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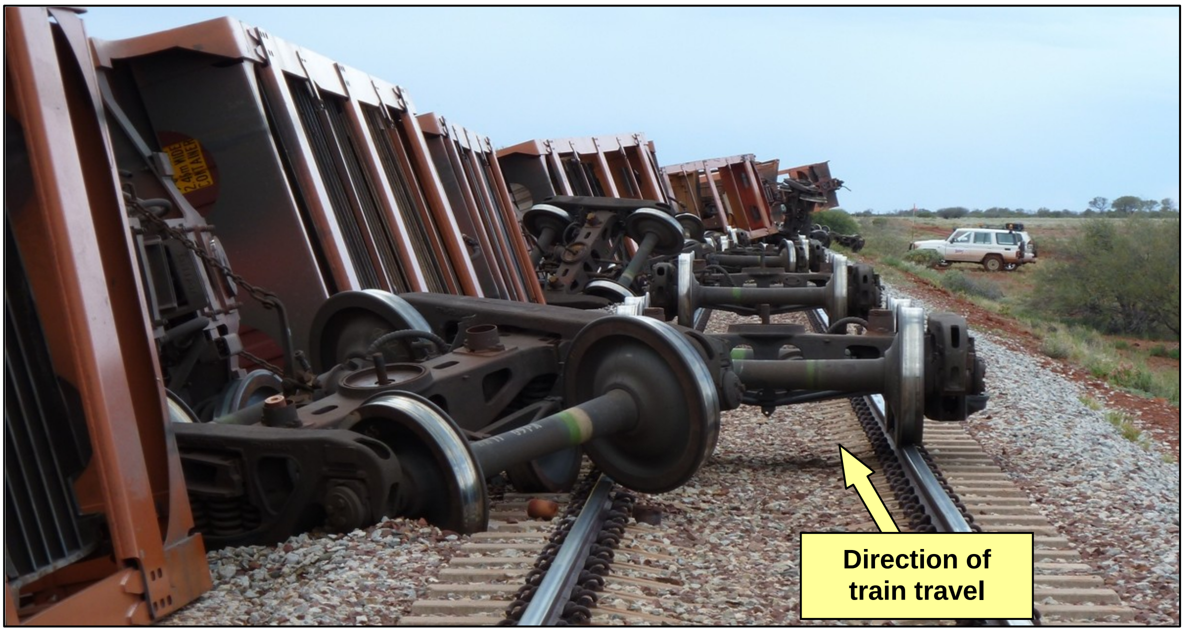
ATSB TRANSPORT SAFETY REPORT
Rail Occurrence Investigation RO-2010-012
Final

Derailment of freight train 4DA2 near Cadney Park, South Australia

25 November 2010

Figure 1: Derailment site looking towards Adelaide



Abstract

At about 0618[1] on Thursday 25 November 2010, freight train (4DA2) operated by FreightLink Pty Ltd[2] derailed on the Central-Australia Railway line, near the 826[3] km mark, about 5 km south of Cadney Park (Figure 2) in South Australia.

There were no injuries as a result of the derailment but there was significant damage to rolling-stock and about 300 m of track required replacement.

The investigation determined that a severe weather event, very strong winds associated with thunderstorm activity, were of a sufficient magnitude to initiate the rollover and subsequent derailment of a group of lightly loaded double-stacked container wagons.

A number of minor safety issues were identified as a result of the investigation and have been brought to the attention of Genesee & Wyoming Australia Pty Ltd (GWA). These issues primarily relate to the wind effect on lightly loaded/high vehicles (particularly double-stacked containers) and the identification of and response to severe weather events.

1 The 24-hour clock is used in this report. Australian Central Daylight-saving Time (CDT), UTC +10.5 hours. Unless shown otherwise, all times are CDT.

2 Genesee & Wyoming Inc finalised the acquisition of the assets of FreightLink Pty Ltd on 2 December 2010.

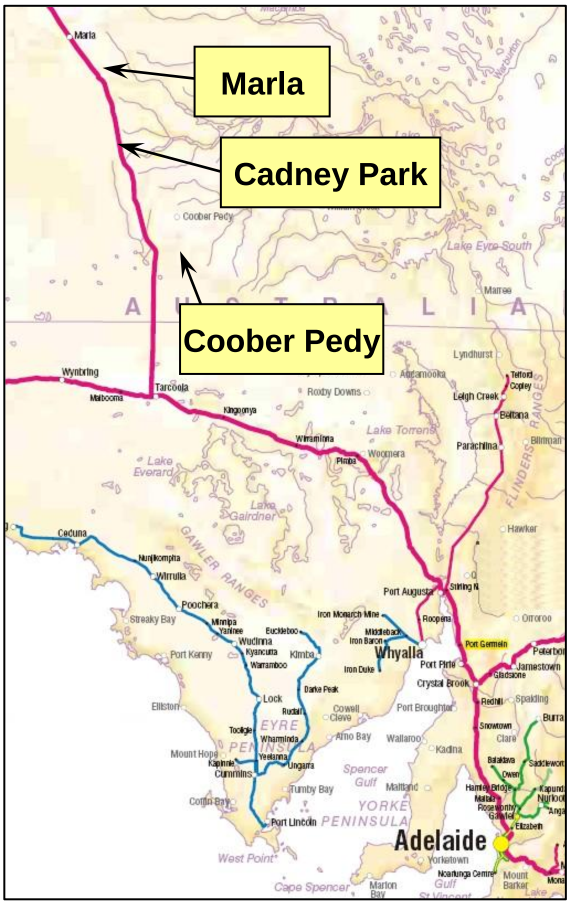
3 Distance in kilometres from a track reference point located at Coonamia in SA.

FACTUAL INFORMATION

Location and environment

Cadney Park on the Central-Australia Railway line in South Australia is about 1050 km by rail north of the Adelaide (Keswick) interstate rail passenger terminal. The line at Cadney Park is about 400 m to the south-west of the Stuart Highway.

