Australian Government
Australian Transport Safety Bureau

Australian Transport Safety Bureau
PO Box 967, Civic Square ACT 2608
Australia

1800 020 616

+61 2 6257 4150 from overseas

www.atsb.gov.au

Publication Date: 29 February 2012

ISBN 978-1-74251-254-7

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

ATSB TRANSPORT SAFETY REPORT
Rail Occurrence Investigation RO-2011-019
Preliminary

Derailment of freight train 7AD1 at Edith River near Katherine, Northern Territory

27 December 2011

Figure 1: Derailment site, looking south towards Katherine, crew van in foreground.

Abstract

At approximately 0542[1] on 27 December 2011, freight train 7AD1 derailed at the rail bridge over the Edith River near Katherine in the Northern Territory (NT).

As a result of the derailment, the co-driver suffered minor injuries. The train driver was unhurt. There was significant damage to the bridge and rolling-stock and a number of wagons, including the crew van which was unoccupied at the time, derailed into the river (Figure 1, 29 December 2011).

The derailment was the result of a severe weather event, a tropical low, which formed on December 26 after tropical Cyclone 'Grant' crossed the coast. The tropical low resulted in torrential rains falling in the vicinity of Katherine causing severe flooding of the Edith River. The flooding was sufficient to cause catastrophic damage to the southern bridge embankment which initiated the derailment of train 7AD1 as it traversed the bridge.

The investigation is continuing.

The information contained in this preliminary report is derived from the initial investigation of the occurrence. Readers are cautioned that it is possible that new evidence may become available that alters the circumstances as depicted in the report.

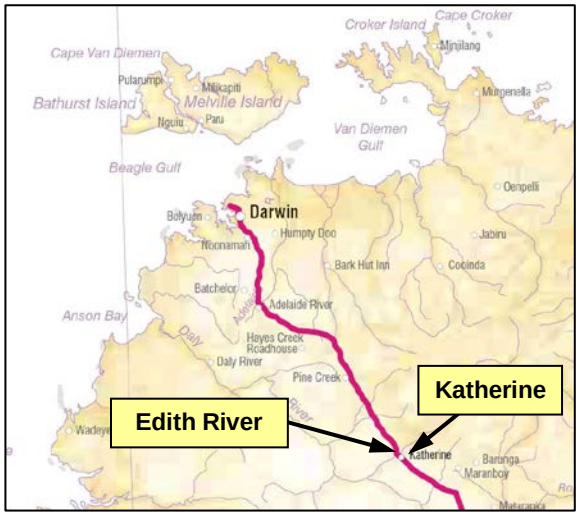
1 The 24-hour clock is used in this report to describe the local time of day, Central Standard Time (CST), UTC +9:30 hours, except where otherwise specified as Central Daylight-saving Time (CDT), UTC +10:30 hours.

FACTUAL INFORMATION

Location and environment

The derailment occurred on the Central-Australia Railway line at the 2490.670[2] km mark, the southern embankment of the Edith River rail bridge. The rail bridge is located about 42 km north-west of Katherine and approximately 250 m to the northeast of the Stuart Highway.

Figure 2: Location of Edith River.



Geoscience Australia. Crown Copyright ©.

Approaching the bridge from a southerly direction, the track, although relatively flat, comes off a sweeping left-hand curve which limits sighting of the bridge until a train is relatively close, about 400 m.

Track and bridge structure

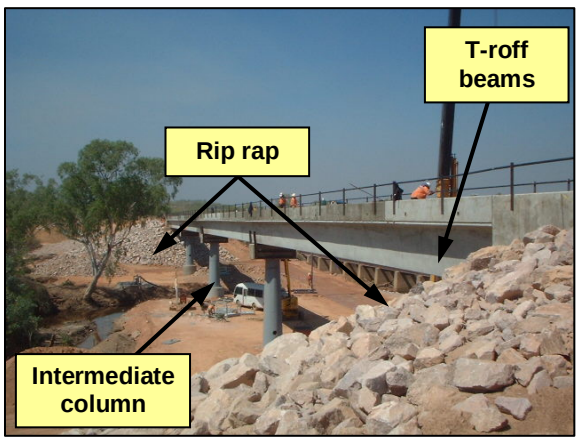
The Alice Springs to Darwin section of the Central-Australia Railway line consists of a bi-directional single line with crossing loops (short sections of double track) provided at regular intervals to allow trains to cross (travelling in opposing directions) or pass (travelling in the same direction) each other.

