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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- Driver briefing
- Equipment failure and equipment monitoring
- Lack of AWS and other train protection systems
- Change management
- Asset record management
- RRV preparation and maintenance
- RRV training
- Component manufacture and modification
- Inadequate guidance
- Risk assessments
- Infrastructure worker error, failure to follow due process
Spain: High-speed derailment at Santiago de Compostela, 24 July 2013

At around 20:41 (local time) on 24 July 2013, a passenger train derailed on a curve four kilometres from Santiago de Compostela, killing 79 people and injuring over 140 (including the driver). The train had been travelling at more than twice the permitted speed of 80 km/h (50 mph). The driver was later charged with ‘79 counts of homicide and numerous offences of bodily harm committed through professional recklessness’.

The full report (in Spanish) may be downloaded [here](#), however RSSB’s Opsweb summary includes the key points and all the recommendations. To read more, log in to Opsweb and click here.

Published 6 June

UK: Near miss at Butterswood level crossing, North Lincolnshire, 25 June 2013

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

At around 07:35 on Tuesday 25 June 2013, a passenger train was involved in a near-miss with a car on Butterswood level crossing in North Lincolnshire. The train passed over the crossing with the barriers in the raised position and the road traffic signals extinguished. There were no injuries or damage to rolling stock or infrastructure.

Normally, the approach of the train would have automatically initiated the closure sequence. However, the crossing was not working normally, as the power supply had been interrupted. The crossing was of a type where train drivers are required to check that it is not obstructed as they approach and that it has operated correctly. A flashing light is provided for this purpose, with a flashing white light displayed if it has correctly closed against road users, and a flashing red light displayed at all other times (including when the crossing has failed to close on the approach of a train). The driver of the train involved in the near-miss did not notice until it was too late to stop that the flashing light was indicating that the crossing was not working normally, and was still open to road traffic.

RAIB found that the train driver expected that the crossing would operate normally as the train approached and that he had not focused his attention on the flashing light at the point where he needed to confirm that the crossing had operated correctly for the passage of his train. Although the crossing had probably failed around nine hours before the incident, the fact of its failure was not known to any railway staff.

The investigation also found that the crossing was not protected with AWS and that the maintenance arrangements at the crossing were not effective in ensuring the reliable performance of the equipment. In addition, the train operator’s briefing material did not clearly explain to drivers their role in respect of failures at this type of interface.

RAIB has identified the following learning points for the railway industry:

- Railway Group Standard **GE/RT8075 AWS and TPWS Interface Requirements** states that AWS shall be fitted on all signalled lines, except where a train protection system provides a level of protection equal to, or better than, that provided by AWS and TPWS. This investigation identified that AWS equipment had not been provided at the level crossing warning board as required by Railway Group Standards and that no derogation had been granted. The railway industry is reminded of the need for compliance with the above standard and to risk assess any proposals for non-fitment of AWS on any line of route.

- The records associated with the testing of the equipment at Butterswood crossing were not completed in accordance with the required process. This meant the asset’s poor condition was not formally recorded and an opportunity to identify repeat failures was lost. Where an asset fails to meet the required test or inspection criteria, it is important that the matter is recorded in accordance with company procedures.
When storing replacement batteries for safety related equipment their age should be recorded and their condition monitored to ensure that they are in adequate condition when they are eventually brought into use.

When carrying out investigations into accidents and incidents, it is important that those investigations involve people with the required technical expertise so that safety lessons can be effectively identified, and recommendations addressed appropriately.

**Action taken**

The driver managers at First TransPennine Express’s Cleethorpes depot now analyse the OTDR equipment fitted to Northern Rail’s Class 153s following training in downloading and analysing the data. The equipment at Butterswood has also been replaced with a new system.

Furthermore, Network Rail is installing AWS on the approach to Butterswood level crossing as part of its upgrade of the North Lincolnshire routes.