Figure 2: Location of Cadney Park, South Australia



Map – Geoscience Australia. Crown Copyright©

Trains travelling through Cadney Park traverse a 1842 m long crossing loop at a mandated track speed of 70 km/h and when clear, can accelerate up to 110 km/h subject to any rolling-stock limitations.

The derailment occurred approximately 5 km south of Cadney Park on a straight section of track near the 826 km mark. Track speed through the area was 110 km/h.

Track structure

The track at the derailment site comprised standard gauge (1435 mm) continuously welded AS 47 kg/m rail fastened to pre-stressed concrete sleepers using resilient clips. The track is constructed on a formation comprising a red sand/clay based soil. The sleepers are supported on a ballast bed with a minimum depth of 250 mm. Sleepers are nominally spaced at 670 mm. FreightLink Pty Ltd was responsible for the section of track over which train 4DA2 was travelling at the time of derailment. BJB Joint Venture performed track maintenance under contract for FreightLink Pty Ltd.

Train information

Freight train 4DA2 was a regular GWA accredited service consisting of two locomotives (CLP17 leading and VL359 trailing) hauling a crew van and 32 freight wagons (22 of which were 5-unit freight wagons[4]). The train was carrying mixed freight including a combination of double and single stacked containers on container flat and well[5] wagons. The front portion of the train mainly comprised single stacked containers, including six empty fuel tank wagons. The central portion (wagon position number 21 through to 32) mainly comprised double-stacked containers and the rear portion was mainly made up with single stacked containers. The ratio of double to single stack container loading was around 1:2 as a proportion of train length. The train was 1395 m long and weighed a total of 2427 t including the locomotives.

The train originated at the Berrimah Freight Terminal, near Darwin in the Northern Territory and was travelling to the Adelaide Freight Terminal, near Adelaide in South Australia.

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4 5-unit: A wagon consisting of five permanently coupled platforms, each platform independently supported on a pair of bogies. Note, 5-units are the most common but they do not need to consist of five units, i.e. there could be 2-units, 3-units in the same configuration. Source: ARA Glossary for the National Codes of Practice and Dictionary of Railway Terminology.

5 A well wagon is a flat car having the height above rail of the underframe/deck structure reduced between the bogies to provide additional vertical load space.

Train 4DA2 was crewed by two drivers operating the train with a further two relief drivers[6] resting in a crew van.

The driver and co-driver involved in the derailment had extensive train driving experience. Both were suitably qualified, assessed as competent and medically fit for duty. Following the derailment police breath tested the train driver and co-driver for the presence of alcohol; the results were zero.

Environmental conditions

The Bureau of Meteorology (BoM) has automatic weather observation stations at various locations throughout central Australia.

Information was sourced for the two closest locations at Coober Pedy, (approximately 134 km to the south of the derailment site) and Marla (approximately 85 km to the north of the derailment site), see Figure 2.

An examination of the data from these two sites did not show any evidence of what might have been considered a severe weather event at about the time of the derailment. In fact the highest recorded wind speed for the day was in Coober Pedy at 0530. At that time the wind was blowing at 28 km/h (east-south-east).

At about the time of the derailment the recorded wind speed in:

1) Coober Pedy (0630) was 17 km/h (east-south-east) with about 1 mm of rain being recorded.

2) Marla (0600) was 11 km/h (east-south-east) with no rainfall recorded.

The ATSB subsequently corresponded with the BoM in relation to sourcing additional weather information for the Cadney Park area.

The BoM advised that there was no meteorological observation station near Cadney Park and observational data in that area was very sparse.