The standard gauge (1435 mm) track comprises 50 kg/m continuously welded rail (CWR) fastened to concrete sleepers using resilient clips. The track structure has a ballast bed with a minimum depth of 150 mm supporting prestressed concrete sleepers spaced at approximately 700 mm centres.

The Edith River rail bridge was constructed as part of the Alice Springs to Darwin rail project and completed early in August 2002. It was one of five new major rail bridges built as part of the project, for crossing the Elizabeth, Adelaide, Cullen, Edith and Katherine rivers. The bridges were each constructed with simply supported 30 m spans, comprising pre-tensioned concrete T-roff beams (T shaped beams) and a composite deck slab.

The Edith River rail bridge was a 120 m long structure, divided into four sections each of 30 m in length. The supporting structures comprise three intermediate tapered steel columns carrying precast concrete headstocks. The steel columns were in turn supported on a concrete column/footing combination anchored into the river bedrock. These columns had a nominal height of 8 m, including the headstock, above the river bed. At each end of the bridge, the T-roff beams were supported by a concrete headstock/column (pier) combination mounted on a concrete footing with integrated wing-wall. The north and south track lead-in embankments and bridge end support structures were protected by rip raps[3] to guard against scour damage caused by water erosion (Figure 3).

Figure 3: Edith River rail bridge under construction.



Brooklyn Engineering Pty Ltd Copyright ©.

The scheduled inspection and maintenance functions for the track infrastructure, including the Edith River bridge and approach structures, are

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

3 Rip rap: Rock or other material used to armour bridge abutments, pilings, etc against scour damage caused by water erosion.

provided by BJB Joint Venture (BJB) under contractual arrangements with Genesee & Wyoming Australia (GWA), the track owner.

Train information

Freight train 7AD1 was a regular GWA operated service consisting of three locomotives (GWA001 leading followed by FQ02 and CLF6 trailing) hauling 33 freight wagons (six of which were 5-pack vehicles)[4]. The train was hauling mixed freight comprising container flat wagons and 15 CQXY class wagons carrying 1500 dry t. of copper concentrate (advised by GWA and OZ Minerals Ltd). Copper concentrate is classified as environmentally hazardous, by the National Occupational Health and Safety Commission, mainly because of its adverse effects on the aquatic environment.

Train 7AD1 was 1352 m long and had a trailing mass of 4296 t.

