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.

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Key issues in this edition:

- Track maintenance (including consideration of historical information and data)
- Driver training (fault finding and resolution)
- Radio reception quality
- Fog (sighting at level crossings, crossing user behaviour)
- Train horns
- Crossing user behaviour (include methods adopted by farm users)
- Possession planning, management and communication
- Curve risk assessment (check rail provision)
At around 05:30 (local time) on 23 October 2011, a Pacific National freight train derailed near Wirrinya, New South Wales. It was heading towards Parkes and was 14 hours into its journey from Sydney to Perth.

The leading bogie of the 42nd wagon left the line three kilometres north of Caragabal. The wheels ran derailed for about 15 kilometres before reaching a set of points at the southern end of Wirrinya, where the train divided and partly overturned.

There were no reported injuries to the crew, though there was significant damage to the infrastructure.

The Australian Transportation Safety Bureau (ATSB) found that a dip in the track with adverse twist close to Caragabal caused the bogie to derail. The dip was caused by the formation subsiding due to a local formation weakness. This resulted in its inability to support the track.

There was no evidence of formation damage due to re-sleepering or any pumping of formation material up though the ballast and the track geometry appeared to be relatively stable for some kilometres either side of the derailment site. Track inspections had been conducted, but it is unlikely that they would have identified any warning signs of weakness before the incident. It is more likely, says the ATSB, that the dip developed under the train as it traversed the site.

There was a history of track geometry defects around this location, but they were generally not significant when compared to defects identified and rectified in other locations. Notwithstanding this, the ATSB point out that the analysis of track defect history is important for planning maintenance activities.

**Action taken**

The Australian Rail Track Corporation (ARTC) has implemented an Engineering Code of Practice (CoP) for its rail network in New South Wales as part of an ongoing programme of procedural standardisation. The CoP is slightly more stringent than the previous standards in its assessment of identified track defects. There was no evidence of pre-derailment track defects in this case, but where the formation may begin to collapse without resulting in a derailment, it is possible that the CoP may have resulted in earlier maintenance action and could prevent a future derailment.

**Safety message**

The ATSB notes that the opportunity may exist for infrastructure managers and maintainers to strengthen their predictive track maintenance systems by considering a greater examination of historical maintenance and defect data.

_for the full report, click [here](#)._
The tram was able to move with its doors open because a fault override switch, which disables safety systems like the door-traction interlock, had been inadvertently operated by the driver while trying to resolve a fault. The driver did not close and check the doors before departing from Lebanon Road and Sandilands partly because he was distracted by dealing with the fault, and partly because he did not believe that the tram could be moved with any of its doors open.

RAIB also found a number of other causal factors:

- Passengers did not succeed in alerting the driver to the fact that the doors were open;
- The controller did not understand a communication from the driver reporting the fault override status message; and
- The tram was not taken out of service despite the indication of a brake fault, because there was no standard process for dealing with faults.

RAIB believe that the following factors were ‘probably’ causal:

- The ‘doors closed’ indication in the driving cab was poor;
- The quality of radio signal reception possibly affected the controller’s understanding of the driver’s verbal communication; and
- Training on fault handling for drivers and controllers is largely based on procedures, and focuses on recovering the tram rather than diagnosing the fault.

The fault override switch bypasses the door-traction interlock, allowing the tram to move with its doors open, is considered by RAIB to be an underlying factor.

Although not linked to the incident, RAIB also observed that controllers and drivers often used mobile telephones to communicate in areas of poor radio reception.

**Action taken**

On 18 April 2013, Tram Operations Ltd (TOL) issued a memo to controllers reminding them that the fault override switch should only be used as a last resort to enable a failed tram to return to the depot, and that trams must not run in service carrying passengers when the fault override switch is activated.

On 20 June 2013, TOL issued an operational notice to drivers reminding them that sealed switches must not be used without the authorisation of the controller. This notice also encourages drivers to look at the switch being operated and to make sure that no other switches are inadvertently operated. It further informs drivers of a new green plastic seal on the fault override switch, and instructs drivers to stop the tram and inform the control room if a ‘253 fault override’ message appears on the display.

