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Overview

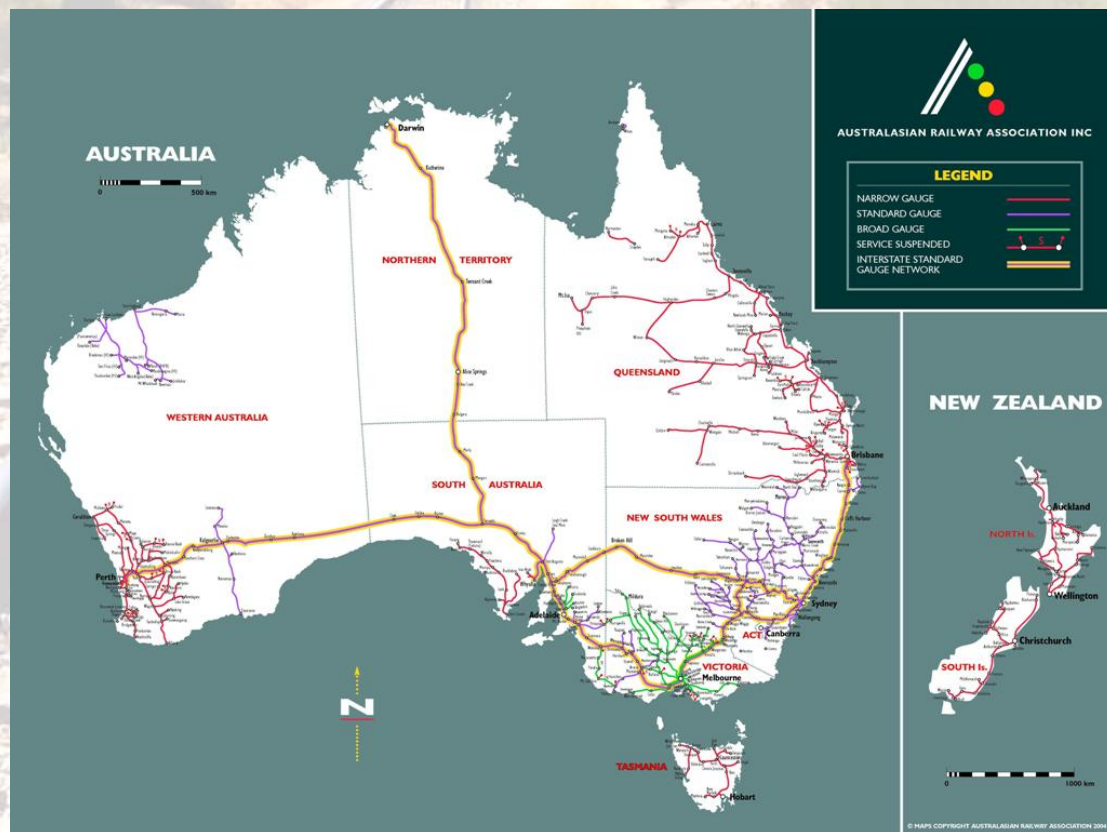
- ATSB rail investigations of level crossing collisions
- level crossing collision case study

Fountain Head Road, Ban Ban Springs NT, 12 December 2006
(Thank you Larry Matters)



Level Crossing Collision Investigations by ATSB 2002 to 2008

- SA
 - Birkenhead 2008 *
 - Salisbury 2002
 - Tailem Bend 2006
 - Two Wells 2007 *
 - Virginia 2 x 2007 *
 - VIC
 - Albury 2006
 - Benalla 2002
 - Horsham 2005
 - Lismore 2006
 - Wingeel 2006
 - NSW
 - Illabo 2006
 - Back Creek 2007 *
 - WA
 - Kalgoorlie 2007
 - NT
 - Ban Ban Springs 2006
 - Elizabeth River 2006
 - QLD
 - Aloomba 2003
- * ongoing



Railway Safety

- Difficult to compare past rail occurrence data due to differences in data collection/classification across 6 States & NT

Analysis of 'US Railroad Safety Statistics & Trends' 1979-1998 *

- US railroads dramatically improved safety over last 2 decades
- Railroads compare favourably with other industries & transport modes
- The most troubling railroad safety problems arise from factors largely outside railroad control
 - trespassing on railways
 - vehicle drivers not stopping at level crossings
 - influence of alcohol use
- Railroads have implemented numerous & effective technological improvements & company-wide safety

