Australian Government

Australian Transport Safety Bureau

RAIL SAFETY INVESTIGATION
2004/003

Signal MR5 Passed at Danger, Freight Train Y245

Murarrie, Queensland

28 June 2004

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INTRODUCTION

Following the passing of a signal at danger at Murarrie on the Defined Interstate Rail Network (DIRN) by train Y245 at about 1932 on Monday 28 June 2004, the Australian Transport Safety Bureau (ATSB) initiated an investigation into the causal factors of this incident under the *Transport Safety Investigation Act 2003*.

The potential for a collision with another freight train existed as the signal passed at stop was protecting an opposing freight train that was being diverted to another line to allow both trains to cross and continue their journeys.

The investigation encompassed an examination of all factors that were either causal or potentially causal to the incident. The investigation methodology included an analysis of signal and track data, relevant safety management systems, the actions of individuals and human factor issues.

To ensure the completeness of this investigation, the ATSB engaged the services of an independent expert medical practitioner and also examined several scenarios based on an altered state of driver awareness and reaction from train controllers.

The ATSB would like to acknowledge the cooperation of all who participated and assisted in this investigation.

EXECUTIVE SUMMARY

At 1931:55[1] on 28 June 2004 train Y245 passed signal MR5 displaying a stop aspect at Murarrie. Train Y245 was a freight train that had departed from the Brisbane port of Fisherman Islands 18 minutes earlier and was en route to northern Queensland. The train was crewed by a Maryborough-based driver who had signed on duty at Fisherman Islands at 1845 after having 'rested' in the traincrew quarters since 0645 that morning.

From Fisherman Islands to Murarrie, train Y245 was routed via the dual gauge[2] line. At Murarrie, signal MR5 was displaying stop (red) in order to hold train Y245 while an opposing loaded grain train (6835) was diverted from the dual gauge line via a crossover to the adjacent suburban line. Once train 6835 was clear of this crossover it was intended that train Y245 would resume its northbound journey on the dual gauge line.

The driver had passed a caution signal and then saw signal MR5 displaying a stop aspect when about 200 metres away. At that point, the driver initiated a brake application. At 1931:55 the train subsequently passed this signal (at 35kph) and at 1931:57 a SPAD[3] alarm sounded at the Mayne Control Centre. At 1932:12 train Y245 stopped 81.8 metres past signal MR5. One second later at 1932:13, a train controller radioed an emergency call to Y245 to stop. During this time train 6835 was proceeding to the suburban line as intended, clearing the crossover at 1932:37. This was 42 seconds after signal MR5 was passed at stop. There were no other signals between MR5 and the crossover from the dual gauge line to the suburban line.

The investigation determined that the train controller controlling this section of track at the Mayne Control Centre was absent from his workstation at the time train Y245 passed signal MR5 at stop. This absence contributed to the 16-second delay in the train control centre broadcasting the emergency stop order. An adjacent train controller had to acknowledge and deal with the SPAD alarm.

The investigation determined that train Y245 was being driven as if all signals controlling its path were displaying proceed aspects. It was determined that the train was being driven in this manner due to the driver's attention being diverted from the primary task of driving the train to an incidental task, stated to be the retrieval of a radio hand-set that had fallen to the cab floor.

The driver of train Y245 died on 26 October 2004 following a severe coronary episode. This and his previous involvement in SPAD incidents (where loss of concentration was cited as a causal factor) led to the examination of this driver's state of health. This in turn led to an examination of the medical standards applicable to Queensland Rail (QR) drivers. The investigation found that, while it

1 All times in this report are based on Eastern Standard Time and are synchronised as detailed at 2.2.2.

2 Dual gauge – The dual gauge line at Murarrie allowed trains of narrow (1067mm) and standard gauge (1435 mm) to operate.

3 SPAD – An acronym common to the rail industry that stands for 'Signal Passed at Danger'.

was unlikely that partial incapacitation was a factor in the SPAD at signal MR5, the possibility could not be ruled out.

The investigation also found the previous internal QR reports (those provided) into the driver's other SPAD incidents focused on the active factors in lieu of latent or systemic factors. Additionally, it was found that the process of returning the driver to full duties following previous SPADs seemingly followed a set pattern. Once returned to full driving duties, there was little evidence the driver was subject to any additional monitoring or supervision.

Safety actions recommended as a result of this investigation include:

- placing a greater emphasis on the identification of systemic and latent issues during the internal investigation process
- greater monitoring and evaluation by the operator of employees who have been involved in SPADs
- a review of practices and procedures at the Mayne Control Centre
- a review of QR medical standards.

1 SEQUENCE OF EVENTS

1.1 Overview of SPAD at MR5

At about 1914 on Monday 28 June 2004 train Y245 departed Fisherman Islands at the start of its northbound journey. The intended route through the Brisbane metropolitan area was Fisherman Islands to Park Road and Yeerongpilly via the dual gauge Defined Interstate Rail Network (DIRN), then to Corinda, Roma Street, Petrie and points north on the Queensland Rail (QR) narrow gauge network.

Travelling in the opposite direction on the dual gauge from Park Road was loaded grain train number 6835 from the Darling Downs bound for the port of Fisherman Islands. It was intended that these two trains would cross at Murarrie by routing train 6835 to the narrow gauge suburban line via the crossover 585.7 metres from signal MR5. It was intended to hold train Y245 at signal MR5 until train 6835 was clear of the dual gauge. Train 6835 was then to continue on the suburban line as far as Lytton Junction where it was to be routed back to the dual gauge for the final segment to Fisherman Islands.

The crossing of trains Y245 and train 6835 was under the direction of the train controller at Mayne Train Control Centre responsible for number two terminal of the Universal Train Control (UTC[4]) workstation.

FIGURE 1: Crossover at Murarrie looking east

4 UTC – Universal Train Control, see 1.4.1 of this report.

Train 6835 was part of the way through the crossover to the suburban line at Murarrie as train Y245 approached signal MR5. At 1931:55 train Y245 was recorded as having passed signal MR5 at stop and at 1931:57 a SPAD alarm activated at the Mayne Control Centre. Sixteen seconds later, at 1932:13, an exchange between a train controller at the UTC2 workstation and the driver of train Y245 occurred. This exchange ceased at 1932:27.

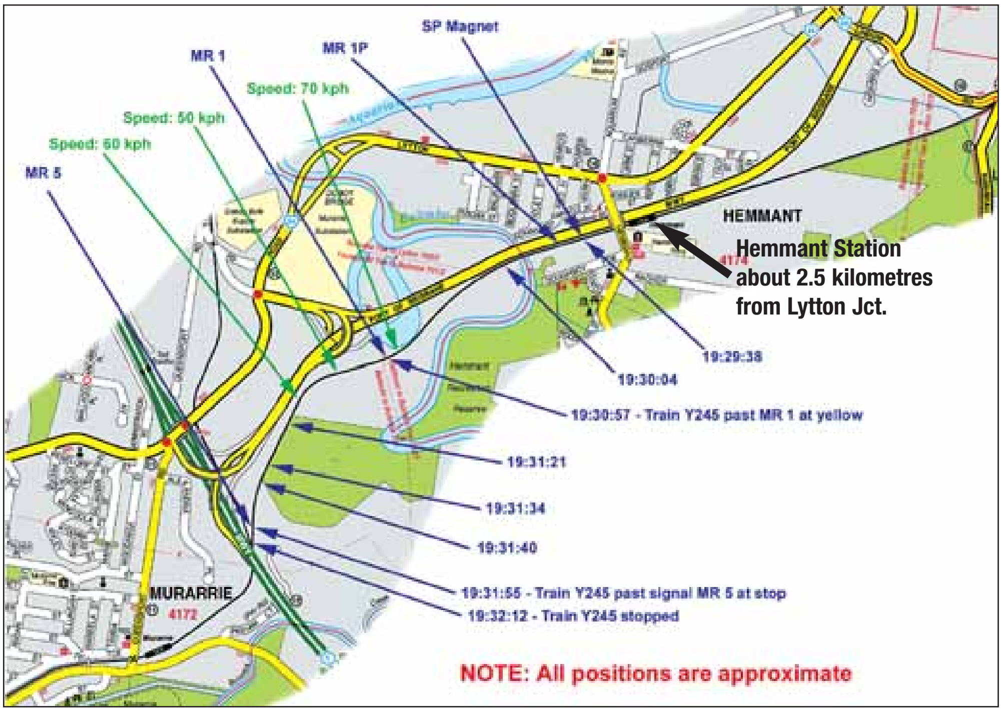
> Mayne control – "*Control to Y245 urgent, control to Y245 urgent, can you stop immediately thank you*".
>
> Driver Y245 "*Yeh I have, I just got past.*
>
> Six seconds later at 1932:33, the exchange continued and lasted for 22 seconds.
>
> Mayne control – "*Yeh, Y245 you have stopped haven't you*"?
>
> Driver Y245 – "*Yeh I have stopped*".
>
> Mayne control – "*Right–oh thanks, how far past that signal have you got do you think*"?
>
> Driver Y245 – "*A couple of diesels*"
>
> Mayne control – "*Right–oh, just remain where you are please*"
>
> Driver Y245 – "*Right–oh*".

Train Y245 had stopped at 1932:12 approximately 81.8 metres past signal MR5, one second prior to the train controller transmitting this message. During this incident, train 6835 continued through the crossover to the suburban line with the rear of this train clearing the dual gauge line in advance of train Y245 at about 1932:37.

The driver of Y245 was relieved from driving duty at 2040 and the train departed with another driver at 2107.

See appendix 6.1 for a diagram of signal and operating systems at Murarrie.

FIGURE 2: Diagram of train position approaching Murarrie



1.2 Train details

1.2.1 Train Y245

Train Y245 was a freight train hauled by locomotive 2804. It consisted of loaded containers from the Multi Modal Terminal at Fisherman Islands destined to delivery points at Rockhampton, Mackay and Townsville. The containers were conveyed on PJZY and PRZY class wagons.

The train was 614.30 metres long, weighed 1,007 tonnes and had a maximum speed of 100 kph. Train Y245 was crewed as driver only operation (DOO), meaning that the driver in the locomotive was the sole crew member of the train.

Locomotive 2804 was built in 1995 by Goninan Engineering at Townsville, Queensland. The locomotive had a gross power rating of 2380 kw (3190 hp) and weighed 116 tonnes.

FIGURE 3: Locomotive 2804

1.2.2 Train 6835

Train 6835 originated from the Darling Downs and was conveying grain bound for export via the port of Fisherman Islands.

This train was hauled by two locomotives of the 2300 classification, was 609.8 metres long, weighed 2,351 tonnes and had a maximum speed of 80 kph. Train 6835 was crewed by two drivers, one based at Toowoomba and one based at Fisherman Islands. The Fisherman Islands based driver had signed on at 0900 to travel to Toowoomba and return on 6835 as a continuous shift.

The 2300 class locomotives are based on older Clyde GM locomotives that had been rebuilt on a progressive basis at the QR Redbank Railway Workshops since 1997. They have a gross power rating of 1655 kW (2250 hp) and weigh 95 tonnes.

1.3 Overview of rail corridor

1.3.1 Defined Interstate Rail Network

The DIRN of Australia was designated in the National Code of Practice, volume one, titled 'General Requirements and Interface Management' as including:

a) all main lines and associated crossing loops

b) track sections capable of carrying narrow (1067 mm), standard (1435 mm) and broad (1600 mm) gauge rollingstock on either single or multi-gauge track.

The Code of Practice for the DIRN, volume three, titled *'Operating and Safeworking'*, part two *Route Standards*, listed the applicable routes in Queensland as being:

- Acacia Ridge – Dutton Park – Fisherman Islands
- Dutton Park – Roma Street
- Acacia Ridge – NSW border (Border Tunnel).

1.3.2 Fisherman Islands to Park Road

Fisherman Islands is situated at the mouth of the Brisbane River about 25 kilometres from the central business district of Brisbane. Fisherman Islands is the main port for the city of Brisbane and handles considerable quantities of domestic and export containerised freight, bulk grain and coal. Road and rail are used for the transportation of this commerce to and from hinterland points of destination and origin.

The rail facilities at Fisherman Islands are set out in such a manner that the Brisbane Multi Modal Terminal (BMT) is separate from the grain and coal unloading facilities. The BMT has narrow and standard gauge access and the coal and grain facilities narrow gauge only.

Once clear of the Fisherman Islands precinct, the dual gauge track continues for about six kilometres to Lytton Junction where the electrified suburban railway from Cleveland, consisting of two electrified narrow gauge tracks, joins the corridor. The rail corridor then continues for about 14.5 kilometres to Park Road configured as two electrified narrow gauge tracks and one non-electrified dual gauge track. At various locations there are crossovers that allow narrow gauge trains to be routed from the dual gauge track to the suburban lines and vice versa. There are no standard gauge crossovers, therefore opposing standard gauge trains cannot be crossed on this section.

The dual gauge is a combination of 47 and 60 kg/m rail laid on concrete sleepers and the maximum allowable loading is 20 tonnes per axle for narrow gauge trains and 23 tonnes per axle for standard gauge trains. The maximum speed of trains on the dual gauge is 80 kph for both narrow and standard gauge trains.

Park Road is a major junction in terms of routing trains. From Park Road narrow gauge trains can be routed to the north and west via South Brisbane or Corinda and south to Acacia Ridge or the Gold Coast. Standard gauge trains can be routed to the passenger terminal at Roma Street (from the southern direction only) or south to Acacia Ridge and beyond.

1.3.3 Overview of Murarrie

The Murarrie rail station is situated on the Cleveland and Fisherman Islands corridors about 14 kilometres from the central business district of Brisbane. Murarrie is a suburb of Brisbane and comprises a mix of residential dwellings and industrial buildings. The Gateway Arterial Motorway dissects the corridor about 200 metres from the passenger station.

Rail traffic through this locality consists, in general terms, of electric suburban trains to and from Manly and Cleveland and freight trains to and from Fisherman Islands. Other than at weekends, peak periods and the late evening, the electric suburban trains run at 30-minute frequencies. Freight train movements through Murarrie over a 24-hour period vary according to the day, time and seasonal requirements of traffic to and from the Fisherman Islands terminal and port.

1.4 Operational safety

1.4.1 Train control centre

The Mayne Control Centre is situated at Bowen Hills which is approximately three kilometres from the Brisbane central business district. Apart from movements within selected yards, the Mayne Control Centre manages all train movements, both passenger and freight, over almost the entire greater Brisbane metropolitan area. This area is bounded by Caboolture in the north, Ipswich in the west and Acacia Ridge/Gold Coast in the south. The centre also houses train crew roster liaison, the electric train maintenance coordinator, station and train security, signal technician and overhead power personnel. The Mayne Control Centre is the operational focal point of the Brisbane suburban rail network.

The Mayne Control Centre train control work area is configured as an open floor plan that affords easy verbal communication between all who work there. The train controllers have individual UTC computer monitors at their allotted workstations. Additionally, a large 'overview screen' provides a less detailed display and allows each controller to monitor the whole network to anticipate how other activities may impact on their area of control. In addition, the large mimic panel allows the supervisor to have an overview of the suburban system at a glance.

Trains in the Murarrie precinct are controlled by the train controller situated at the UTC No. 2 (UTC2) workstation. At the time of this incident the UTC2 workstation covered the area from Acacia Ridge to Fisherman Islands to Wynnum, encompassing Moolabin and Park Road.

1.4.2 Passage of trains

The passage of trains through Murarrie is regulated by safety standards in combination with coloured light signalling. The Mayne Control Centre routes and prioritises movements using the signalling system.

The signalling procedures are referred to as Remote Controlled Signalling (RCS). At Murarrie signalling consists of two and three aspect controlled[5] signals with ancillary equipment such as junction route indicators and position light shunt signals.

FIGURE 4: Mayne Control Centre showing overview screen and individual UTC workstations in the foreground

Interlocking[6] is remotely controlled by the train controller at Mayne by UTC. The UTC is a non-vital control system that processes the commands entered by the controller and transmits these to the field signalling system. The system allows the train controller to queue (set) up to ten routes in advance and place blocks (safety reminders) on sections of track for maintenance and other purposes. In the field, the Vital Processor Interlocking (VPI) allows these routes to be set when they are available and safe to do so. VPI is a vital control system[7].