Weather

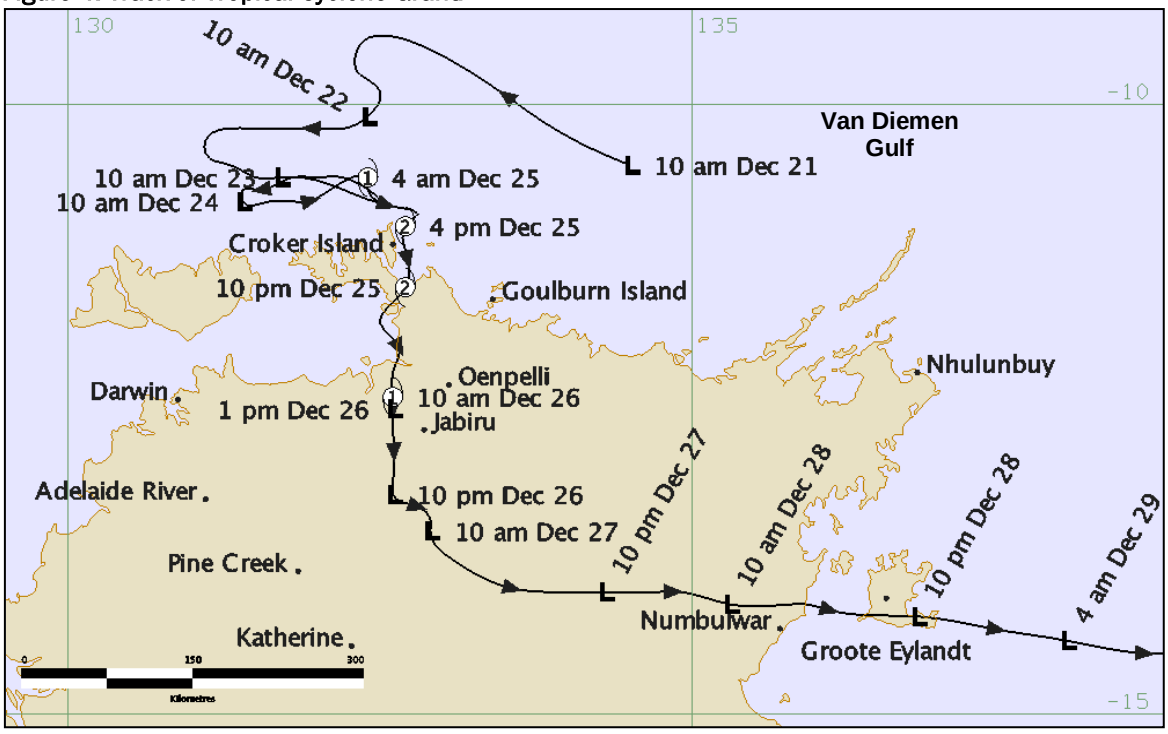
In the 48 hour period preceding the derailment, a tropical cyclone, 'Grant' (Figure 4) had developed and then crossed the coast about 150 km east of Darwin in the Northern Territory.

After the cyclone crossed the coast heading south towards Katherine it began to weaken before becoming a tropical low. As the tropical low moved inland and southwards, it produced significant rainfall throughout the Edith, Cullen, Fergusson and Katherine river catchments, with recorded falls being as high as 385 mm in the 24 hours to 0900 on the 27 December 2011, at Edith Falls Ridge, about 32 km north of Katherine.

The occurrence

On Wednesday 21 December 2011 at about 1000 the Bureau of Meteorology (BoM) in Darwin identified the existence of a tropical low off the northern coast of Australia that would potentially develop into a cyclone. The movement and strength of the system was monitored by the BoM with regular alerts being publicly issued. On Saturday 24 December at 1735 the BoM upgraded a previously issued 'Tropical Cyclone WATCH' to a 'Tropical Cyclone WARNING' covering the Darwin area. Tropical cyclone 'Grant' was publically declared.

Figure 4: Track of Tropical Cyclone Grant.



Bureau of Meteorology. Crown Copyright ©.

4 5-pack: An articulated wagon comprising five platforms, the adjacent ends of individual units being supported on a common bogie and permanently connected by a device which permits free rotation in all planes. Example: 5-pack Articulated Wagon. Note, these do not always consist of five units; they could be 2-packs, 3-packs etc.

Source: ARA Glossary for the National Codes of Practice and Dictionary of Railway Terminology.

Train 6AD1 (service preceding) and train 7AD1 (service that derailed) both originated at the Adelaide Freight Terminal, (AFT) South Australia, with a final destination of the Berrimah Freight Terminal (BFT) in Darwin. Train 6AD1 was scheduled to depart Adelaide at 2350 on Friday 23 December and arrive at the BFT at 1710 on Sunday 25 December. Train 7AD1 was scheduled to depart Adelaide at 1500 on Saturday 24 December and arrive at the BFT at 0940 on Monday 26 December.