Bombardier subsequently developed a modification to the fault override switch, protecting it with a key-operated cover incorporating the green plastic seal, in order to prevent inadvertent operation. This modification has been installed across London Tramlink’s CR4000 fleet. It was supported by a briefing to controllers and drivers and a new procedure involving walking through the tram to physically check that all the doors are closed before operating the fault override.

In August 2013, London Tramlink installed new radio terminals at all three desks in the control room to fix a problem with the duty manager’s radio. This also resolved the problem of the non-functioning loudspeaker on the controller’s desk.

**Recommendations**

- TOL should revise its policy on verbal communications to:
  - Reinforce rules on the avoidance of communicating with drivers by mobile telephone while trams are moving;
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Summary

- Minimise, where possible, communication by radio while trams are moving particularly for complex issues (such as the resolution of faults); and
- Enhance the use of readbacks for safety-critical communications in abnormal, degraded and emergency scenarios.

- TOL should revise its training modules and procedures on fault handling to achieve:
  - Improved awareness amongst drivers and controllers of critical fault modes, the effects of operating override switches (including the fault override and the driver’s emergency door release) and how to respond to faults, including guidance on co-operation between drivers and controllers; and
  - Clarification of the procedure for handling critical faults, including explicit guidance for defined circumstances (such as how many attempts should be made to rectify a fault and when the tram should be taken out of service).

- London Tramlink, in conjunction with TOL, should improve cab displays and labelling in all of its trams. This should include, but not be limited to:
  - A prominent indication of the status of the doors (for example, by changes to the cab panel indicator light, or by introducing an audible warning); and
  - Information provided to the driver about the fault override function and other safety-critical overrides (such as the emergency door release), including the switch label and the associated alert on the message display, to clarify its purpose and effects of its operation.

- UK tram operators should conduct an assessment of controls in driving cabs in their current and future fleets to identify those which override safety systems, the risk of drivers inadvertently operating those controls and, where reasonably practicable, design and implement solutions to minimise such risk, based on the lessons from this investigation.

- ORR should ensure that UK tram operators publish suitable guidance on ergonomics principles for cab interface design (with reference to appropriate tramway, railway and European standards), and identify where such guidance is to be found in the long term. This should include guidance on protecting safety-related controls from accidental operation.

- TOL should take steps to improve the clarity and consistency of passenger controls and displays on its trams, taking into account the findings of RSSB project T052c as appropriate.

- London Tramlink should develop and implement a programme to prioritise and expedite the planned upgrade of the radio system, to achieve an improvement in signal coverage and strength across the whole network (including tunnels) and reliable operation in adverse weather conditions.

  TOL should improve its fault reporting processes to ensure that faults are properly logged and tracked to resolution.

Received 16 March

Czech Republic: Fatal collision at a level crossing between Jaroměřice nad Rokytnou and Kojetice na Moravě, 12 September 2013

For the full report, click here (includes summary in English).

At 12:02 (local time) on 12 September 2013, a passenger train struck a tractor at an open level crossing between Jaroměřice nad Rokytnou and Kojetice na Moravě and derailed. The tractor driver was killed, the train driver injured.

The NIB determined that the accident had been caused by the tractor driver failing to obey the crossing’s audible and visual warnings that a train was approaching.
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Recommendations

- The infrastructure manager should inspect all open level crossings and make sure that all visible warnings can be seen from the road in all directions, taking any appropriate remedial action required.

- The National Safety Authority should ensure the above recommendation is actioned.

Published 18 March

Canada: Fatal collision at rang de la Deuxième-Chaloupe level crossing, Joliette, Quebec, 9 January 2013

For the full report, click here.

At around 09:50 (local time) on 9 January 2013, a VIA Rail passenger train struck a westbound road vehicle at rang de la Deuxième-Chaloupe level crossing at 60 mph. The impact killed the two road vehicle occupants – a mother and child – instantaneously.