1.4.3 Communication

Voice communication between train control and trains on the corridor between Park Road and Lytton Junction is via UHF channel 117. This is an open channel that allows train-to-train communication and train control-to-train communication. All trains on this corridor, freight or suburban, have common access to this channel. Should local communication be required for issues such as shunting, another radio channel is allotted.

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5 Controlled signal – a signal the train controller, via the UTC and Vital Processor Interlocking (VPI) systems, has control over.

6 Interlocking – An arrangement of signals and points so connected that they operate in a defined sequence.

7 Vital control system – A safety critical system, under failure conditions, that will default to a safe mode of operation.

1.4.4 Train and track safety devices

The 2800 series of diesel locomotives are fitted with Westect Automatic Train Protection (ATP) and a Vigilance Control System (VCS).

ATP is a communications-based automatic train protection system that, in its optimum configuration, is fitted to both the locomotive and trackside equipment. When configured in this manner, ATP forms a link between the trackside signalling system and the train braking system. During the journey ATP constantly monitors train speed and calculates the braking distance to limits of authority in advance. Should a driver fail to react to a limit of authority or speed restriction the ATP system will initiate a brake application at the last safe moment to avoid any breaches. ATP also protects against runaways, unauthorised reverse movements and complements safe shunting by preventing an exceedence of shunting speed and authority. When the ATP is fully functional in this manner the VCS alerting system is suppressed.

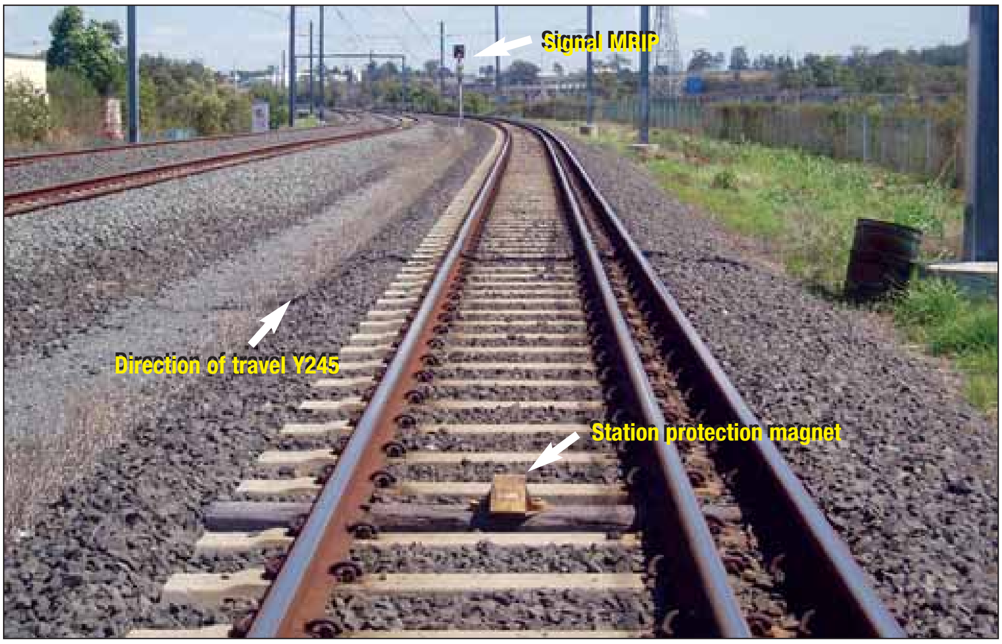
When a locomotive is operating over a section of track that does not have ATP trackside equipment, the ATP system will only prevent the train from exceeding its maximum speed or runaway. In these instances the VCS alerting system will be functional. The section of track from Fisherman Islands to Park Road does not have the ATP trackside equipment fitted.

The VCS is designed to assist in the verification of driver alertness only, as it does not have the capability to monitor and/or intervene in the operation of the train by the driver. To acknowledge an alarm or restart the VCS time cycle the driver has to depress and release the acknowledgment button on a regular basis. Eighty seven seconds after the last such acknowledgement a vigilance light will flash. At 90 seconds an intermittent alarm sounds and the vigilance light continues to flash. At 93 seconds the train brake will be applied.

The only track-mounted device fitted to the dual gauge in the Murarrie precinct is a magnet known as a station protection magnet. When a locomotive passes over these magnets an alarm sounds for a maximum of three seconds and a light illuminates regardless of whether of not the driver presses the acknowledgement button. If the acknowledgement button is not depressed the train brakes will apply. This station protection magnet is situated 2,033.9 metres from signal MR5 on the approach from Fisherman Islands.

The requirement for these and other secondary protection measures are specified in QR STD/0076/SWK 'Safeworking Principles' (See 2.5.3 of this report).

FIGURE 5: Station protection magnet and warning signal MR1P



The route from Lytton Junction to signal MR5 is about 4.5 kilometres in length. The dual gauge line is situated to the right of the two narrow gauge suburban lines in the direction of travel from Fisherman Islands.

Signals encountered on the approach to signal MR5 are MR1P and MR1. Signal MR1P is two-aspect approach signal that displays yellow if signal MR1 is at stop (red) or green if signal MR1 is displaying either a yellow or green aspect. Signal MR1 is a three-aspect controlled signal capable of displaying either a red, yellow or green aspect. Signal MR1 displays a yellow aspect when signal MR5 is at red. Signal MR5 is a controlled signal also capable of displaying either a red, yellow or green aspect. In addition, signal MR5 has a position light signal mounted below the main signal head that, when illuminated, authorise movement no further than the next signal or as far as the line is clear.

FIGURE 6: Signal MR1

The signal visibility distances as measured from ground/track level by the joint Queensland Rail, Queensland Transport, and ATSB site inspection on 14 September 2004 in clear and sunny conditions were:

- MR1 restricted[8] – 774.5 metres
- MR1 clear – 679.5 metres
- MR3 restricted – 538.8 metres (momentarily between trees)
- MR3 clear 386 metres
- MR7 clear 257.9 metres
- MR5 clear 257.9 metres.

Therefore MR3, the signal that has application to the Down[9] suburban line, can be visible to the driver of a train on the dual gauge line about 128 metres prior to sighting signal MR5. Although visibility distances will vary as ambient light decreases (normally distances increase), the likely visibility in this incident is of the same order.

QR STD/0024/SWK titled 'Signal Positioning Principles' defines signal sighting distance as being:

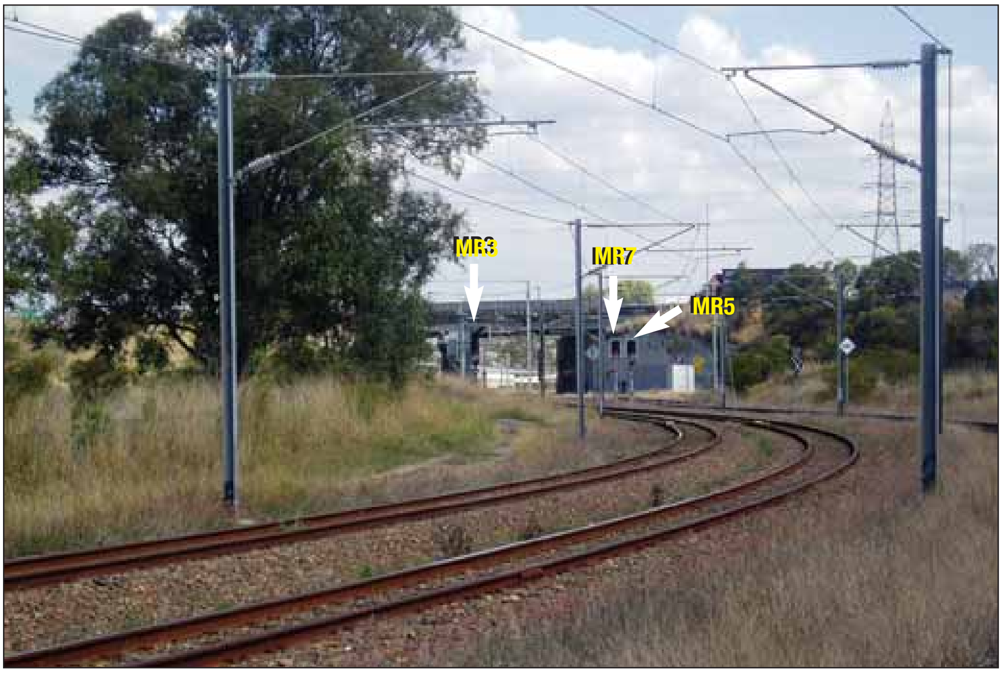
> The distance along the track between where a signal can first be reasonably viewed, in clear weather both day and night, by a train driver of an approaching train, and the physical location of that signal. The train driver should not lose sight of the signal for more than one second at any time whilst the train is moving towards that signal.

8 Restricted sighting – intermittently obstructed by either overhead power masts or foliage.

9 Down suburban line – direction of traffic (predominately) to the Brisbane CBD.

This standard also requires drivers to have a minimum of eight seconds of viewing of the signal they are approaching at the maximum line speed applicable to that section of track. The maximum line speed approaching signal MR5 is 60 kph; STD/0024/SWK sets the nominal sighting distance (at this speed) as 135 metres.

FIGURE 7: Aspect being displayed in signal MR5 visible 257.9 metres (daylight conditions)



There are two, three-aspect controlled signals that apply to the suburban lines located opposite to MR5. Signal MR7 is located immediately adjacent (to the left) to signal MR5 and applies to the Up suburban line while signal MR3 is located to the left of the two suburban lines. Signal MR3 applies to the Down suburban line.

1.5 Injuries or damage

There were no injuries or damage as a result of this incident.

1.6 Environmental factors

At 1930 on 28 June 2004 the weather was fine and clear and the sun had set about two hours earlier. A nearly full moon was bearing about 170 degrees at an altitude of about 47 degrees. The average maximum temperature for the day was 21 degrees Celsius and the average minimum temperature 6 degrees.

1.7 Toxicology

The driver of train Y245 was breath tested by officers of the Queensland Police at about 2030 on 28 June 2004. The result of this test was negative.

The train controllers at the Mayne Control Centre that were involved in this incident were not breath tested. There is no legislative requirement to do so.

1.8 Organisational context

1.8.1 Overview of Network Access Group

The Network Access Group is a business unit of Queensland Rail. QR is independent of Queensland transport, the regulator. The primary role of this group is to maintain, control and manage access to QR's fixed rail infrastructure. Railway operators external to QR liaise directly with the Network Access Group for access. Within the entity of QR though, access to rail infrastructure is managed by QR. QR has rail safety accreditation as a railway manager and railway operator.

The process of accreditation of railway operators is managed by Queensland Transport. Network Access Group is independent of Queensland Transport. The Passenger Services Group manage the Mayne Control Centre on behalf of the Network Access Group.

1.8.2 Overview of Coal and Freight Services Group

Coal and Freight Services Group was a business unit of Queensland Rail. In April 2005 it became QRNational. Coal and Freight Services Group managed over 50 freight terminals throughout Queensland and, in addition to general freight, carried commodities such as livestock, sugar, fuel, cement, bulk minerals and grain. Typical amounts railed per annum were 10 million tonnes of general freight and grain, and 145 million tonnes of coal.

In total these tonnages were, apart from some private operators in Western Australia, the highest of any of the rail systems in Australia.

1.8.3 Traincrew configurations

Freight trains on the Queensland narrow gauge network are crewed by two drivers or a driver and an assistant, or a driver only.

Driver-only operation on the QR network first started in 1989 between Brisbane and Maryborough. Since then this mode of crewing has been extended across much of the state.

The removal of the second person from the locomotive cab meant that a number of risk mitigation measures were taken. In this regard Automatic Train Control (ATC) and ATP systems have been installed on most of the single line track where this form of crewing operates. In essence, these systems ensure that trains cannot proceed normally without the interlocking's authority (normally seen as signals displaying a proceed aspect to the driver), or exceed speed limits. If necessary, the ATC/ATP systems can apply the train brakes to achieve this end.

Further mitigation against the lack of a second person in the locomotive cabin are shorter shift lengths, nominally around eight hours duration and 'personal needs' breaks taken during the shift. In addition, locomotive cabins are designed or modified to support single-person working. For example, the driver must have as much unrestricted forward and peripheral vision as possible.

Two-driver operation started on QR in 1994. This type of train crewing utilises two qualified drivers who share the driving duties during a shift that can be rostered up to 12 hours. This type of crewing is generally used on corridors where the distances between crew depots or train speeds are such that longer shifts are required. Further considerations are terrain of the corridor (for access purposes) and attaches or detaches of wagons en route.

2 KEY ISSUES

Neither the condition of the track, nor the condition of the rolling stock are considered to be contributory factors to the SPAD. The two key safety issues are:

- Why did the driver of Y245 pass signal MR5 when it was at stop?
- Why was the emergency response delayed?

2.1 Emergency response to the SPAD

The train controller contacted the driver of Y245 one second after the train stopped at 1932:12. From this time, the driver acted on instructions from personnel at the Mayne Train Control Centre.

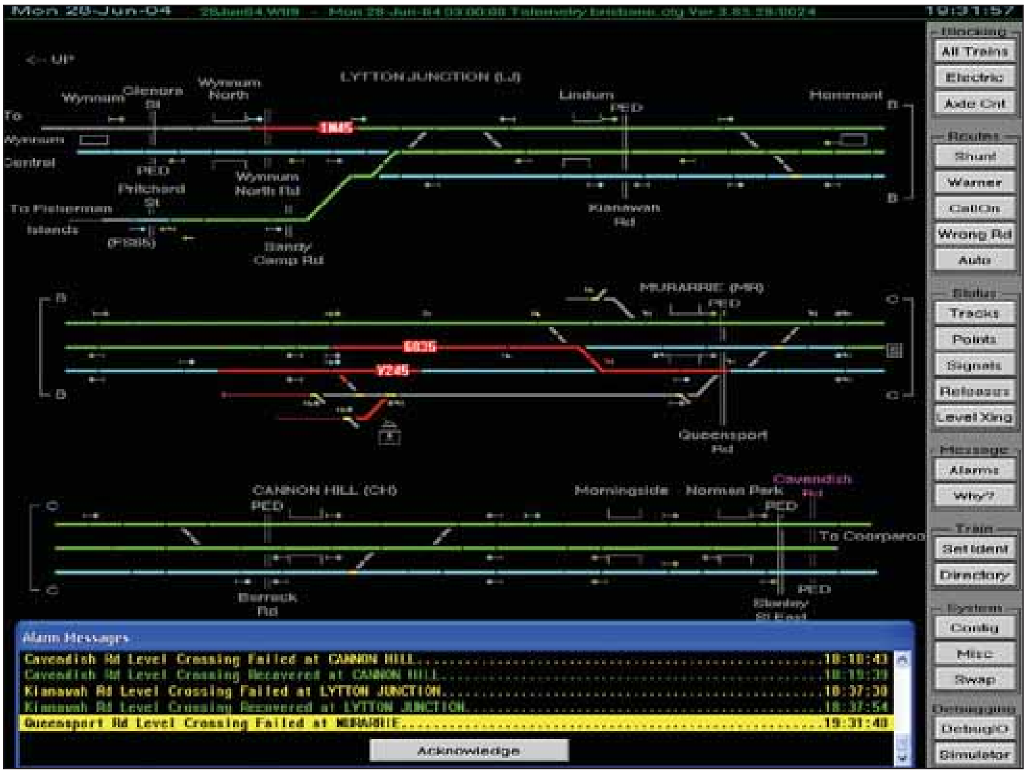
2.1.1 Train control actions

The audible SPAD alarm caused by train Y245 occupying track 24GT immediately beyond signal MR5 activated at the Mayne Control Centre at 1931:57. When a SPAD occurs an audible alarm sounds continuously until it is acknowledged. In addition, a text SPAD alarm is generated that gives details of the SPAD. This alarm will 'jump the queue' over lower priority alarms that are being held awaiting display. This means that, if there is an existing alarm being displayed on the workstation visual display unit (VDU) screen, it must be acknowledged before the SPAD alarm can be displayed as a text message. This feature and distinctive audible warning and visual display on the workstation VDU sets this type of alarm apart from the other alarms.

