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Fatal collision between passenger train 3C37 and a Ford Falcon station wagon

at the Hesp Road/Bennett Road level crossing
Aloomba 23 May 2003

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TERMS OF REFERENCE

In pursuance of the powers given to me under Section 103/2 of the Transport Infrastructure Act 1994, I hereby require you to chair an independent investigation and report on the circumstances and cause of the accident involving a level crossing collision at Aloomba (DOT reference 1209) which occurred on 23 May 2003 and report your findings in writing to Tony Kursius, Executive Director, Land Transport & Safety Division, Queensland Transport by 23 June 2003 (should a full report be unable to be provided by this date an interim report must be submitted).

The investigation will, specifically in respect of the Aloomba Level Crossing Accident:

1. Undertake a systematic investigation into the accident.
2. Establish the factual circumstances leading to, and immediately following the accident.
3. Identify the direct cause or causes of the accident and any other contributing factors including human factors or any underlying matters which may have caused or contributed to the accident
4. Examine the systems and procedures which were in place prior to the accident and establish if appropriate risk management procedures were in place and/or applied to minimise the risk of such an accident.
5. Identify any safety actions to prevent, to reduce the risk of reoccurrence, future injury or damage and generally improve any safety system as it applies to the Aloomba Level Crossing.

The investigation report should be based on a systematic style investigation approach and should not be written in a manner that apportions blame.

The investigation team will comprise:

Mr Kit Filor – Investigation Team Chairperson, Australian Transport Safety Bureau

Mr Graham Guy – Principal Advisor (Rail Safety Unit) Queensland Transport

Tony Kursius

Executive Director (Land Transport & Safety Division)

EXECUTIVE SUMMARY

At about, or a little before, 1558 on 23 May 2003, while approaching the public level crossing on the North Coast railway line approximately 700 m south of the small town of Aloomba, Queensland, the two drivers of the Sunlander passenger train 3C37 saw a station wagon car travelling ahead and parallel to the railway line on the adjacent roadway to the east. The train driver maintained a prolonged blast on the train horn as the car slowed and came to a halt at the crossing.

As the train approached the crossing at a speed of about 80 kph the car was seen to move onto the level crossing immediately ahead of the train. A matter of seconds later both drivers lost sight of the car as it passed out of line of sight ahead of the locomotive. Almost simultaneously, they felt and heard an impact and the front of the cab was showered with shards of glass. At the same time the locomotive driver applied full service brakes prior to making an emergency brake application. The train locomotive came to a stop 430 m after the impact. The train was not derailed.

The car was struck by the left hand side of the locomotive's cowcatcher at the rear left hand door pillar causing severe damage. The car was struck so that it rotated violently anticlockwise, probably through 630 degrees, so that it came to rest on the broad grass verge on the west side of the track. There were three occupants in the car, a woman, who was driving, and her two male children, of seven and five years in the rear seats. The seven year old, was seated on the left hand side with a seat belt fastened, the five year old was on the right hand side in a purpose designed child seat and restraints.

The locomotive driver immediately notified train control of the accident. The passenger service staff on board the train immediately rang '000'. Witnesses in a car approaching from the opposite direction drove directly to the local shop, about 700 m from the crossing from where a further call was made to the emergency services. Ice and blankets were supplied by the shop owner, who went with a number of local residents to assist.

The seven year old male child was pronounced dead at the scene. The woman and five year old child were taken to hospital, the child suffering from severe head injuries.

The investigation established that the locomotive and rolling stock were in good operational condition. The train brakes worked within specification, the horn was operational, the head light was on full beam and the yellow locomotive should have stood out and been visible against the predominantly green background of the sugar cane and other vegetation. The track and train control systems did not contribute to the accident.

Although the driver of the car initially stopped, she either did this in 'automation' mode and did not check that the line was clear, or she did not see the train before starting over the level crossing.

The investigation established some problems with the approach angle and sighting distance of cars approaching the crossing from Moller Road and Fixter Road. There was also an absence of pavement markings associated with the passive protection for this level crossing. These observations have to be set against the driver's knowledge of the area. She (and her family) had been a long term resident of Aloomba and would have been familiar with the crossing and the adjacent roads.

The signage and at Hesp Road/Bennett Road level crossing have been upgraded and pavement markings renewed following this accident. Sign off on the Memorandum of Understanding for the Management and Funding Responsibility for Level Crossing Safety in Queensland developed between the Local Government Association of Queensland, the Department of Main Roads, Queensland Transport and QR should formalise responsibility for the ownership of the level crossing componentry.

Sighting distances assessments made for the Hesp Road/Bennett Road level crossing for the Queensland Transport Public Level Crossing Upgrade Program did not represent the actual angle of approach for cars travelling from Moller Road to Fixter Road and vice versa. The investigation recommends that in accordance with the requirements of the Level Crossing Upgrade Program, the crossing be re-assessed in light of this report and that the proposals to meet the risk threshold and compliance be implemented as a matter of priority.

INVESTIGATION TEAM

Chair Christopher William Filor, Deputy Director Surface Safety Investigations, Australian Transport Safety Bureau

Member Graham C Guy, Principal Advisor, Rail Safety, Queensland Transport

Assisting

Mr Geoffrey Featherstone, Service Delivery Manager, Coal and Freight Services, QR

Mr Lindsay Johnson, Rail Safety Coordinator, Network Access, QR

INVESTIGATION METHODOLOGY

The purpose of this investigation is to enhance rail safety at the Hesp Road/Bennett Road level crossing at Aloomba, North Queensland; firstly, by determining the sequence of events which led to the accident; and secondly, by determining why those events occurred. Of particular importance was the need to understand what the accident revealed about the environment within which this particular rail operation was being conducted, and to identify deficiencies with the potential to adversely affect safety at the level crossing.

The Reason model was used as the framework for the analysis of this accident.

During the investigation, information was obtained and analysed from a number of sources, including:

- Visits to the accident site
- Extraction of data from the ATP event recorder and analysis of that data
- In-cab observations of train operations at the level crossing
- A review of aspects of QR's Safety Management System
- Rollingstock and track maintenance records
- Interviews with personnel directly associated with the accident
- Interviews with management personnel relevant to the accident
- Interview with the Police Officer in charge of the police accident investigation
- Interviews with witnesses
- A review of safety occurrences at the crossing
- A review of the drivers medical assessments and training history
- Advice received from QR technical experts
- Analysis of Fatigue Management Score
- Review of local factors
- Review of QR Safety Risk Report
- Examination of rosters
- Examination of train control records
- Examination of Ford Falcon station wagon
- Examination of site maps, route maps and charts
- A limited review of driver behaviour at the Hesp Road/Bennett Road level crossing

The investigation team acknowledges the full co-operation received from all parties to this investigation both, individuals and organisations.

1. INCIDENT DESCRIPTION AND FACTORS

1.1 Overview of Aloomba and its environs

Aloomba is a small township of about 200 people, about 30 km south of Cairns Railway Station. The area is predominantly a sugar cane farming area.

The North Coast railway line from Brisbane to Townsville and Cairns is narrow gauge (1067 mm). Between Townsville and Cairns the line is single track, with passing loops at various locations. At Aloomba the line runs to the east of the main township and there is also a passing loop. Each day there are seven regular train movements on the line. In the sugar season this increases to as many as 17 movements. From the south, Aloomba is approached over Behana Creek and Crooked Creek, through a short left hand curve (1609 radius) and up a short gradient of 1:94 before levelling just before the Hesp Road/Bennett Road level crossing with passive protection at 1651.580 km from the zero kilometre post at Roma Street Station, Brisbane. The line speed approaching and on the gradient is 80 kph, 15 m after the crossing there is a 70 kph speed board at the points to a 794 m loop. The railway line runs at a bearing of 350° to the east of the main township before a left hand curve of 160 m radius.

FIGURE 1:
Extract from Australian Topographic Survey Gordonvale 8063 1 - scale 1:50 000

The level crossing at 1651.580 km is about 700 m southeast from the centre of Aloomba. It is also a junction of five roads: Fixter Road runs north of the crossing, parallel with and to the west of the track; Broughton Road north of the crossing, parallel with and to the east of the track; Hesp Road east of the crossing, Bennett Road west of the crossing and Moller Road south of the crossing, parallel with and to the east of the track. Fixter, Hesp, Bennett and Moller roads are paved bitumen roads.

FIGURE 2:
Hesp Road/Bennett Road level crossing at 1651.80 km from Hesp Road

Photo May 2002

Moller Road runs for about 3 km south from the Hesp Road/Bennett Road level crossing, mostly parallel to the railway line to Quingilli and a junction with the Bruce Highway about 26 km from the town of Babinda.

The cultivated land bordering the roads each side of the crossing was mature, ready to harvest, sugar cane.

1.2 Basis of the report

This report is based on interviews with key witnesses including the train drivers and people in the vicinity of the crossing at the time of the accident. More information was gathered from datalogger downloads, QR technical experts, maintenance records of track and rollingstock together with records of the field assessment of the crossing by the Cairns Local Level Crossing Committee.

