This is a collation of some of the world's railway formal inquiry reports. It includes a brief incident synopsis, along with the main causes and recommendations from each investigation.

Readers may find some of the actions and recommendations useful to their own operations.

Co-ordinated by Greg Morse, RSSB

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Key issues in this edition:

- Late incident reporting
- Driver distraction
- Inconsistent instructions
- Equipment design
- Vehicle approval process
- Flat rail crossings
- Lack of train protection system
- Lack of incident training/experience
- Dealing with multiple passcom activations
Australia: Overrun of movement authority by freight train at Blamey, WA, 14 July 2013

For the full report, click here.

At around 21:21 (local time) on 14 July 2013, a Pacific National freight overran the limit of its movement authority at Blamey, Western Australia. The train travelled 23 kilometres before the crew realised what had happened and applied the brakes.

The crew did not immediately report the overrun to the Network Control Officer, as required. Instead, they provided misleading information about the train’s location, adding that they were having problems with the on-board communication systems. Unaware of the authority overrun, the Network Control Officer issued a Train Authority for the train to proceed from Blamey to Parkeston.

The crew signed off duty at Parkeston and, after reflecting on their actions, reported the occurrence to the Depot Manager at Kalgoorlie the following day.

The Australian Transport Safety Bureau (ATSB) found that during the safety critical period approaching the limit of authority at Blamey, the train crew had focused their attention on planning for the upcoming refuelling at Parkeston. As a result, they were distracted from the primary task of driving the train and missed vital cues and information that identified the limit of the current train authority.

The investigation also found that there were inconsistencies in the instructions contained in the various Pacific National procedural documents relating to refuelling at Parkeston.

Action taken

Pacific National has amended procedures related to the arrangements for refuelling trains at Parkeston to remove inconsistencies and ensure that ancillary tasks do not have the potential to distract train crews from undertaking safety critical work.

Safety message

Train crews must be cognisant of and apply the operational procedures intended to prevent or control the consequence that may arise from an overrun of authority.

Rail transport operators should ensure that any ancillary tasks undertaken by a train crew do not have the potential to divert attention away from the safe operation of a train.

Published 17 July

UK: RRV runaway and collision at Glasgow Queen Street High Level tunnel, 21 April 2013

For the full report, click here.

At about 03:00 on Sunday 21 April 2013, an RRV ran away as it was being on-tracked north of Glasgow Queen Street High Level Tunnel on a section of line sloping towards the tunnel. The RRV ran through the tunnel and struck two scaffolds that were being used for maintenance work on the tunnel walls. A person working on one of the scaffolds was thrown to the ground and suffered severe injuries to his shoulder. The track levelled out as the RRV ran into Glasgow Queen Street station and, after travelling a total distance of about 1.1 miles, it stopped in Platform 5, about 20 metres short of the buffer stop.

The RRV was a mobile elevating work platform that was manufactured for use on road wheels and then converted by Rexquote Ltd to permit use on the railway. The RRV’s road wheels were intended to provide braking in both road and rail modes. This was achieved in rail mode by holding the road wheels against a hub extending from the rail wheels. The design of the RRV meant that during a transition phase in the on-tracking procedure, the road wheel brakes were ineffective because the RRV was supported on the rail wheels but the road wheels were not yet touching the hubs. Although instructed to follow a procedure which prevented this occurring simultaneously at both ends of the RRV, the machine
operator unintentionally put the RRV into this condition. He was (correctly) standing beside the RRV when it started to move, and the control equipment was pulled from his hand before he could stop the vehicle.

The RRV was fitted with holding brakes acting directly on both rail wheels at one end of the vehicle. These were intended to prevent a runaway if non-compliance with the operating instructions meant that all road wheel brakes were ineffective. The holding brake was insufficient to prevent the runaway due to shortcomings in Rexquote’s design, factory testing and specification of maintenance activities. The lack of an effective quality assurance system at Rexquote was an underlying factor. The design of the holding brake was not reviewed when the RRV was subject to the rail industry vehicle approval process because provision of such a brake was not required by Railway Industry Standards.