Interviews with the train controllers confirmed that the controller was absent from the UTC workstation that controls this section of track (UTC2) when the SPAD at MR5 occurred. The initial response to this alarm was initiated by the train controller at the adjacent UTC1 workstation. This controller had to stop what he was doing, move to the UTC2 workstation and cancel an alarm that read 'ALM Queensport Rd Level Crossing Failed at MURARRIE'[10] that was already displayed in order to bring up the SPAD alarm details on the UTC2 workstation VDU. The emergency call for train Y245 to stop was subsequently made 16 seconds after the SPAD alarm first sounded.

10 ALM Queensport Rd Level Crossing Failed at Murarrie – An alarm generated by the boom barriers being lowered in excess of a predetermined period.

FIGURE 8: **Computer monitor 9 of UTC2 workstation at time of the SPAD (1931:57). While the audible SPAD alarm was heard, the SPAD alarm text was still awaiting display**



Neither train controller could accurately recall how long the UTC2 workstation was unattended. A detailed analysis of work station outputs and radio transmissions using voice analysis software was conducted to best establish the period.

The UTC data from the UTC2 workstation was downloaded for the period 1839:55 on 28 June to 0334:31 on 29 June 2004, using the necessary software and data files to replay the UTC data. The train controller audio communication from UTC1 and UTC2 workstations for the period 1900 to 2030 were also downloaded. The train controller audio files were imported into Sony Sound Forge[11] for analysis.

Train controller inputs are recorded in the replay file. These consist of three-letter abbreviations indicating system commands. The following inputs indicate when the train controller was performing workstation input:

BUT – clicked on a screen button	TRK – clicked on a track,
PTS – clicked on a points track diagonal arm,	PVT – clicked on a points track pivot
RLS – clicked on a release	XNG – clicked on a Level Crossing
SLT – selected a train from a train list	DIR – selected a directory from a directory list
AUT – clicked on an Auto Signal Restorer Box	CBX – clicked on a Control Box
STN – clicked on a Station Title	AXC – clicked on an Axle Counter
ZON – clicked on a Zone Release	

All other text abbreviations are either outputs (e.g. CTL for telemetry control) or are received from other sources (e.g. IND for telemetry indication) and as such are automatically generated by the workstation without any intervention from the train

11 Sony Sound Forge – audio analysis software.

controller. The UTC2 train controller had three computer monitors on his desk. They are numbered 9, 10 and 11 and each has its own replay file.

The last of the manual UTC2 workstation inputs prior to the audible SPAD alarm occurred at 1930:51 and the last audio transmission was completed at 1931:07. Given that the train controller did not acknowledge the 'ALM Queensport Rd Level Crossing Failed at MURARRIE' at 1931:40 on monitor 9, it is likely that he had left the UTC2 workstation sometime between the audio transmission and the level crossing alarm. The following table shows the times of alarms immediately before and including the SPAD

Computer Monitors UTC2	*Time*
10	1927:50
11	1928:00
09	1930:51

Thirty six seconds after the audio SPAD alarm sounded, the UTC2 train controller started a radio transmission at 1932:33. Therefore, it is probable that the UTC2 train controller returned to his workstation sometime between when the adjacent train controller made the emergency call to train Y245 (1932:13) and 1932:33. The following table shows the times of controller input at the UTC2 workstation after the adjacent train controller accepted the SPAD alarm at 1932:11.

Computer monitor UTC2	*Time*
09	19:32:58
11	19:44:23
10	19:48:43

The UTC2 work station was unattended for up to 86 seconds. Upon return the UTC2 train controller took over from the UTC1 train controller and enacted contingency measures aimed at ensuring the welfare of the driver, breath testing requirements and having the driver relieved from driving duty.

2.1.2 Summary

In the event of a SPAD prompt or alarm a train controller is bound by QR Operational Emergency Procedures to:

- immediately call the train on the radio using the emergency radio procedures and tell the train driver to stop
- warn any train that may be in danger
- take any action necessary to protect trains and any workers working on the track
- ask train drivers of any trains in the vicinity to confirm their location
- report the emergency to the train control supervisor
- check relevant corridor plan, site plan and traffic plan for any necessary requirements and take action as necessary.

The emergency radio procedures are contained in standard 0037/SWK at SG 7.5. and read (in part):

> In an emergency situation a worker stating emergency is to immediately transmit a message announcing the urgency of the situation, for example say 'URGENT, URGENT, EMERGENCY AT…(location)'.

In this instance, there was 14 seconds between the activation of the SPAD alarm and its cancellation. There was then a further two seconds before radio contact was made with the driver of train Y245 (16 seconds in total). It is apparent that a contributing factor to this delay was the absence of the train controller from the UTC2 workstation at the time of the SPAD. Also, there were a number of queued UTC alarm messages at the UTC2 workstation, including the Queensport level crossing alarm. *QR Train Control Manual STD/0029/SWK* categorises a SPAD alarm as response level one. Response level one, in part, requires the train controller to:

> Investigate cause. Make emergency call to stop offending train. If other trains are present, call all trains in the areas to stop.

In this instance train Y245 had already stopped by the time the emergency call was made and the opposing train, 6835, was not instructed to stop due to advice being received that Y245 was in fact stationary. Had the emergency call been made immediately after the SPAD alarm activated train 6835 should have been stopped. However, train Y245 stopped before such a message was transmitted and there was no danger in allowing train 6835 to continue.

The nature of a QR train controller's task requires that train controllers be at their workstations. Relevant procedures reflect these requirements. However, the investigation has found that train controllers are absent from workstations for operational reasons, personal needs and other requirements. Therefore, short term absences from train control workstations at the Mayne Train Control Centre are not an unusual occurrence and are routinely tolerated. In addition, while there are procedures to cover the handover of duties from one controller to another at the end of a shift or turn of duty, no procedures exist to cover the handover of duties to another controller for short-term absences. Moreover, while UTC workstations can be amalgamated in times when the work load is reduced, no validated instruction on one train controller working two workstations simultaneously has been sighted during this investigation.

2.2 Combined data examination

2.2.1 Overview – Combined data examination

In order to establish the sequence in which events occurred in this incident, a detailed analysis of the ATP locomotive data logger, UTC and audio recording data from the Mayne UTC2 train control workstation was carried out. This analysis allowed an accurate determination of events leading up to and subsequent to the passing of signal MR5 by train Y245.

2.2.2 Synchronization of times

As each system is independent of each other, recorded times derived from the ATP locomotive data logger, UTC and audio recording from the train controller workstation were not synchronised.

Although the timings recorded by the UTC system are not regularly checked against a common time, all telemetry control signals from the Mayne Control Centre are recorded by the UTC system. Therefore, for the purposes of synchronization, the times recorded by the UTC system were regarded as the standard.

To give effect to this, 76 seconds was added to the times recorded by the ATP data logger on locomotive 2804 and 105 seconds was subtracted from the times recorded by the network audio.

2.2.3 Combined analysis

This combined analysis commences at 1929:38 and examines the manner in which train Y245 was handled on the approach to signal MR5 and the emergency response from the Mayne Train Control Centre. To assist in the understanding of these events, figures 9 to 14 depict the events as they occurred simultaneously from the Mayne Control Centre and the locomotive of train Y245. It should be noted that the sighting distances quoted refer to daylight conditions. At the time of the incident it was nightime. Although there was a full moon, the signals would have appeared to be brighter than in daylight.

At 1929:38 train Y245 was travelling at 61kph (16.94 m/s) with the throttle in three notches (full power is eight notches) with the brake pipe fully charged and the brakes off. At this time Y245 was 2,049 metres from signal MR5 and 15 metres from the station protection magnet. Therefore, 15 metres after this point (within one second) the driver received an audible and visual warning generated by the trackside station protection magnet that would require acknowledgement.

At 1930:04 train Y245 was travelling at a fairly constant 57 kph (15.83 m/s) with the throttle in three notches and the brake pipe fully charged. At this data point it was 672 metres from signal MR1 and 1,620 metres from signal MR5. As the sighting distance of signal MR1 was 679.5, metres the yellow aspect that was being displayed in signal MR1 should have been visible to the driver of Y245 at this time.

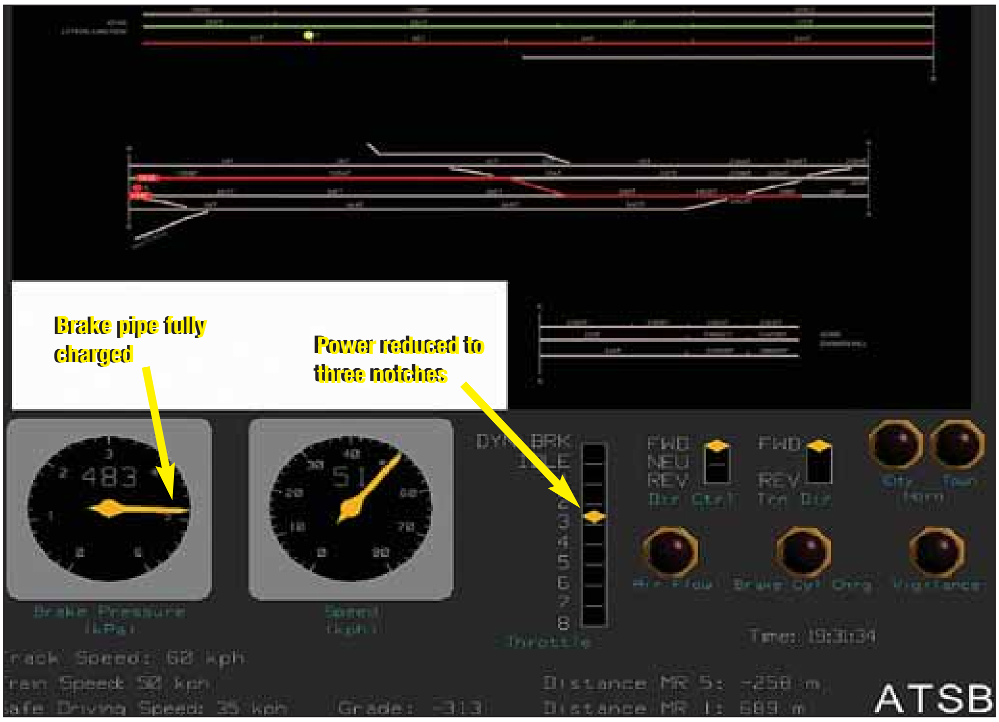
By 1930:57 the locomotive of train Y245 had passed signal MR1 at yellow and was now at the 50kph speed board that applies to the left hand 244 metre radius curve. At this point, train Y245 was 976 metres, from signal MR5 and was travelling at 54kph (15m/s) slowly decelerating with the throttle in three notches. The brake pipe was fully charged.

At 1931:21, when 439 metres from signal MR5, the driver advanced the throttle from three notches to five notches.

FIGURE 9: 1931:21 train Y245 439 metres from signal MR5, power being increased to five notches

Thirteen seconds later at 1931:34 the throttle setting was lowered and one second later was in notch two. The speed of Y245 was 51kph and slowly decreasing; the brake pipe was fully charged and independent brake released. At 1931:34 train Y245 was 258 metres from signal MR5, which is the unrestricted sighting distance of signal MR5 as measured during this investigation.

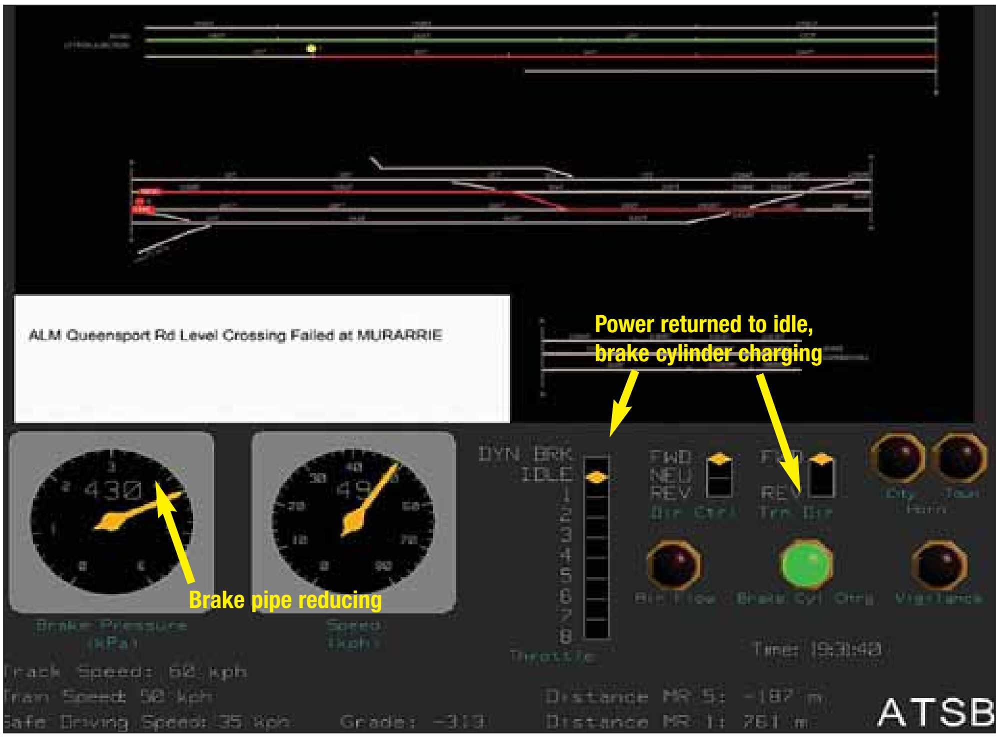
FIGURE 10: 1931:34, train Y245 at sighting distance (258 metres) from signal MR5



Five seconds later at 1931:39 the brake pipe pressure was recorded at 465 kpa in lieu of 501 kpa. This is the first recorded indication of a brake pipe pressure reduction during this analysis. However, as the ATP data logger only records any change greater than 20 kpa, the initiation of this brake application occurred in the moments prior to 1931:39. By this time train Y245 was 201 metres from signal MR5.

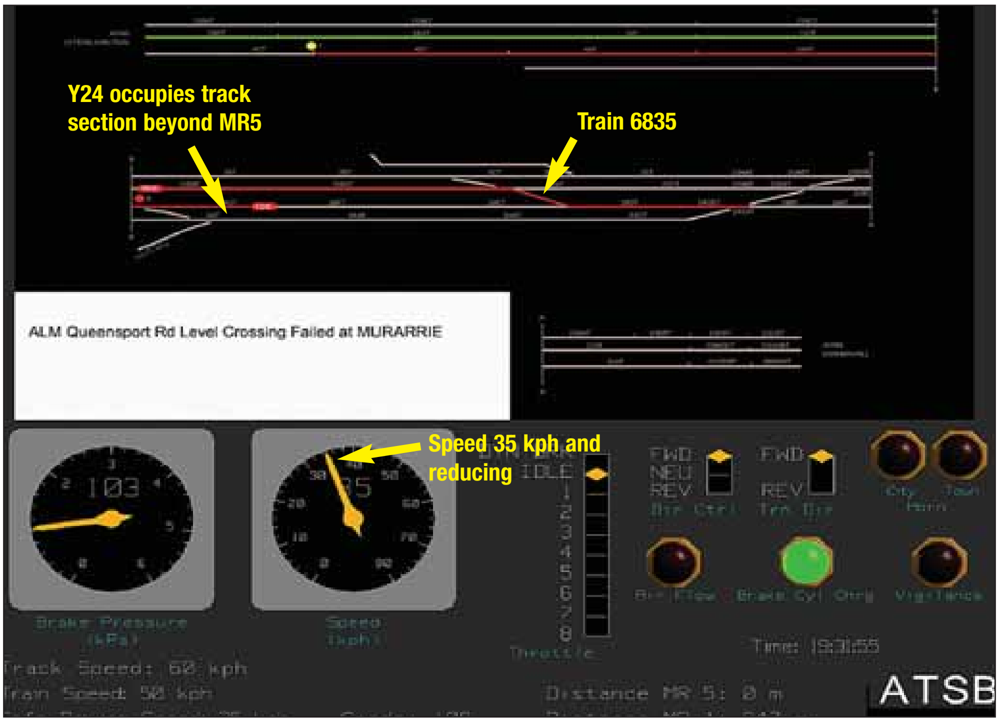
One second later, at 1931:40, the throttle was moved from notch two to idle and the locomotive brake cylinder was recorded as 'on' indicating at least a partial application. It appears that this driver-initiated brake application was, momentarily, a service application followed quickly by an emergency brake application. This is indicated by a gradual, then rapid drop in brake pipe pressure. At the same time, a UTC alarm shown as 'ALM Queensport Rd Level Crossing Failed at MURARRIE' appeared at the UTC2 train controller workstation. By this time train Y245 was 187 metres from signal MR5.