* *US railroad Safety Statistics & Trends*, P W French, 20/9/99, Association of American Railroads as quoted in *Know The Risk*, RB Duffey & JW Saull, 2003, Butterworth-Heinemann

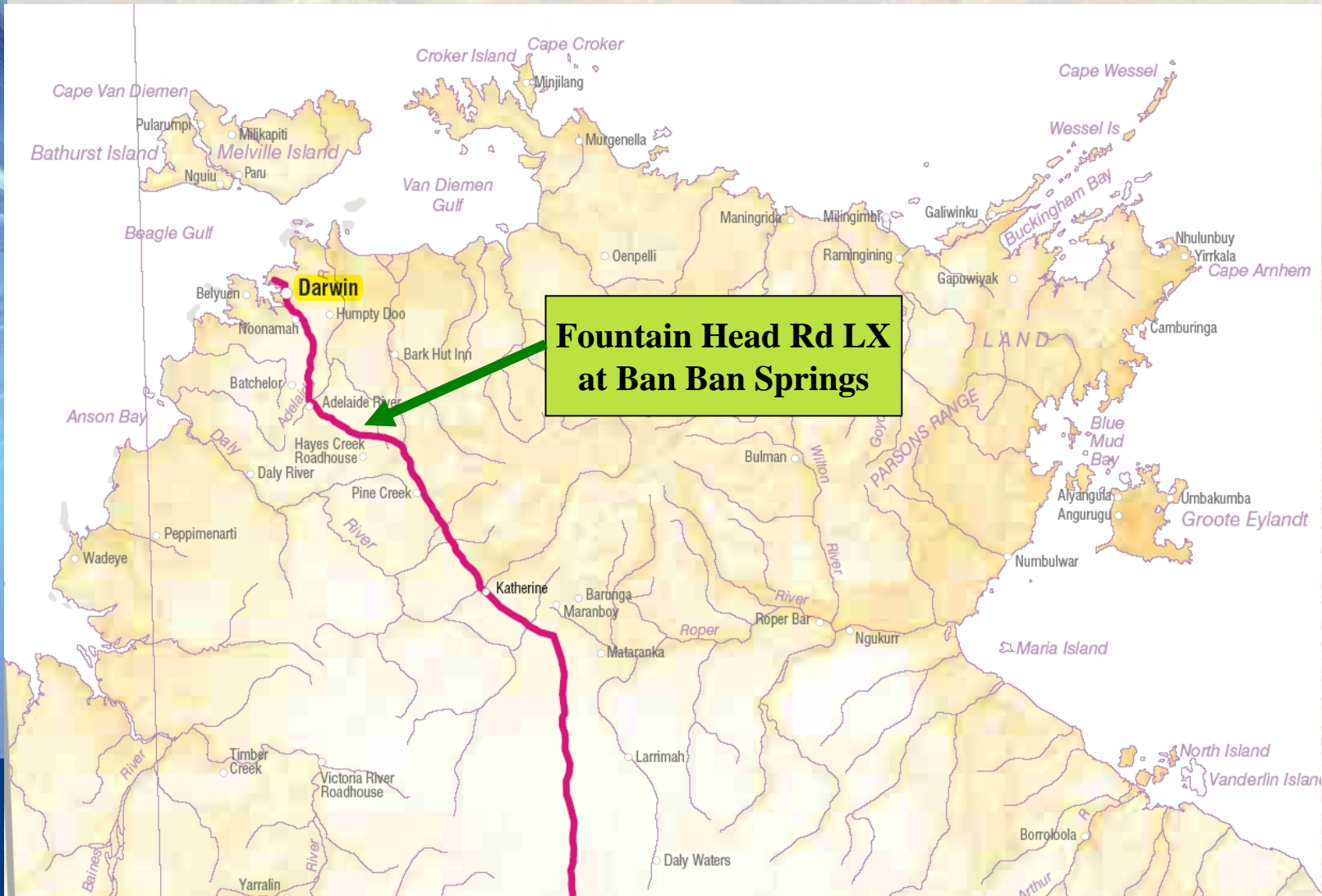


Major level crossing collision at Ban Ban Springs at 1356 on 12/12/06

- Both locomotives, motorail wagon and nine passengers coaches derailed as a result of the collision
- No fatalities
- Injuries incurred were mainly superficial, but a female passenger collapsed and lapsed into unconsciousness about 15 minutes after the collision. The unconscious passenger and the truck driver were the only persons admitted to hospital
- The road-train truck was damaged beyond repair
- The lead locomotive incurred extensive structural damage, two passenger coaches were damaged beyond repair
- About 280 metres of rail infrastructure was extensively damaged.