RAIB has identified one learning point which reminds the rail industry that the rail vehicle approval process does not cover all aspects of rail vehicle performance:

- Although the vehicle approvals process assesses compliance of plant design with the relevant mandatory requirements of railway industry standards, it does not provide assurance concerning all aspects of the design and manufacture of that plant. For this reason, it is important that designers, manufacturers and convertors of plant for use on railway infrastructure apply established principles of engineering safety management to the specification, design, manufacture and testing of plant. Reliance should not be placed on approvals bodies identifying that new plant may prove to be unsafe when placed into service. Guidance on applying good practice in this field is to be found in the RSSB document *The principles of the safe management of engineering change: Guidance* (Issue 1, May 2012).

Action taken

TXM Plant has briefed machine operators about the circumstances of the accident, and about the need to use the documented TXM Plant procedure when on-tracking all high ride RRVs.

Network Rail reported to RAIB in January 2014 that it intends to amend its response to Recommendation 4 of the Bradford Interchange investigation report to include audits of engineering safety management systems of rail plant manufacturers and converters who do not directly supply Network Rail, but whose equipment is used on Network Rail managed infrastructure.

ORR served a Prohibition Notice on Network Rail, prohibiting the use of RRVs of the same type as that involved in the accident where there was a risk from runaway during on-tracking. ORR reported that Network Rail had complied with this requirement by prohibiting this type of RRV from use on its infrastructure until each machine had been demonstrated as being able to meet the following pull test criteria, intended to allow for both a safety factor and the effects of contamination and pad wear:

- Immediately following repair or adjustment: 750 kg (26% more rail wheel holding brake retarding force than that required to prevent movement of a fully laden machine on a 1 in 29 gradient); and
- At any time: 680 kg (14% more rail wheel holding brake retarding force than that required to prevent movement of a fully laden machine on a 1 in 29 gradient).

Rexquote revised the operation and maintenance manual to adopt the increased pull test figures as required by Network Rail. This revision also incorporated a requirement to adjust the brake cylinder positions if required to meet the pull test figures, along with instructions for carrying this out.

TXM Plant, along with other operators, tested the rail wheel holding brakes on all examples of this type of RRV, and adjusted them, where necessary, to meet the revised performance criteria. TXM Plant also incorporated the higher 750 kg brake pull test into the three-monthly maintenance checks on the RRV, instead of testing the rail wheel holding brakes annually as specified in the operation and maintenance manual.

Rexquote made available a redesigned rail wheel holding brake cylinder, with the same maximum available brake retardation, but which used a longer spring assembly, and so had a lower rate of
reduction of brake retarding force with brake pad wear. These cylinders were only fitted to RRVs that had been unable to meet the higher brake retarding force pull tests with the existing cylinders.

Rexquote modified the rail wheel holding brake release interlock circuit to prevent the possibility of the rail wheel holding brake being released when the road wheel braking is not effective through contact with the rail wheel hubs.

ORR reported to RAIB that Network Rail has committed to extending the direct rail wheel braking retrofit programme to cover all remaining high ride RRVs, including the type involved in the accident. This will replace the rail wheel holding brake on this type of RRV with a direct rail wheel service brake, which will provide higher brake retardation.

Network Rail is undertaking tests of RRV direct rail wheel braking performance with varying levels of brake pad wear. The results of these tests will inform the future development of standards and guidance for brake performance and testing.

**Recommendations**

- Rexquote should implement a quality assurance process commensurate with good practice in engineering safety management.

- Development of the process should include, but not be limited to, consideration of the following measures:
  - Undertaking peer review or checking of design assumptions and design calculations;
  - Ensuring that the intended design performance of equipment is used as the basis for assessing the results of design validation testing;
  - Ensuring that maintenance procedures and the associated tests are consistent with the intended design performance of equipment;
  - Ensuring that the design of safety related systems, such as brakes, and of any associated maintenance processes, takes account of foreseeable degradation mechanisms, such as brake pad wear, the need for adjustments and environmental conditions; and
  - Formal certification by an external body.

- Network Rail should extend its process for auditing the engineering management system of rail plant suppliers (linked to Bradford Interchange Recommendation 4) so that it includes auditing the engineering safety management processes of all organisations manufacturing and/or converting rail plant likely to be used on Network Rail infrastructure.

- Network Rail, in conjunction with RSSB, should review the requirements for RRV lighting in standard **RIS-1530-PLT**, with the objective of reducing the risk of RRVs running away without active lights. This should include consideration of:
  - Requiring rail mode lighting to be activated when rail wheels start to be deployed (when on-tracking is taking place); and
  - Requiring all illuminated lights to remain lit on activation of engine stop or emergency stop controls.