FIGURE 11: 1931:40, brake application initiated, UTC Queensport Road level crossing alarm first appears



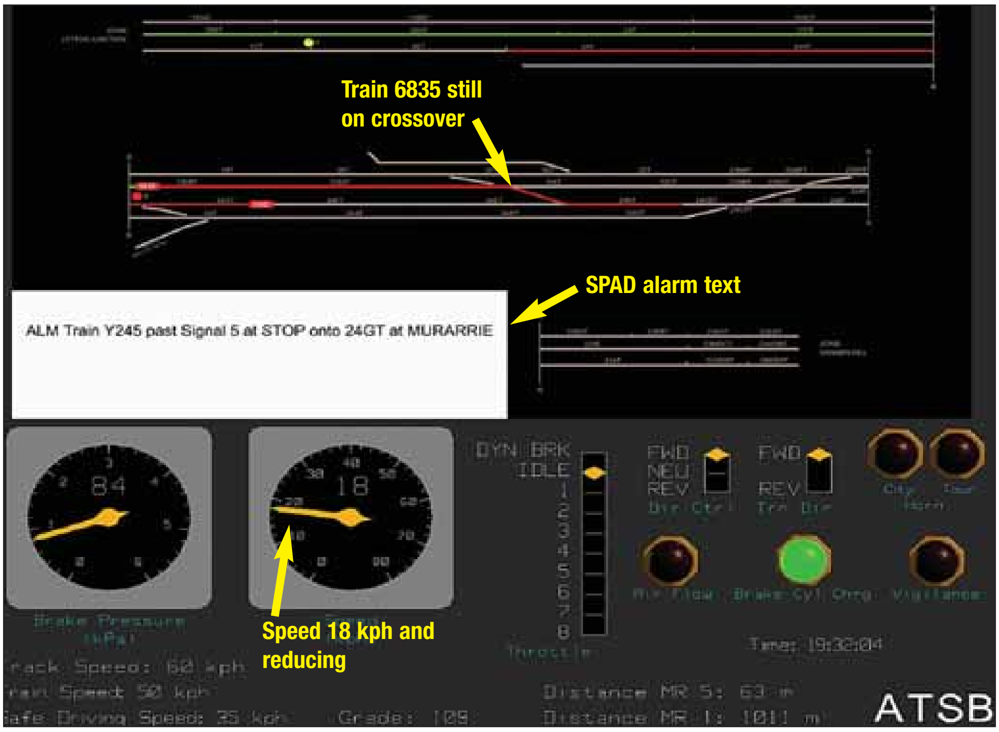
At 1931:55 train Y245 occupied 'track 24GT' that is immediately beyond signal MR5, passing this signal at stop in the process. The speed of Y245 was now 35 kph and decelerating, the throttle was in idle and the brake pipe pressure 103 kpa and locomotive brake cylinder charged. The UTC alarm 'ALM Queensport Rd Level Crossing Failed at MURARRIE' at the UTC2 workstation had yet to be acknowledged. At 1931:57 the audible SPAD alarm at the Mayne Control Centre activated.

FIGURE 12: 1931:55, train Y245 occupies 'track 24G' beyond signal MR5



At 1932:04 'ALM Queensport Rd Level Crossing Failed at MURARRIE' was acknowledged and a message reading 'ALM Train Y245 past Signal 5 at STOP onto 24GT at MURARRIE' appears on the VDU at the UTC2 workstation.

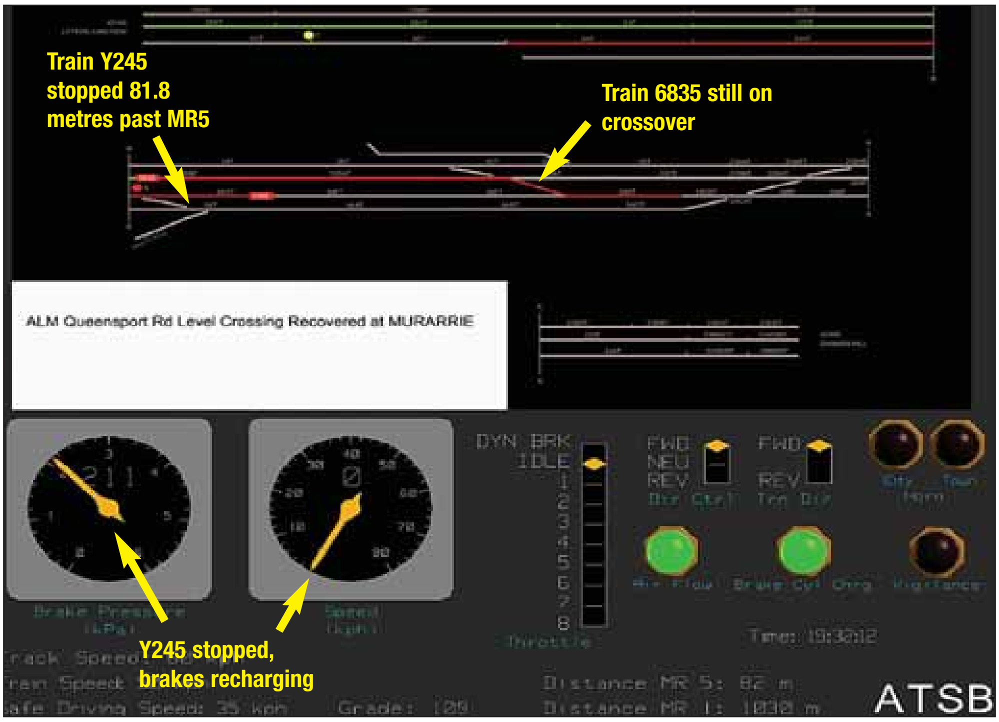
FIGURE 13: 1932:04 SPAD Alarm appears at the UTC2 workstation



At 1932:11 SPAD alarm 'ALM Train Y245 past Signal 5 at STOP onto 24GT at MURARRIE' was accepted and is replaced by the UTC alarm that reads 'ALM Queensport Rd Level Crossing Recovered at MURARRIE'. At 1932:11 the audible

SPAD alarm ceased. At 1932:12 train Y245 stopped with the lead end of locomotive 2804 about 81.8 metres past signal MR5 and at 1932:13 the train controller radioed the emergency message for the driver to stop. No SPAD alarm could be heard in the background of this transmission.

FIGURE 14: 1932:12, SPAD alarm acknowledged, train stopped, brakes recharging



See appendix 6.2 for a tabulated version of the sequence of events

2.2.4 Summary

Although train Y245 stopped safely 81.8 metres beyond signal MR5 and was, therefore, no longer on a conflicting course with train 6835, it was nevertheless possible that other factors may have altered this outcome. To ensure the fullness of this investigation, some hypothetical scenarios had been examined. These scenarios are indicative only because issues such as response time from the driver could vary.

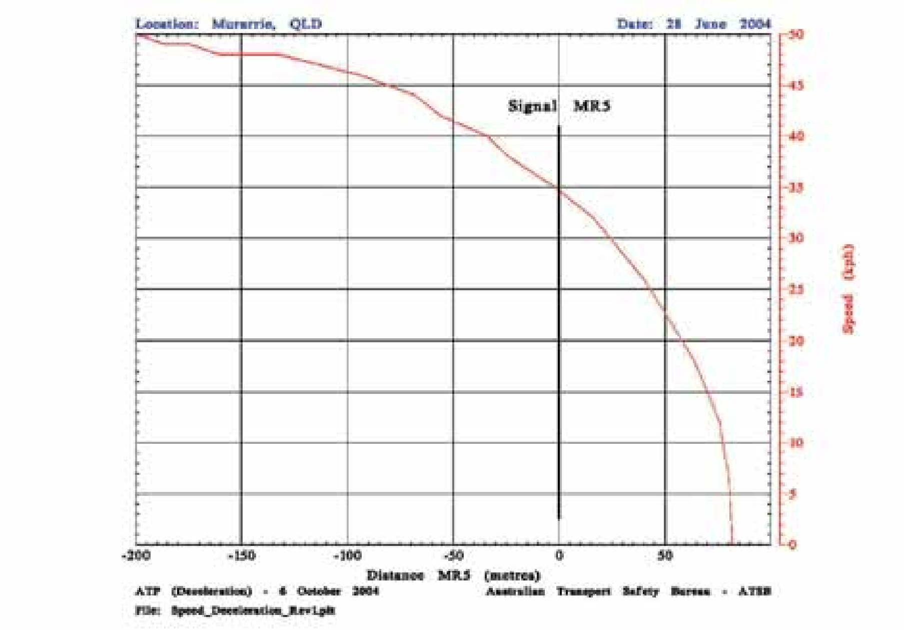
The three key factors in this examination are: firstly, there was a distance of 585.7 metres from signal MR5 to the clearance point at the crossover where train 6835 was diverted from the dual gauge to the Up suburban line[12]; secondly, train 6835 cleared track MR24E at 1932:37; and thirdly, the braking distance of train Y245. The braking data entered in the ATP prior to departure from Fisherman Islands was:

- Brake delay time = 10 seconds
- Deceleration rate = 0.55 metres per second squared.

Prior to signal MR5 there is an ascending gradient of 1:109 (approximately 0.92%)

12 Up suburban line – direction of traffic (predominantly) from the Brisbane CBD.

FIGURE 15: Theoretical braking curve, train Y245



Scenario	*Explanation/Question*	*Outcome*
No further acknowledgement of the VCS after passing and acknowledging the station protection magnet and driver has not acted on red signal.	The station protection magnet is 2034 metres from signal MR5. If train Y245 maintained the speed of 61kph as recorded at the station protection magnet where would it stop after the VCS timed out 93 seconds later?	Train Y245 would have stopped approximately 23 metres prior to signal MR5.
Driver has not acted on red signal. Train controller is at workstation and transmits emergency radio message at 1931:59.	1931:59 is two seconds after the SPAD alarm sounded. Two seconds has been allowed to acknowledge the alarm and comprehend what is being displayed. The original transmission lasted 14 seconds and the driver has been allowed two seconds to make an emergency application at the conclusion of this transmission (1932:15) Train speed is 50kph.	Train Y245 would have stopped approximately 544 metres past signal MR5. This is about 42 metres prior to the potential collision point.
Driver has not acted on red signal. Train controller is not at workstation, emergency radio transmission sent at 1932:13.	1932:13 is the actual time the radio transmission was sent to train Y245. The original transmission lasted 14 seconds, the driver makes an emergency application two seconds later at 1932:29 and the train speed was 50kph.	Train 245 would have stopped approximately 738 metres past signal MR5. Train 6835 would have cleared these points by this time (within seconds).
Driver has not acted on red signal. Emergency radio transmission is not sent or acknowledged.	If train Y245 retained a constant speed of 50kph from 201 metres from signal MR5 would a collision have occurred with train 6835?	Train Y245 would have arrived at the potential collision point at about 1932:36. Train 6835 cleared track MR 24E at 1932:37. A collision could have occurred.
Train Y245 was travelling at the 'safe driving speed'[13] (after having passed signal MR1 at yellow) and the driver saw signal MR5 at stop when about 200 metres from it.	Train Y245 was 614.30 metres long. Because the rear of this train was still on the 50kph curve the safe driving speed is 35kph. If the driver made an emergency application in the moments after sighting signal MR5 at stop at about 200 metres away where would train Y245 have stopped?	Train Y245 would have stopped in about 151 metres, some 49 metres prior to signal MR5.

13 Safe driving speed – see 2.5.1 of this report.

2.3 Train handling

2.3.1 Driver experience and route knowledge

The driver of Y245 had extensive experience in the train crewing grades having started service as an engine cleaner (trainee) at Maryborough in 1965. He was promoted to the position of fireman (second person) in 1969 and was based in several depots in this role before returning to Maryborough in late 1973. He was promoted to a driver at Mayne (Brisbane) in 1990, a position in which he was to serve for two years and two months. During this period he regularly drove suburban electric and freight trains on the Fisherman Islands/Lytton Junction to Park Road corridor on the two suburban lines. The dual gauge track had not been constructed at this time. Since December 1992 he had been stationed at Maryborough as a driver.

The driver of Y245 was qualified in the operation of:

- Driver only operation – April 1991
- 2800 class locomotives – June 1997
- ATP – May 1998
- Dual gauge Lytton Junction to Park Road – 15th June 2001.

The driver had last traversed this route several weeks before this incident.

2.3.2 Signalling

Signal MR1 was showing a yellow aspect as train Y245 approached. The sighting distances and visual continuum of all signals met the QR standards. Signal MR7, which is adjacent to MR5, was also showing a red signal and therefore no confusion or ambiguity is suggested.

Of note is that data obtained regarding the aspect displayed in signal MR5 during the 147 day period from 01 March 2004 to 25 July 2004 indicate that this signal displayed a proceed aspect to approaching trains 94.3% of the time. Specifically, MR5 was approached by 1,344 trains and of these times displayed a proceed aspect on 1,268 occasions.

2.3.3 Driver account

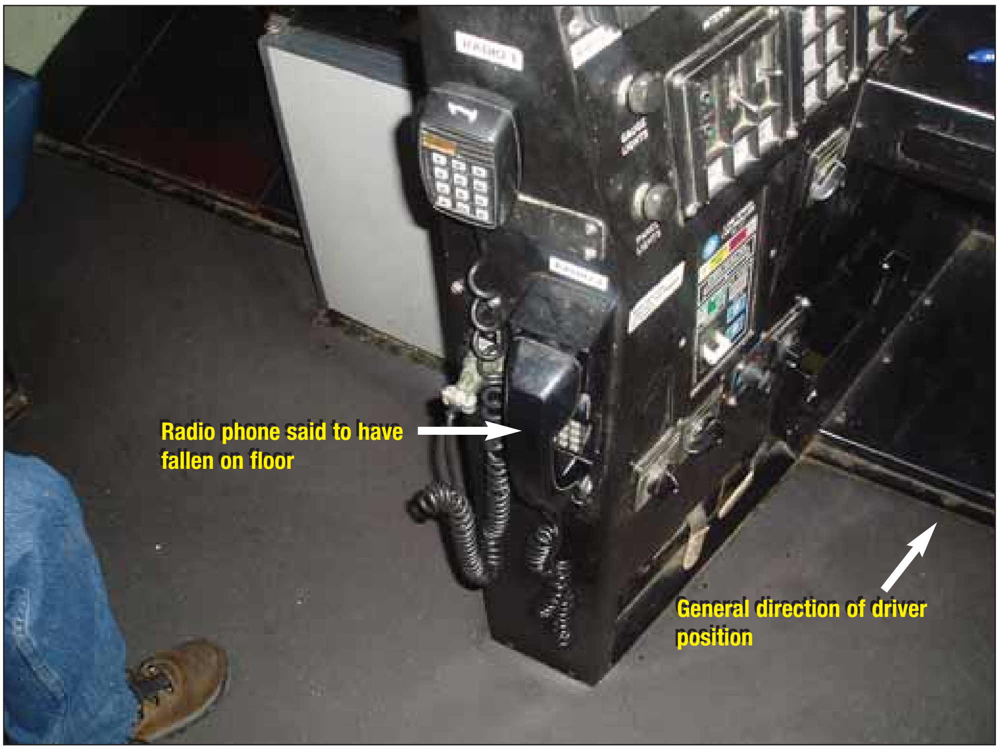
The driver of train Y245 had previously worked a freight train from his home town of Maryborough to Fisherman Islands, signing off duty at 0645 on 28 June 2004 at Fisherman Islands. He then rested in the traincrew quarters at Fisherman Islands until sign-on for the return journey home at 1845 that evening.

