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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Some of the key issues raised and/or suggested by the stories in this edition:

- Staff error (shunting)
- Safety critical communications
- Track inspection and maintenance
- Risk assessments
- Knowledge management
- Management check function
- Records management
- Crossing user behaviour
- Sighting distance
- Level crossing inspections
- SPAD
- TPWS set-up
- Signal box instructions and signaller practice
- Staff training
1 December

US: Collision between two trains near Keithville, Louisiana, 30 December 2013

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

At 06:37 (local time) on 30 December 2013, a southbound Union Pacific (UP) freight collided head on with a BNSF service that was stabled in a siding near Keithville, Louisiana. The three leading locomotives and one wagon from the UP train and two locomotives and 11 wagons from the BNSF train left the rails.

There were three crew members aboard each train; all of the UP staff and one from BNSF were injured. There was no significant fire or dangerous goods release.

The National Transportation Safety Board (NTSB) found that the BNSF train been stabled in the siding to allow the UP service to pass. The collision occurred because the guard of the BNSF train mistakenly set the points for the siding. It is possible that a radio message he heard moments before may have distracted him. He later said under interview that he walked a short distance away before realising his error, but that it was too late to change the points back before the UP train arrived. The on-train data recorder showed that that driver of the UP train applied the emergency brake when he saw the lay of the points, taking the train's speed from 48mph to about 34mph at the moment of impact.

Recommendations

- None listed.

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11 December

UK: Derailment near London Liverpool Street, 23 January 2013

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

Shortly after 10:00 on 23 January 2013, a Norwich service derailed 260 metres from Liverpool Street station. The train comprised nine coaches pushed by a locomotive, and had just left Platform 13. A total of 17 wheelsets derailed on a tight curve and, as the train proceeded, all were guided back on to the correct rail within 40 metres.

The driver was unaware of any problem until the senior conductor told him that passengers had reported a rough ride and the signaller advised him that the signalling system had identified a problem at a set of points at the station throat. The driver then stopped and examined his train at Shenfield, but saw nothing unusual. No one appreciated that there had been a derailment until the train was examined by a specialist inspector when it arrived at Norwich and, at about the same time, a signal maintenance team found track damage close to Liverpool Street station.

The train derailed on the curve because the track fixings had deteriorated over a period of time. This tight curve and other non-standard trackwork at Liverpool Street should have triggered consideration of mitigation measures to deal with the associated enhanced derailment risk. The investigation found that no consideration had been given to these enhanced risks because the maintenance management staff did not have the knowledge necessary to appreciate the need for, and to undertake, this activity. This lack of knowledge had not been appreciated by more senior staff. The Network Rail procedures for establishing a track inspection and maintenance regime for non-standard track did not require the regime to be independently checked. Specifically, manual inspections did not report, and possibly did not identify, wider than normal static track gauge or indications of a loss of strength in the fixing between
the rail and sleepers, and automated track monitoring and associated data analysis did not identify the combined effect of widened static track gauge and loss of strength in the fixing between the rail and sleepers. Furthermore, no consideration had been given to providing an enhanced inspection regime for the non-standard track layout, and consequently, special mitigation measures had not been implemented.

RAIB also noted that neither the Track Maintenance Engineer (TME), nor the Section Manager [track] SM[T], had identified the need for a non-standard inspection and maintenance regime at Liverpool Street. In addition, the Infrastructure Maintenance Engineer (IME) did not appreciate, and so did not manage, shortcomings in the technical knowledge of the TME and the SM[T].

RAIB found too that records of maintenance inspections were not available due to shortcomings in the filing system. The Network Rail standards required records to be kept for a minimum of three years. These records confirm completeness of inspections, assist competency assessment and can assist development of maintenance strategies.

Furthermore, shortcomings in communications between staff in the Anglia Integrated Control Centre (AICC) could have had serious consequences in other circumstances.

**Action taken**

Network Rail undertook emergency repairs to the track in the immediate vicinity of the track failure following the derailment. Since then, the sleepers and fixings in the area have been replaced.