The Transportation Safety Board of Canada (TSBC) noted that, after the train travelled about two miles, the visibility decreased significantly due to fog. Near the whistle post for the crossing, the train crew began sounding the horn in accordance with the local rules. The crossing’s flashing lights were functioning. Just before the train reached the interface, the train crew observed a westbound vehicle on the crossing and then exiting the crossing. Shortly after, a sport utility vehicle (SUV), which was following the first vehicle, entered the crossing and was struck by the train.

The SUV driver was a local resident, who had lived in the area for 13 years. On the day of the accident, she was en route from her home to Joliette. She drove there frequently, often using the rang de la Deuxième-Chaloupe crossing. The child was in the rear of the vehicle, buckled into a forward-facing child seat.

Rang de la Deuxième-Chaloupe is a paved, two-lane, undivided rural road that intersects the track at a 35°/145° angle. Under normal visibility conditions, sightlines along the railway right-of-way were clear. The crossing is protected by flashing light signals and a bell. In good weather, the light signals are visible to approaching motorists for at least 600 feet. Advanced warning signs are installed about 600 feet from the crossing along the roadway approach in both directions and are visible to approaching motorists for at least another 600 feet. The road has a maximum speed limit of 80 km/h.

The flashing lights and bell had been tested on the previous day (that is, 8 January 2013). Testing and inspection of the light signals and bell following the accident did not reveal any deficiencies. It was determined that the lenses of the light signals were properly aligned for approaching vehicles. However, the TSBC note that LEDs would have improved the visibility of the crossing in the prevailing foggy conditions.

The drivers of the struck vehicle and the vehicle preceding it were familiar with the road and the crossing. However, the density of the fog present in the vicinity of the crossing severely reduced the sightline distance available and prevented them from observing both the approaching train and the activated railway crossing signals prior to reaching the crossing.

The driver of the first vehicle was travelling below his routine speed for that section of the road but was still not able to stop in the sightline distance available. By the time he noticed the flashing signals, he was too close to stop safely before the crossing. Following the first vehicle over the crossing at a similar speed, the driver of the second vehicle continued on to the crossing and was struck by the train.
In this case, the three-flute horn situated mid-locomotive was sounded from the whistle board (about 1450 feet away) to close to the crossing. However, it was not effective in alerting the drivers of the first and following vehicles to the presence of the train.

The emergency horn is generally used only for high risk or emergency situations (for example, when trespassers are walking along the track facing away from oncoming trains). However, during severe weather conditions such as dense fog or blowing snow, when visibility in the vicinity of the crossing is hindered, proactive use of the train's emergency horn could provide an effective warning to oncoming vehicles, reducing the risk from crossing collisions.

The TSBCs list the following causes and contributory factors:

- The density of the fog in the vicinity of the crossing severely reduced the sightline distance available and reduced the opportunity for the driver to observe both the approaching train and the activated railway crossing signals prior to reaching the crossing.

- Although the train horn located mid-locomotive was being sounded, it was not effective in alerting the drivers of both the first vehicle and the following vehicle to the presence of the train.

- Following the first vehicle over the crossing, the driver of the second vehicle continued on to the crossing and was struck by the train.

Findings as to risk:

- When vehicle drivers do not adapt their speed to severe weather conditions, the effectiveness of the visual warning system at crossings diminishes during periods of low visibility, increasing the risk of crossing collisions.

- During severe weather conditions, when visibility in the vicinity of the crossing is hindered, proactive use of the train's emergency horn could provide an effective warning to oncoming vehicles, reducing the risk from crossing collisions.

Other findings:

- The visibility of the crossing signal would have been improved with the installation of LEDs.

- Although drivers reduce speed somewhat during adverse weather or visibility conditions, typically the speed adjustment is not sufficient to be able to stop in the sightline distance available.

**Recommendations**

None specified.