The driver advised at interview that he had breakfast before going to bed and that he obtained about four hours sleep during the day. He said four hours sleep was about normal for this type of shift. After he awoke he passed the time by watching television and reading a book. Prior to signing on he had a home made casserole that he heated up in the microwave oven and several cups of tea. He said he had no alcoholic or soft drinks during his stay at Fisherman Islands. He described being based at Fisherman Islands as a 'long boring stay' as there is virtually nothing aside from the traincrew quarters at this location. He told the interviewers that, overall, he felt quite well when signing on.

After signing on for train Y245 the necessary pre-departure tests were carried out. Train Y245 departed Fisherman Islands at about 1914, five minutes and 58 seconds ahead of the scheduled departure time of 1923.

From Lytton Junction train Y245 encountered a green aspect in signal LJ11 at Lindum station, another green aspect in signal LJ 15 and then a green aspect in approach signal MR1P. Upon sighting signal MR1, the driver noted it was displaying a yellow aspect. Prior to passing signal MR1 though, the radio hand-set that was situated adjacent to, and immediately to the left of the driver, fell out of its cradle to the cab floor. The driver said he bent down to retrieve the phone and return it to the cradle. When he looked up he saw two red signals (adjacent signal MR7 was red also) about 200 metres away and placed the train brake in the emergency position. The driver said that the train was already stationary by the time the train controller radioed an urgent message for Y245 to stop.

FIGURE 16: 2800 locomotive radio



The driver of train Y245 said that he normally drove this route by allowing the train to slow for the 50kph curve on the approach to signal MR5 and then let the train run up the grade to the Gateway Motorway overhead bridge although sometimes, depending on the train, power has to be applied as this bridge is approached. After letting the train roll around the back of the Murarrie passenger station, power is then applied for the ascending grade towards Cannon Hill.

He said that signal MR5 cannot be seen clearly until it is about 200 metres away because of the curve and, if anything, the signal for the suburban line (MR3) is sighted first. Also, because of loading gauge restrictions that prevent travel on the adjacent suburban line, it had been his experience that trains hauled by a 2800 class locomotive on the dual gauge are kept moving and that MR1 and MR5 are normally green. To the best of his recollection, he had never stopped at signal MR5 before. He said that if a caution signal is encountered, the train speed has to be reduced to three quarters of the track speed limit.

Although the driver was carrying a personal mobile phone it had not been used since signing on at Fisherman Islands. Mobile phone records obtained during this investigation have confirmed this account.

2.3.4 Summary

Various agencies have conducted research regarding causal factors that ultimately lead to a SPAD occurrence. Generally, this research has concluded that the driver at the approach of a warning signal will prepare the train for a stop at the next signal. Failure to do this is usually a conscious decision on the part of the driver. Such a decision can be termed a routine violation and is often made with a mental model that presents a picture of having scope to delay braking action because of the distance and/or grade to the stop signal, braking capabilities of the train, or the perception that the signal may be clear to proceed.

As the train continues between the warning signal and the red signal, the driver is vulnerable to losing concentration and forgetting about the yellow signal just passed. The risk of forgetting increases with time. Studies show that short term (or working memory) is limited in capacity, decays rapidly and is affected by distractions or competing interests. As the red signal comes into sight or increasing prominence, the driver will often identify the mistake. At this point an attempt will be made to bring the train to a stop before the red signal, often successfully. However, when there is an inability to recover due to speed, signal sighting distance or late identification, a SPAD results.

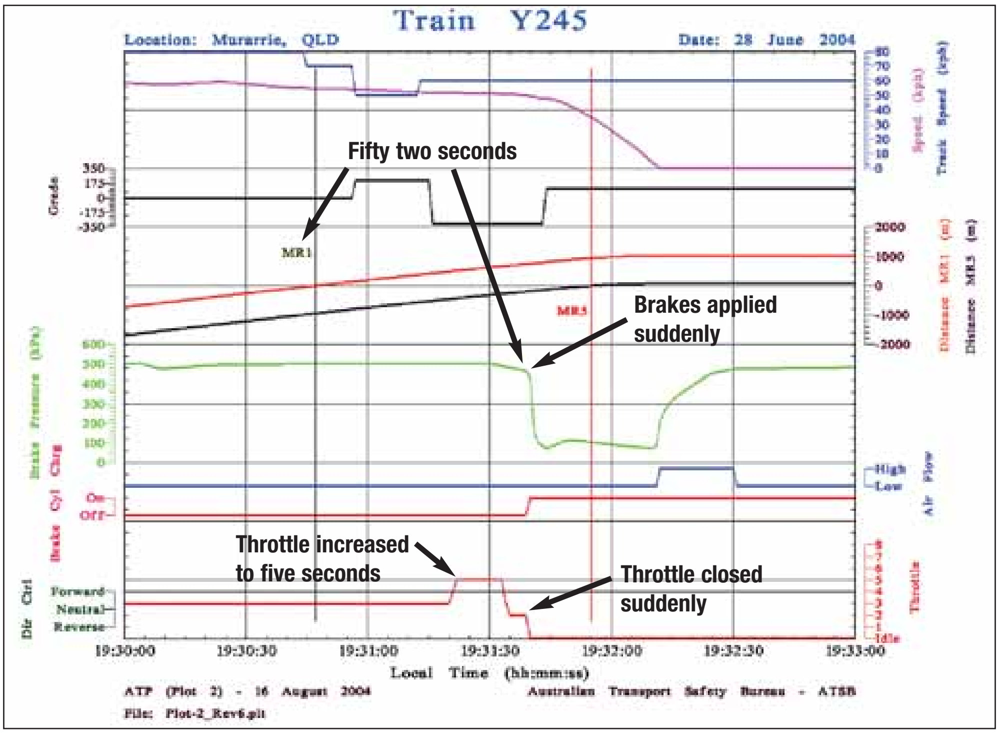
There are similarities between this scenario and the passing of signal MR5 at stop on 28 June 2004.

For example, train Y245 passed signal MR1 at about 1930:47. Thirty four seconds later, at 1931:21, the driver advanced the throttle from three to five notches when train Y245 was 439 metres from signal MR5. The action of advancing the throttle at this time indicates that the aspect displayed in signal MR1 had been forgotten, particularly as this location is where power often has to be applied to maintain speed against the rising grade.

The brakes were applied about 201 metres from signal MR5 immediately prior to 1931:40, which was, allowing for reaction time, moments after the driver saw the signal at red. The sighting distance of signal MR5 is 257.9 metres. Therefore, it is probable that the red aspect of signal MR5 was not recognised by the driver of train Y245 when it could or should have been.

A re-enactment of the radio hand-set falling to the floor and being retrieved by a person positioned in the drivers seat showed that this task could be done from the seated position and took no longer than five seconds. The time frame from when the radio hand-set fell from the cradle (shortly before signal MR1) until the brake application was about 52 seconds. Therefore, the driver did not prepare the train for a stop at signal MR5 where it could or should have been but rather when the red light itself was recognised.

FIGURE 17: Time between MR1 and MR5

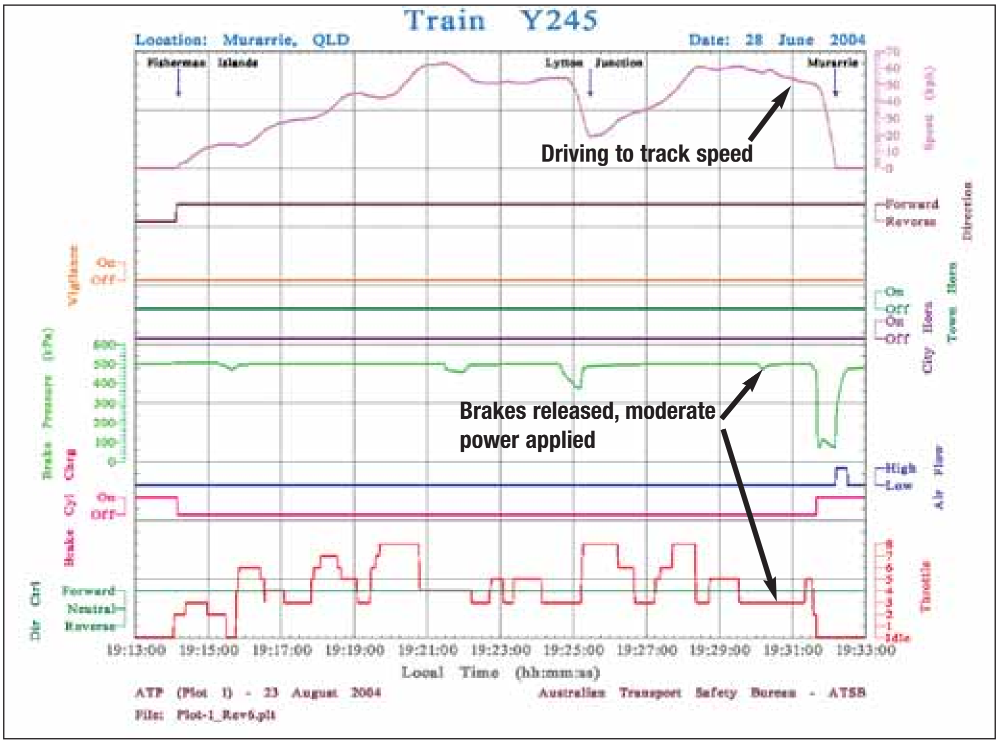


The driver was fully qualified and very experienced. On 28 June 2005 he was apparently anticipating a run with Y245 through Murarrie without stopping. For a driver of his experience the task was primarily ‘skills based’ – essentially routine, requiring limited cognitive processes such as driving to the road and monitoring the signals and track ahead. Routine tasks involving ‘automatic’ responses can lead to inattention or distraction, a state of mind ‘in neutral’, where past experience influences a persons actions or inactions.

The driver, to the best of his recollection, had never stopped at signal MR5 on any previous occasion and his perception was that train control liked to ‘keep you moving’ when driving a 2800 class locomotive on the dual gauge. This perception is supported by the low frequency of red aspects presented to trains at MR5 from 01 March to 25 July 2004. It is possible, or even probable, that the driver was not appropriately concentrating on the task at hand. In this state an unexpected ‘out of course event’, such as the radio hand-set becoming dislodged to the floor, could distract the driver such that he forgot an intended action formulated only moments before.

In this instance, although neither the signal sighting nor the dislodging of the radio hand-set are considered directly causal to the SPAD, the falling radio hand-set may well have contributed to the aspect of signal MR1 being forgotten. This memory lapse could have led to the reversion back to normal ‘clear signal’ driving and, ultimately, to the SPAD.

FIGURE 18: Data logger readout, Fisherman Islands to Murarrie, 'clear signal' driving



With the intention of assisting drivers in the management of trains at and beyond restricted signals, QR has implemented a procedure known as 'safe driving technique'. This procedure provides for a maximum speed of 75 per cent track speed at a signal displaying a restricted aspect, for the speed to be continually reduced, and for the driver to target (stop) short of the signal. In essence, this procedure calls for positive action at the restricted signal with the dual intentions of mitigating against short term memory loss and enforcing a speed at which a successful recovery, upon the sighting of a red signal, is more likely. This technique was not applied at signal MR1 in this instance. It is probable that a combination of inattention and distraction by the driver at this crucial period was the reason for this omission. See appendix 6.3 for documentation regarding 'safe driving techniques'.

There is recorded and anecdotal evidence of other drivers reporting radio hand-sets falling from their cradles on the 2800 class locomotives. Modifications to the phone hand-sets are currently being considered and implemented by Queensland Rail.

2.4 Medical standards

2.4.1 Overview

While off duty, four months after the SPAD at Murarrie on 25 October 2004, the driver developed severe central chest pain. He died the following day. As a result of the driver's death relatively soon after the SPAD, the investigation focused on his medical records to determine whether the state of his health may have been a causal factor in the passing of signal MR5 on 28 June 2004.

Given the nature of this examination and subsequent analysis, the ATSB engaged the services of a medical practitioner, expert in:

- military medicine
- general medicine, general practice and rural medicine
- medical administration
- aviation and occupational medicine
- aircraft accident investigations (civil and military)
- environmental and survival medicine
- disaster victim identification
- human factors in aviation
- search and rescue/aeromedical evacuation
- medical certification and risk assessment of flight crew
- transport safety.

Employee medical records were accessed through QR and private medical records were accessed through the driver's regular general medical practitioner. This was supplemented with interviews of medical personnel, both of employee and private origin.

2.4.2 Driver Y245

At the time of passing signal MR5 on 28 June 2004, the driver of train Y245 had just turned 60 years of age. He was known to have had been subject to non-insulin dependent diabetes mellitus (NIDDM) and hypertension. NIDDM is a medical condition of significance often associated with ischaemic heart disease, as is elevated blood pressure (hypertension). Between 1995 and 2000 the driver had been involved in five earlier SPADs, for one of which he was not responsible. Three of the four other SPADs occurred while driving a 'driver only' train (See 2.5.5).

In 1991 the driver was diagnosed with NIDDM by his general practitioner. His condition was managed through a regime of medication, diet and lifestyle advice prescribed by his doctor. His hypertension had been treated by anti-hypertensive medication over a ten-year period.

Three years after, in 1994, the driver's NIDDM was first noted in his QR medical records, in which year he was subject to two QR medical examinations. Thereafter, he underwent annual QR medical examinations except in 1999, his last being in October 2003, at which he was passed as fit for driver-only operations. At the time of his death he was yet to be examined in 2004 by a doctor on behalf of QR. At the QR medicals he underwent pathology (blood and urinalysis), electrocardiographs (ECGs) and other ancillary investigations. Both his general practitioner and the QR doctor belonged to the same regional medical practice and accessed the same medical records relating to the driver's health. There is no evidence that the driver was seeking any other medical or alternative treatment.

The evidence is that, at the time of the SPAD on 28 June 2004, of the known medical conditions only NIDDM, hypertension and the use of prescribed medication for treatment of these conditions were considered to be a potential factor for driver impairment.

There was no direct evidence that the driver was subject to a specific diabetic hypoglycaemic episode, which is caused by a drop in sugar levels and results in sweating, nervousness, tremor, weakness and other symptoms including 'lack of concentration'. Although lack of concentration may well have contributed to the SPAD, there is no evidence that it was due to low blood sugar levels.

Hyperglycaemia (abnormally elevated blood sugar levels) can result in blurred vision, fatigue and nausea. Hyperglycaemia, however, is not likely to cause an acute incapacity.

The driver's medication included drugs known as Gliclazide and Angiotensin converting enzyme (ACE) inhibitors. The Gliclazide is classified as a hypoglycaemic agent of the sulphonylureas family of drugs for 'type two' diabetes not controlled by diet alone. In long term studies, about 11 per cent of patients taking Gliclazide experienced hypoglycaemic events. In some cases ACE inhibitors are known to increase the hypoglycaemic effect of Gliclazide.

Immediately after the SPAD the driver neither complained of, nor exhibited, any symptoms that suggested the failure to stop before signal MR5 was caused by heart disease. An analysis of the voice recordings between the driver and the controller does not indicate any incapacitation or disorientation.

However, the possibility that the driver experienced a hypoglycaemic event on 28 June 2004 cannot be ruled out, particularly given his history of SPAD events since 1995. The possibility underlines the imperative of good medical screening and management of drivers with diabetes and other medical conditions that are associated with, or contribute to, sudden incapacitation such as heart attack.