The times of calls to the ambulance service and their record of attendance is provided by the Queensland Ambulance Service. Other information relating to the accident site and subsequent actions were provided by the Queensland Police Service.

There were a number of different records based on internal clock systems. Therefore a variation exists in some of the times recorded but none of the critical times vary by more than 60 seconds.

The driver of the road vehicle involved in the accident was not interviewed on the advice of the local police and the trauma councillor. The account of the driver's actions are based on eyewitness accounts of the accident and what the car driver is alleged to have said after the accident.

The investigators recognised the extreme stress under which any such statement was made.

1.2.1 Journey of train 3C37

Train 3C37, departed Brisbane Roma Street Station on the morning of 22 May 2003 on the 'Sunlander' passenger service on the North Coast railway line to Cairns, with a scheduled journey time 31½ hours and a scheduled arrival at Cairns Station of 1625 on 23 May.

The locomotive and 18 rail vehicles made up a consist of 332.4 m and 557 tonnes.

By the time 3C37 arrived at Townsville Station at 0842 the train was about 51 minutes late. A Townsville crew of two drivers relieved two Mackay drivers and boarded the diesel locomotive of the 2170 class, number 2200F. The drivers were provided with a new 'Train Wire'[1] and entered the maximum 80 kph parameter in the locomotive computer. Train 3C37 left Townsville at 1006, 58 minutes behind schedule with about 14 passenger service staff and about 150 passengers aboard. The two drivers decided to share the driving duties over the 340 km of track, changing at Cardwell at about 1235. The passage of the train was uneventful to this stage of the journey.

Between Tully and departing Innisfail, 3C37 made up 14 minutes on its schedule. It departed Innisfail with 129 passengers at 1452, 53 minutes behind schedule. The train passed through Babinda at 1538, Deeral at 1543 and crossed the level crossing at Assam Road, Quingilli at about 1552. There was a volume of road traffic on the Bruce Highway to the west of the train, but neither driver saw any vehicle at the Assam Road crossing. At this crossing, train 3C37 was travelling at about 65 kph, as recorded on the train's event recorder, accelerating to 80 kph, the designated line speed.

At Behana Creek 1070 m from the crossing the train reached a speed of 85 kph (23.61 m/s), marginally over line speed. From this point the train gradually decelerated, crossing Crooked Creek about 390 m from the level crossing, and climbing the short rising gradient of about 125 m. As the train passed the whistle board about 300 m before the crossing both drivers saw a station wagon on Moller Road, travelling ahead of the train towards the crossing. Both train drivers pushed their respective horn controls at this point and continued to sound the horn until the impact.

As the car reached the eastern, Moller Road, side of the level crossing the locomotive drivers saw the car come to a stop at an angle to the crossing. As the train approached the crossing at about 82 kph (22.777 m/s) the car moved forward onto the crossing.

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[1] Train Wire – A form containing details of the consist and details of any dangerous goods carried together with ATP Train Parameter input data including train length and maximum line speed to provide braking characteristics.

1.2.2 Journey of Ford Falcon station wagon

On the day of the accident, students from Aloomba State School attended a sports carnival at Babinda School about 31.5 km by road south of Aloomba. Parents and teachers took the students by private cars and minibus to the carnival, the start of which was delayed by a late bus. As a result, the carnival ended about 15 or 20 minutes after its scheduled time.

The driver of the Ford Falcon station wagon left the sports ground some time after 1520 but before 1530, with her two children properly and adequately secured in the rear passenger seat. She drove via the Bruce Highway for about 24.4 km and turned off onto Assam Road to take Moller Road to Aloomba.A second car with two adults and children left soon after the Ford Falcon. The journey of the second car coincided with the passage of the Sunlander. The second car ran parallel and, for a while, in company with the Sunlander passenger train. Children in the car waved to the train. Passengers on the train responded. The car and the train lost visual contact as the Bruce Highway and the railway line diverge north of Quingilli. This car stayed on the Bruce Highway to Hesp Road, about 3.5 km beyond Assam Road.

When the Ford Falcon station wagon reached Quingilli the driver turned onto Assam Road and crossed the Quingilli level crossing approximately 3.6 km from the Hesp Road/Bennett Road level crossing. Train 3C37 was apparently not in view. Moller Road is relatively straight, but narrow. It runs adjacent to and parallel with the railway line except for a length of road of about 700 m which diverges from the track over Behana Creek and rejoins the railway line about 1.7 km before Aloomba, 950 m from the Hesp Road/Bennett Road level crossing. At 1550, probably after the Ford Falcon wagon had turned onto Moller Road, a phone call was made from the driver's mobile telephone. There is no evidence that the driver was talking on the phone at the level crossing.

A witness standing on the veranda of his Moller Road house, talking on a telephone, saw the Ford Falcon driving up the slight incline outside his house about 300 m from the Hesp Road/Bennett Road level crossing. It was travelling at a steady but not fast pace. He recognised the car and its driver. A few seconds later he heard the horn of the approaching train, which sounded a loud and sustained blast. He then saw the train pass his house proceeding towards the Hesp Road/Bennett Road level crossing. The witness lost sight of the Ford Falcon as it approached the crossing. As he saw the train close the crossing he saw the Ford Falcon on the crossing travelling slowly, the car was then obscured by the train. He remarked to the person to whom he was speaking that the 'driver had just made it'. He also formed the opinion from the timing of his observations of the car that the car must have stopped at the crossing for a few seconds.

1.3 The collision and immediate aftermath

As the car started to move across the level crossing, train 3C37 was probably between 90 and 70 m from the crossing. There was little reaction time and no possibility that anything done by the driver could have avoided a collision. The drivers lost the Ford Falcon from their line of sight as the train neared the level crossing. Both drivers heard an impact and shards of glass sprayed across the locomotive's windscreen.

The precise time of the impact could not be accurately determined but from the train records has been taken as 1558. A number of emergency calls were received by the Cairns Ambulance Service. The first three calls logged by the centre were received at 1557:50, 1558:43 and 1601:59.

The car was hit by the locomotive's cowcatcher in way of the rear left hand door pillar. The impact spun the car anticlockwise, across the road pavement on to the grass verge, narrowly missing the steel rail utilised as a post for a traffic warning sign for the crossing. The vehicle came to rest about 25.8 m from the point of impact.

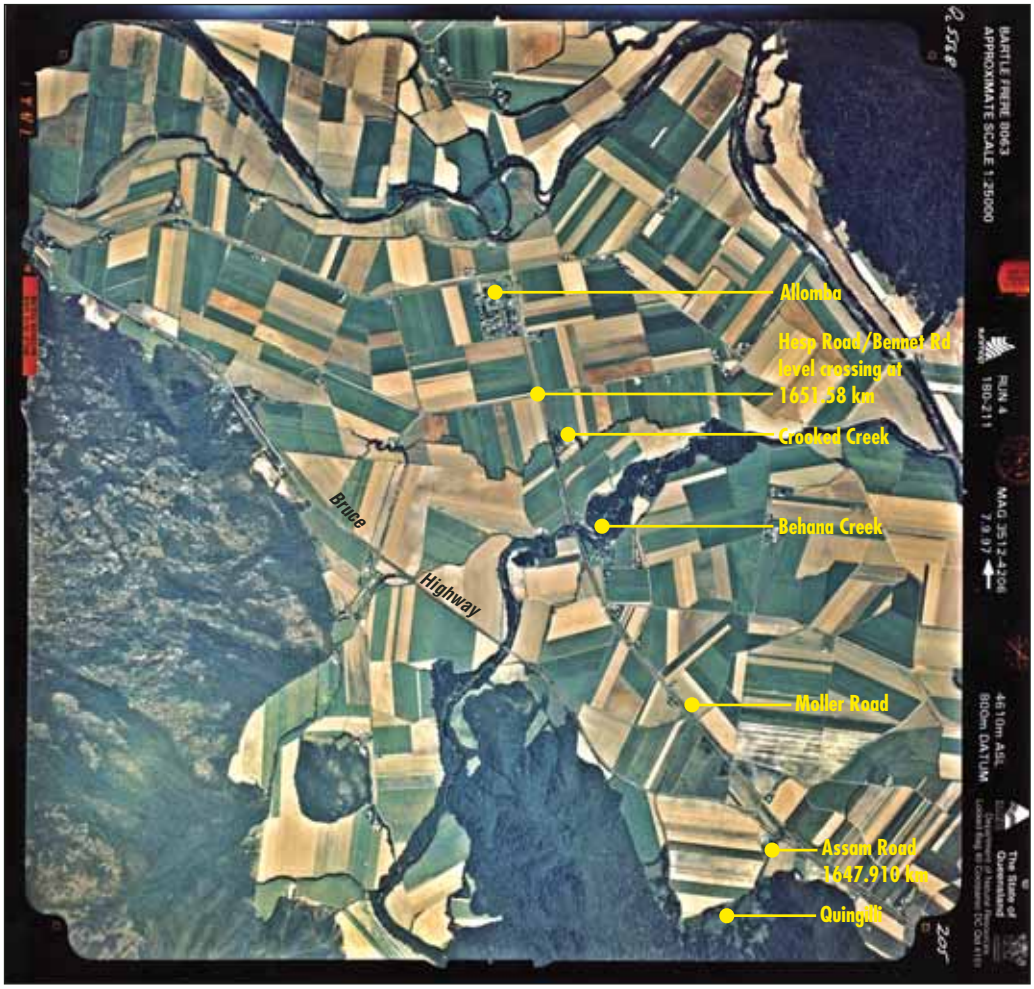
At or just after the impact the driver applied full service brakes prior to making an emergency brake application. The train came to a complete halt in 40 seconds in a distance of 430 m. The train driver immediately contacted the train controller in Townsville, reporting the accident. The train controller immediately contacted emergency services.