**Received 18 March**

*Ireland: Possession incidents on the Iarnród Éireann network*

For the full report, click [here](#).

In 2012, Iarnród Éireann (IÉ) had four possession-related incidents within the space of one week. These incidents led the Rail Accident Investigation Unit (RAIU) to begin a trend investigation.
The scope of the investigation included the four incidents and all other relevant reported possession incidents that occurred between January 2009 and January 2013.

Initial analysis of these incidents identified recurring issues with possession planning, therefore the investigation focused on the management and execution of possession planning. Due to the recurring nature of these issues the RAIU have also examined how IÉ manage internal post incident recommendations previously made in the area of possession management.

Contributory factors in relation to possession incidents identified were:

- The Control Room Process is not fully adhered to in all meetings in that the protection arrangements associated with the occupational safety risks are not discussed;

- The continued planning and implementation of back-to-back possessions has introduced practices that are non-compliant with prescribed instructions in the IÉ Rule Book for fog signal protection.

- The consistent booking of pre-established possessions with regards to work, limits and duration has led to possession protection being arranged to coincide with these limits instead of an assessment taking place on a site by site basis;

- The Weekly Circular is currently ineffective for communicating actual works that are to be undertaken on a given day/night due to the current practices of booking and cancelling of possessions;

- Late alterations to possession arrangements are not always communicated to relevant staff and have also in some cases led to inadequate possession protection.

The underlying factors were as follows:

- There is no standardised procedure on the requirements and frequency of possession planning meetings and prescribing staff to be involved;

- The procedure for closing out IÉ recommendations has not been effective with regards to planning and back-to-back possessions.

Recommendations

- IÉ (Infrastructure Manager) should develop a formal possession planning meeting framework that is consistent through the IÉ network;

- IÉ (Infrastructure Manager) should review the application of back-to-back possessions and implement actions to eliminate any informal practices that do not comply with IÉ Rule Book;

- IÉ (Infrastructure Manager) should establish a possession planning procedure that ensures protection arrangements are based on the work to be delivered and are verified by a suitable member of staff and formally communicated to all relevant personnel;

- IÉ (Infrastructure Manager) should monitor and review entries into the Engineering works requiring absolute possessions – Section T Part III section of the Weekly Circular to ensure that the information published in this document is accurate and credible;

- IÉ (Infrastructure Manager) should review the current process for late changes to possessions to ensure changes to possession arrangements are verified by a suitable member of staff and formally communicated to all relevant personnel;
IÉ (Infrastructure Manager) should undertake a review of possession incidents that have occurred over the last four years to ensure that reports are completed and recommendations are identified and addressed. 

Published 27 March

**UK: Collision at Buttington Hall user-worked crossing, 16 July 2013**

For the full report, click [here](#).

At 11:44 on 16 July 2013, a collision occurred between a passenger train and a farm trailer at Buttington Hall farm crossing near Welshpool on the line between Shrewsbury and Machynlleth. The tractor driver and two other people nearby sustained minor injuries; two passengers on the train taken to hospital, but were discharged later the same day.

The train was operated by Arriva Trains Wales and consisted of two 2-car units. It was travelling at 75 mph at the time of the collision. There were 140 passengers and two crew members on board. On the day of the accident, the farm crossing was being used by tractors bringing in a harvest from fields on the opposite side of the line. The farmer had appointed a contractor to do the work, and an attendant had been provided at the crossing to telephone the signaller and operate the gates.

The accident occurred because the system of work in use at the crossing was inherently unsafe, leading to ineffective control of road vehicle movements over the crossing and frequent use of the crossing without the signaller being contacted. This system broke down. There were also underlying management factors:

- The harvest contractor did not implement an effective safe system of work at the crossing;
- Network Rail’s process for risk assessment of these types of crossing did not adequately deal with periods of intensive use; and
- Network Rail’s instructions to users of these crossings did not cover periods of intensive use.