2.4.3 QR Medical fitness regime

There is no direct evidence to link the SPAD of 28 June 2004 with the driver's medical condition at that time, but the possibility cannot be excluded altogether. In addition, his death certificate cited not only an acute myocardial infarction but also chronic heart disease. These had not been detected at his annual medicals.

QR Safety Management System STD/0019/WHS titled 'Health Control' contains *STD/0021/WHS Medical Fitness Standards* which applies to QR workers employed in safety-critical tasks. The scope of this standard limits its applicability to traincrew. These medical fitness standards became effective on 17 August 1998 and remain in force at the present time. The provisions contained in this medical fitness standard applied to the driver of train Y245 at the time of his most recent SPAD.

Classification as fit for duty as traincrew in two-driver crews, driver's assistants or guards may be considered for those with:

- IDDM[14] providing they are completely free of hypoglycaemia.

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14 IDDM – Insulin dependent diabetes mellitus.

- NIDDM/T2DM but requiring insulin as part or their management providing they are completely free of hypoglycaemia.
- NIDDM taking sulphonylureas providing they are completely free of hypoglycaemia, are well-controlled and in good health.

Classification for driver-only operations may be considered for drivers with:

- NIDDM controlled by diet, oral hypoglycaemics alone or in combination. The only monitoring requirement under this standard is for ‘at least annual HbAlc levels’. General health must otherwise be satisfactory and these individuals must be fit in respect of other fitness standards.

Under a strict reading of the Medical Fitness Standards, as the driver was taking sulphonylureas to lower blood glucose levels, he would have been classed as fit for duty in a two-man crew-the inference being that he should not have been operating as ‘driver-only’.

The standard is, however, ambiguous. The auxiliary verb ‘may’ denotes something that is allowed, but not necessarily mandatory. Also, the reference to hypoglycaemic drugs under the driver-only standard does not differentiate between the various class of drugs classified as oral hypoglycaemic that do not have the same risk of hypoglycaemia as sulphonylureas. (Biguanides, ±Glucosdase inhibitors, Meglitinides, Thiazolidinediones)[15].

There were other factors that raised the risk threshold in the driver operating alone. There is some evidence that he did not control his lifestyle in a manner that would help manage his NIDDM state. He was also prescribed ACE inhibitors, which in themselves may lower blood glucose.[16] Despite the increased cardio vascular risk to which a diabetic is prone, the driver was not identified as being at high risk and was only subject to an ‘at rest’ ECG at his QR medicals. QR Medical Standards does provide that individuals at highest risk should be subject to a stress ECG using the Bruce Protocol[17]. In addition, his general practitioner and the Queensland Rail doctor were members of the same practice, which introduces the risk that, with access to shared medical records, independent objectivity could be compromised.

An interesting comparison can be made between the QR Medical Standards and the requirements for periodic assessment of ‘High Level Safety Critical Rail Workers’ as prescribed in the National Standard adopted by the other States[18]. In many ways, in terms of NIDDM, the existing QR Standards are more rigorous and prescriptive. The National Standard, however, does include a ‘Cardiac Risk Score’, which triggers more in depth examination, including referral to specialists.

15 Shenfield, G., (2001), Drug interactions with oral hypoglycaemic drugs, *Australian Prescriber*, Vol.24 No.4, p.83–85.

16 Ibid

17 Bruce protocol: A standardized multistage treadmill test for assessing cardiovascular health.

18 Queensland has undertaken to phase in the National Standards over time.

The Cardiac Risk Score uses an approved algorithm from the American Heart Association. The same algorithm has been in use by the Civil Aviation Safety Authority of Australia for approximately 10 years to assess annual cardiovascular risk of airline transport pilots and commercial pilots. While the threshold risk value for aviators is set at 1 per cent per year, the National Rail Standard is set at 2 per cent per year, in keeping with a nationally accepted risk target for locomotive drivers and other designated Category 1 personnel. Threshold risk values are arbitrary and are usually set by a regulator.

An important issue to note here is that the presence of diabetes (of any description) adds three points for a male, and six points for a female to the total in the risk algorithm. Diabetes is known to be a potent risk factor for coronary artery disease.

In the case of the driver of Y245, based on his age, blood lipids, blood pressure and the fact that he already had NIDDM, his risk score would have exceeded 22 points. This converts to an annualised risk in excess of 2 per cent, requiring further cardiological investigations under the guidelines laid down in the National Standard. Had he been assessed under the National Standard at his age 60 annual medical, it is more probable than not, that he would have been assessed temporarily unfit, pending referral to a cardiologist and undertaking a stress ECG.

A driver presenting with health problems in the interval between QR medical examinations may be reported to the responsible manager by permanent QR medical staff. The manager, however, may not be have sufficient knowledge to be able to make an appropriate judgement in a timely manner as to whether or not such an individual poses an unacceptable risk if allowed to continue working.

2.5 SPAD management

2.5.1 Overview

The QR SPAD Management Program involved a structure that comprised a principal committee supported by regional committees. In June 2004 this program was driven (in a strategic sense) by the QR Risk Unit. At the time of this occurrence, control of this program had been transferred to the QR Network Access Group.

The program was the responsibility of a committee structure, comprising a principal committee, the Corporate SPAD Reduction Committee, and regional committees centred at Brisbane, Rockhampton (or Mackay), and Townsville. The principal and regional committees met quarterly. All QR groups were represented on both committees.

The principal committee reviewed the performance of the Corporation in regard to SPAD targets set by the Chief Risk Officer (in June 2004). This committee reviewed, recommended and/or endorsed the SPAD reduction strategies and initiatives of the business groups. Multi SPAD locations and mitigation measures taken or proposed by the business groups were also reviewed.

The regional committees consisted of the respective business and services groups that operated within the particular locality. The committees provided a forum where personnel associated with the operation of trains and track vehicles could table and discuss any issues to do with SPADs.

The charter of these committees was to:

- provide a forum where regional SPAD-related incidents could be tabled and discussed
- provide a forum where solutions for regional SPAD issues could be tabled and discussed
- provide a communications links among the operators, maintainers, and the corporate SPAD committee
- provide a communication link between the corporate SPAD committee and the front line managers
- provide overall awareness links among operators, maintainers, and the corporate SPAD committee
- evaluate infrastructure on the rail network and provide ideas for improvements
- proactively search for innovative and effective ways of managing SPADs
- ensure that the underlying causal factors of SPAD risk are identified, analysed, and treated
- better understand the relationship between human factors and SPADs
- provide a forum where trade unions can raise and receive consultation on SPAD-related issues
- develop, implement, and monitor progress of SPAD-reduction initiatives within associated regions
- mentor and discuss regional SPAD statistics with the view of SPAD-reduction.

The driver of train Y245 on 28 June 2004 was an employee of the Coal and Freight Services Group. Within this group interaction and participation regarding SPAD-related issues at individual local depot level was originally intended to be (primarily) via local depot SPAD committees supplemented from time to time by 'toolbox' talk sessions. Difficulties in regard to train crew rostering, particularly with freight traincrew often being away from their depot for extended periods, led to alternate methods of information sharing and individual employee participation being examined. At this local level, some of the initiatives included:

- intermittent depot presentations
- intermittent SPAD videos
- SPAD Newsletters
- local depot newsletters
- business instructions (eg, safe driving techniques etc)
- 'active' depot SPAD notice boards
- appointment of divisional train management improvement officers.

A copy of a SPAD newsletter dated May 2004 is at appendix 6.4.

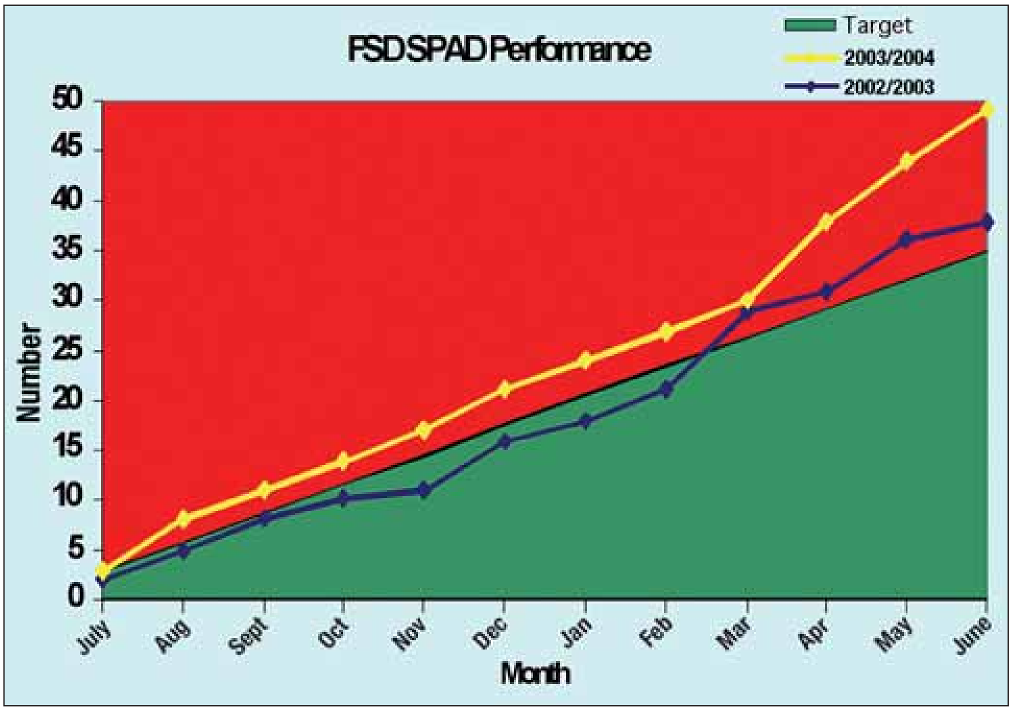
FIGURE 19: Acacia Ridge Depot SPAD notice board

As described at 2.3.4 of this report, another initiative that could be promoted locally was the instruction known as 'safe driving technique'. This instruction was a simple but valuable tool in providing advice on train handling when a restricted signal is encountered. Within this instruction other simple tips in train handling were also provided.

In addition to the written and spoken instructions, a system known as the Potential SPAD Hazard Notification System was implemented in the freight sector of the Coal and Freight Services Group. This system allowed individuals to enter details (electronically) regarding signals and localities that they believed had the potential to be a SPAD hazard. Also, this system allowed the user to view mitigation measures that were being taken in regard to potential hazards. The individual entries and data from this system were then reviewed by the regional SPAD committees. As at June 2004, however, this system was in the trial stage.

The instances of SPADs within the freight sector of the Coal and Freight Services Group, from March 2003 to July 2003 and during the financial year July 2003 to June 2004, continued to be above the target set by the Corporate SPAD Reduction Committee. Of the freight sector train crew depots, Maryborough had the highest instance of SPADs.

FIGURE 20: Freight sector SPADs (running total), Coal and Freight Services Group 2002/2003 and 2003/2004



2.5.2 Management of SPADs

The process of the management of SPADs, at an individual incident level, was set out in QR *SAF/STD/0016/SWK Management of SPADs*. The purpose of this standard is stated at section one of this document as being:

> This standard sets the requirements for a standard procedure for actions to be taken when signals are passed at danger (SPAD) without the correct authority or where a limit of the safeworking authority has been exceeded by a train/on track vehicle. This document also established a process for identifying signals and drivers that may be at a higher than average risk. The risks controlled by this standard is/are:
>
> - signal passed at danger
> - collision
> - worker stress.
>
> The benefits of implementing this standard are:
>
> - management of the risks identified above
> - compliance with QR, legislative and industry requirements.
>
> This standard supports *POL 07 Safety and Security*.

This standard, among other issues, defined a multi-SPAD or blackspot signal or location as being a signal or location that had been passed or exceeded twice in a three-year period and allocated points to employees involved in SPADs.

Signal MR5 at Murarrie was not identified as a multi-SPAD or blackspot signal and the driver of Y245 had no current SPAD worker points allocated at the time of this incident as the previous SPAD incident was 42 months earlier.

2.5.3 Signals and secondary protection measures

Signals MR1 and MR5 conform with the specifications contained in QR *STD/0024/SWK Signal Positioning Principles* in regard to sighting distance and visual continuum.

QR STD/0076/SWK is titled 'Safeworking Principles'. The purpose of this document is to specify the safeworking and associated 'secondary protection measures' for particular portions of the QR network. This standard defines 'secondary protection measures' as being:

> Controls, in addition to the train driver, which provide additional levels of safety and include such items as vigilance, AWS, station protection and specific operating procedures.

The requirements of this documentation are based on a risk assessment of QR safeworking systems, traffic densities and incident history in order to determine tolerable risks. Train density values used in this standard are simplified and expressed as a number of trains per day.

On single-line sections of track where the train density is less than 75 per day, the safeworking systems required are remote controlled signalling and station protection magnets. Trains must be equipped with either VCS or deadman devices.

The section of track from Fisherman Islands to Park Road has a daily train density of less than 75 and therefore complies with this standard.

2.5.4 SPADs Park Road to Fisherman Islands

As detailed at section 1.4.4 of this report, with the exception of a station protection magnet, the section of the dual gauge from Park Road to Fisherman Islands had no track-mounted driver warning in the vicinity of Murarrie.

In order to gauge whether or not this had influenced the frequency or severity of the incidents of SPADs on this section of track, details of SPADs for the period March 2001 to March 2004 were obtained. During this period there were three SPADs recorded, two at signal FS66 and one at signal FS62. Both of these signals are in the Fisherman Islands area.

2.5.5 Driver's previous SPADs

The driver of train Y245 on 28 June 2004 had five previous incidents where trains he had been working passed signals at danger. These incidents occurred in May 1995, July 1996, April 1997, March 2000 and December 2000. One of these SPADs was deemed to be outside the driver's control.

Investigations into two of these SPADs concluded that they were caused by lack of attention or failure to comply with standard operating procedures. One was apparently not investigated, at least not in any formal sense, and one investigation report into a SPAD of May 1995 had been lost. Three of the four SPADs in which the driver was involved occurred while he was working trains as driver-only.

Performance management of the driver was delayed, in one case by three months and another by six months.

2.5.6 Queensland Transport audit

Queensland Transport carried out a random audit of Queensland Rail's SPAD Management program in December 2002. The analysis and conclusion of this audit focused on the key areas of:

- QR SPAD objective
- QR safety plan
- Corporate SPAD reduction committee aims
- Corporate SPAD reduction committee responsibilities
- QR SPAD reduction committee strategy.

The audit noted that a Safety Division (now renamed the Risk Unit) was established in 1997. From that time strategic direction for SPAD management was provided and incorporated into Queensland Rail's Safety Management System incorporating centralised recording of SPADs across the QR network.

This audit found that between 1997 and December 2002 compliance with the QR SPAD objective was achieved with a reduction in SPADs in the order of 40 per cent, achieving a better outcome than the target of 20 per cent. In this regard the audit said in part;

> Since 1996, QR has progressed the issue of trains accidentally passing signals at stop with reductions recorded from close to six incidents for each million train kilometres (MTK) travelled to a present (at time of audit) overall level of 3.01 incidents MTK. It could be said that QR has achieved an enviable reputation in SPAD management.

The audit identified the Coal and Freight Services and Infrastructure Services groups as recording SPADs above their MTK criterion and that there was room for improvement when the incidents of SPADs, even at the figure of 3.01 per MTK, were compared to similar railway administrations globally.

The audit found that partial compliance was achieved in the areas of:

- QR safety plan
- Corporate SPAD reduction committee aims
- Corporate SPAD reduction committee responsibilities
- QR SPAD reduction strategy.

Some areas where improvements were recommended that are of relevance to this investigation included:

- worker management process – monitoring to be focused on the underlying causes of the SPAD and to be relevant to the individual driver
- lack of standards specifying improvements to ongoing driver training for SPAD mitigation
- little causal data were being obtained from each event
- lack of progress in relation to human factors based control measures

- the removal of the Corporate SPAD reduction committee's responsibility to review multi-SPAD workers (delegated to the business groups)
- a balance between the resources devoted to initiatives that focus on technology and signalling with human factors issues.