- Network Rail, in conjunction with the M&EE Networking Group, should review and improve the requirements and guidance for testing of RRV parking brakes so that such tests reliably demonstrate that the brake will be effective in all foreseeable operating conditions. The review should include, but not be limited to, consideration of:
  - Demonstrating sufficient safety margins (including any related to uncertainties in the testing method);
  - Allowing for foreseeable degradation, such as brake pad wear;
Published 21 July

US: Freight train collision at Arcadia, Kansas, 21 July 2012

For the full report, click here.

At around 15:30 (local time) on 21 July 2012, a Kansas City Southern (KCS) freight collided with a Burlington Northern Santa Fe (BNSF) service on a flat crossing near Arcadia, Kansas.

At the time of the incident, the BNSF train was travelling at about 35 mph; the KCS train was running at around 31.

Both KCS crew members jumped from the leading locomotive prior to the collision and were injured. One was treated and released from hospital, the other was kept in overnight, being released the following day. The two BNSF crew members were not injured.

The flat crossing at Arcadia is automatic. The system is designed to allow the first train that arrives at the crossing to receive a proceed aspect if the other track approach sections are unoccupied. Any train arriving later on the other line receives a stop signal until the first train is clear.

The northbound BNSF train departed Springfield, Missouri, at 12:45 on 21 July. As it approached the Arcadia railroad crossing, the train crew received an approach diverging signal, indicating that the train would be proceeding into the lay-by located immediately north of the crossing. The BNSF crew said they noted nothing unusual as they approached and passed through the crossing.

The northbound KCS train departed Pittsburgh, Kansas, at 15:10 the same day. Its crew told National Transportation Safety Board (NTSB) investigators that they had an uneventful trip until approaching the wayside signal at the South Mulberry siding. The KCS crew received a flashing yellow signal aspect, requiring them to proceed on the main track and to reduce the speed to 35 mph before reaching the next signal. However, it was determined by NTSB investigators that the train did not reduce speed, but continued north at a speed of about 52 mph.

About two miles farther north, at the North Mulberry siding pointwork, the KCS train received a continuous yellow signal aspect, requiring the crew to immediately reduce the train speed to 35 mph and prepare to stop at the next signal. NTSB investigators determined that the KCS train was moving about 45 mph when passing the yellow (approach) signal.

About half a mile further north, the KCS crew saw that the signal controlling movement over the flat crossing was displaying a stop aspect. Immediately after recognizing the red signal, the KCS crew saw the BNSF train pass over the crossing and the KCS driver applied the emergency brakes. Both KCS crewmembers exited the leading locomotive and jumped from the train prior to the collision.

The NTSB determined that the KCS train was traveling about 42 mph when the emergency rake application was made, and collided with the BNSF train at 31 mph.

Signal system tests were also conducted on approaches involving both the BNSF and KCS trains. In all cases, it was found that the signal systems operated as intended.

Investigators examined all undamaged rolling stock equipment, as well as mechanical records for the movement of both trains. No mechanical defects were found.
Both trains were authorized to occupy the main track by the signal indications. The BNSF traffic control system was controlled by a train dispatcher located in Fort Worth, Texas; and the KCS traffic control system was controlled by a train dispatcher located in Kansas City, Kansas.

Records of the portable electronic devices of the crews of both trains involved in the accident were acquired and reviewed. The records showed that no calls or texts were sent or received by the crew of either train during the times when the trains were being operated.

The KCS engineer and conductor had been on duty for less than two hours and both indicated that they felt very alert at the start of their shift. They said they had received the amount of sleep they needed to feel rested during the three days leading up to the accident. Neither crew member had been diagnosed with a sleep disorder.

Positive Train Control

Had a positive train control (PTC) system been installed, says the NTSB, the collision would have been prevented. The system would have intervened by activating an audible warning in the leading locomotive cab, alerting the train crew of the ‘over-speed condition’. PTC could also have initiated an automatic brake application to stop the train before the point of collision.

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Published 28 July

UK: Uncontrolled evacuation of a London Underground train at Holland Park, 25 August 2013

For the full report, click here.