**Recommendations**

- Network Rail, in consultation with RSSB, should conduct a human factors and technical review of the indications displayed at driver’s crossing indicators provided on the approach to automatic locally monitored level crossings, and evaluate alternative means (eg audible and visual) of indicating to train drivers that the level crossing has not operated as intended. A time-bound plan for improvements arising from the review should be developed using a risk-based approach.

- Network Rail should review the arrangements in place at all types of automatic locally monitored level crossings, and make improvements to the reliability of those crossings. The review, and associated improvements, should include (but not be limited to):
  - Locations where parallel protective systems exist (such as multiple earthing systems combined with ‘residual current device’ protection) where their presence can lead to unnecessary loss of the main network power supply to the level crossing;
  - The plans in place to ensure that ‘uninterrupted power supply’ (UPS) systems maintain adequate performance throughout their life (including plans to replace UPS battery systems during the life of the UPS system); and
  - Understanding the age of UPS systems in use, and the manufacturer’s life expectancy of those assets.

- Network Rail should evaluate the practicality of remote condition monitoring of the power supply system, and key sub-systems whose failure can have the same effect as loss of power supply, at all locally monitored level crossings, so that prompt action can be taken to manage the failure (such as telling train drivers that the crossing has failed and arranging for technical staff to attend the level crossing to investigate the failure).

- First TransPennine Express should review and enhance its briefing techniques and guidance material for train drivers:
  - To explain the role of the driver at locally monitored crossings;
  - To ensure that it properly reflects the operation of key infrastructure assets such as level crossings (including revisions to its description of the arrangements at automatic locally monitored level crossings, beyond the level of detail described in the railway rule book);
  - To allow its train drivers to practice dealing with unannounced level crossing failures, including, for example, the use of its train driving simulator or video-based hazard perception exercises;
  - By using focused, risk-based, presentation material for briefing operational staff; and
By stating clearly the action drivers should take when passing the special speed restriction board of any locally monitored automatic level crossing, when a flashing red light is visible at the drivers crossing indicator.

Published 11 June

Australia: Collision between two road-rail vehicles near Rinadeena, Tasmania, 4 June 2013

For the full report, click here.

On 4 June 2013, track workers were preparing a road-rail vehicle (RRV) to travel to a worksite near Rinadeena Station on the West Coast Wilderness Railway, Tasmania, when the vehicle unexpectedly started to roll backwards down a 1:20 grade. The driver was unable to slow the vehicle, so he and the passenger jumped clear, sustaining minor injuries.

The now unmanned out-of-control vehicle continued to accelerate down the steep grade, heading towards a second RRV containing four track workers. Two passengers of the second vehicle jumped clear, sustaining minor injuries, but a third passenger and the driver were still inside when the unmanned road-rail vehicle collided with theirs.

The passenger sustained minor injuries, but the driver was trapped and seriously injured in the collision. He was subsequently removed from the vehicle and air lifted to hospital. Both road-rail vehicles were extensively damaged.

The Australian Transport Safety Bureau (ATSB) found that the vehicle’s rear road tyres were lifted from the track to examine a suspected problem with the rear rail guidance wheels. As a result, the brake force provided by the rear road wheels was lost and the vehicle began to roll down the incline. The rail guidance wheel electric brake controller had not yet been set correctly and, as a result, little braking effort was applied through the rail guidance wheels.

The investigation also found that the West Coast Wilderness Railway had not considered all of the risks associated with the operation of road-rail vehicles on the steep railway. As a result, documented operational procedures had not been developed and locations where vehicles could be safely on and off railed had not been defined.

Other findings related to the effectiveness of the training provided to RRV operators, road-rail vehicle procurement standards, acceptance testing and commissioning of road-rail vehicles, reliability of the VHF radio network in the Rinadeena area and radio communication protocols.