2.5.7 Summary

QR and, in this instance, the freight sector of the Coal and Freight Services Group, have devoted considerable resources to the management of SPADs since 1997. The QR SPAD Management Program is structured to allow significant corporate and regional management/employee input. It appears that at times though, difficulty has been experienced in getting the thrust of this program through to traincrew level. Given that traincrew are so diverse in terms of location and job structure, the logistics of managing such a program presents known hurdles. It is difficult to maximise attendance at depot SPAD meetings, particularly those where 'tucker box' working predominates.

The Coal and Freight Services Group had recently undertaken an initiative in this regard in the form of the Potential SPAD Hazard Notification System. This system was implemented across the coal sector and, at the time of this report, was being progressively implemented in the freight sector of this services group. This system provided traincrew an opportunity to participate in the SPAD management program, regardless of location, time or day, by virtue of being able to input potential SPAD hazards into an electronic data base. Additionally, because this program was 'active', traincrew were able to view and monitor the proposed mitigation measures when they were entered into the system. More importantly, this system, by its very use, assisted in keeping the issue of SPADs at the forefront in the minds of those who used it.

Other initiatives included the 'active' SPAD notice boards that were installed at the majority of freight sector depots (figure 19), the promulgation of the business instruction 'Safe Driving Techniques' and the appointment of management positions whose primary task is to coordinate and deliver the Coal and Freight Services Group's response to the QR SPAD Management Program.

Notwithstanding these measures, however, the SPAD rate of the Coal and Freight Services Group continued to exceed the MTK criterion for much of the period between 1997 and June 2004. This concern (as at December 2002) was also raised by Queensland Transport at the time of their audit of Queensland Rail's SPAD Management Program in December 2002 (released in August 2003).

The three available QR investigation reports into the SPADs involving the driver of Y245 focused primarily on the immediate actions of the driver. The investigations seemed to follow a proforma approach that, apart from factors such as the driver's previous history, signal sighting, fatigue analysis of rosters and the like, undertook little identification or examination of latent or systemic issues.

Similarly, employee management seemingly followed a standard process directed at returning the employee to full duties. In the main, the process addressed the immediate causes and paid little attention to underlying latent or systemic issues. For instance, no connection was made with the possible effects of NIDDM on the driver's concentration or any cross reference made with medical records. The driver was returned to full duties after a limited period of 'on track' supervision by a supervisory driver. As noted earlier, on two occasions there was a substantial period between the SPAD and the investigation and the retraining process. The risk in this approach is that where an employee is performing a safety-critical function and where there could be underlying factors that have contributed to previous failures, these may not be acted upon before a repeat incident.

Once returned to full duties following previous SPAD's, little evidence of additional ongoing monitoring or supervision of this driver was sighted. Following the SPAD at MR5 however, a tiered monitoring program of additional 'on road' supervision on six occasions over a six-month period was proposed.

Despite the previous SPAD incidents, the driver of train Y245 was not 'flagged' to the employer as a potential risk.

It is noted that a large portion of *SAF/STD/0016/SWK SPAD Management* was devoted to emergency response procedures such as train controller and driver actions as a first response to a given incident. Emergency response and investigation instructions were contained in other QR standards. Apart from section 8.3 and references to the Employee Management System, there was little in this document that guided supervisory staff in regard to tailoring the 'management processes' to suit the individual employee and circumstances of the SPAD.

QR monitors individual signals in terms of SPADs (in accordance with SAF/STD/0016/SWK) but not corridors. While the rate of SPADs on the Park Road to Fisherman Islands corridor fell within an acceptable risk profile for the volume of traffic for the period March 2001 to March 2004, the lack of 'in cab' warnings in regard to signal aspects no doubt contributed to the SPAD of Y245 on 28 June 2004. On such corridors the safe passage of a train is largely reliant on driver alertness, assisted by VCS and the station protection magnets only.

3 CONCLUSION

3.1 Findings

3.1.1 The location and sighting distance of signals MR5, MR7, and MR3 is in accordance with QR STD/0024/SWK Signal Positioning Principles.

3.1.2 The driver of train Y245 observed signal MR5 to be displaying a red stop aspect prior to passing this signal. The train brakes were applied at this time.

3.1.3 Train Y245 passed signal MR5 at danger at a speed of 35 kph with the train and locomotive brakes fully applied.

3.1.4 Train Y245 stopped 81.8 metres beyond signal MR5 and 503.9 metres from the point of a potential collision with an opposing movement.

3.1.5 By the time the train controller made an emergency call for this train to stop, train Y245 was already stationary.

3.1.6 A collision with opposing train 6835 was possible only if train Y245 had continued beyond signal MR5 at a constant speed of 50 kph.

3.1.7 If train Y245 was travelling at a speed consistent with the Safe Driving Technique policy, an emergency brake application at the time of sighting (200 metres) would have stopped train Y245 about 49 metres prior to signal MR5.

3.1.8 On the evidence provided, train Y245 was appropriately examined (safety checked) prior to departure from Fisherman Islands.

3.1.9 The driver of train Y245 was qualified in all aspects of this train's operation between Fisherman Islands and Park Road.

3.1.10 The driver of train Y245 was certified as fit for driving duties, driver-only operations.

3.1.11 *STD/0021/WHS Medical Fitness Standard* at 8.5.1 is ambiguous in regard to a driver with NIDDM that is being treated with sulphonylureas being certified as fit for driving duties, driver-only operation.

3.1.12 *STD/0021/WHS Medical Fitness Standard* at 8.3.12 provides that individuals at the highest risk of cardiac events be subject to a stress ECG using the Bruce protocol. The driver of train Y245 met the criteria of 'individuals at highest risk of cardiac events' according to this standard. A stress ECG test was not conducted.

3.1.13 There was no direct evidence of incapacity or impairment of the driver of Y245 at the time of the SPAD at signal MR5, but the possibility of the effects of non-insulin dependent diabetes mellitus or medication for the diabetic or associated conditions cannot be ruled out.

3.1.14 The immediate post incident treatment of the driver of train Y245 was in accordance with relevant QR policies and procedures.

3.1.15 An examination of the locomotive data logger indicated that, apart from several minimum brake pipe reductions, train handling between Fisherman Islands and signal MR1 was within acceptable operational parameters.

3.1.16 Notwithstanding the distraction caused by the radio phone falling to the cab floor, no adverse issues in terms of the locomotive driver operating environment in locomotive 2804 were apparent.

3.1.17 Notwithstanding the absence of the train controller from the UTC2 workstation, no adverse issues in terms of the train controller operating environment were apparent.

3.1.18 No evidence of signalling system or communication equipment malfunction was found.

3.1.19 An examination of SPADs on the Park Road to Fisherman Islands dual gauge DIRN track from March 2001 to March 2004 revealed three previous incidents. No SPADs were recorded at MR5 during this period.

3.1.20 The dual gauge DIRN from Park Road to Fisherman Islands met the criteria of STD/0076/SWK in terms of driver only operation having regard to train density and the 'secondary protection measures' provided.

3.1.21 QR has a SPAD management program in place that enables input from corporate to worker level. In addition, a number of initiatives have been or are being implemented by the Coal and Freight Services Group.

3.2 Contributing factors

3.2.1 On the approach to signal MR5, train Y245 was being driven as if the signals pertaining to its path were displaying a proceed aspect.

3.2.2 Train Y245 was being driven in this manner due to either a lack of concentration and attention or the driver's attention being diverted from the primary to an incidental task.

3.2.3 The lack or loss of attention to the primary task resulted in a lack of appropriate action when the signal in advance (MR1) was observed by the driver of Y245 to be displaying a restricted aspect. Specifically, the train speed was not reduced in accordance with the 'safe driving technique' policy and the train was not controlled so as to be able to stop prior to signal MR5.

3.2.4 Habit patterns and short term memory loss are possible contributing factors as evidenced by the application of increased power 34 seconds after the restricted signal was passed.

3.2.5 There was a lack of any expectation on the part of the driver, based on past experience, that signal MR5 would be at stop.

3.2.6 During the period 1 March 2004 until 25 July 2004 inclusive (147 days) signal MR5 was displaying a proceed aspect to approaching trains 94.3% of the time.

3.2.7 Other than audible warnings generated by the station protection magnet and VCS, there were no other technical or human protection against a 'one-person' error.

3.2.8 QR internal SPAD reports into three of the previous five SPADs of the driver of Y245 focused on the active causal factors with little examination of systemic or latent issues.

3.2.9 The interview/counselling for the driver of Y245 lacked timeliness and urgency, so that any reinforcement from the process was compromised.

3.2.10 The 'flagging' and monitoring of the driver of Y245 following previous SPAD events were not effective in preventing the SPAD of 28 June 2004.

The following contributing factors are not relevant to preventing SPADs but relate to the emergency response:

3.2.11 An immediate response to the SPAD alarm at the Mayne Control Centre was delayed by the absence of the train controller from the UTC 2 workstation.

3.2.12 There are no validated procedures in place that cover short-term absences from train controller workstations at the Mayne Control Centre.

3.2.13 Apart from when train controller workstations are formally amalgamated, there are no validated procedures in place that allow for one controller to work two train controller workstations simultaneously.

4 RECOMMENDED SAFETY ACTIONS

RR20050032

The ATSB recommends that QR review their SPAD investigations and related Employee Management System procedures with focus on the following:

- Ensuring that a system of investigation and counselling for relevant safety-critical staff exists, which adheres to strict timelines, to ensure SPAD incidents are fully dealt with in the timeliest manner.
- Investigation of SPADs includes examination of individual actions and organisational factors so that all causal factors are identified.
- Review the monitoring and management of employees who have returned to safety-critical tasks after involvement in a SPAD, particularly multi-SPAD or high-category SPAD employees.

RR20050033

The ATSB recommends that QR undertake a review of practices and procedures at the Mayne Control Centre to cater for necessary short-term absences from train controller workstations.

RR20050034

The ATSB recommends that QR review their medical standards to ensure that safety-critical staff who are at high risk of incapacitation are subject to increased medical surveillance.

RR20050035

The ATSB recommends that QR introduce a scheme to ensure that operational managers can properly assess and act upon the risk posed by significant changes in the health of safety-critical staff who develop or exacerbate health problems between mandatory medical examinations.

5 SUBMISSIONS

Under Part 4, Division 2, Section 26 of the *Transport Safety Investigation Act 2003* the Executive Director may provide a draft report, on a confidential basis, to any person whom the Executive Director considers appropriate, for the purposes of:

- allowing the person to make submissions to the Executive Director about the draft; or
- giving the person advance notice of the likely form of the published report.

5.1 From QLD Transport

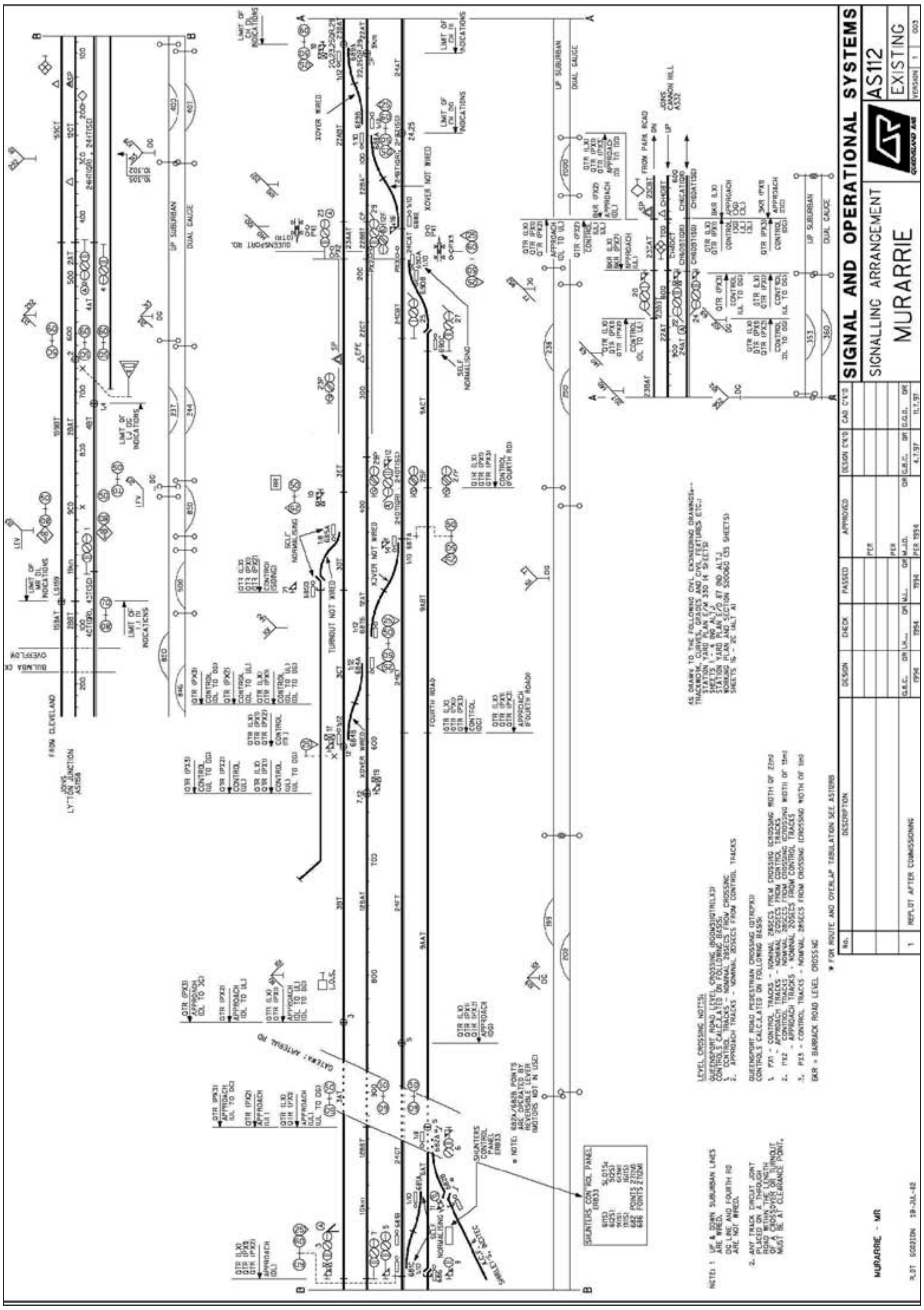
Queensland Transport made a number of comments and observations on the draft report issued to directly involved parties. Some of these comments and observations have been incorporated into this report.

5.2 From QLD Rail

Queensland Rail made a number of comments and observations on the draft report issued to directly involved parties. Some of these comments and observations have been incorporated into this report.