Figure 3: Satellite image with overlay of lightning activity for 0530-0630

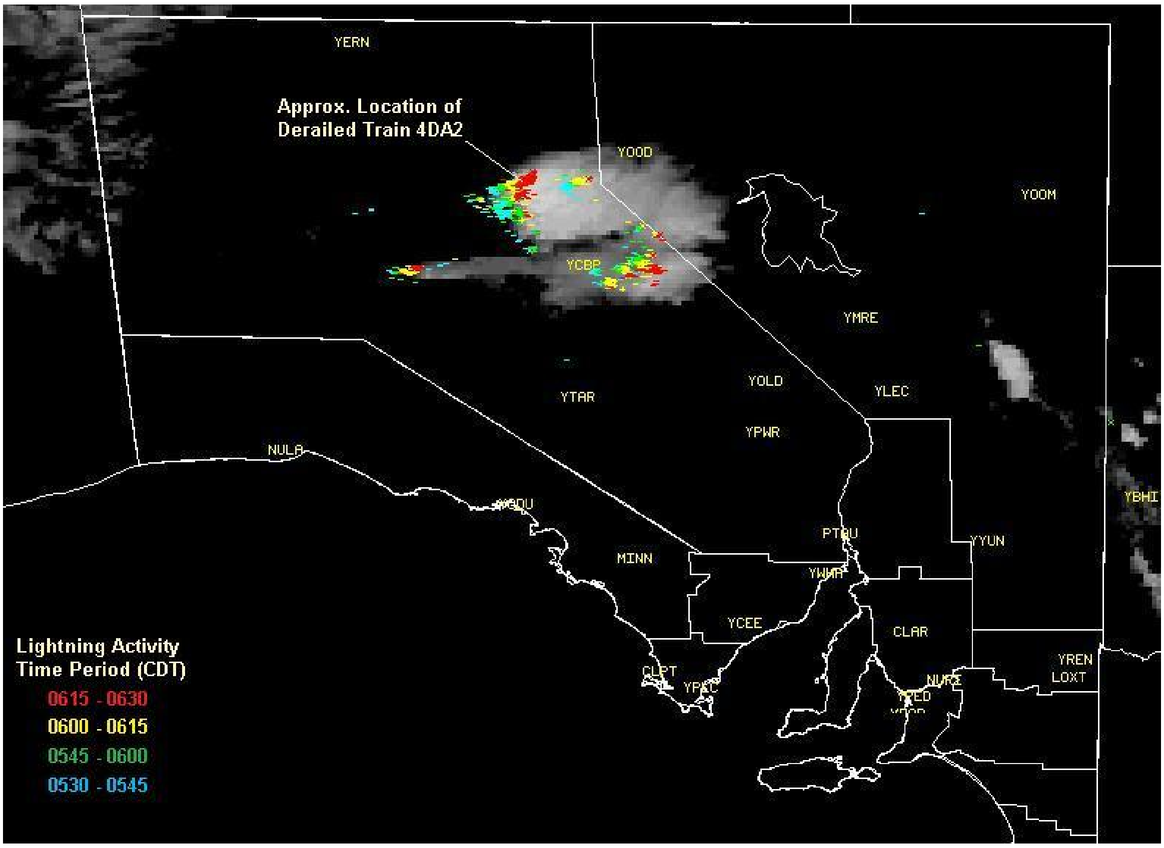


Image supplied by – Bureau of Meteorology. Copyright©

6 Train crews work in relay on the Darwin to Adelaide line and rest at regular intervals.

The BoM was able to supply three satellite images covering hourly intervals (Figure 3) around the time of the derailment. All three images show evidence of significant lightning activity and in their response the BoM advised:

> ... there were thunderstorms in the area at the time of the derailment, moving from the west-south-west.

There were no warnings current for the area around Cadney Park at the time of the derailment. However, examination of BoM data established that while there had only been limited rainfall in Marla, 7.4 mm over a 24 hr period (0900 25 November 2010 through to 0900 26 November 2010) that Mintabie, just 32 km to the west of Marla had received significant rainfall, about 25 mm, during the same 24 hr period.

The occurrence

On Wednesday 24 November 2010, the train drivers involved in the derailment signed on for duty at 2300. Prescribed engine, brake and safety checks were completed on train 4DA2 before departure from the Berrimah Freight Terminal, Darwin. The train's departure from the Berrimah Freight Terminal and subsequent passage through the section of track where the derailment occurred was authorised by qualified GWA transport controllers located at the Dry Creek control centre, Adelaide.

The earlier part of the journey was uneventful with the train running normally and able to maintain track speed. When the train was about 250 km north of Cadney Park, near Kulgera, the train crew observed frequent lightning activity in the distant southern sky. They continued to drive at track speed in a southerly direction, towards the lightning activity, on their journey to Adelaide.

On approaching Cadney Park lightning activity was intense. The driver slowed the train to 70 km/h for the Cadney Park 'Crossing Loop'. Once clear of the loop, he began to accelerate the train but noted that progress was slow because a strong southerly wind had come up and was directly opposing the train. Shortly thereafter he observed some light spots of rain on the train's front windscreen. This was followed by a torrential downpour with very strong wind that had veered 90 degrees and was now blowing from the west and onto the right-hand-side of the train. The driver became concerned with both forward visibility and the strength of the wind, which the co-driver estimated to be at least at 70 to 80 km/h. The driver, now quite concerned, was about to slow down and stop the train when he felt a couple of light tugs and then observed decrease in the train brake pipe pressure. Realising that the train had probably parted and/or had become derailed he pulled ahead before slowing down to stop. His intention was to minimise the risk of the rear portion of the train colliding with the slowing front portion. He finally brought the train (leading locomotive) to a stand approximately 1620 m from the point of derailment.

Shortly thereafter the co-driver contacted transport control to advise that train 4DA2 had come to a stand just south of Cadney Park and was probably derailed. He further advised that they were experiencing severe weather and would not leave the safety of the locomotive to inspect the rear of the train until conditions improved.

After about 10 minutes the main storm front had passed so the co-driver alighted from the locomotive cab to commence the inspection of train 4DA2. He walked back towards the rear part of the train (the surrounding area was heavily inundated by water) and reported that the train had parted at the 18th wagon and that the 19th through to the 32nd wagon were rolled over and generally located to the eastern side of the track.

The last three wagons were upright although the leading bogie of the 5-unit wagon FQAY 0009R (Unit 1) was derailed. An ISO container[7] of methanol on this wagon had become separated from the wagon and was lying on its side.

Damage and Recovery

A total of 14 wagons, all of which had been 5-unit double-stacked freight wagons, had derailed and sustained significant damage. Approximately 300 m of track was also damaged and required replacement. The undamaged front portion of train 4DA2 was released by the ATSB at 1900 on

7 ISO containers are used for the intermodal transport of freight. They are manufactured according to specifications from the International Standards Organization (ISO) and are suitable for multiple transportation methods such as truck and rail, or rail and ship.

the day of the derailment and departed the site at about 1930 to complete the journey to Adelaide.

Track and rolling-stock recovery began early on 26 November 2010 with the track being re-opened for traffic at 1057 on 29 November 2010. However much of the derailed rolling-stock was not fully recovered until a later date.

ANALYSIS

Investigators from the Australian Transport Safety Bureau (ATSB) were dispatched on 25 November 2010 arriving on site at about 1730. Once on site the condition and positions of rolling-stock, containers and track were examined and photographed. The train drivers were interviewed before they departed that evening along with the undamaged front portion of train 4DA2.

On-site information was subsequently supplemented with data supplied by GWA comprising track information, train control graphs, locomotive data logs, train consist information, train driver/co-driver, medical fitness, fatigue and training records. The Bureau of Meteorology (BoM) provided weather records and weather analysis information.

Sequence of events analysis

Observations travelling to site

When flying into Coober Pedy, ATSB investigators noted that the surrounding area was quite dry, there was little indication of a severe weather event or rainfall activity. The distance by road from Coober Pedy to Cadney Park is about 154 km and it was not until about 10 km from Cadney Park that there was any evidence of rainfall.