Staff from GWA had been actively monitoring the BoM weather alerts with respect to the scheduling of its train movements. Following the issue of the 'Tropical Cyclone WARNING' GWA management set in motion the organisation's 'Cyclone Response Plan'. As part of the GWA response plan locomotives and rolling-stock located at the BFT in Darwin were moved to the Union Reef siding located about 200 km south of Darwin. Trains 6AD1 and 7AD1 were held at Katherine and Alice Springs respectively until the cyclone threat had passed. Cyclone Grant continued to move south initially crossing the coast, as a category 2 cyclone, near Croker Island about 230 km northeast of Darwin, at 2230 on the 25 December. The cyclone then travelled south/southwest over the eastern portion of the Van Diemen Gulf and recrossed the coast 150 km east of Darwin. As the cyclone moved further inland it weakened initially to a category 1 cyclone and then was further downgraded to a tropical low at 1353 on 26 December. However, the BoM continued to promulgate severe weather and flood warnings that in part highlighted:

> HEAVY RAIN is expected to cause localised flooding and significant stream rises over the northern Darwin-Daly, Arnhem and Roper-McArthur Districts.

The tropical low continued to move further south, slowing in the vicinity of Katherine and producing torrential rain in its path.

Staff from GWA continued to monitor the BoM weather alerts and as soon as they assessed that the cyclone risk had diminished, train 7AD1 was authorised to depart Alice Springs for Katherine at approximately 1130 on 26 December. At about the same time GWA staff arranged for BJB staff to inspect the track section between Berrima and Katherine for any evidence of cyclone/flood damage. The inspection did not reveal any significant damage and so GWA management made a decision to resume services between Katherine and Darwin.

A fresh crew was despatched from Darwin to operate train 6AD1 previously held at Katherine. The drivers signed on for duty at the BFT at 1600 on 26 December and then drove to Katherine by road vehicle. Whilst in transit they noted heavy rain and water covering the Stuart Highway in several locations, but considered this to be normal for that time of year. On arrival at Katherine the driver prepared train 6AD1 while the co-driver checked on-line BoM weather information and river depths, noting in particular that river levels were quite low, ranging from between 1.5 m to 2.5 m, for the Edith, Fergusson and Cullen rivers. Train 6AD1 departed Katherine at 2020 after receiving authorisation from the GWA train controller. Prior to departure the controller requested that the crew check the river levels as train 6AD1 traversed each of the major bridge crossings, and report on arrival at the BFT. Train 6AD1 passed over the Edith River rail bridge at about 2220 followed closely by the Fergusson and the Cullen river rail bridges. As the train traversed each bridge the driver and co-driver shone their torches on the river surface and observed the river heights. Train 6AD1 arrived safely at the BFT at 0120 on 27 December with the driver reporting no abnormalities had been observed whilst in transit. Unbeknown to the train drivers, the train controller and other GWA staff, heavy rains from the tropical low had resulted in the rapid rise of the Edith River behind train 6AD1.

Train 7AD1 continued on its northward journey from Alice Springs arriving in Katherine early on Tuesday the 27 December. The train crew (Alice Springs/Katherine) comprised two drivers operating the train with a further two relief drivers[5] resting in a crew van marshalled behind locomotive CLF6. The Alice Springs/Katherine crew departed the train at Katherine.

The crew involved in the derailment, comprising a driver and co-driver, were rostered to take train 7AD1 the short distance through to Darwin and booked on for duty at Katherine at 0500. They inspected the locomotive, checked the train manifest and following authorisation from the train controller departed Katherine at 0510. The

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

journey was uneventful and proceeded without incident until reaching Edith River.

Travelling at a speed of about 80 km/h train 7AD1 approached the 2490 km mark through the sweeping left-hand curve before the Edith River rail bridge.. At about this time the driver selected throttle notch eight and sounded the locomotive horn for the Edith Falls Road level crossing (2490.325 km). On traversing the level crossing he observed a large expanse of flood water, about 0.5 m deep covering the rails over the Edith River rail bridge. He immediately throttled off, warned the co-driver, and both prepared for the imminent water entry.

Figure 5: View from lead locomotive GWA001, looking south towards Edith River, about one hour after the derailment.