Ban Ban Springs



The road-train truck & task

- The road-train truck combination was a 1994 Mack prime mover hauling two side tip trailers
- The combination was 36 metres long. The two trailers were empty, the gross combined mass was 26 tonnes
- The company that owned the combination had been contracted by a local mining company to build a private access road from the Stuart Highway to its Brocks Creek mine
- This task involved conveying multiple loads of 'road-base' from a disused mine to the road under construction (about 12 km)
- Three road-train truck combinations were employed on this task. All were similar to the combination involved in the accident
- Each combination travelled about 15 round trips per day, each round trip crossed the Fountain Head Road level crossing twice.



The road-train truck & task (cont)

- This equals about 30 movements across the level crossing per driver, about 90 for the three trucks every day
- This task had been performed continuously for about a month before the accident
- Including travel time to the site, the road-train drivers worked from 0600 until about 1700 seven days a week
- Therefore, each road-train driver would have traversed the Fountain Head Road level crossing somewhere in the order of 800 times over the month
- The road-train driver involved in the accident said he had only seen four freight trains during this period
- He did not have to alter his driving pattern for any of these trains.



The Ghan

- Powered by an AN and NR class locomotive
- One motorail wagon, 13 passenger carriages and a luggage van
- Length 425 metres, weight 1022 tonnes, maximum speed 110 km/h
- 64 passengers, 13 on-train staff and four train drivers
- Very experienced train driver – 30 years on locomotives, 20 as a driver, mainly in NSW. Had driven the Alice Springs to Darwin corridor almost since the opening in 2004
- Second driver was an Adelaide based Driver Trainer, was learning the route from Alice Springs to Darwin
- Had a valid train order authority to be on the section of track where the Fountain Head Road level crossing is located.