At about this time the second car was approaching the crossing from Hesp Road. The occupants of the car saw the train carriages crossing the level crossing. As they approached the junction of Fixter Road they saw the Ford Falcon wagon on the grass verge on the north side of the crossing and realised that there had been an accident. They did not stop, but accelerated to the local shop about 700 m north of the level crossing. At the shop they asked the owner to dial '000' and contact the emergency services. They left the children at the shop and with another adult returned to the scene to render what help they could.

The train passenger services staff heard the prolonged blast on the train horn and felt the train brake. Three staff, in the Conductors Cab in the train's mid length, saw dust and a car on the grass strip alongside the railway line on the left hand side of the train. The On Board Service Technician (OBST), a railway man with 43 years experience immediately realised that the train had hit the car. As the train came to a halt he jumped down from the train to render what assistance he could. He ran about 150 m or so to the car where two women were assisting the female driver. He looked in the rear passenger seat and established that a young boy on the driver's side had a pulse. The second boy in the left hand seat had blood coming from his mouth and the OBST could not detect a pulse. At this time the OBST was joined by three or four other passenger service staff.

The Passenger Service Supervisor (PSS) was at the front of the train ready to handle luggage at Gordonvale, about five minutes from Aloomba. He too heard the prolonged whistle blast and felt the braking of the train. As the train stopped he looked out of the window and realised that the train had been in collision with a car. He walked rapidly to the conductor's compartment, picked up two first aid kits and alighted from the train. He instructed one of the other staff to keep all passengers on board and accompanied by two other staff went immediately to assist.

FIGURE 3:
Extract of photograph by the Queensland Department of Natural Resources of Bartle Frere 8063



With the arrival of the PSS and the two other staff and under instruction from the train controller Townsville, the OBST assumed on site command, controlling the traffic in and about the immediate area of the accident. The PSS and his staff assessed the younger of the two boys as having possible neck injuries, but with the absence of a pulse in the older child, they removed him from the car using an improvised stretcher. They then administered Cardio Pulmonary Resuscitation until relieved by the arrival of the ambulance. One Sunlander passenger, a nurse, offered assistance and alighted from the train for a brief period, but returned to the train with the arrival of the ambulance. The police from Gordonvale were on the scene within minutes. The first ambulance from Cairns arrived at 1618. Ambulance officers removed the younger boy from the car.

When the injured had been removed from the scene, the police and Queensland Rail (QR) investigators surveyed the accident site.

The cowcatcher was removed from the train. Following inspection and authorisation, the train resumed its journey to Cairns at 1822 arriving at about 1915. The train crew were offered counselling from both the Police and QR counsellors.

1.4 Fatalities and injuries

The seven year old male child was pronounced dead at the site. The woman driver who was 26 weeks pregnant at the time of the accident and 5 year old male child were taken to hospital. The 5 year old had severe head injuries.

1.5 Damage

1.5.1 Locomotive 2200F

Damage to the locomotive was confined to a distorted cowcatcher, minor distortion to the steps on the forward left hand side driver's entrance together with damage to some of the light fittings. There was no damage to the rail infrastructure, however the cowcatcher gouged the bitumen road surface between the rails.

1.5.2 Ford Falcon station wagon

The Ford Falcon station wagon was struck at the rear passenger side door pillar. The rear of the car, including the chassis was severely distorted.

1.6 Environmental conditions

The day was fine and clear. The temperature at Cairns Airport at 1500 was 27.1° C with 49 per cent relative humidity and an east-south-easterly wind at 17 kph. At 1558 the sun was bearing 302° at an altitude of 23°.

The track was dry and there was no evidence of grease or dirt that may have affected the performance of the train.

The road was dry and some unsealed shoulder widening works had been carried out on the west side of the junction between Moller Road and Bennett Road.

There were no environmental conditions, including issues of sun glare or angle that inhibited the sighting of the train or otherwise contributed to the accident.

1.7 Train crew details

The two drivers were appropriately fit and qualified for duty.

Crew details	Driver at controls	Co-driver
Gender	Male	Male
Year of birth	1954	1959
Qualified driver Class II	October 1989	1989
Route knowledge	6 August 1996	13 December 1994
Number of trips on route	141	76
Qualified on traction expires	30 September 2004	September 2004
Safeworking re-accreditation date	3 February 2002	14 April 2001
Last medical	September 2002	August 2002
Time on duty	8 hours	8 hours

Following the collision, both locomotive drivers underwent a test for alcohol and returned a negative result.

QR is in the process of implementing a fatigue management program in the management of driver rosters to minimise the possibility of the onset of unacceptable fatigue levels. This will be based on the Fatigue Audit InterDyne (FAID) fatigue modelling program, which was developed by Interdynamics in collaborative partnership with the Centre for Sleep Research at the University of South Australia. The FAID program quantifies an individual's level of fatigue based on hours of work for the previous seven days. Train drivers duty hours, including travel, are entered into the computer program, which returns a 'fatigue index score' for each driver at any given time. Based on the draft QR program, the driver at the controls had a score of 33, while the co-driver's score was 20. The driver's roster was not fatigue inducing. Both scores were well under any score to suggest that fatigue was a contributing factor. Neither driver reported fatigue symptoms.

Passenger service staff consisted of a Passenger Service Supervisor, an On Board Service Technician and twelve other passenger service staff. All were in possession of advanced first aid qualifications and the PSS and other senior staff were qualified in advanced Cardio/Pulmonary Resuscitation techniques.

1.8 Vehicle particulars

1.8.1 Train 3C37

Train 3C37 consisted of a diesel locomotive of the 2170 class, number 2200F, 14 coaches, two vehicle wagons, a power car and one luggage car. The train, including the locomotive, was 332.4 m in length with a mass of 557 tonnes.

Locomotive 2200F completed a major inspection on 27 March 2003 and underwent a full brake test on 18 March 2003. The most recent 'three week' inspection was completed[2] on 14 May 2003. In addition when the locomotive was connected to the Sunlander a 'Locomotive Serviceability Certificate' was completed and a train-testing certificate was completed in accordance with routine procedures[3].

Following the accident a full assessment was made of the locomotive. Brake block thicknesses, brake travel and brake cylinder pressures were examined or tested and found to be fully compliant. Wheels were checked for 'flat' spots[4]. One sanding pipe on the driver's side was found to be not working, otherwise the locomotive systems were fully compliant with proper operating standards. Similarly the remainder of the consist was examined and found to be fully compliant.

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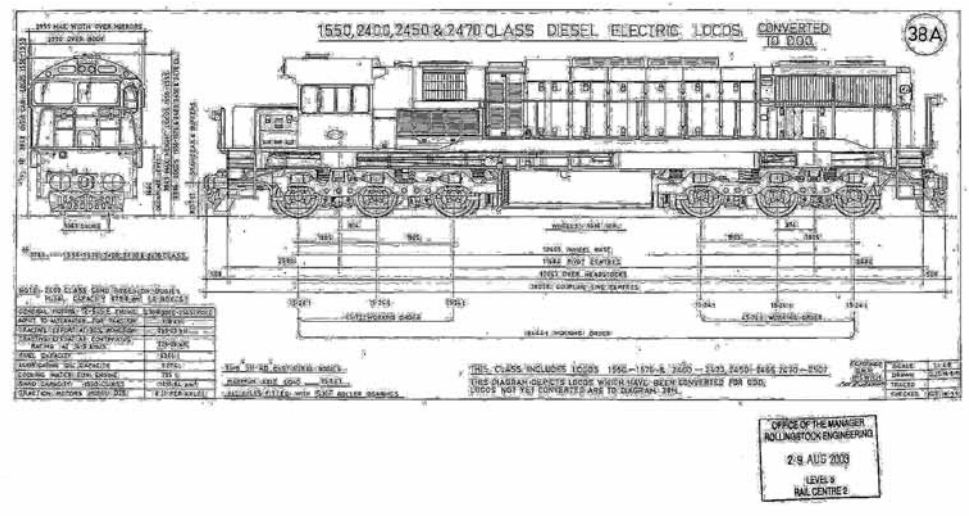
2 As per business instruction BI-2044-3 and STD/0037/SWK 'Operational Integrity of Trains'.