The accident occurred due to a combination of the following causal factors:

- The system of work in use at the crossing was inherently unsafe. This resulted in:
  - Ineffective control of road vehicle movements over the crossing; and
  - Use of the crossing without the signaller being contacted.
- The system of work broke down.

The following underlying management factors were also identified:

- The farmer did not establish an effective safe system of work at the crossing.
- The output of a risk assessment using the ALCRM is based on an estimate of the road traffic, averaged over the whole year. This does not separately identify the risk at times of intensive use, such as at harvest time.
- Network Rail’s instructions to authorised users on the safe use of UWCs did not cover periods of intensive use.
RAIB also note that the signaller’s method of working did not involve asking the crossing attendant to call back to confirm that the crossing was clear after a series of crossings by tractors.

Although not linked to the cause of the accident on 16 July, RAIB has observed that the prolonged closure to road traffic of the nearby Buttington AHB crossing on the A458 road may have led many road users to ignore the wig-wags and barriers. Finally, RAIB has identified the following key learning point:

*It is important that infrastructure managers, in conjunction with the police, ensure that, when an automatic crossing is closed across the road for an extended period due to a mishap, suitable measures are promptly taken to manage the traffic, reopen the road and discourage road users from passing the illuminated wig-wags without proper authorisation.*

**Actions taken**

Network Rail staff at Machynlleth have defined a method of working for use when a UWC is to be intensively used in their area. They have applied this to a UWC which is being used by civil engineering contractors working at a sewage works and have also written to the authorised user of another UWC which has a history of misuse to ask that it be used.

The method of working is based on that given in *Rule Book module TS9*, but also requires the crossing user to post an attendant at the crossing to call the signaller for permission to cross. The signaller then gives a call back time by which the attendant must call the signaller to confirm that they are clear of the crossing and the gates have been closed. The signaller applies reminders to the block markers each side of the crossing during the time between granting permission and receiving the call back.

**Recommendations**

- Network Rail and Northern Ireland Railways should review and improve their processes for assessing the risk at user worked crossings so that the increased risk during periods of intensive use (eg during harvest) is properly taken into account.
- Network Rail and Northern Ireland Railways should define one or more safe and practical methods of working that may be adopted at user worked crossings during periods of intensive use; and provide clear information to their staff and authorised users on how and when they should be applied. They should also ensure that any such methods of working are suitably reflected in instructions and training given to railway staff.

RSSB should review, and improve where appropriate, measures in the level crossing risk management toolkit that are designed to mitigate the risk at UWCs at times of intensive use.

**Published 31 March**

*UK: Locomotive derailment at Ordsall Lane Junction, Salford, 23 January 2013*

For the full report, click [here](#).

At 14:34 on 23 January 2013, a Class 47 diesel-electric locomotive derailed on a small radius curve approaching Ordsall Lane Junction in Salford, and caught fire. The locomotive was being hauled on the rear of an empty train, which was formed of another Class 47 locomotive and five coaches.

The derailment was caused because lateral forces acting as the locomotive negotiated the curve were sufficient to cause the leading right-hand wheel to climb the rail. Despite being required by standards, there was no check rail on the curve. This safeguard would have restricted the lateral displacement of the wheels and prevented the derailment.
RAIB found that the following factors had resulted in the lateral forces being high enough to initiate wheel climbing conditions:

- The dry and clean state of the inside face of the outer rail on the curve that enabled high levels of wheel-rail contact friction to be established; recently-modified arrangements for lubricating the rails did not prevent this.

- Machining work that had recently been undertaken to restore the wheel profiles on the locomotive; this removed any pre-existing lubricant and contaminant from the locomotive wheels that would otherwise have helped reduce wheel-rail contact friction levels.

- The relatively low angle of contact between the wheel and rail associated with the newly-restored wheels on the locomotive; this reduced the locomotive’s ability to resist the climbing forces acting at the wheel-rail interface.

- The wider than normal distance between the rails (track gauge) that had developed on the curve.

The above combined to generate the conditions necessary for derailment, but none of these factors involved non-compliance with applicable standards.