Closer into Cadney Park there was light shower activity and evidence of heavy rain with large areas inundated by water. A number of local roads that lead off the Stuart Highway and cross over the Central-Australia Railway line were observed to be under water and impassable.

On arrival at Cadney Park and following discussions with some of the local residents it was apparent that the area had experienced a severe weather event with torrential rain and very strong winds. A number of the locals stated that they had never seen weather as extreme as had occurred on this occasion.

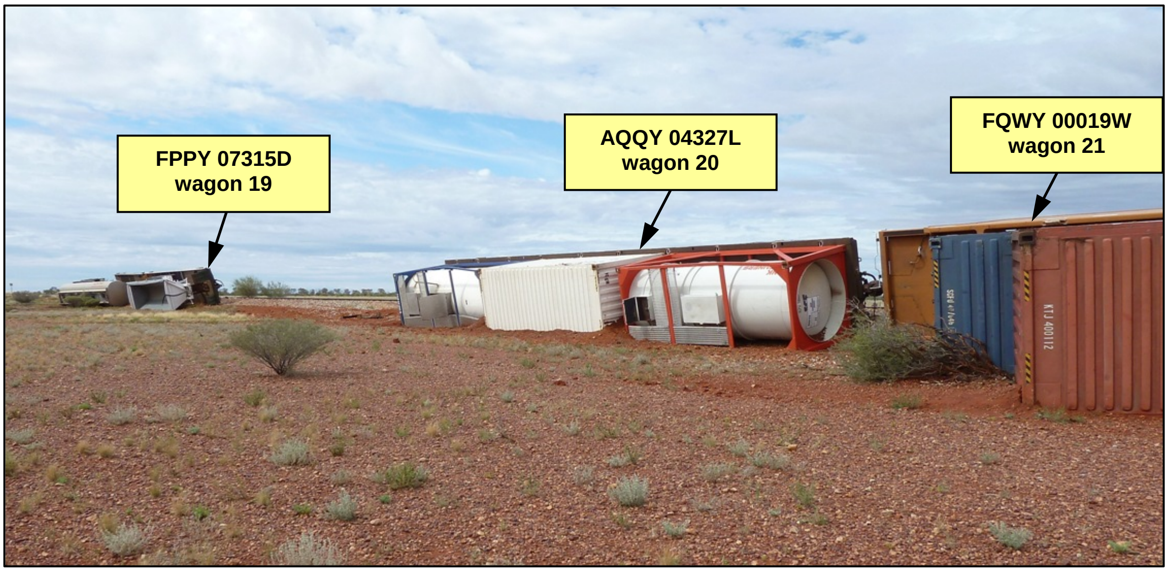
To access the derailment site it was necessary to use the railway maintenance road. In driving along the road it was evident that the area had experienced very heavy rain (consistent with the observations made by the train drivers) with many sections of the road still covered by water (Figure 4).

Site observations

Examination of the derailment site focused on wagon FQWY 00019W, the 21st (Figure 5) in the consist, a double-stacked container wagon (this

Figure 4: Sections of the railway maintenance road with evidence of heavy flooding

Figure 5: Derailed wagons FQWY 00019W, AQQY 04327L and FPPY 07315D



unit was considered the likely initiator of the derailment) and the track in the immediate vicinity of this wagon to establish the likely point of derailment (POD).

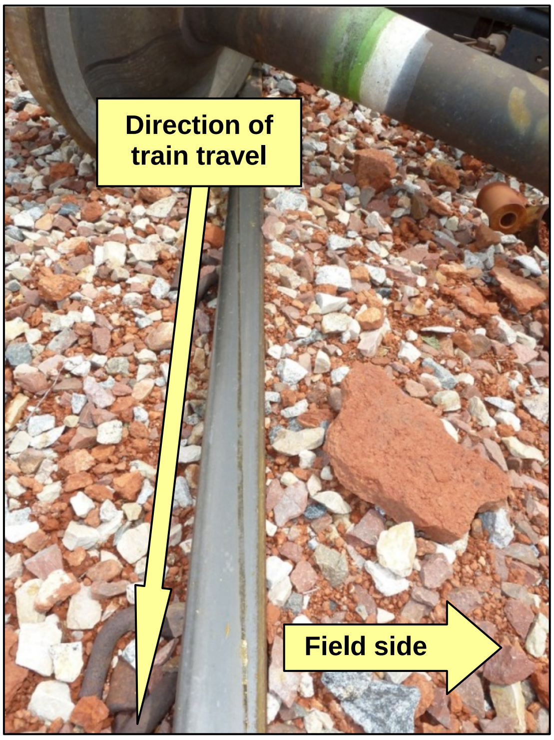
FQWY 00019W was the first in the series of 13 double-stacked container wagons, all of which had rolled over. The two wagons ahead of FQWY 00019W (AQQY 04327L and FPPY 07315D see Figure 5) probably derailed as a consequence of being dragged over by FQWY 00019W.

The 33rd freight wagon (FQAY 00009R), was a single stacked container wagon. It was noted that only the leading bogie of this wagon had derailed, the wagon was upright and substantially on track.