3 Specification SPC/0048/SWK

4 Flat spots – flattening of the wheel through the action of skidding.

The diagram of the locomotive of the 2170 class, number 2200F below shows the drivers' line of vision from the cab.

FIGURE 4:
Diagram of the locomotive 2170



1.8.2 Ford Falcon station wagon

The Ford Falcon station wagon was a little over 5 m in length with a weight just over 1630 kgs. It was silver in colour. There was nothing inherent in the car design and no modifications had been undertaken that would have made the car unroadworthy immediately before the accident.

1.9 Infrastructure and train control

The North Coast main line from Brisbane to Cairns is narrow gauge of 1067 mm. From Townsville to Cairns the maximum axle loading is 20 tonnes. The track is a single track 'A' class line. In the week ending 25 May 2003 there were a total of 49 trains using the Townsville to Cairns line.

Approaching Aloomba, the track is 41 kg rail, attached by Rex-Lok rail fasteners to steel sleepers (about 720 mm spacing) on 'B' class crushed rock ballast. The ballast was clean, allowing for effective drainage. The sleepers beneath the bitumen seal on the Hesp Road/Bennett Road level crossing are timber. The line speed approaching the crossing from the south is 80 kph, with a line speed 15 m north of the crossing of 70 kph.

The track had been regularly inspected. The last PV6 recording unit assessed the Deeral – Aloomba section on 21 February 2003. The quality of the track was not a causal factor in the collision.

The train safe working system on the 300 km of track between Purono and Woree is by Direct Traffic Control from Townsville. The railway line is divided into sections or 'blocks' of line. To traverse any block a train needs a DTC Authority permitting the train occupation of the block. This is sent by radio, with a coded number, which the driver enters into the on board computer. As each block is cleared the driver must report to train control, thus releasing the block. A driver may receive a DTC Authority for a number of consecutive blocks, but must report as the train clears each individual block. The driver must stop at the limit of authority and obtain a new DTC Authority prior to proceeding passed that limit of authority.

Train 3C37 reported at Deeral at 1543 and had authority to occupy the section from Deeral to Aloomba.

1.10 The level crossing

The level crossing south of Aloomba at 1651.580 km is typical of many level crossings with passive protection in rural areas. It is at the junction of a number of roads meeting at a single crossing point. Moller Road to the south and the unsealed Broughton Road to the north of the crossing run parallel with the track to the east. Fixter Road runs north of the crossing, parallel to the railway line to the township of Aloomba. Hesp Road from the west and Bennett Road from the east are at about right angles to the crossing.

There is no record of previous accidents at this crossing.

1.11 Queensland Transport level crossing upgrade program

Queensland Transport is managing a seven year $17M Level Crossing Upgrade Program, which is in place for the period to 2005/06 for the upgrading, where necessary, of public level crossings on the non-commercial railway lines included in the Transport Service Contract (Rail Infrastructure) with QR. A Risk Scoring Matrix, developed by the Queensland Level Crossing Safety Steering Group is used to determine the adequacy of current protection at crossings and indicate any additional safety enhancements that may be needed. Traffic control compliance is also assessed against the requirements of the Manual of Uniform Traffic Control Devices (MUTCD). The Risk Scoring Matrix has been accepted by the Australian Transport Council to be the national model to become part of the National Level Crossing Level Crossing Safety Strategy and Action Plan. The Hesp Road/Bennett Roads level crossing is one of approximately 1484 level crossings assessed under this program.

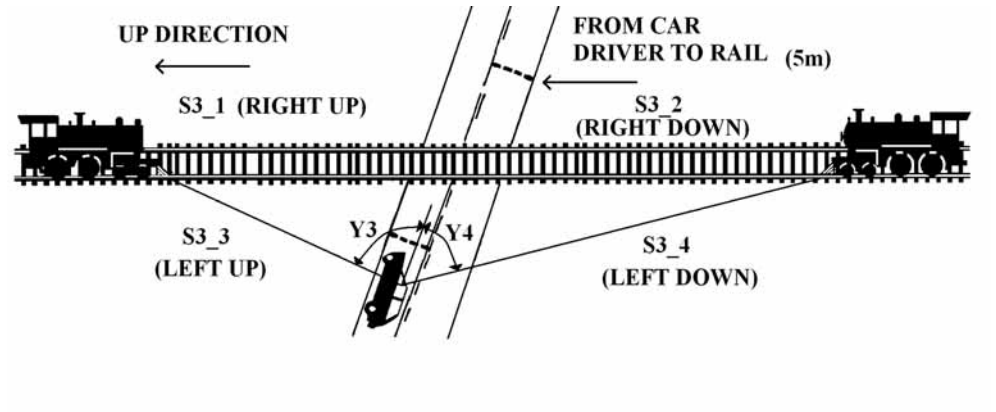
Local Level Crossing Committees comprising representatives from the Department of Main Roads (Chair), QR and Local Government Authorities have been established with responsibility for the collection of field data for each identified crossing and making recommendations for level crossing safety. After collection, the committee forwards the field data on to the QR Survey Section for processing through the Risk Scoring Matrix to identify if treatment is needed and of any compliance issues. This information is returned to the Local Level Crossing Committee to review the proposed control measures and to suggest any further alternatives. Following this review, the Local Level Crossing Committee forwards this information through the QR Regional Manager Network Infrastructure back to the QR Survey Section. QR Survey Section then compiles the risk score and submits details to the Level Crossing Safety Technical Working Group[5] for approval.

Existing sighting distances are a critical aspect of the data collected for the risk assessment. The Queensland Level Crossing Safety Steering Group developed a Public Level Crossing Assessment Report which is used for the collection of field data including the sighting distances. This form depicts the sighting distance applicable to

[5] The Level Crossing Safety Technical Working Group is chaired by Queensland Transport and is made up of representatives from QR and Main Roads. It has the role to review and approve level crossing upgrades for the Level Crossing Upgrade Program.

this accident as the S3_3 taken at a distance of 5m from the nearest rail. S3_3 is the minimum distance of an approaching train from the crossing, so that there is sufficient sight distance for a vehicle driver stopped at the crossing to be aware of an approaching train, and subsequently decide if they can safely cross the tracks as a result of the sight distance. Ability to see is made at a height of 1.15m above the road, (a car driver's eye height), to a target at 2.40 m above the rail centre line, (the height of a train headlight). The sighting distance is recorded as the distance from the driver to the target so that the target can be seen to a maximum allowed angle of 110°. (refer diagram below)

FIGURE 5:
Sighting diatance diagram



Y^3 = 110° Maximum (To the left)
Y^4 = 140° Maximum (To the right)

Representatives of the Cairns Local Level Crossing Committee conducted an onsite assessment of the Aloomba level crossing in May 2002. The angle of the road over the crossing (Z) was recorded as 73°. The S3_3 sighting distance for Bennett Road (eastern side of crossing), in the up (south) direction, was recorded as 480 m at an angle of 102°. The S3_2 sighting distance for Hesp Road (western side of crossing), in the down (north) direction, was recorded as greater than 700 m also at an angle of 102°. Non compliance of road traffic controls with the MUTCD was also identified. QR Survey Section's review of the parameters from this assessment, established that while the crossing met the risk threshold for the existing road crossing, it did not comply with the MUTCD.

The problems identified with the crossing were:

- The signage did not conform with the MUTCD
- Road (pavement markings) including vehicle holding lines were faded or missing
- A section of rail placed vertically to form posts for the signage were used rather than proper pipe sign posts (more forgiving of car contact)
- Sugar Cane in the adjacent fields restricted (S2) vision
- There was no pedestrian protection
- The road crossing runs in an east/west direction. (The sun can obscure crossing or protection equipment at the crossing.)

QR Survey Section provided a number of proposals to the Local Level Crossing Committee to achieve compliance, consisting of:

- changes to the signage, including substituting the 'give way' signs for 'stop' signs

- installing advance warning signs and pavement markings in accordance with the MUTCD
- replacing the rail sign posts with pipe sign posts
- installing a properly signed and marked pedestrian footpath.

These proposals were forwarded by QR Survey Section to the Local Level Crossing Committee for review/acceptance in September 2002. The local committee is yet to review the proposals and return the recommendations to the Level Crossing Safety Technical Group for approval.

Both Moller Road and Fixter Road are separated from the railway line by a grass verge of about 15 m width. The parallel section on Moller Road ends about 25 m before the crossing where a transition into a curved approach to the crossing starts. The road also has a pronounced camber.

At the time of the accident, the crossing was protected by a series of warning signs on the approaches and a stop sign at the crossing. Cairns QR Infrastructure replaced the 'Give Way' sign with the 'Stop' sign at the Bennett Street approach to the crossing between July and November 2002. QR did not advise the Cairns City Council that they had replaced the sign. The 'Stop' sign was positioned at a distance of about 5.6 m from the nearest rail. The MUTCD requires stop signs to be placed at a minimum distance of 3.5 m from the nearest rail.