Copyright – Driver of 7AD1 ©.

The train continued towards the bridge, shuddering as it collided with the water and then lurching heavily as it advanced onto the bridge structure. Both drivers were thrown violently about in their seats and feared for their safety. The lead locomotive GWA001 continued across the bridge coming to a stand about 800 m beyond the first point of impact with the water on the southern side of the bridge. The lead locomotive was upright but surrounded by floodwaters, about 1 m deep on either side of the track (Figure 5). The crew knew that the train had derailed.

Post occurrence

The driver activated the locomotive radio emergency alarm at 0543 and then communicated with the GWA train controller in Adelaide advising that train 7AD1 had derailed in floodwaters on the Edith River rail bridge. He further advised that although he was uninjured the co-driver had suffered what appeared to be a back injury. The GWA train controller responded by requesting assistance from the Emergency Services and then reported events internally. At about 0800 the floodwaters had subsided enough to allow the train driver to disembark the train and walk back along the track to assess the extent of damage. He determined that the lead locomotive GWA001 although upright had derailed the leading wheel set. Approximately 80 m to the south, the second locomotive FQ02 was upright, all wheels derailed and a further 30 m south, the third unit CLF6 was upright; all wheels derailed. The crew van and the leading portion of the train had derailed into the Edith River.

At about 1000 a rescue helicopter arrived near the derailment site. The driver and co-driver walked over to the helicopter where the co-driver was treated for his injuries. Both the driver and co-driver were evacuated, by helicopter, to the Katherine hospital for further treatment and observation.

Preliminary observations

Investigators from the Australian Transport Safety Bureau (ATSB) were dispatched from Adelaide early on 29 December 2011[6] flying to Darwin and then travelling by road to Edith River, arriving on site at about 1400. Once on site the positions of rolling-stock, containers and track were examined and photographed. The train drivers were interviewed at the Berrimah Freight Terminal, in Darwin on 30 December 2011.

Initial information has determined that:

- The train drivers' were suitably qualified, assessed as competent and medically fit for duty at the time of derailment.

6 Investigators were not dispatched until 29 December 2011 due to site access difficulties.

- The train driver and co-driver were tested for the presence of alcohol by the NT Police, the results were zero.
- The train was travelling at a speed of about 80 km/h as it approached/entered the curve in advance of the Edith River rail bridge. The speed was below the authorised track speed.
- It is highly unlikely that the condition of the rolling-stock or the actions of the train driver, including train speed or braking, were factors that contributed to the derailment.
- The lead locomotive GWA001 followed by FQ02 and CLF6 fortuitously traversed the bridge but the crew van, a number of container flat wagons and 13 of the CQXY class wagons derailed into the river/flood effected area. The owner of the copper concentrate, OZ Minerals, estimated that about 1200 t. of copper concentrate was lost in the derailment.

The investigation is continuing and will include an examination of the following:

- The decisions in relation to dispatching trains 6AD1 and 7AD1 (the derailed train) over the Edith River rail bridge with weather warnings current.
- Bureau of Meteorology and/or other sources of weather/flood information available to GWA preceding the derailment.
- GWA's 'Operational Procedures' for responding to severe weather events.
- GWA driver and operational staff training, in particular related to risk mitigation strategies associated with severe weather events.
- GWA track inspection requirements with respect to detecting flood risks.
- Hydrological studies/calculations and applicable standards used in the design and construction of the Edith River rail bridge.
- Design parameters used for return precipitation events covering major under track bridges e.g. 1 in 100 year precipitation event.
- History of similar events and strategies for mitigating the risks arising from extreme weather events in relation to the safety of train operations.
- The Department of Natural Resources, Environment, The Arts & Sport (NRETAS) is undertaking an investigation into the environmental impacts of the derailment. This aspect of the derailment will not be addressed by the ATSB in its report.
- Northern Territory WorkSafe is conducting investigations into transport arrangements in relation to the *Transport of Dangerous Goods by Road and Rail Act*, This aspect of the derailment will not be addressed by the ATSB in its report.