Key on-site observations:

- A single diagonal wheel contact mark[8], about 2 m in length, (Figure 6) was found on the head of the eastern rail about 70 m before the resting place of derailed wagon FQWY 00019W. The mark extended from the inside to the outside of the rail head. This indicated that a wheel had ridden up and over the rail at this point. It then dropped off on the field side of the eastern rail. From this point on the ballast was gouged into the sub-grade as the wheels and bogie side frames of derailed wagons dragged along the track, breaking the sleeper ends in the process. About 10 m after the POD the derailed wagons also began to push the eastern rail in towards the western rail causing gauge narrowing and escalating the derailment process.
- There was no evidence of wheel drop-in on the gauge side of the western rail, that is, the side opposite the POD. This indicated that the wagons had probably rolled over rather than being dragged through the four foot[9].
- Wagon FQWY 00019W rolled off the eastern rail. It then travelled about 70 m before

Figure 6: Wheel contact mark



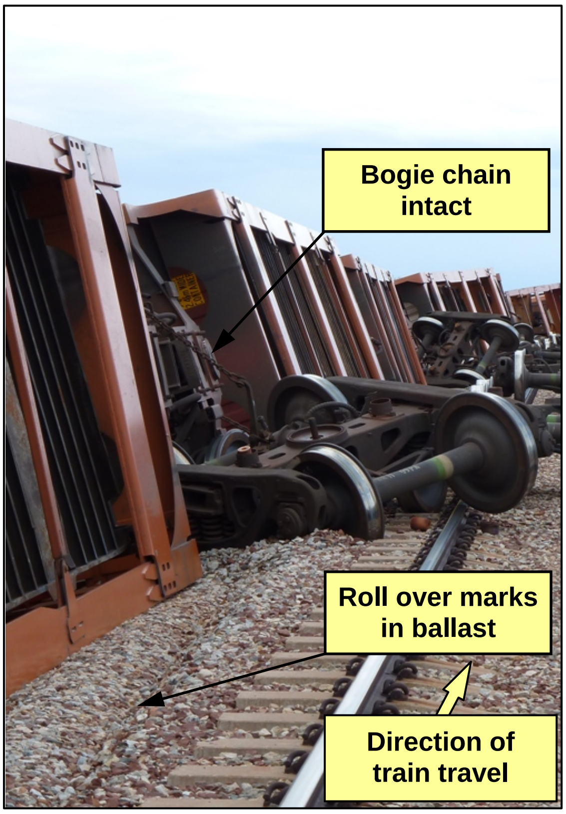
8 This was considered to be the likely Point Of Derailment.

9 Four foot – The area between the rails of a standard gauge railway. (ARA Glossary for National Code of Practice and Dictionary of Railway Terminology)

coming to rest. An examination of the skid marks, on the ground, showed that the wagon had slid only a short distance, about 20 m, on its side.

- Thirty metres after the POD a dislodged bogie became wedged between the eastern and western rails. Five wagons then piled up behind this bogie.

Figure 7: Roll over marks in ballast



- Wagons further behind this group of five vehicles appeared to have been travelling slowly or were almost stationary when they rolled over as evidenced by the lack of drag marks (Figure 7) in the ballast and adjacent ground surface where they came to rest. It was also noted that most of the bogies were adjacent to their respective body bolsters or had been dragged off the track but remained attached to the wagon with the bogie safety chain.

Track condition

The track near the derailment site was elevated about 1 m above the natural ground surface. It was straight, almost level and appeared to be in good condition with a full ballast profile through the shoulder and crib.

There was no evidence of a broken rail, buckle or signs of sub-grade failure immediately preceding the derailment site.

Locomotive data and train handling

A reconstruction of events based on the data log of lead locomotive CLP17 (Figure 8) corroborated the statement given by the driver and co-driver of train 4DA2. Analysis of the data shows that about 10 km before the POD, train 4DA2 was travelling at a speed of about 90 km/h and therefore below the allowable track speed. The driver slowed the train to 60 km/h on approaching Cadney Park for the crossing loop. On clearing the crossing loop he commenced accelerating the train, placing it in notch eight, full throttle. The train reached a speed of about 70 km/h and then appeared to slow slightly. At 0616:20 the driver placed the train into notch seven, about 40 seconds later the train lost brake pipe pressure indicating that it had probably parted and may have become derailed. At that time the driver slowed the train bringing it to a stand about 800 m after the first loss of brake pipe pressure. Information extracted from the locomotive data logger also supports the train driver's post-derailment account of trying to keep the train stretched.

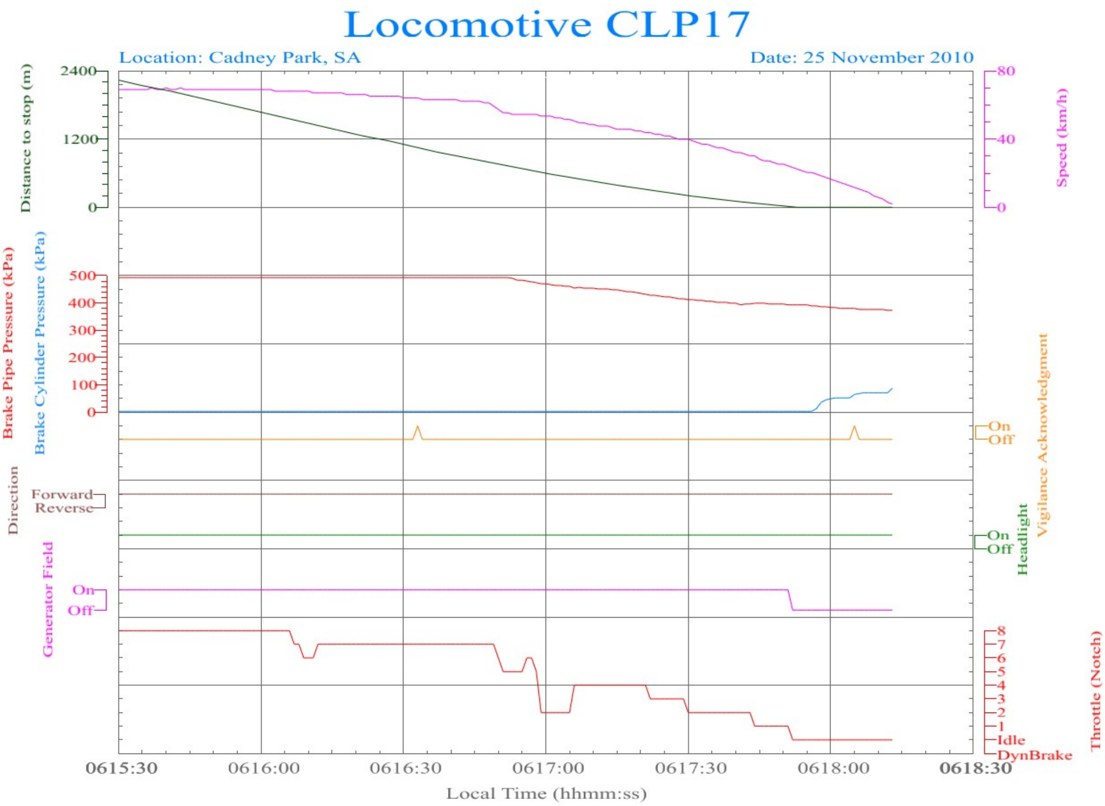
An examination of available evidence indicates that train 4DA2 was handled in an appropriate manner and that the actions of the driver did not contribute to the derailment. However, it was noted train drivers receive no formal training with respect to understanding severe weather events, the associated derailment risk and mitigation strategies.