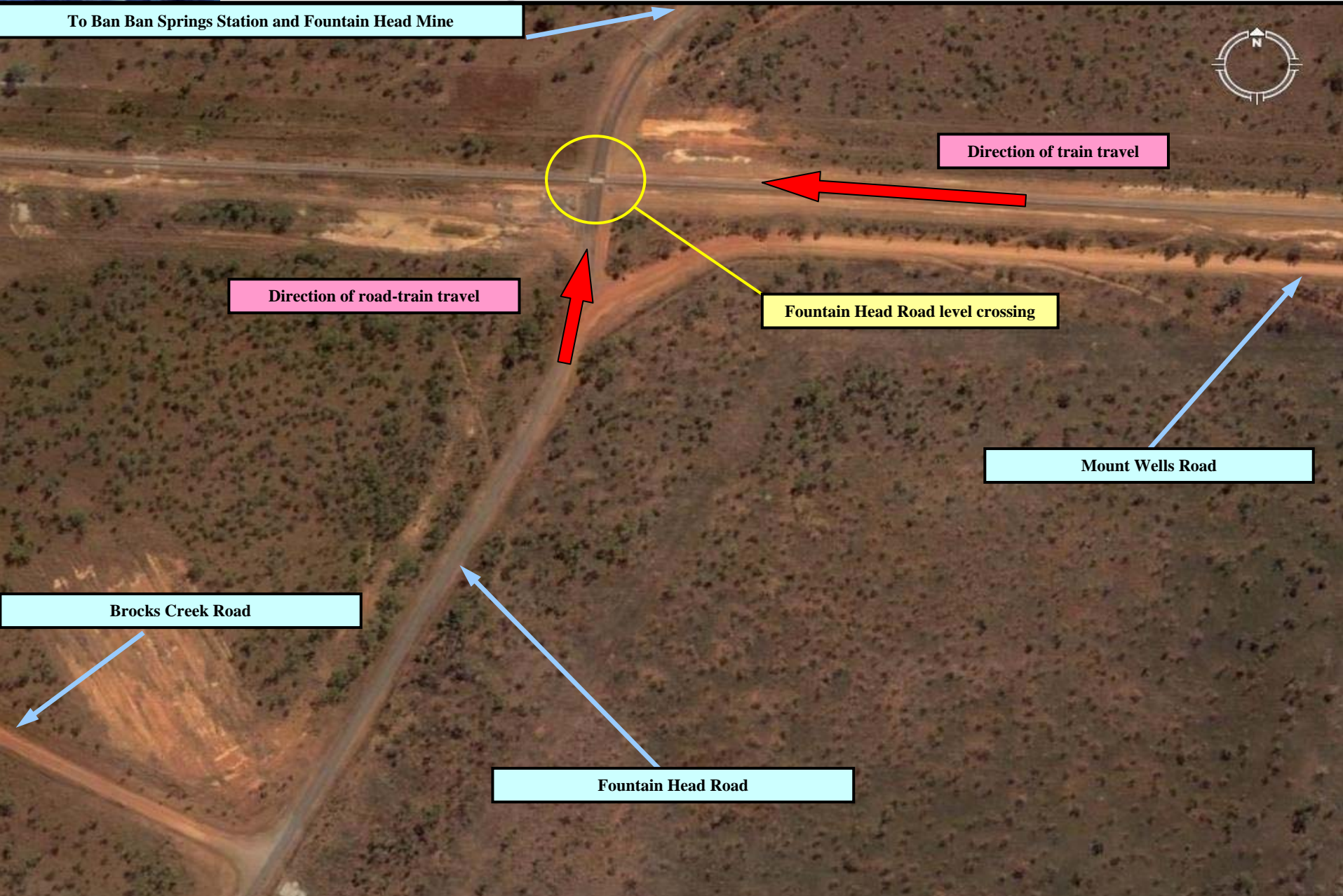


The Fountain Head Road level crossing at Ban Ban Springs

- Public level crossing
- Passive level crossing, controlled by 'Stop' signs.
- Fountain Head Road is oriented North - South, it intersects the rail line at 90 degrees
- Sighting distance from the Stop Line is about 1200 metres to the East and about 1000 metres to the West
- However, there is a mound of dirt and trees that prevents a driver of a northbound road vehicle from seeing along the track to the east until about 17 metres from the level crossing Stop sign. This is the direction that the road-train and *The Ghan* were travelling
- Although not as restricted, there is also a limited view from the opposite side of the level crossing along the line to the West.



Fountain Head Road level crossing.



To Ban Ban Springs Station and Fountain Head Mine



Direction of train travel

Direction of road-train travel

Fountain Head Road level crossing

Mount Wells Road

Brocks Creek Road

Fountain Head Road

Leading to the accident - the road-train

- Had unloaded road base at the head of the road construction and was returning empty to Fountain Head Mine
- Weather very hot, cab windows up, air conditioning on
- Road-train driver stopped several hundred metres from the level crossing to close a gate on the leading trailer
- Started off again, was just changing to the 'high-box' as entered the level crossing
- Estimated his speed to be 20 – 30 km/h. Did not stop at the Stop sign
- First sighting of train was when he heard the train horn and turned his head 90 degrees to the right
- Applied power to try and get the prime-mover clear.



Before the collision - *The Ghan*

- Train was travelling at about 110 km/h under partial power, slight undulating upgrade
- Driver said headlight was illuminated
- Said he sounded horn twice, once at the whistle board and again closer the level crossing
- Saw a road-train approaching the level crossing at an estimated 50 km/h, could see the top of the vehicle over the mound of grass and shrubs
- Knew a collision was imminent, made an emergency application of the trail brake with his left hand, blew the whistle with his right had
- Yelled a warning for the second driver to hit the floor.



The accident

- Impact point was immediately behind the prime-mover cab
- Prime mover separated to the right of the track, the two trailers to the left of the track
- The lead locomotive broke away from the second locomotive and continued 440 metres with five of the six wheel-sets derailed
- Both locomotives, the motorail wagon and nine passenger carriages derailed
- Extensive damage to the locomotives
- Road-train truck written off
- Extensive damage to the track
- No major injuries.



Road-train separated either side of track



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Accident site



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Analysis - Key questions

- Did the train have authority to occupy the section of track and was it being driven in accordance with the rules and procedures?
- Were the emergency response measures adequate?
- Was the crashworthiness of the locomotive and carriages adequate?
- Were the level crossing warning signs and sighting distances in accordance with the standards?
- Why did the road-train driver not stop?
- Medical standards, how do road and rail compare?
- Road-train clearance times, level crossings.