When approaching from Moller Road, while it is possible for cars to 'swing out' to stop at right angles to the track, the more natural line is to draw up at angle. Particularly if crossing to Fixter Road the car would tend to be at a pronounced angle with the left side at an acute angle of about 60° to 70° to the up direction of the railway line.

1.12 Rail Safety Accreditation

QR is a vertically integrated Government owned enterprise (GOE) with its own board and two principal shareholding Government Ministers and is divided into seven business groups:

- Passenger Services Group which manages the Sunlander operations through TravelTrain Operations. The Rollingstock Maintenance Division within this group is responsible for the cleaning, maintenance, inspection and servicing of all TravelTrain rollingstock throughout the State
- Coal & Freight Services Group which provides train drivers to Passenger Services Group TravelTrain Operations under an Internal Service Agreement
- Infrastructure Services Group responsible for the maintenance of QR's network on behalf of Network Access
- Network Access responsible for the management of QR's network assets provide train control, scheduling and incident management services to Passenger Services Group under an Internal Service Agreement
- Technical Services Group includes the Survey Section responsible for determining level crossing risk scores and MUTCD compliance issues
- Workshops Group provides maintenance, modification, major overhaul, component exchange and manufacturing support for rollingstock requirements
- Corporate Services Group provides QR with corporate functions.

Queensland Transport granted rail safety accreditation to QR on 1 July 1997 enabling QR to act as a Railway Manager and Railway Operator across the QR rail network. The Rail Safety Unit of Queensland Transport assessed QR's safety management system against Australian Standard AS4292.1 – Railway Safety Management General and Interstate Requirements.

In April 2003, QR introduced a Governance and Management Framework which contains all mandatory requirements and risk controls, including the safety management system. The aim of the Governance and Management Framework is to:

- Provide QR with a formally developed, implemented and monitored compliance programme
- Assist in giving effect to the QR Board governance charter
- Assist QR to comply with laws, regulations and best practice
- Provide QR with processes to enable continuous improvement in the above areas.

This change was validated through the QR Safety Case 'The Integration of the SMS Within the QR Governance and Management Framework'.

QR has developed its safety management system that is based on the identification, evaluation and treatment of its operational risks. This system is subject to constant monitoring and review and when applicable amendment to reflect the changing needs of the organisation. All risks identified have been ranked using a:

- Likelihood Table
- Consequence Table
- Risk Matrix.

Through risk analysis and risk management plans QR's first priority is to eliminate the hazards or conditions that have the potential to cause harm.

The QR Safety Risk Report (Version 5.0) ranks level crossing accidents as the 5th highest of its risks on the Injurious Risk Ranking profile. The Risk Report states that there has been a gradual decrease in level crossing accidents over the last few years and that the decrease may be due in part to a general improvement in road safety that has occurred as a result of Queensland Transport's road safety initiatives. In addition QR has played a key role in Queensland Transport's Level Crossing Safety Steering Group, including providing key staff to run a project team to drive safety initiatives for level crossings. The control of level crossing safety within QR is governed by SAF/STD/0044/CIV (Version 1) Level Crossing Safety and numerous other applicable standards and specifications.

2. Analysis

2.1 Train operations

As train 3C37 struck the car the locomotive driver applied the train brakes and the traction power was also reduced to zero at the same time. The total train mass was 557 tonnes and it was travelling at about 82 kph. The ATP log data shows that the air pressure in the brake reservoir decreased from 510 kPa to 320 kPa and thence to 79 kPa in 6 seconds. The track was clean and dry and the gradient level. The train came to a complete halt in 40 seconds, 415 m from the crossing. All brake blocks were 'bedded in'.

The distance in which the train came to a halt, together with the time, is evidence that the braking characteristics of the locomotive and the other vehicles making up the consist, were within specification. The track was dry and free of grease and the absence of sand on the driver's side did not adversely affect the braking characteristic.

The condition of the train and its equipment was not a causal factor.

The permitted speed at the crossing was 80 kph. Just 15 m past the crossing the permitted line speed was posted at 70 kph. Operationally the train should have been decelerating to be travelling at 70 kph at the speed board prior to the points to the Aloomba 'loop' at 1651.618, 38 m from the middle of the crossing. The train speed approaching and at the crossing was marginally in excess of the permitted track speed. The digital speedometer read to the nearest kilometre per hour. Therefore a speed of 82 kph varied between 81.5 and 82.5 kph. Further the train's speedometer was showing about 0.5 kph below the actual speed.

The evidence of the locomotive drivers is that they both saw the Ford Falcon ahead of them as it cleared the trees north of Crooked Creek. Given the alignment of the track and the position of the stand of trees the car would have been seen about 160 m ahead of the train. Both drivers stated that the Ford Falcon wagon stopped at the crossing as the train approached. This is supported by the observation of the eyewitness at the house at Moller Road about 300 m from the crossing. Also witnesses attending the accident scene heard the car driver state that she had stopped. The train horn was sounding and the headlight was lit. The locomotive crew had a reasonable expectation and were entitled to believe that the car driver would remain stopped and clear of the line while the train passed.

The train, in all probability, was between 3 and 4 seconds from the crossing when the car started to move to cross the track. The locomotive driver had minimal time to react and whatever he had done he would not have succeeded in avoiding the collision, regardless of whether the train was travelling at 70 or 80 kph.

There was no deficiency within the rail operation system (locomotive, carriages, track or train control) that contributed directly to the accident.

The train was being driven marginally over line speed (2.5 per cent over) and within 15 m of the crossing, while decelerating would have been travelling about 10 kph (12.5 per cent) above the speed needed to be able pass the 70 kph speed board at the loop at the correct speed. The digital and analogue speedometer was reading up to one

kilometre below the actual speed. The train was late on its schedule and the driver was driving at the line speed wherever possible to make up time. Based on 3C37 Train Variance Report, 20 minutes had been made up since Tully. In terms of distance, the car probably started to cross in front of the train when it was between 70 and 90 m from the point of impact. The difference in time for a train to travel 80 m at 80 kph and 70 kph is about 0.5 seconds.

The train's speed should not be viewed as a primary causative factor. The train speed is not considered reckless. The onus was on the car driver to stop.

The ATP log was downloaded from the train on its arrival in Cairns. The time shown on the logged data was eight hours and 24 minutes slow of Eastern Standard Time. The ATP data log shows the status of the key safety systems at any time the driver initiates an 'event' such as a change in throttle setting, a brake application or the sounding of the train horn for more than 1 second. From the ATP log the following information can be read:

- the kilometres travelled[6]
- time
- train speed
- status of the vigilance control
- horn status
- brake status and brake pipe pressure.