Rolling-stock condition

The FQWY class wagon is a 2-pack well wagon with a low-floor 'well' design that allows for the double stacking of freight containers. FQWY wagons are capable of transporting double-stacked containers at a maximum speed of 115 km/h, subject to track condition.

At the time of the derailment wagon FQWY 00019W was loaded with four near empty containers that were double-stacked and secured to the wagon platform using spigots. The gross weight of the wagon and containers was 77.23 t

Figure 8: Extract of locomotive log CLP17



with an approved out of gauge[10] (OOG) height of 6.374 m.

During the derailment sequence, wagon FQWY 00019W rolled over onto its left-hand-side (direction of travel) and spilled onto the eastern side of track. All four containers that were being carried on the wagon broke loose and were ejected a small distance diagonally from the front part of each well wagon.

The separation of the containers from the well wagon probably occurred during the final part of the rollover sequence, probably as wagon FQWY 00019W came to rest.

No mechanical deficiencies were identified with wagon FQWY 00019W.

Train loading

A critical issue for wagon stability is the centre of mass (rail vehicle and load) above rail height. The Code of Practice for the Defined Interstate Rail Network (CoP), 'Freight Loading Manual' states that for interstate routes, the height above rail level of the combined centre of mass of the vehicle and its load shall not exceed 2500 mm without a special authorisation from the access provider.

Wagon FQWY 00019W (wagon position 22) was loaded with four containers, two on the platform, double stacked. The load was fairly evenly balanced between top and bottom containers with an authorised out of gauge height restriction of 6.374 m as detailed on the train manifest.

There was a further four wagons FQWY00020S (wagon position 22), FQWY00009Y (wagon position 25), FQWY00025R (wagon position 28) and FQWY00001Y (wagon position 29) similarly configured each with an authorised out of gauge height restriction.

Severe weather

Wind generated by thunderstorm activity is usually associated with a squall line/intense rainfall activity and at other times micro burst winds. The most frequently encountered wind type is that associated with the leading edge of the rain-cooled outflow, known as a gust front. Although outflow winds typically range in speed from 50 to

10 Out of gauge - Vehicle or load exceeding the Loading Gauge for a particular section of track. Source: ARA Glossary for the National Codes of Practice and Dictionary of Railway Terminology.

80 km/h, it is not uncommon for the gust front to exceed 160 km/h[11].

In their statement, the train drivers commented on the ferocity of the winds and torrential rain that they experienced just before the derailment, these are all characteristics associated with a squall-line. Cadney Park residents corroborated the observations made by the train drivers and although the BoM could not supply on-site observations there was very strong evidence to suggest that intense and localised rainfall (typically associated with thunderstorm activity) and very strong winds associated with a squall line had occurred at the time of the derailment.

Based on supporting observations, including information from the BoM, it was concluded that Cadney Park had experienced severe thunderstorm activity at about the time of the derailment. It is likely that the winds associated with a gust front exceeded 80 km/h and could have been as high as 160 km/h. Information from the BoM corroborates the driver's observations, in that the wind was probably blowing from the west and almost at right angles to the right-hand-side of train at the time of derailment.

Derailment scenario

The derailment at Cadney Park occurred on tangent track of relatively flat grade. Typically, key mechanisms for derailment on tangent track include:

- broken rail.
- track buckle/lateral misalignment.
- gauge spread.
- flooding.
- vehicle failure.
- flange climbing, (speeding through bends/ track twist) and
- rollover.

The investigation found no evidence of a broken rail, track misalignment or gauge spread.

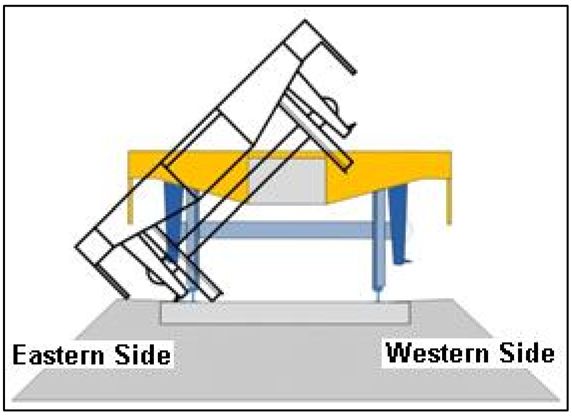
Although there was widespread flooding adjacent to the derailment site the track was intact. All culverts protecting the site were undamaged and there was no indication of track failure due to wash-away or sub-grade collapse.

An examination of the derailed wagons showed them to be in good condition and unlikely to have been a factor in the derailment.