Operation of *The Ghan*

- *The Ghan* had a valid train order
- The train crew said the horn was operated and that the headlight was on
- The driver said that at first sighting he simultaneously placed the train brake in the emergency position and again operated the horn
- Logger of locomotive AN 5 did not record several parameters correctly or at all (throttle position, brake-pipe pressure and headlight and time)
- Correlation necessary with NR 109 however, still no recording of headlight on AN 5
- Later testing of the horn revealed that it met the minimum requirements of the Draft Code of Practice for the DIRN (Rollingstock).

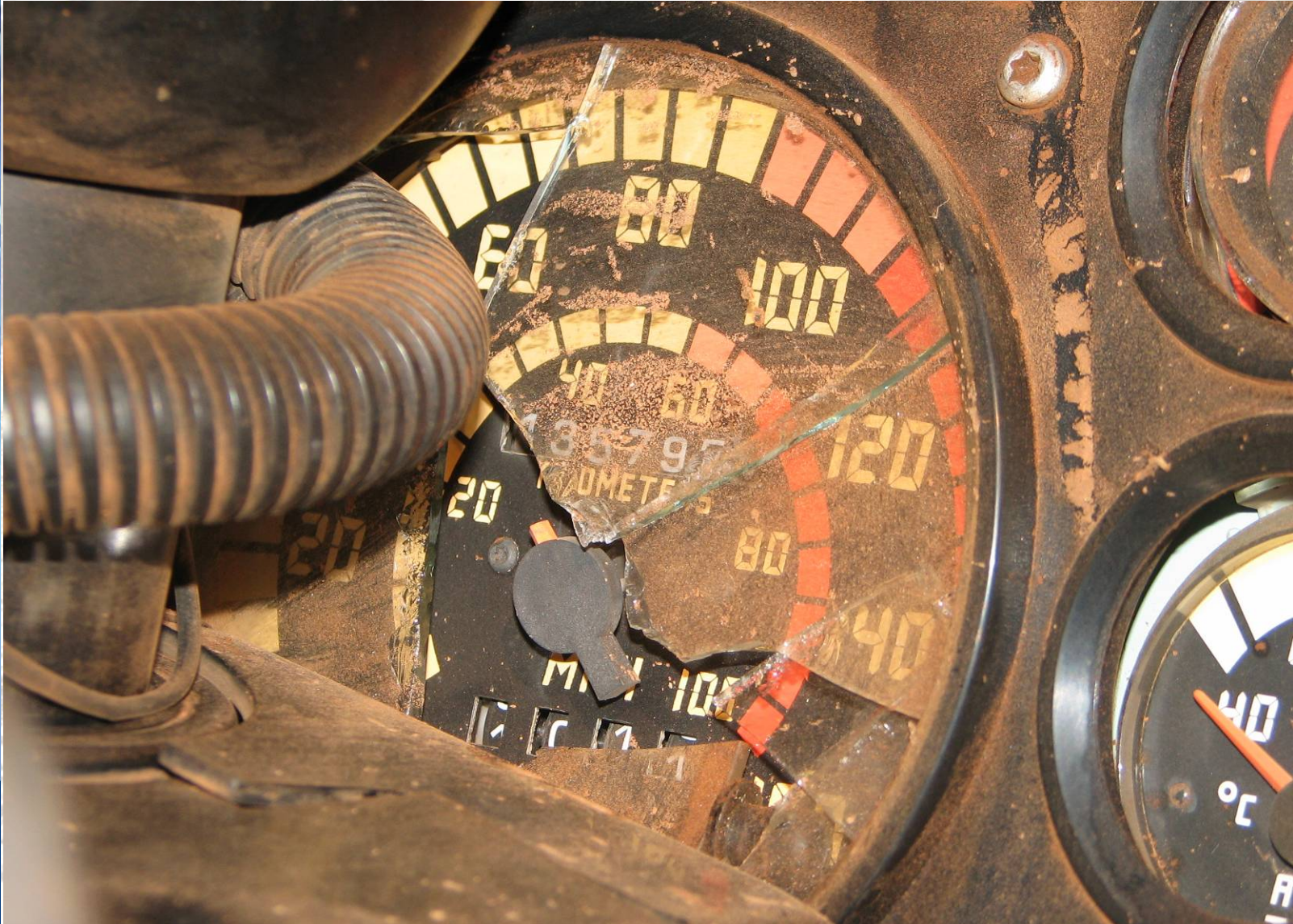


Speed of the road-train

- Train driver estimated he first saw the road-train when it was 100 metres from the level crossing, over a mound of dirt and scrub on the southern side of the level crossing.
- The train driver estimated the speed to be about 50 km/h