Although it was found that the re-profiling of the wheels had left the wheel surface slightly rougher than specified, RAIB decided not to investigate this any further. This was because the surface was only marginally non-compliant and there is contradictory evidence about its effect on wheel-rail friction.

The basic approach to managing the risk of derailment on small radius curves on the national network relies on vehicles and track complying with separate technical standards. However, because these standards do not require consideration of the worst possible combination of conditions, there remains a residual risk of derailment. It is generally recognised by the railway industry that the level of this residual risk is reduced by certain traditional features, such as check rails and trackside rail lubricators. Therefore, although not generally relied upon, RAIB observed that any change in the provision of such features has the potential to reduce the overall level of derailment safety.

The immediate cause of the accident was that the lateral forces acting at the wheel-rail interface, as 47500 negotiated the curve approaching Ordsall Lane Junction, were sufficient to cause the flange of the leading right-hand wheel to climb the outer rail. Nothing was provided to limit the lateral displacement of the wheel and prevent it crossing over the railhead into derailment.

RAIB noted that the causal factor was that a check rail had not been installed on this curve, although its location radius met the criteria for fitment. Without a check rail there was nothing to prevent the lateral wheel-rail forces tending to cause the right-hand wheel flanges to climb the outer rail and into derailment. The following factors were necessary to make the Y/Q derailment quotient high enough to cause the leading right-hand wheel flange to climb the outer rail:

- The high friction conditions that had been established on the gauge face of the outer rail of the curve approaching Ordsall Lane Junction. Rail lubrication arrangements did not stop this happening, and inspection processes did not identify it.

- The recent wheel re-profiling removed any residual lubricant and contaminant from the wheels of 47500, which would otherwise have helped reduce the high wheel-rail contact friction; it is also possible that the resulting changes to the surface finish had a similar detrimental effect.

- The relatively low flange contact angle associated with the new P1 wheel profiles reduced the ability of 47500 to resist derailment by flange climbing.

- The wide track gauge increased the risk from derailment on the curve in question.
Although not linked to the accident on 23 January 2013, RAIB observes that, while Network Rail’s current requirements for check rail provision should have prevented this accident, locomotive 47500 remained at risk of derailment on curves of slightly larger radius and on other types of running line, where a check rail would not have been required.

**Action taken**

Network Rail has now fitted a check rail on the curve where the derailment occurred and has also installed additional rail lubricators in the area. It has also:

- Issued a safety bulletin alerting its track engineers to the circumstances of the derailment and highlighting the importance of effective rail lubrication in reducing derailment risk;
- Conducted a review of its rail lubricator assets in the Manchester area in order to identify any other associated deficiencies; and
- Begun a review of curves on the London North Western (North) route. (So far, it has identified another other eight sites that do not comply with the company’s requirement for check rail provision.)

Siemens has made changes to its wheel re-profiling processes. Wheel lathe operatives are now required to check every first wheelset that they re-profile on a shift in order to confirm and record that the resulting surface finish and wheel profile geometry complies with the relevant specification. It has also specified that operatives use a finer feed rate on the final cut.

**Recommendations**

- Network Rail should identify all curves that are non-compliant with the Railway Group Standard GC/RT5021 and Network Rail standard NR/L2/TRK/2102 in respect of the need to fit a check rail. For each identified curve, Network Rail should implement measures to adequately mitigate the risk of derailment.
- Network Rail should review its approach to managing changes that may affect the friction on small radius curves to understand whether any alterations to infrastructure and/or management arrangements have resulted in higher levels of friction. At locations where it is considered that the rail friction is greater than that which applied previously, actions should be taken to reduce the corresponding increase in derailment risk so far as is reasonably practicable. These actions may include:
  - Improvements to the rail lubrication equipment that is provided and/or the associated management processes; and/or
  - The provision of a check rail.
- Network Rail should develop and implement:
  - Criteria for when it is necessary to formally assess the need to bring existing track assets in line with current design standards; and
  - A process to record the findings of such assessments.