Although the wheel flange marking identified in Figure 6 was characteristic of a flange climb derailment, train speed and handling were not considered to be factors that would have given rise to this type of derailment and were discounted accordingly.

Wheel contact damage on the field side (eastern rail) of the sleepers was close to the POD. Damage beyond this point was more representative of scrape marks caused by a bogie side frame (Figure 7 and Figure 9) as it rotated into the ballast and then pushed the eastern rail in towards the western rail.

Figure 9: Overlay of rolled FQWY wagon



On examining the western rail (gauge side opposite the POD) there was no evidence of damage to resilient clips, steel resilient clip anchor housings and sleepers within the four foot. This tended to suggest that complete wheel unloading had occurred on the west facing side of wagon FQWY 00019W.

A further examination of the derailment site established that there were many locations where the ballast profile on the field side of the eastern rail was only disturbed by the side frame of well-wagons when they rolled over. In these locations (Figure 7) ballast was not dragged along the length of the track, therefore it was reasonable to conclude that wagons, particularly those located towards the rear of the train, had slowed down substantially and were almost stationary at the time they rolled over.

11 Severe Thunderstorm Risks - Bruce Harper, Ken Granger and Sarah Hall

Wind induced lateral forces; especially those acting on the side of wagons can contribute significantly to body roll and may cause wagons to rollover as identified by the ATSB in two of its previous reports, Mt Christie in South Australia on 1 September 2008 (RO-2008-010) and Loongana in Western Australia on 11 November 2008 (RO-2008-013).

In the absence of evidence to the contrary, the ATSB examined the possibility that severe wind forces at the time of the derailment may have led to a wagon rollover scenario.

Centre of gravity and wind force

Wind force and mass distribution

The combined wind force acting on the side of a train is a result of the effects of atmospheric wind (weather) and induced wind, due to the train's movement. In the two previous ATSB investigations it was concluded that:

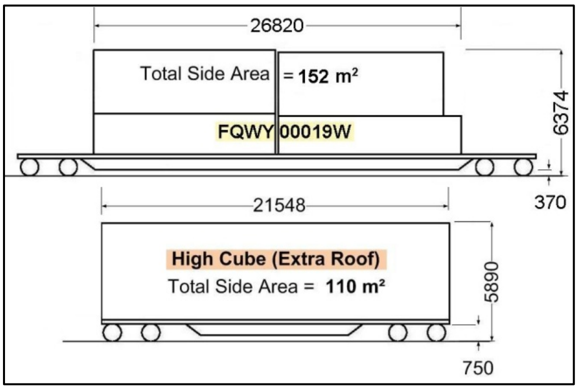
> The side of a double stacked container wagon will act like a sail when considering wind induced lateral forces acting on a wagon. As the combined side area of a loaded wagon increases, so too will the resultant wind force acting on the wagon.

Practical experience and calculations[12] have established that wind induced forces, acting on the side of a train increase in magnitude as the atmospheric wind progressively nears an angle of 90 degrees to the direction of train travel.

The drivers' in their statement mention that the wind was blowing onto the right-hand-side of the train at the time of derailment. Site observations also confirmed that the train was generally derailed to the eastern side of the track consistent with the direction of atmospheric wind induced forces exerted on the train's right-hand-side.

12 Calculations were based on research done by the RMIT University 'An Experimental Investigation of Aerodynamic Properties for Rollover Risk of Double Stacked Container Wagons' and the Australian Standard AS 7509.2, titled *Railway Rolling Stock - Dynamic Behaviour – Part 2 – Freight Rolling Stock*.

Figure 10: Wagon profile and area comparison



The investigation found that wagon FQWY 00019W was loaded with two containers (14.63 m x 3.00 m and 12.19 m x 2.89 m) located in the bottom position and two containers (both 12.19 m x 2.89 m) located in the top position. This configuration exposed a significant side area of 152.26 m² (Figure 10) to the gust front.

When wind acts on the side of a rail wagon, the force exerted by the wind induces an overturning moment on the wagon. This is opposed by a restraining moment due to the weight of the wagon. Overturning and restraining moments are a function of the force and the distance that force acts from a pivot point.

Based on data provided by GWA, the 'Container Manifest Report' dated 25 November 2010, it was calculated that the vertical centre of mass for wagon FQWY 00019W was about 1400 mm above rail level. This conforms to the CoP Freight Loading Manual which states:

> For the interstate routes, the height above rail level of the combined centre of mass of the vehicle and its load shall not exceed 2500 mm without a special authorisation from the access provider.

Calculations established that the wind force needed to cause 100% wheel unloading of wagon FQWY 00019W travelling at a speed of 70 km/h was about 120 km/h. As previously identified by the ATSB static and dynamic wind force calculations do not take into account the tilting of a wagon body on the bogie suspension, nor do they consider the transmission of forces from adjacent wagons. Both of these factors could increase the risk of wheel unloading at wind speeds lower than those calculated.

Calculations also established that had train 4DA2 been stationary 100% wheel unloading would have occurred at about 140 km/h which is approaching the upper limit of thunderstorm generated gust fronts.

Summary

It was concluded that at the time of derailment a severe weather event, associated with thunderstorm activity, had generated significant atmospheric winds that probably exceeded 80 km/h and may well have been up to 160 km/h. The wind was determined to be blowing on the right-hand-side of the train and this would have generated the greatest overturning affect.

With wagon FQWY 00019W travelling at a speed of 70 km/h dynamic wind force calculations established that a wind speed of about 120 km/h would have caused 100% wheel unloading, triggering the derailment of train 4DA2. The effect of dynamic vehicle oscillation would have accentuated any overturning moment effectively lowering the required wind force needed to capsize a wagon.

Examination of the 'Container Manifest Report' established that almost all derailed wagons were double stacked and relatively lightly loaded.