- The road-train driver said he had stopped 200 to 300 metres from the level crossing to close a door on the leading trailer. He said he then accelerated to the extent that he had just changed to the 'top box' gear range. He estimated his speed at the level crossing to be 20 to 30 km/h
- The road-train speedometer needle was stuck at about 50 km/h



Road-train speedometer



Emergency response

- First on scene was the Ban Ban Springs station manager and his son who were mustering cattle in a Robinson R22 helicopter
- They flew to the GBS Gold Mine Site several km away
- Meanwhile, GSR staff and the 'resting' train drivers extinguished line-side fires. GSR staff also accounted for the passengers
- GBS Gold responded with company ambulance, fire truck paramedics and other medically qualified personnel and were on site in about 20 minutes
- No serious injuries but, about 15 minutes after the accident, a woman lapsed into unconsciousness
- GBS Gold transferred passengers to their employee/contractor Cosmo Camp (about 15 km away) commencing at about 1515.

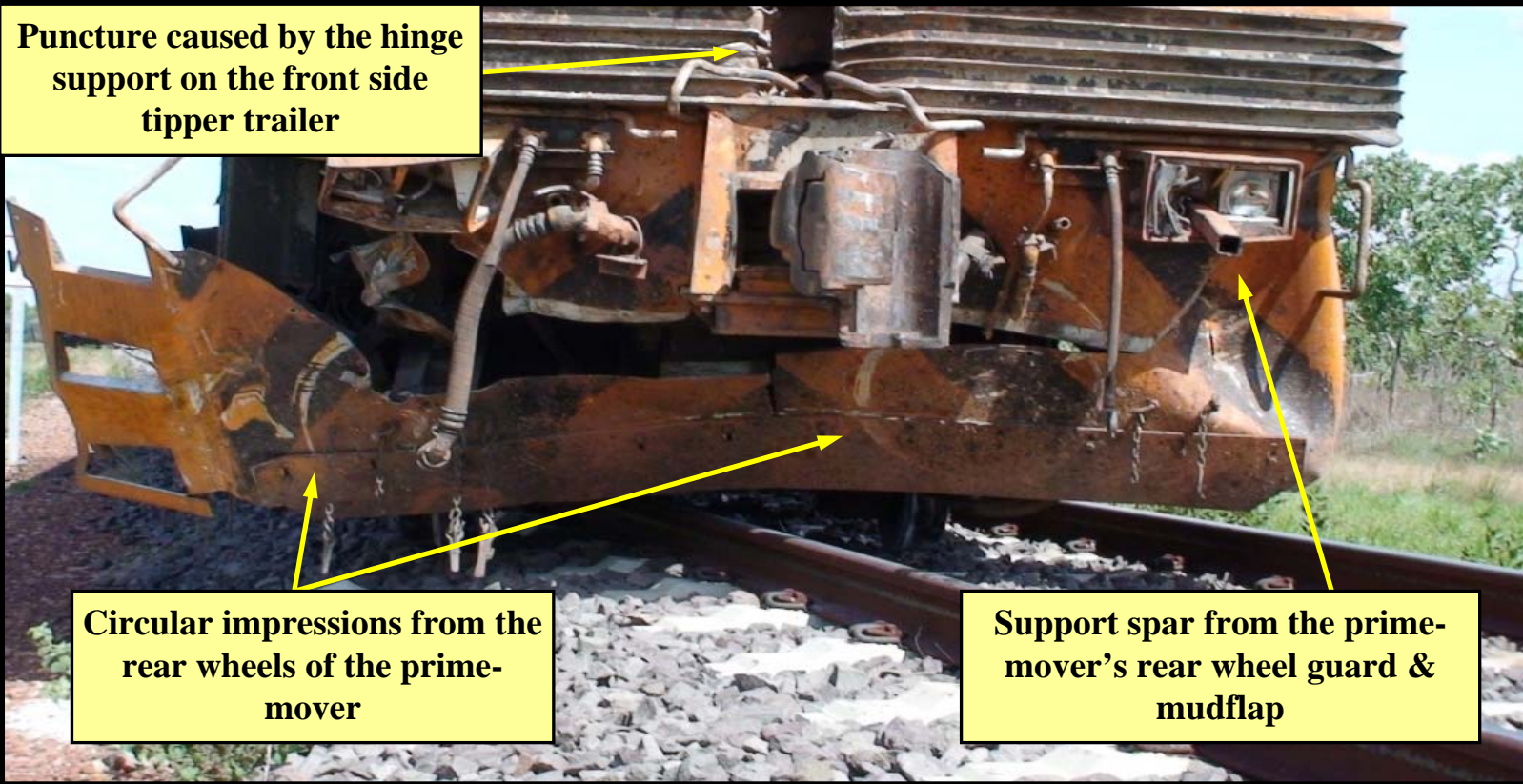
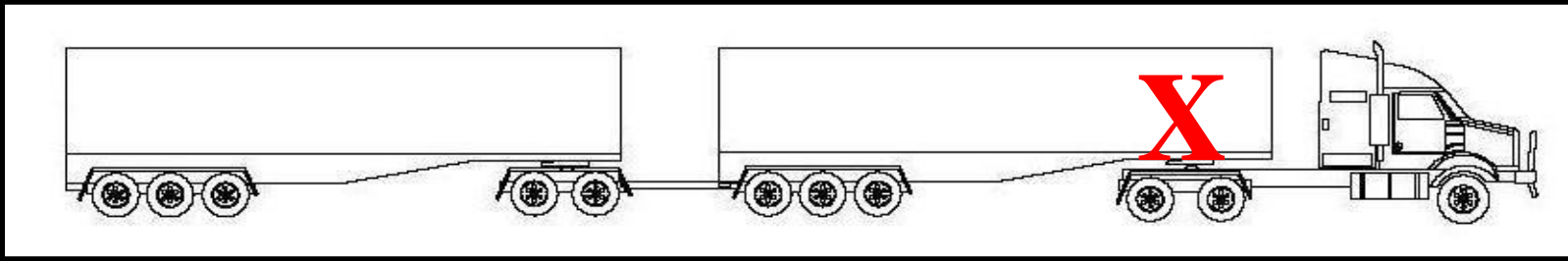