Action taken

West Coast Wilderness Railway has reviewed its risk register and implemented operational procedures covering the safe operation of RRVs on the network. This has led to the development and implementation of an updated training package, procurement specifications and documented on/off tracking points. The company has also taken action to improve radio reception in the Rinadeena area and to ensure reliable communications at the station.

Safety message

All organisations operating RRVs should consider the risks associated with operating them on their networks. Information on the risk from RRV operation can be found at the Office of National Rail Safety Regulator website.

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At about 18:50 on Saturday 23 November 2013, while a steam-hauled passenger train from Waterloo to Weymouth was approaching Winchfield in Hampshire at about 40 mph, the right-hand connecting rod of the locomotive became detached at its leading end (referred to as the small end), which dropped down onto the track. The driver stopped the train immediately, about one mile outside Winchfield station. There was some damage to the track, but no-one was hurt. The accident could, in slightly different circumstances, have led to derailment of the train.

RAIB found that the immediate cause of the accident was that the small end assembly came apart, allowing one end of the connecting rod to drop to the ground. The reasons for this could not be established with certainty because some components could not be found after the accident. It is possible that the gudgeon pin securing nut unwound following breakage of the cotter and previous loosening of the nut. A possible factor is that the design of some components had been modified during the restoration of the locomotive some years earlier, without full consideration of the possible effect of these changes. There were deficiencies in the design and manufacture of the cotter. It is also possible, but less likely, that the securing nut split due to an inherent flaw or fatigue cracking.

**Action taken**

The West Coast Railway Company (WCRC) reports that it has repaired the locomotive in question (no. 34067 Tangmere) and returned it to service. On the locomotive itself, the right-hand side gudgeon pin, nut and cotter have been renewed in accordance with the original BR (Southern) drawing number W11335. This means that the castellated nut previously fitted has been replaced with a plain nut and a Southern Region style split cotter which is now aligned vertically. The left-hand side and middle cotters have been renewed and the nuts have been examined and subjected to non-destructive testing. All motion cotter pins have been renewed. The piston rod/crosshead, connecting rod and brake hanger have all been stress relieved by a specialist contractor and checked for straightness and alignment. The right-hand connecting rod has been through a thorough non-destructive testing process using an Eddy Current system.

WCRC also reports that it has modified its maintenance processes for its locomotives to highlight the need to change the internal battery of the OTDR at the manufacturer’s recommended frequency.

RAIB has identified the following learning point for the railway industry:

- In addition to regular checks on the function of the on-train data recorder, operators of steam locomotives should take appropriate action (such as regular changes) to keep the internal batteries in good condition.

**Recommendations**

- WCRC, in consultation with the Main Line Steam Locomotive Operators Association, the Bulleid Pacific Locomotive Association and the Heritage Railway Association, should review the design of the small end joint on the Bulleid pacific locomotive to establish the safety benefits, and risk, of using a castellated nut. The results of this review should be shared with other owners of these locomotives.
• The Heritage Railway Association and the Main Line Steam Locomotive Operators Association should prepare guidance for their members on the design and manufacture of split cotters to encourage the use of best engineering practice. This may include considering:
  o Reference to the British Railways drawing SL-DN-K.569; or
  o Other methods of fabrication such as the use of folded strip, welded at the head, which is widely used in the industry.

• WCRC should review and improve its safety management system to take account of the need for assurance that the standards of maintenance work carried out on locomotives owned and/or operated by the company are adequate, consistent and subject to monitoring and supervision independent of those doing the work.

• The Heritage Railway Association and the Main Line Steam Locomotive Operators Association should bring this report to the attention of their members and invite them to consider thoroughly evaluating and risk assessing changes to the design of steam locomotives that are made during restoration, overhaul or maintenance. The following should be considered:
  o Whether the purpose and function of the original design, and the reasons for making the change are fully understood;
  o Whether any additional risk will be introduced by the change; and
  o Any measures that may be needed (during overhaul, operation or maintenance) to reduce the risk associated with the change, and to assess its impact.