Double stacked container wagons are at higher risk of wind induced rollover. This is a direct reflection of exposed side area, and was therefore exacerbated by any out of gauge/high load with a large exposed surface area.

In this instance there were no examples of heavy loading of upper containers adversely affecting vehicle centre of gravity.

The profile of the disturbed shoulder ballast and in the absence of any evidence to the contrary it is likely that wind induced rollover was the most likely initiator for the derailment of train 4DA2.

Identifying severe weather events

There is limited opportunity for detecting severe weather events along much of the Central-Australia Railway line. Automatic BoM weather stations such as those located at Coober Pedy and Marla only transmit half-hourly weather information and on this occasion neither location was in the direct path of the severe weather event that occurred near Cadney Park. Further, severe winds associated with thunderstorm activity are often erratic in nature and are typically of short duration, about 10 minutes, making it hard to predict when and where they occur.

Although severe weather events cannot always be accurately predicted/detected it is nevertheless desirable that operators have timely access to reliable weather information so that they can pre-warn drivers of any weather related risk. It would also be of benefit to provide drivers with an understanding of severe weather events and actions and strategies that they can take to mitigate associated derailment risk.

GWA may therefore benefit by building closer relationships with the BoM and local observers (councils, farmers, etc.) who could pass information to assist them with the identification of localised severe weather events and driver education targeted at understanding weather related risks.

ATSB - previous observations

In its previous reports the ATSB has identified a number of factors that should always be considered in reducing a wagon's risk of wind induced rollover, these include:

- Reduce the combined side area of a loaded double stacked container wagon.
- Keep a wagon's combined centre of area as low as practical and evenly distributed across the width of the vehicle.
- Avoid double stacking two large but empty containers onto any one wagon or platform.

FINDINGS

Context

At about 0618 on Thursday 25 November 2010, freight train (4DA2) operated by FreightLink Pty Ltd derailed on the Central-Australia Railway line, near the 826 km mark, about 5 km south of Cadney Park in South Australia.

Based on available evidence, the following findings are made with respect to the derailment but should not be read as apportioning blame or liability to any particular individual or organisation.

Contributing safety factors

- At the time of derailment a severe weather event, with very strong winds, was probably of sufficient magnitude to initiate the rollover and subsequent derailment of lightly loaded double-stacked container wagons on train 4DA2.
- Double stacked container wagons are at higher risk of wind induced rollover. This is directly related to exposed side area, and was therefore probably exacerbated by out of gauge/high loads on some wagons with a large surface area exposed to the gust front. *[Minor safety issue]*

Other safety factors

- Train drivers receive no formal training with respect to understanding severe weather events, the associated derailment risk and mitigation strategies. *[Minor safety issue]*

Other key findings

- There was no evidence to suggest that any track or rolling-stock defect contributed to the derailment of train 4DA2.
- There was no evidence to suggest that inappropriate train handling contributed to the derailment of train 4DA2.
- There were no examples of heavy loading of upper containers adversely affecting vehicle centre of gravity.

SAFETY ACTION

The safety issues identified during this investigation are listed in the Findings and Safety 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.

Depending on the level of risk of the safety issue, the extent of corrective action taken by the relevant organisation, or the desirability of directing a broad safety message to the rail industry, the ATSB may issue safety recommendations or safety advisory notices as part of the final report.

Genesee & Wyoming Australia Pty Ltd

Effects of wind load on rail wagons

Minor Safety Issue

Double stacked container wagons are at higher risk of wind induced rollover. This is directly related to exposed side area, and was therefore probably exacerbated by out of gauge/high loads on some wagons with a large surface area exposed to the gust front.

Action taken by Genesee & Wyoming Australia Pty Ltd

> GWA acknowledges that double stacked container wagons are at a higher risk of wind induced rollover due to the large surface area they present. GWA has considered it's options in relation to the double stacking of containers and has adopted a loading protocol which is designed to minimise the potential for wind induced rollover by requiring that the heaviest container in any double stacked configuration is loaded on the bottom. This practice is designed to reduce the wagon/loading centre of gravity to levels that are as low as reasonably practicable.

ATSB assessment of action

The Australian Transport Safety Bureau is satisfied that the action proposed by Genesee & Wyoming Australia Pty Ltd will adequately address the safety issue.

Identification of severe weather events

Minor Safety Issue

Train drivers receive no formal training with respect to understanding severe weather events, the associated derailment risk and mitigation strategies.

Action taken by Genesee & Wyoming Australia Pty Ltd

> GWA will engage a specialist service provider to monitor and issue warnings of the formation of severe weather events which have the potential to impact on the railway network and operations.

In addition, GWA will develop an education program for delivery to its train crews which aims to provide them with the skills required to identify and respond appropriately to potentially severe weather events.

ATSB assessment of action

The Australian Transport Safety Bureau is satisfied that the action proposed by Genesee & Wyoming Australia Pty Ltd will adequately address the safety issue.

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:

- Genesee & Wyoming Australia Pty Ltd
- South Australian Railway Safety Regulator
- Train drivers.

Submissions were received from:

- Genesee & Wyoming Australia Pty Ltd

The submissions were reviewed and where considered appropriate, the text of the report was amended accordingly.

Sources of Information

Information for this report was obtained from:

- Bureau of Meteorology
- Genesee & Wyoming Australia Pty Ltd

References

- An Experimental Investigation of Aerodynamic Properties for Rollover Risk of Double Stacked Container Wagons (RMIT University)
- Glossary for the National Codes of Practice and Dictionary of Railway Terminology
- ATSB Investigation: RO-2006-012 'Derailment of Train 3DA2K – Tarcoola, SA 1 November 2006' and
- ATSB Investigation: RO-2008-013 'Derailment of train 2PM6 – near Loongana, Western Australia 11 November 2008'
- Severe Thunderstorm Risks - Bruce Harper, Ken Granger and Sarah Hall