Crashworthiness

- Seven of the ten vehicles that derailed were passenger carriages
- No fixtures such as seating, tables, chairs fixed panels, windows etc dislodged
- Loss items such as crockery, kitchen utensils etc were thrown about
- Only one carriage exit door jammed, this was forcefully opened
- Apart from walkways between the carriages, occupant safety was not compromised by failed structural components
- The lead locomotive was damaged at the point of impact at the cowcatcher/skirt and at the side by the whipping motion of the road-train trailers
- The crew cab was not breached or compromised
- A key factor in this was that despite continuing 440 metres with only one wheel-set railed, the locomotive remained upright.



Point of impact



Puncture caused by the hinge support on the front side tipper trailer

Circular impressions from the rear wheels of the prime-mover

Support spar from the prime-mover's rear wheel guard & mudflap



Level crossings, NT

- The Fountain Head Road level crossing is a public level crossing. There were some minor non-conformances in signage and road markings, but these were not considered causal to the accident
- There are 171 level crossings between Alice Springs and Darwin. 145 are passively controlled. Of this 145 only 21 are public level crossings (124 are occupational crossings)
- It was decided that Stop sign control would be the default level of passive control to all level crossings in the NT, this was due primarily to the cost of clearing sight triangles
- It was also decided that all level crossing would have a sight distance from the Stop line of at least 1000 metres
- This was in excess of the requirements contained in the various sight distance warrants at the time.



Road-train driver did not stop...why?

- As said earlier, the task was repetitious, seven days a week, in the order of 30 crossings per day per driver
- Factors that can lead to an *error* in this instance could relate to fatigue, environmental conditions, distraction, toxicology and medical issues (causing attention or memory problems)
- Factors that can lead to a *violation* in this instance are expectation, equipment constraints and the manner in which the task is usually performed
- Fatigue, environmental conditions, distraction and toxicology were all ruled out during the course of the investigation
- Medical issues, expectation, equipment constraints and usual practice were all ruled in.