Published 26 June

**UK: Road vehicle incursion at Aspatria, 26 October 2013**

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

At 10:01 on Saturday 26 October 2013, an unattended commercial vehicle on the B5299 at Aspatria, ran away down the road. It crossed the main A596, broke through a wooden fence and rolled down the side of a cutting onto the railway. Although a passenger train was approaching Aspatria at the same time, prompt action by those concerned resulted in this train being stopped about 1.5 miles from the incident site. There was therefore no collision with the commercial vehicle on the track, and none of the passengers or crew on the train were actually put at risk.

The management of road vehicle incursions onto the railway is described in guidance published by the Department for Transport (DfT). RAIB’s investigation found that the guidance does not explain how to assess the risk of a vehicle that has lost control on a side road (eg a runaway on a side road with a downhill gradient towards the railway). Also, the guidance does not describe how this risk should be combined with the risk of road vehicle incursion from the corresponding main road to give an overall risk ranking score.

**Recommendations**

• The DfT, in liaison with highway authorities and railway infrastructure managers, should review and amend the current guidance ‘Managing the accidental obstruction of the railway by road vehicles’ published in 2003 so that it adequately takes into account in the risk ranking process for neighbouring sites the risk of road vehicles on side roads, including those that are unattended, running downhill onto a railway. The guidance, when amended, should clearly describe how this risk should be derived and included in the overall risk ranking score.

• Following the completion of Recommendation 1 above, railway infrastructure managers, with highway authorities, should use the new guidance to implement a time-bound plan to review the risk ranking scores for sites where there is a significant risk from side roads, in particular...
with respect to road vehicles running downhill onto a railway. Additional risk mitigation measures justified by increased risk ranking scores should be considered and implemented.

**US: Fatal accident involving an infrastructure worker in Mathis, Texas, 4 September 2013**

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

At around 16:15 (local time) on 4 September 2013, a Union Pacific Railroad (UP) welder was killed and another UP welder was seriously injured when an S-60 Trax aerial lift vehicle overturned in Mathis, Texas.

On the morning of the accident, the welder, who was assigned to operate the aerial lift vehicle, went on duty at 09:00. He had received a briefing, and had not taken exception to the work planned for the day. He was part of a UP work crew that was working on a fixed wooden bridge. The bridge was 192-feet long and 45-feet high. On both sides of the bridge abutments were steep embankments to the valley floor. The aerial lift vehicle was on a flat section of ground below the centre of the bridge. This area was usually filled with water; however, the ground was dry at the time of the accident.

While a UP welder was repairing a railroad bridge from the lift bucket of an aerial lift vehicle, the lift bucket became stuck on two cap bolts in a concrete girder. After several attempts, he was unable to free the lift bucket. Two UP welders, who were working directly above the welder, saw that the lift bucket was stuck. To offer assistance, one of these welders unhooked his fall-arrest system and climbed from the bridge into the lift bucket. This welder did not re-secure himself to the fall-arrest system once he was in the lift bucket.

After about five minutes of operating the controls of the lift, the unsecured welder freed the bucket. On being freed, the lift bucket suddenly dropped about three feet, and then sprung upward. As a result of this sudden movement, the unsecured welder was ejected from the lift bucket; he fell about 30 feet to the ground. He was taken to Corpus Christi Memorial Hospital, Texas. He had a dislocated hip, a broken leg, and a collapsed lung. The welder, who was in the bucket when it struck the ground, was killed.

The National Transportation Safety Board determined that the probable cause of the accident was the welders’ attempt to free the snagged aerial lift bucket from within the bucket, in lieu of evacuating the bucket and using the ground controls.

In this accident, both welders also failed to comply with regulations and the equipment operators’ manual instructions. One welder improperly climbed into the lift bucket, and did not properly secure himself. Both welders tried to free the equipment by using the controls in the lift bucket instead of the ground-level controls.