6 APPENDICES

6.1 Murarrie signal and operational systems diagram



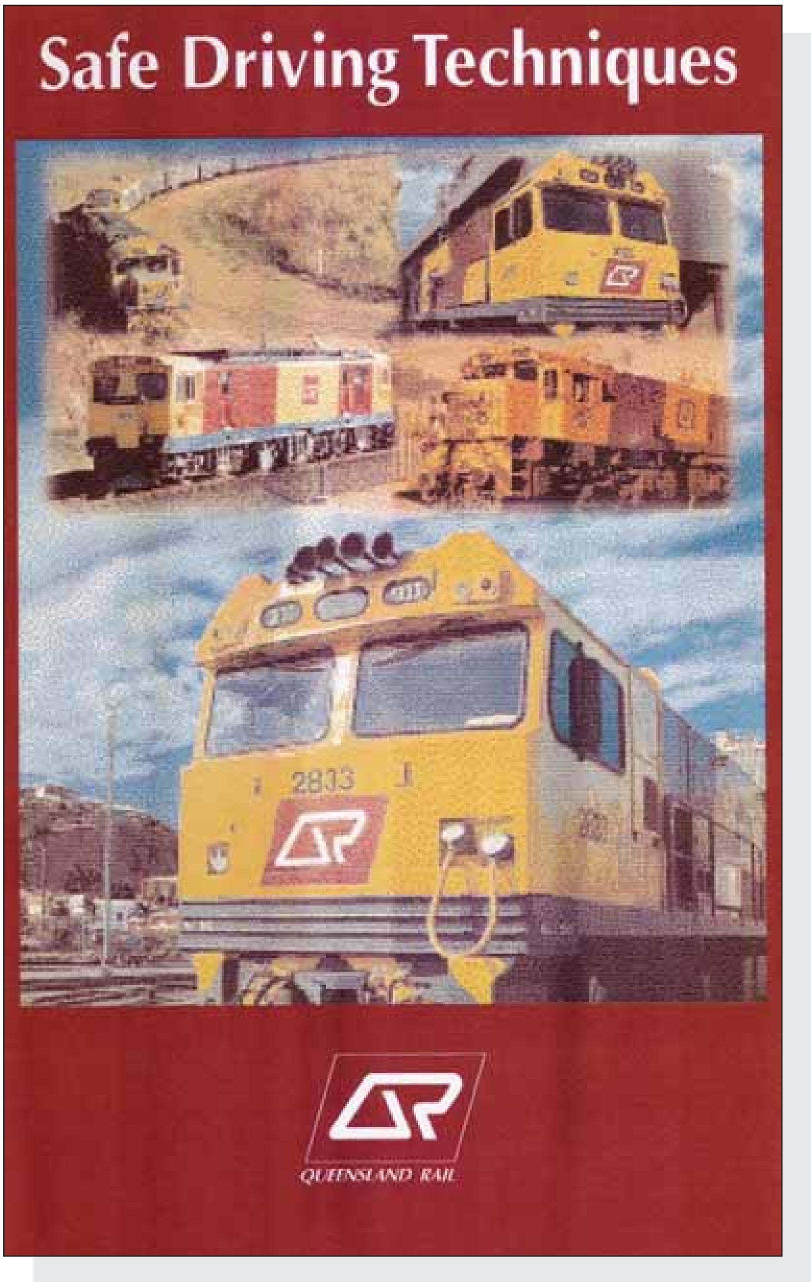
6.2 Table, sequence of events

The sequence of events was developed from the UTC and ATP systems. The timing of the events is presented in Eastern Summer Time (ESuT).

Time (hh:mm:ss)	*Event*
18:48:16	ATP data entered in Y245 ATP • Brake Delay Time = 10 seconds • Maximum Train Speed = 100 kph • Train Length = 614 m • Deceleration Rate = 0.55 m/s^2 • Speed Factor = 100%
19:14:04	Y245 throttle advanced to notch 2.
19:14:11	Y245 train Speed = 2 kph and increasing
19:28:49	Train 6835 occupied MR 24A track
19:29:38	Train Y245 • Speed = 61 kph • Throttle = Notch 3 • Distance MR 5 = 2049 m
19:29:40	Train 6835 occupied MR 24B track
19:29:52	Train 6835 occupied MR 24C track
19:30:00	Train Y245 1685 metres from MR5
19:30:01	Train 6835 occupied MR 24D track
19:30:04	Train Y245 • Speed = 58 kph • Throttle = Notch 3 • Distance MR 5 = 1620 m • Distance MR 1 = 672 m
19:30:19	Train 6835 occupied MR 24E track
19:30:21	Train Y245 occupied MR 4C track
19:30:27	Train 6835 occupied MR 12A track
19:30:47	Train Y245 occupied MR 4B track
19:30:47	Train 6835 occupied MR 12B track
19:31:06	Train Y245 occupied MR 4A track
19:30:58	Train Y245 • Speed = 54 kph decelerating • Throttle = Notch 3 • Track speed = 50 kph • Distance MR 5 = 782 m
19:31:21	Train Y245 Throttle increasing from notch 3
19:31:22	Train Y245 Throttle is notch 5
19:31:30	Train Y245 • Speed = 51 • Distance MR5 = 314 m
19:31:34	Train Y245 • Throttle decreasing from notch 5 • Distance MR5 = 258 m
19:31:35	Train Y245 Throttle is notch 2
19:31:25	Train Y245 occupied MR 24H track

19:31:39	Train Y245 • Speed = 50 kph • Throttle = Notch 2 • Brake Pipe Pressure = 465 kPa • Distance MR 5 = 201 m 'ALM Queensport Rd Level Crossing Failed at MURARRIE'
19:31:40	Train Y245 • Speed = 49 kph • Throttle decreased from notch 2 to idle • Brake Cylinder Charge changed from Off to On • Brake Pipe Pressure = 430 kPa • Distance MR 5 = 187 m 'ALM Queensport Rd Level Crossing Failed at MURARRIE' displayed to UTC controller
19:31:53	'ALM Queensport Rd Level Crossing Recovered at MURARRIE'
19:31:54	'ALM Queensport Rd Level Crossing Recovered at MURARRIE' queued for display to UTC controller
19:31:55	Train Y245 occupied MR 24G track Train Y245 • Speed = 35 kph • Throttle = Idle • Brake Cylinder Charge = On • Brake Pipe Pressure = 103 kPa • Distance MR 5 = 0 m
19:31:57	Audible SPAD alarm starts. 'ALM Train Y245 past Signal 5 at STOP onto 24GT at MURARRIE' queued for display to UTC controller
19:32:04	Controller accepts 'ALM Queensport Rd Level Crossing Failed at MURARRIE' message 'ALM Train Y245 past Signal 5 at STOP onto 24GT at MURARRIE' displayed to UTC controller
19:32:11	Controller accepts 'ALM Train Y245 past Signal 5 at STOP onto 24GT at MURARRIE' message Audible SPAD alarms stops 'ALM Queensport Rd Level Crossing Recovered at MURARRIE' displayed to UTC controller
19:32:12	Train Y245 • Speed = 0 kph • Throttle = Idle • Brake Cylinder Charge = On • Brake Pipe Pressure = 211 kPa • Distance MR 5 = 82 m past MR 5
19:32:13	Train controller transmits on radio 'Control to Y–two–four–five urgent control to Y–two–four–five urgent can you stop immediately thank you' Train Y245 driver responds with 'Yeh I have, I just got past'
19:32:24	Train 6835 occupied MR 12C track
19:32:37	Train 6835 clears MR 24E track
19:32:47	Controller set up all trains blocks around Y245

6.3 Promotional material, Safe Driving Techniques



What is Safe Driving?

SAFE DRIVING TECHNIQUES

Over recent years the number of accidents and near misses has increased. This increase can be attributed to a number of reasons; higher traffic volumes, increased speeds and better reporting systems are some factors. However, a significant percentage of these incidents can be attributed to driver error.

Significant amongst these is the number of Signals Passed at Danger. In recent years QR, in conjunction with unions, has been proactive in developing strategies to reduce the number of these incidents. Part of this process has been improving recording systems in order to assist in identifying the more common causes of SPADs. This has shown that the majority SPADs are caused by: bad judgment, distraction or, as in the case of shunting incidents, misunderstanding. These types of SPADs can be prevented.

To assist in reducing these incidents the following safe driving techniques are provided. These tips have been developed by experienced Drivers In Charge, Tutor Drivers and Drivers. Please consider these techniques in the day to day performance of your duties.

JULY 1998

Safe Driving Techniques

APPROACHING YELLOW SIGNALS

- Always reduce speed when approaching restrictive signals or areas where you know signals are close together and sighting distances are reduced.
- The speed you travel at will be determined by the signal indication, the distance between signals, the speed of the train, the weight and length of the train, the gradient and the weather conditions. A simple guide which can be used at yellow signals is:

WHEN APPROACHING A DOUBLE YELLOW OR STEADY YELLOW SIGNAL	Do not exceed 75% (3/4) of road speed (not less than 25kph). Gradually reduce speed towards the red signal.

SPEED	160	140	120	100	80	70	60	50	40
75% OF SPEED	120	105	90	75	60	50	45	35	30

- If you have stopped at a signal which is showing green or yellow – check the indication before moving off – it may have changed
- Always call the signal indication to other traincrew.

STOPPING AT RED SIGNALS

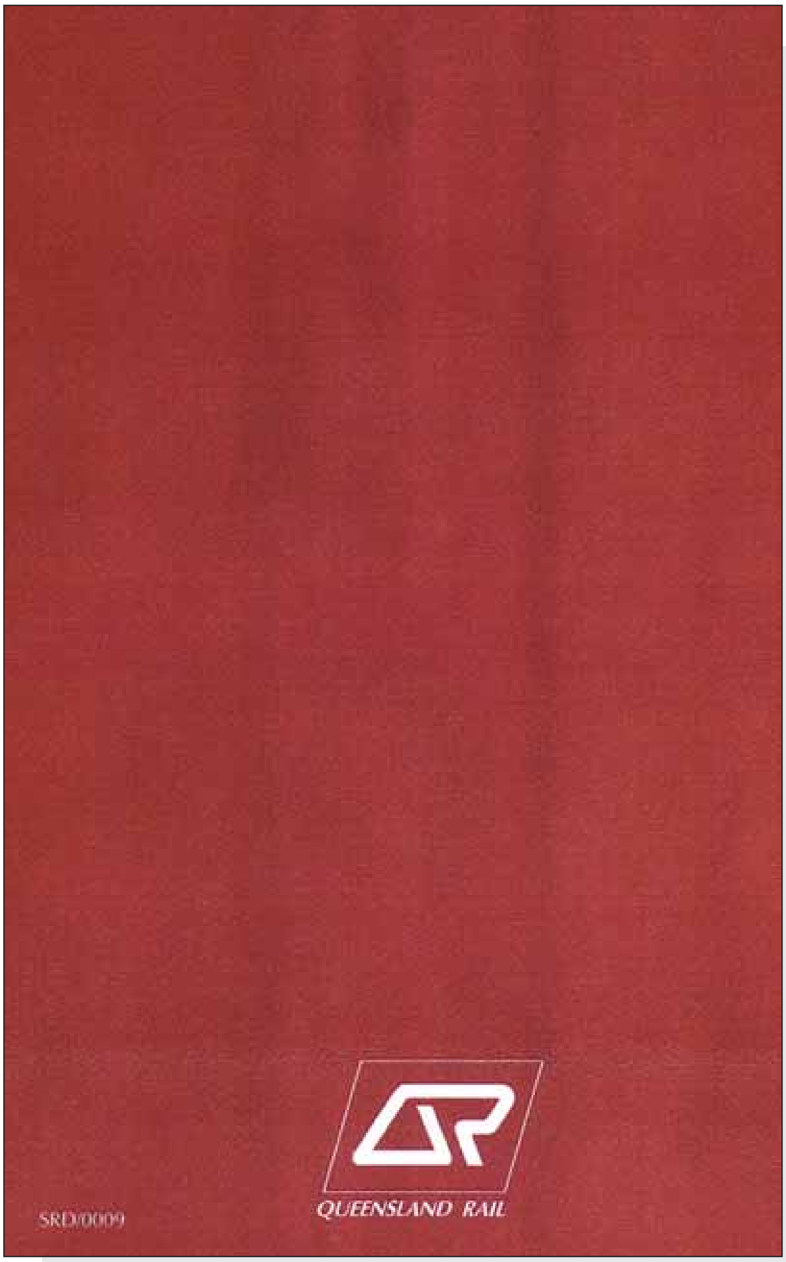
- Always be aware of the braking power and stopping capabilities of the train before approaching any signals that display a restrictive or stop indication.
- Do not allow yourself to be distracted when approaching a stop signal – remain focused on the signal position and indication.
- Passing or crossing another train can give a false perception of your own train speed, remain focused on the signal position and indication.
- If approaching a red signal at which you rarely stop or have never stopped before – be aware of the gradient and track conditions, brake early and target a point at least 50 metres before the signal.
- Do not assume a signal will clear – especially where signals are approach activated.

- Do not "charge" signals, give yourself plenty of time and space to stop at a signal displaying a stop indication.
- If you do stop short of a signal and need to move closer – ensure the braking system is fully charged before moving.

SHUNTING

- Often, when shunting, a train will stop in a position where neither the driver nor the person performing the shunt can see the signal indication. When shunting into or out of sidings protected by signals:
  - always check the signal indication before moving;
  - where possible move back inside the signal before proceeding ahead;
  - if you cannot see the signal indication check with the train controller, rail operator or other officer in charge of the shunting movement.
- A "Limit of Shunt" board is a signal – passing a limit of shunt board without authority will register as a SPAD.

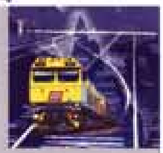
- If you have stopped for any reason, for any length of time, between signals and cannot see the next signal, regardless of the previous signal indication, always exercise caution and approach the next signal as if it were at red.
- If you are unsure of a signal indication due to sunlight, reflected light, poor visibility or for any other reason – treat it as a stop signal – before proceeding check with the controller. Report any signal which you think may be faulty or poorly focussed.
- If you are unsure of the indication of the preceding signal – check with the train controller.
- Exceeding your safe working authority, such as train order, DTC block limit, ordinary staff or ticket is classed as a SPAD. If working in Train Order, DTC or Staff and Ticket systems – always check your safeworking authority before entering or leaving any station.
- Avoid internal or external influences that may impede judgement of distance and speed. Seek counselling where appropriate or necessary. A lack of concentration may end in an unnecessary incident or accident.


SRD/0009
QUEENSLAND RAIL

6.4 SPAD Newsletter, May 2004

Edition FSD26/May/2004

Freight Service Delivery



SAFETY NOW

YOU CAN, ASK FOR DIRECTIONS!!

Recently there have been SPADs, where the driver concerned was either unsure of the location of the next signal, or if the signal displaying the STOP indication, pertained to the train. On both occasion the SPAD would not have occurred if the driver would have just stopped and asked the Network Controller. In both case the drivers had not been over the route for almost a year.

If unsure of a route because you have not been over it for a long time or you are not sure of a signal location or indication – STOP and ASK!! Don't keep going thinking you know the location of the next signal. It is safer to stop and ask, then to continue on blindly hoping the next signal is at proceed.

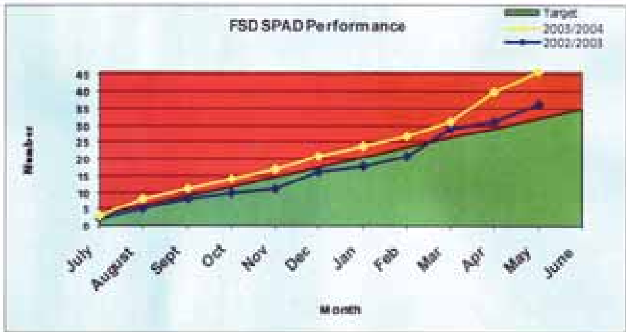
If you receive your roster for your next job and realise that you are going to be travelling over a route that you are unsure of, contact your DIC as soon as possible so arrangements can be made to either organise training or a pilot. If working a train and the Network Controller advises that you will need to travel over a route that you have not been over for some time and are unsure of, advise him that you will require a pilot.

EVERY SPAD HAS THE POTENTIAL TO CAUSE DEATH, SERIOUS INJURY AND MAJOR DAMAGE.

Freight Service Delivery - Depot SPAD Performance

Depot	2002/03	2003/04
Acacia Ridge	2	5
Alpha	0	0
Bundaberg	3	1
Cairns	1	0
Charleville	0	0
Charters Towers	1	0
Cloncurry	1	1
Emerald	4	0
Fisherman Is	0	1
Gayndah	1	0
Goondiwindi	0	0
Hughenden	3	0
Ipswich Freight	0	1
Longreach	0	0
Mackay	5	[illegible]
Maryborough	3	[illegible]
Mount Isa	0	2
Rockhampton	2	[illegible]
Roma	0	0
Townsville/Stuart	11	11
Toowoomba	1	0
Other	1	1
Total FSD	39	46

Red	Needs Attention to reduce
Orange	Needs some improvement
Yellow	Maintain or do better
Green	Excellent



Above graph current to the end of May 2004 - Lets get into the Green

SPAD Corridor Targets: Current Stats of SPADS

Area Supervisor	Actual Target	Actual SPADs
Rockhampton	9	15
Brisbane	11	17
Townsville	15	14
Other		

Can we do it?? YES, TOGETHER WE CAN DO IT!!!!!!!! With your ideas and your depot rep's help.

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