An error or a violation?

- The road-train driver said during the month of work at this site (some 800 crossings) he had only seen four trains. All were freight trains and he did not have to alter his driving habits for any of them
- It was practice for drivers to warn others on the radio when a train was seen (further reducing the expectation of seeing a train 'unannounced')
- It is good driving practice not to bring a road-train to a complete stop where a stop is not mandated (commonly referred to as 'rolling stops')
- The evidence is that it was usual practice for the three road-train drivers engaged in this task to not stop at the level crossing
- All this points to a routine violation!



An error or a violation? (cont)

- However, there was a serious medical issue. The road-train driver had severe bilateral hearing loss
- This loss was to the extent that he would not have been eligible to retain his MC class vehicle license
- The question is, would the loss have prevented him from hearing the approaching train? This cannot be concluded with certainty.
- However, compared to a person with normal hearing, would his ability to hear the approaching train be compromised? The answer is most certainly yes.
- Despite the severe bilateral hearing loss, the evidence is that in this instance the act was a routine violation, characterised by the unsafe act being the normal way of performing the task



Medical standards, road and rail drivers

- The drivers of *The Ghan* were examined in accordance with *The National Standard for Health Assessment of Rail Safety Workers*
- Road users are examined in accordance with *Assessing Fitness to Drive for Commercial and Private Vehicles Drivers* guidelines
- Both publications are approved by the ATC. A detailed comparison of the two publications was not conducted as a part of this investigation
- What is readily apparent though is a major disparity in regard to when an examination is conducted
- Despite about 40 years of heavy vehicle operation, the road-train driver had never been examined in conjunction with obtaining or renewing his MC commercial road vehicle driver's licence
- The extent of his hearing loss was such that he would not have met the criteria for an unconditional MC class licence.



Road-train clearance times

- Had heard that GBS Gold Pty Ltd had conducted some level crossing timing tests. The results were of concern
- The ATSB, accompanied by the NT DPI and other interested parties, conducted 12 tests with 53.5 metre road-trains on 29 August 2007
- Results ranged from 33.25 seconds to 71.25 seconds
- Biggest disparity was between when gears were held to when gears were changed (The USA and Canada do not allow the drivers of heavy vehicles to change gears on a level crossing)
- ATSB released a supplementary report in August 2007



53.5 metre B+2A road-train



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Road-train routes

- The Australian Vehicle Standards Rules (AVSR) is based on the Australian Design Rules and provides the framework for in-service standards
- 53.5 metre road trains are allowed in Australia under the AVSR
- Road-trains of up to 53.5 metres are authorised in WA, SA, Qld, The NT and, to a small extent, NSW
- The point is that there are many level crossing across much of Australia where the road/rail interface involves the use of 53.5 metre road-trains
- The other salient point is that the same risk is proportionally evident for other high combined mass road vehicles.



Key findings

- *The Ghan* was being operated in accordance with the relevant rules and procedures
- The agreed level crossing sighting distances for 'Stop' sign control adopted by the NT DPI, FreightLink were in excess of the requirements of the relevant standards
- The stop sign control at the Fountain Head Road level crossing was largely being ignored by road vehicle drivers before the accident
- The road-train driver had severe bilateral hearing loss which compromised his ability to hear *The Ghan* before the accident
- This hearing loss would have made him ineligible to hold an unrestricted MC class licence



Key findings

- The crashworthiness of the locomotives and carriages was such that, with the exception of the vestibules between the carriages that concentrated, no area of occupation was breached or compromised
- The first response measures enacted by GBS Gold were of a very high standard, in terms of timeliness and the level of assistance provided
- The remoteness of much of the rail corridor in the NT could make a timely response to a rail accident challenging
- Tests conducted by the ATSB in August 2007 found that the time taken for 53.5 meter road-trains to clear a level crossing from a stop calls the calculation of sighting distances into question.



Recommendations

- Members of the Standing Committee On Transport note the ineligibility of the road-train driver to hold an MC class licence due to hearing loss and that he had never been medically examined in conjunction with this licence
- State and Territory regulators consider the implications of the clearance times of the 53.5 metre road-trains
- Continued action by the NT DPI regarding enforcement and education of motorists at railway level crossings





Thank you – questions?

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31 May 2008



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