The object of a safety investigation is to identify and reduce safety-related risk. ATSB investigations determine and communicate the factors related to the transport safety matter being investigated.

It is not a function of the ATSB to apportion blame or determine liability. At the same time, an investigation report must include factual material of sufficient weight to support the analysis and findings. At all times the ATSB endeavours to balance the use of material that could imply adverse comment with the need to properly explain what happened, and why, in a fair and unbiased manner.

## Developing safety action

Central to the ATSB's investigation of transport safety matters is the early identification of safety issues in the transport environment. The ATSB prefers to encourage the relevant organisation(s) to initiate proactive safety action that addresses safety issues. Nevertheless, the ATSB may use its power to make a formal safety recommendation either during or at the end of an investigation, depending on the level of risk associated with a safety issue and the extent of corrective action undertaken by the relevant organisation.

When safety recommendations are issued, they focus on clearly describing the safety issue of concern, rather than providing instructions or opinions on a preferred method of corrective action. As with equivalent overseas organisations, the ATSB has no power to enforce the implementation of its recommendations. It is a matter for the body to which an ATSB recommendation is directed to assess the costs and benefits of any particular means of addressing a safety issue.

When the ATSB issues a safety recommendation to a person, organisation or agency, they must provide a written response within 90 days. That response must indicate whether they accept the recommendation, any reasons for not accepting part or all of the recommendation, and details of any proposed safety action to give effect to the recommendation.

The ATSB can also issue safety advisory notices suggesting that an organisation or an industry sector consider a safety issue and take action where it believes it appropriate. There is no requirement for a formal response to an advisory notice, although the ATSB will publish any response it receives.



## Australian Transport Safety Bureau

**Enquiries** 1800 020 616

**Notifications** 1800 011 034

**REPCON** 1800 011 034

**Web** [www.atsb.gov.au](http://www.atsb.gov.au)

**Twitter** @ATSBinfo

**Email** [atsbinfo@atsb.gov.au](mailto:atsbinfo@atsb.gov.au)

## Investigation

### **ATSB Transport Safety Report** Rail Occurrence Investigation

Proceed authority exceeded by train 2AD1  
Tarcoola, South Australia, 21 August 2012

RO-2012-009

Final – 28 May 2014