At around 18:35 on Sunday 25 August 2013, a London Underground train departing Holland Park station was brought to a halt by the first of many passenger emergency alarm activations, after smoke and a smell of burning entered the train. During the following four minutes, until the train doors still in the platform were opened by the train operator (driver), around 13 passengers, including some children, climbed out of the train via the doors at the ends of carriages.

RAIB found that rising fear spread through the train when passengers perceived little or no response from the train operator to the activation of the passenger emergency alarms, the train side-doors remained locked and they were unable to open them, and they could not see any staff on the platform to deal with the situation. Believing they were in danger, a number of people in different parts of the train identified that they could climb over the top of safety barriers in the gaps between carriages to reach the platform.

A burning smell from the train had been reported when the train was at the previous station, Notting Hill Gate, and although a request had been made for staff at Holland Park station to investigate the report, the train was not held in the platform for staff to respond. A traction motor on the train was later found to have suffered an electrical fault, known as a ‘flash-over’, which was the main cause of the smoke and smell.

A factor underlying the passengers’ response was the train operator’s lack of training and experience to deal with incidents involving the activation of multiple passenger emergency alarms.

The report observes that London Underground Limited (LUL) commenced an internal investigation of the incident after details appeared in the media.

Action taken

LUL has reported that, in the short term, the algorithm used to calculate the risk of motor flashover will be changed to increase the weighting given to a motor once it has been in service for 1.6 years after overhaul. This will allow motors to be more accurately targeted for preventative maintenance. Efforts are also ongoing to prevent motors becoming susceptible to flashover; there is an ongoing trial of a modification to the motor which is due to be completed in 2015 and a proposal to develop another
modifications to reduce wear on motor components associated with flashover (paragraph 72). In the longer term, LUL is seeking to introduce changes to the train and motor control systems to reduce stresses on the motor which appear to be a factor in the process leading to a motor flashing over.

LUL has also reported that it intends to review the special events planning and staff allocation for Holland Park, in consultation with local representatives, as part of the planning cycle for the 2014 Carnival.

LUL is undertaking a review of the risk assessment for inner inter-car barriers, taking account of emergency situations.

**Recommendations**

- **LUL** should carry out an ergonomics assessment of the driver interface with the passenger emergency alarm system on 1992 tube stock. This assessment should include the functioning of the talkback system and the compatibility between the controls and the display. Taking account of guidelines on alarm handling and prioritisation (such as the *Good Practice Guide for the design of alarms and alerts* (T326) RSSB 2008), LUL should then take appropriate action to present critical information to the train operator in a way that supports decisions and actions so that they can deal appropriately with the emergency situation.

  Relevant outcomes of this ergonomic assessment should also be applied to other stock as appropriate.

- **LUL** should review the rules, procedures and training applying to the handling of emergency situations on 1992 tube stock where multiple passenger emergency alarms have been activated and/or where only part of the train is stopped in a station. This review should include an assessment of the ways in which train operators can best manage a situation and adequacy of existing training arrangements. Particular attention should be paid to helping operators make appropriate and timely announcements and the safe management of doors in such circumstances. Any necessary changes to existing arrangements should then be implemented and staff briefed and trained as appropriate.

  Relevant outcomes of this review should also be applied to other stock as appropriate.

- **LUL** should put procedures in place to require train operators to carry their hand-held radio when going back into the train, for example, to investigate the activation of a passenger emergency alarm, so that they can communicate with the line controller in a timely manner.

- **LUL** should:
  - Review the procedure applying to line controllers for dealing with reports of faults on trains, particularly reports relating to smoke or burning, and improve as necessary, in order that line controllers are provided with a clear process to assist timely decision-making and response; and
  - Establish a protocol to manage the shift changeover between controllers, so that there is no loss of time or continuity in dealing with an incident.

- **LUL** should review the required competencies and training for dealing with out-of-course events on trains in platforms. This should include consideration of how best to prepare station staff, train operators and line controllers to respond to such events in a rapid, coordinated and coherent manner, to protect the safety of passengers and station users.

- **LUL** should devise a time bound programme to reinforce, by briefing and further training if necessary, its procedures on the reporting and investigation of incidents in which there are no reported injuries but which could have led to more serious consequences. This should include the need for the early debriefing of staff involved and, where appropriate, the withdrawal of any trains from service for inspection and testing, to permit such incidents to be properly investigated.

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