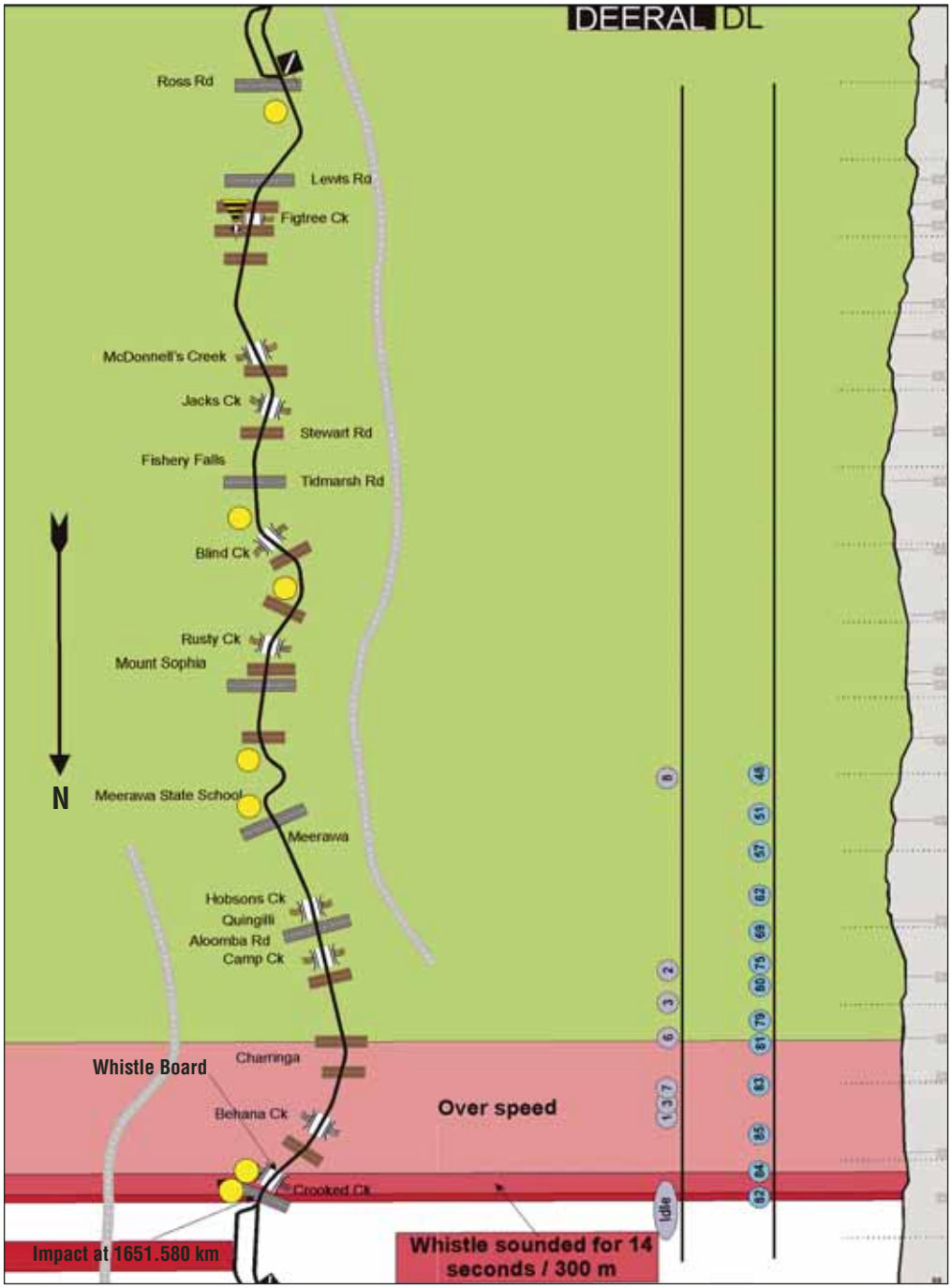
The ATP log shows that at 1557:14, about 45 seconds and over 1000 m before the crossing the driver reduced the throttle setting from position 3 to position 1, the train speed was between 84 and 85 kph. Thirty six seconds later at 1557:50, the train horn is sounded. This coincided with the whistle board about 318 m south of the road crossing. It was also within one or two seconds of the time that the Ford Falcon station wagon was seen by both drivers. The ATP records the brake pipe pressure at 1558:01 at 510 kPa, the reservoir pressure maintaining the brakes in the 'off' position. At 1558:04 the horn was shown as being 'off'. At 1558:05 the brake pipe pressure had reduced to 320 kPa and one second later 79 kPa. This confirms full service braking followed by an emergency brake application at or about 1558:06. At the same time the locomotive power was reduced to zero.

The ATP records a deceleration of the train speed to 1558:44 when the speed was recorded as zero. From the ATP records the train came to a complete stop about 40 seconds in a distance of 430 m from the first brake application.

Emergency braking calculations, based on the mass of the train, speed, gradient and track condition provides a stopping distance of 475 m with a driver delay (reaction time) of 1½ seconds, without reaction time the distance is 440 m. Given that the driver went for full service braking prior to emergency, the driver brought the train to a halt within the theoretical emergency stopping distance.

[6] Distance from the last reset. ATP distances reset every 1000 km

FiGURE 4:
Sequence of events overlay



2.2 Road traffic

There is an onus on the drivers of road vehicles to stop at level crossings and give way to rail vehicles. These requirements are addressed under Part 9 - Railway Level Crossings of the Queensland Road Traffic Regulations 1962 and provides inter alia:

> 'Stopping and giving way at level crossings'
>
> 48.(1) A driver approaching a railway crossing shall stop his or her vehicle so that the leading portion thereof is on the approach side of and safely clear of the nearest rail of the railway:
>
> (c) if a stop sign facing the driver is erected at or near the level crossing and shall proceed only if it is safe to do so.

Also, section 143(1) of the Transport Infrastructure Act requires road vehicles and pedestrians to give way to railway traffic.

> Level Crossings
>
> 143 (1) Pedestrians and drivers of vehicles must give way to-
>
> (a) a railway operator's rolling stock on railway tracks at a level crossing; and
>
> (b) a railway manager's rail vehicle on railway tracks at a level crossing.

The Ford Falcon station wagon had travelled along Moller Road ahead of the train. The speed limit on the road is 100 kph. The car was not in sight when train 3C37 approached Quingilli level crossing 3.6 km before the Hesp Road/Bennett level crossing. Nor did the locomotive drivers see the Ford Falcon station wagon until the train was about 300 m from the crossing. The car at this time would have been between 150 and 170 m from the crossing. The fact that the train was overtaking the car and had not been seen earlier by either driver in the locomotive supports the probability that the vehicle was travelling well below the maximum permitted speed. Given the position of the locomotive at the time the drivers first saw the car, it can be deduced that it would have been travelling at about 60 kph before slowing to stop at the crossing. There is no evidence to suggest that the car driver was racing the train or intentionally tried to cross ahead of the train.

Stopped, and at a position about 5 m from the nearest rail, the rear extreme of the Ford Falcon station wagon needed to travel about 13 m to clear the path of the approaching train. From the stopped position, assuming an average speed of 10 kph, the station wagon would have taken about 4.6 seconds to reach safety. The train was about 80 m from the contact point when the car started to move and covered that distance in 3.6 seconds.

FIGURE 6:
Locomotive driver's view about 300 m from Aloomba level crossing, approx position of first sighting the Ford Station wagon

FIGURE 7:
Locomotive driver's view about 180 m from crossing

Note car at crossing

What evidence there is, indicates that the car driver stopped and either did not look, or turned her head but the presence of the train did not register. It is unlikely that the driver looked but the train was not sufficiently conspicuous. The train's headlight was on, the locomotive was a conspicuous yellow colour that should have stood out and been visible against the predominantly green back ground. Also the sustained sounding of the horn should have been audible, though the car windows were closed and the air conditioning running.

The driver was a local resident who had lived in the area for many years and should have been very familiar with the roads of the area and the railway (and cane tramway) level crossings. She would had driven across the level crossing at this junction of five roads countless times.

The initial information is that the driver stopped, paused for a few seconds and then crossed the track either without looking or looking and not registering that a train was approaching. The act was an unconscious one. There is no suggestion that the driver intentionally did not look. Rather there is a probable element of repetition and automatic response in the driver's reaction to the level crossing, particularly if thoughts or planning future actions or events distract the individual, or if running behind some self imposed or planned schedule. It is known that the driver's mobile telephone had been used about seven minutes before the car reached the crossing. The content of the telephone conversation could have added a distraction to a situation in which the driver was also repeating an often conducted action in an automatic state.

FIGURE 8:

Vehicle stopped at Aloomba crossing, note angle of approach

Note: The signage was changed from 'Give Way' to 'Stop' between July and November 2002

FIGURE 9:
View from road vehicle. Driver's side from Moller Road looking in Up direction. Red arrow marks about 80 m from crossing, about position of train 3C37 when Ford Falcon station wagon started to cross

That the driver went through the mechanism of looking, but did not perceive the danger may first seem unlikely. It is, however a phenomenon that has been reported in road accidents, particularly where the driver is mentally 'somewhere else' and the individual does not expect to see a train.

Maurino, Reason et al (1995) discuss the propensity for individuals to experience skill-based slips and lapses, slips in attention and perceptual errors while undertaking well-practiced, familiar and largely automatic tasks, 'with only intermittent checks on progress by conscious attention'.

> Attentional slips in which we fail to monitor the progress of our routine actions at some critical choice point, often following a change in either our routine or the surrounding circumstances. The upshot is that we do what is customary or habitual in those circumstances rather than what was then intended.
>
> Perceptual errors in which we misrecognize some object or situation. Here, expectation and habit play a large part. Many train accidents, for example, have been due to the driver expecting (on the basis of past experience) to see a green signal, whereas the actual signal was red.[7]

Errors at the skill-based level were attributed mainly to monitoring failures. Most usually these involved in-attention: the omission of high-level check upon behaviour at some critical point beyond which routine actions are branched towards a number of possible end states. The failure to bring the conscious workspace 'into the loop' at these critical points generally causes actions to run, by default, along the most frequently travelled route when the current intention was otherwise.[8]

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7 Maurino, D., Reason, J., Johnston, N. and Lee R, (1995), *Beyond Aviation Human Factors*, Ashgate Publishing, Aldershot.

8 Reason, J. (1990), *Human Error*, Cambridge University Press.

Supporting the observations of these psychological studies is a United States National Transportation Safety Board (NTSB) study into level crossing accidents.

In July 1998, the NTSB issued a two volume safety study 'Safety at Passive Grade Crossings'[9]. The study analysed 60 grade crossing accidents (both public and private roads) occurring between December 1995 and August 1996. Thirty-five of the road vehicle drivers were killed as a result of the accident. Of the 25 surviving the study, 18 were interviewed.

Of relevance to the Aloomba crossing is that in the NTSB study:

- forty-six accidents occurred in daylight, six at dawn or dusk, and two at night
- in 59 of the accidents the train was displaying its head-light
- in 55 of the accidents the train horn was sounded prior to impact
- the train horn was sounded in 14 of the cases in which the road vehicle driver was available for interview
- ten of the 14 drivers did not hear the train horn
- ten road vehicles stopped before crossing the rail lines (four vehicles stalled on the crossing)
- in 16 cases the road vehicle slowed before crossing the rail lines
- in 16 cases the approach road was parallel to the railway and
- in 27 cases the intersection of the road and railway were 'skewed'.

The NTSB report found that whether or not a driver actively looked for a train depended on their expectation of seeing a train, which in turn was a function of the perceived frequency of train usage. The 18 road vehicle drivers interviewed underestimated the actual frequency of trains. The report states:

> 'This low estimate suggests that drivers do not expect trains and thus may not look for trains at crossings…
>
> The driver's perception that a train is not likely to be at a crossing is reinforced each time that driver passes the crossing without seeing a train.'

One of the primary causes identified by the NTSB was the failure of drivers to look for trains. The NTSB report also refers to an Australian study (Wigglesworth, 1976), which showed that only about 30 per cent of road vehicle drivers look, so as to 'search' for trains at passive or active crossings[10]. Drivers are recorded as not seeing or hearing oncoming trains as they were distracted by other occupants in the car using mobile phones and the like.

The report did not quantify the road vehicle driver's local knowledge (familiarity) with the crossing. The narrative specifically mentions familiarity in two cases, and as 14 accidents occurred on private crossings, it is reasonable to assume that 'familiarity' was an attendant factor in a significant number of the accidents.

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[9] National Transportation Safety Board, *Safety at Passive Grade Crossing, Volume I: Analysis* – PB 98-917004 NTSB/SS-98/02.

National Transportation Safety Board, *Safety at Passive Grade Crossing, Volume II: Case Summaries* – PB 98-917005 NTSB/SS-98/03.

[10] Wigglesworth, E.C. [Royal Australian College of Surgeons, Melbourne], 1976. *Report on human factors in road-rail crossing accidents.* Melbourne, Victoria: Ministry of Transport.

It is reasonable to conclude that the causal factors attending the accident at the Hesp Road/Bennett Road level crossing, though tragic were not unique[11].

2.3 Hesp Road/Bennett Road level crossing at 1651.580 km

The Hesp Road/Bennett Road level crossing was surveyed in May 2002 as part of the Queensland Transport Public Level Crossing Upgrade Program. The crossing was assessed based on a range of characteristics identified in the Level Crossing Safety Steering Group Public Level Crossing Assessment Report and for compliance with the Manual of Uniform Traffic Control Devices. The characteristics and compliance requirements include sighting distances, road and rail traffic volumes, pedestrian usage and road construction. The assessment of the Hesp Road/Bennett Road level crossing together with other assessments of crossings at in and around Cairns and the surrounding districts were submitted by the Local Level Crossing Committee to QR Survey Section for processing through the risk scoring matrix and for determining compliance with the MUTCD. QR Survey Section provided a number of proposals and returned these to the Local Level Crossing Committee for review/acceptance in September 2002. The local committee is yet to review the proposals and return the recommendations to the Level Crossing Safety Steering Group Technical Sub-Committee for approval.

The responsibility for passively controlled level crossing safety and maintenance is shared between the rail infrastructure provider and the road authority. The rail infrastructure provider, in this case QR, is responsible for the crossing within 0.6 m of either rail. The road authority is responsible for the maintenance of the road infrastructure beyond these limits, including road vehicle advanced warning signage and road markings. To operate effectively the two authorities need to work in consultation. A Memorandum of Understanding (MOU) between the Local Government Association of Queensland, Queensland Department of Main Roads, Queensland Transport and Queensland Rail with respect to Management & Funding Responsibility for Level Crossing Safety has been developed. This MOU includes a Statement of Institutional Responsibilities which formalises the management and funding responsibilities at QR public level crossings in Queensland. The MOU is expected to be signed off by all parties in late September 2003.

At the Hesp Road/Bennett Road level crossing QR infrastructure staff replaced a 'give way sign' by a 'stop' sign sometime between July and November 2002. The road authority was not informed of the change and was not aware of the replacement until shortly before the accident. This points to a lack of understanding of responsibilities and effective communication between the rail and road authorities, at least in the case of the Hesp Road/Bennett Road level crossing.

The immediate approach to the railway crossing from the road junctions on each side of the crossing was short. Cars approaching the crossing from Bennett Road or Hesp Road would normally arrive at the level crossing stop sign at, or nearly at right angles to the stop sign, with the car positioned towards the crown of the road. Cars turning west onto Bennett Road from Broughton Road must cross the eastbound lane and

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[11] See also - Ford G and Mathews A (2002) *Analysis of Australian Grade Crossing Accident Statistics*. Seventh International Symposium on Railroad-Highway Grade Crossing Research and Safety. Monash University

ATSB, (2002), *Level Crossing Accidents,* Monograph 10

would also come to a halt at right angles close to the railway line. From this point the sighting distance to the south would be 480 m.

Cars on Moller Road, however would tend to arrive at the stop sign at an angle, particularly if their route took them along Fixter Road. The same would be true for vehicles travelling in the opposite direction. About 20 vehicles were observed negotiating the level crossing from Moller Road onto Fixter Road. All drew up at an angle. This typically made an acute angle of between 60° and 70° to the railway line. The approach angle was very much a function of the road alignment and possibly a lack of visible cues to encourage cars to approach the crossing at right angles. This meant that car drivers had to look to their left at an angle greater than 110°, the result being that the track to the south could be partially obscured by the door pillar, or had to be viewed through the rear driver's side passenger window. The angle that a car arrives at a crossing and the distance from the railway line makes a significant difference in the direct sighting distance of an approaching train.

Although Moller Road was paved, there were no pavement markings visible on the approaches to the crossing on the Moller Road side of the crossing. More critically there was no stop line 3.5 m at right angles to the centre line of the road, a reference for drivers to align their vehicle. In addition, the issue of the sighting angle was compounded by the pronounced camber of the road.

If the assumption is made that a car stops at a stop sign which is placed 3.5 m from the nearest rail and the driver is a further 1.5m from the stop sign (5 m in total from the nearest rail) the application of this requirement for a vehicle travelling from Moller Road to Fixter Road would provide an S3_3 sighting distance measurement significantly less than 480 m. Based on the angle at which road vehicles were observed negotiating the level crossing from Moller to Fixter Roads, an approximate measurement of the S3_3 sighting distance was measured to be about 90 m.

With the stop sign being positioned 5.6 m from the nearest rail and the driver being about a further 1.5 m from the stop sign, the driver would have been about 7.1 m from the nearest rail. This extra 2.5 m would have the effect of increasing the sighting distance for cars that tended to increase their angle of approach to the crossing to be closer to right angles with the track as they approached the crossing.

3. CONCLUSIONS

3.1 The driver of the Ford Falcon station wagon had stopped at the railway level crossing before moving off slowly ahead of the oncoming train.

3.2 The probability is that the driver of the Ford Falcon station wagon responded automatically, did not look when stopped at the level crossing and proceeded across the level crossing because the presence of approaching train 3C37, the Sunlander, did not register on her consciousness.

3.3 The failure of the Ford Falcon station wagon to either see or to hear the approaching train was probably due to a combination of distraction through peroccupation, the closed car windows, the noise of the air conditioning and the familiarity with the area and the crossing.

3.4 The locomotive drivers on train 3C37 saw the car travelling ahead of them and parallel to the crossing and sounded a sustained warning blast for 14 seconds on the train horn.

3.5 The train was travelling marginally in excess of the permitted track speed. The over-speed was not, however, of such a magnitude that a road user seeing the train would misjudge the speed or distance of the train or effect any judgement regarding crossing safely in front of the train.

3.6 The locomotive drivers could not have avoided the collision with the car.

3.7 The braking system on train 3C37 brought the train to a halt within the theoretical emergency braking distance.

3.8 The locomotive and rail vehicles were mechanically sound and were not causal factors in this accident.

3.9 The railway line and infrastructure were properly maintained and operated and were not causal factors in this accident.

3.10 The weather was fine and clear and there were no environmental factors that contributed to the accident.

3.11 The alignment of Moller Road and Fixter Road to the railway crossing predisposes car drivers to stop at an angle to the railway which has a limiting effect on their vision to the driver's left.

3.12 To achieve S3 sighting distances of 480m (S3_3) and >700m (S3_2), sighting distances would have been taken at right angles or nearly right angles to the crossing. For a vehicle travelling from Moller Road/Fixter Road due to the angle at which cars were observed to traverse the crossing the sighting distance is significantly reduced.

3.13 The positioning of the stop sign and pavement markings at the crossing did not comply with the Manual of Uniform Traffic Control Devices. The absence of markings, in particular a stop line would help to counteract the tendency for cars to stop at an angle.

3.14 The communications between QR and Cairns City Council concerning the changing of signage and road marking at the Hesp Road/Bennett Road level crossing at Aloomba was deficient.

3.15 The driver of the Ford Falcon station wagon had long familiarity with the area and was experienced in driving in the area.

3.16 Given the familiarity of the driver with the area and the probability of an automatic response at the crossing, the absence of appropriate pavement markings and particularly the stop line, would not have affected her actions.

4. SAFETY MEASURES INITIATED

4.1 The signage and at Hesp Road/Bennett Road level crossing have been upgraded and pavement markings renewed following this accident.

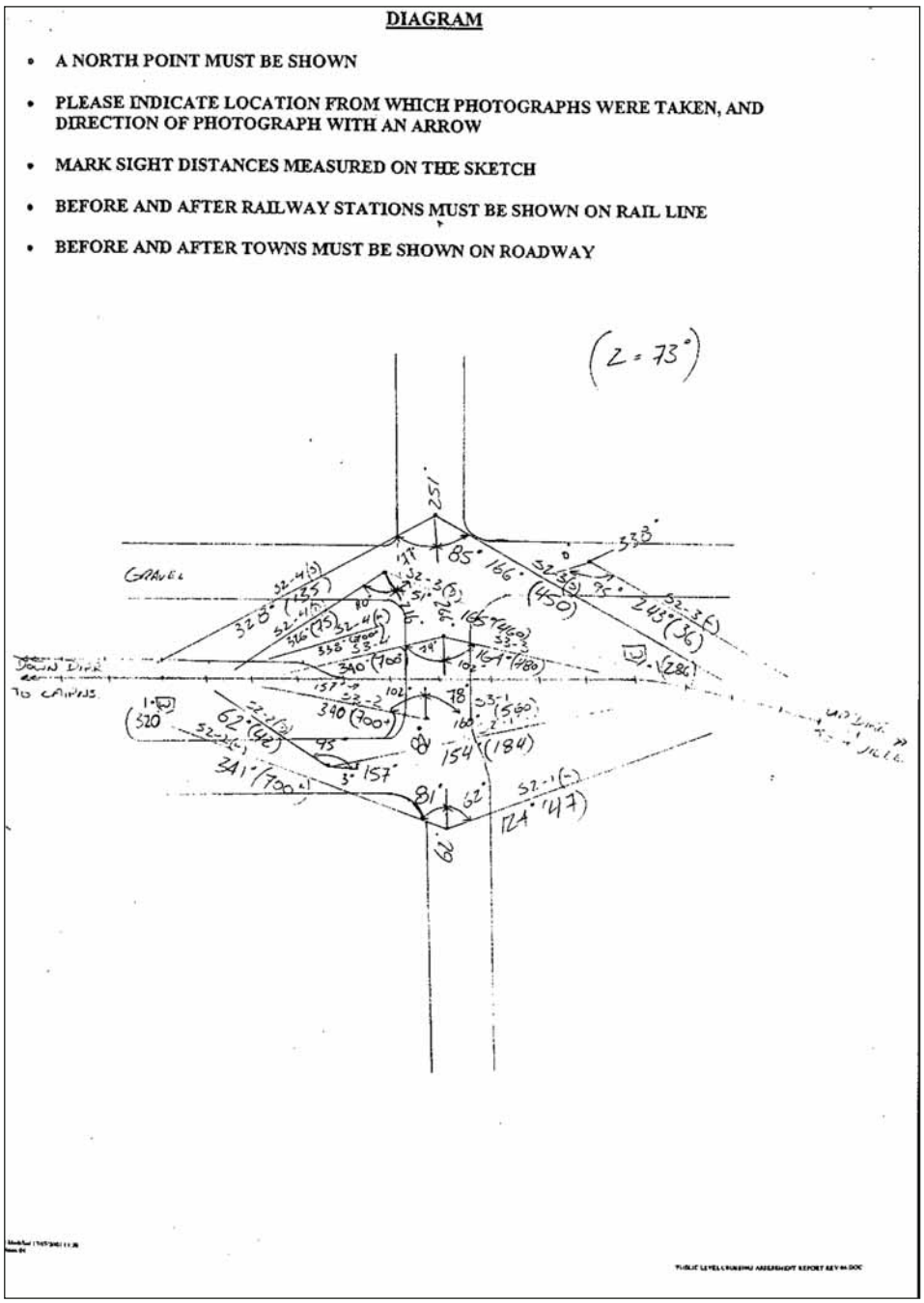
4.2 Sign off on the Memorandum of Understanding for the Management and Funding Responsibility for Level Crossing Safety in Queensland developed between the Local Government Association of Queensland, the Department of Main Roads, Queensland Transport and QR will formalise responsibility for the ownership of level crossing componentry between the road and rail authority.

5. SAFETY RECOMMENDATIONS

5.1 In accordance with the requirements of the Level Crossing Upgrade Program, the Hesp Road/Bennett Road level crossing be re-assessed in light of this report and the proposals to meet the risk threshold and compliance implemented as a matter of priority.

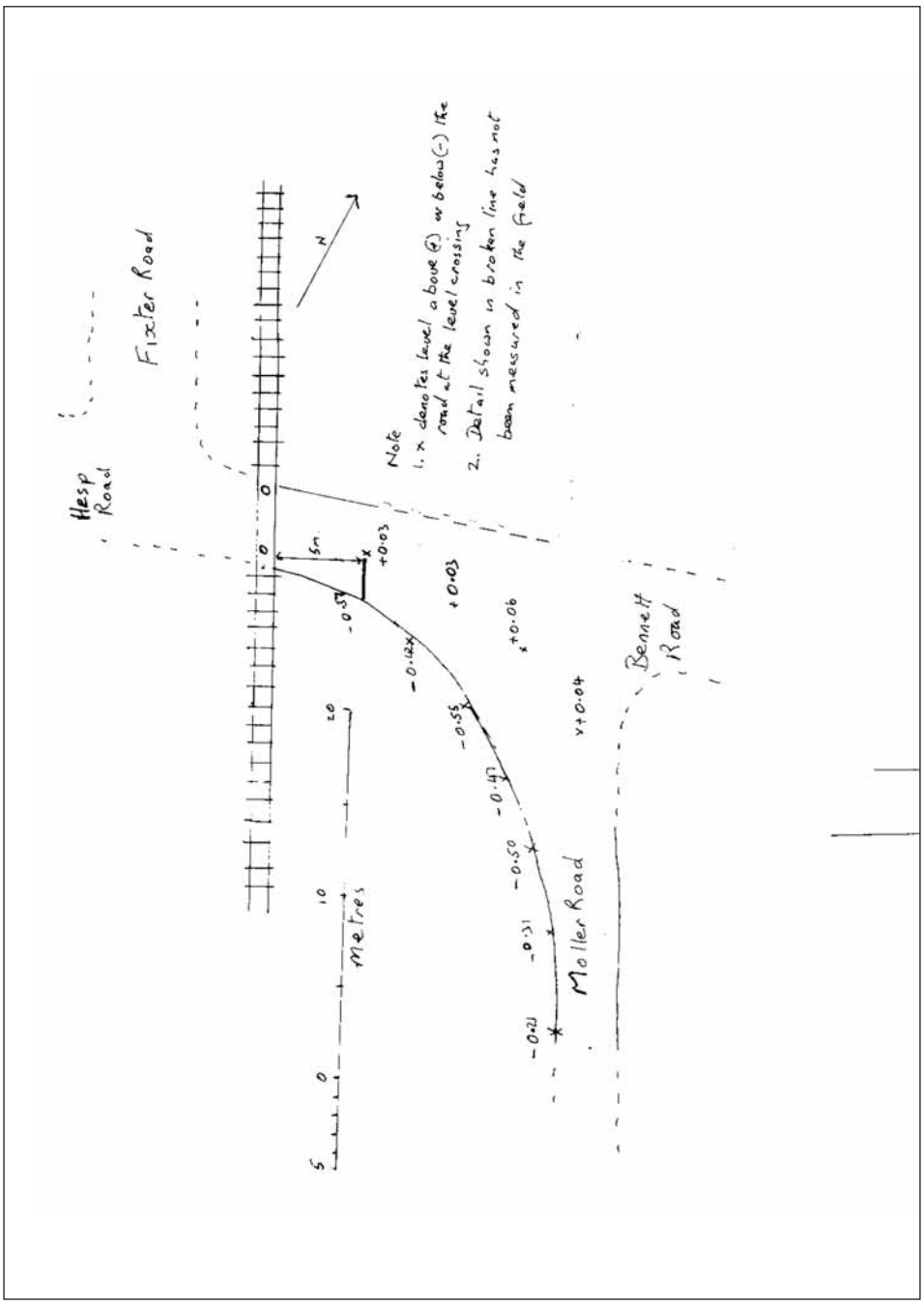
Attachment 1

Field Assessment Sketch



Attachment 2

Sketch of Cross falls



Fatal collision between passenger train 3C37 and a Ford Falcon station wagon

at the Hesp Road/Bennett Road level crossing Aloomba, 23 May 2003

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