Network Rail has also reported that dynamic track gauge is now being recorded throughout the Liverpool Street area and that an experienced track engineer is assessing track condition, and making recommendations for enhancements to the inspection and maintenance regime, at Liverpool Street.

Network Rail and Greater Anglia have stated that AICC staff have been briefed on the need for effective liaison when dealing with events which may involve both trains and track. Network Rail has nominated a route control manager to monitor the quality of safety-critical communications within the AICC.

**Learning points**

RAIB has identified the following key learning points:

- The importance of prompt and effective communication between train and track controllers when dealing with events which could be associated with urgent safety issues.

- The need to check that the Ellipse computer system contains the correct inspection and maintenance tasks for all assets intended to be included within the database.

- The need for effective management of track gauge, including in areas of intensive train services, where this is not monitored by track recording trains. Available techniques include:
  - Looking for visual indicators, (eg shuffle marks, running band position and head checking) which show that rails could be moving under trains;
  - Identification of broken or loose fixings (ie those which allow rails to move when subject to train loads) by simple manual testing;
  - Observing rail behaviour while trains are passing;
  - Combining static gauge measurements with dynamic rail movements assessed from visual indicators (possibly implemented only if visual indicators suggest a problem);
  - Direct measurement of rail movement including the consideration of technical solutions such as dynamic track gauges and electronic monitoring where personnel access is limited (possibly implemented only if visual indicators suggest a problem); and
  - Identification of repeat defects indicative of track being inadequate for the loads being imposed on it.
Staff using trolley data should be aware that, although pre-programmed to generate alerts related to dynamic gauge intervention limits, the trolley is only recording static gauge and so could mislead the operator. Users must assess dynamic movement by alternative means and take this into account when assessing whether maintenance intervention is necessary.

The importance of IMEs managing the competence of SM[T]s and TMEs in accordance with the requirements given in NR/L2/TRK/001. This states that IMEs must:

- Confirm that SM[T]s and TMEs can demonstrate knowledge and understanding of identifying risk to the track assets, risk assessment and taking action to control risk;
- Arrange training and coaching for SM[T]s and TMEs to address any shortfalls in their knowledge and understanding of risk;
- Applying controls to mitigate risk where this is needed until any shortfalls in SM[T]s and TMEs knowledge and understanding of risk have been addressed; and
- Arrange transfer of knowledge of high risk locations from previous postholders to SM[T]s and TMEs when they take responsibility for a new area or route.

The need to archive inspection and maintenance records as a minimum in accordance with NR/L2/TRK/001, or as required to meet the needs of the inspection and maintenance regime implemented by the maintenance management team.

Recommendations

- Network Rail should improve its management systems so that both the identification of all non-standard track assets, and the associated inspection regimes intended to manage any enhanced risk of derailment, are recorded and independently checked. The scope of these inspection regimes should include mechanisms for identifying indications of possible gauge widening and, where necessary, assessing dynamic track gauge.
- Network Rail should introduce a timebound programme for assessing (and reassessing at intervals) the competence of its managers with safety critical roles linked to track maintenance (eg section managers [track] and track maintenance engineers), and addressing any shortfalls arising.
- Network Rail should introduce a timebound programme for the review of the processes used for assessing (and reassessing at intervals) the competence of managers with safety critical roles linked to the maintenance of assets other than track, and addressing any shortfalls arising.

15 December

**UK: Collision at Jetty Avenue level crossing, 14 July 2013**

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

During the early evening of Sunday 14 July 2013, a passenger train approaching Woodbridge station in Suffolk struck a car at Jetty Avenue user worked level crossing (UWC). The accident occurred in daylight and at low speed. The train was not derailed, but the car driver suffered minor injuries.

The car driver was using the level crossing to access a private boatyard situated between the railway and the River Deben. He was a volunteer, assisting in removing equipment following a local regatta which had been held partly on land owned by the boatyard earlier in the day. The car driver had used the crossing on previous occasions, but had not been briefed on its use.

There were no telephones or warning lights at the crossing so safe use depended on vehicle drivers looking for approaching trains. The car driver, who was an occasional user of the level crossing, normally relied on checking for trains by looking up and down the railway when swinging open the vehicular gates on foot. He did this because he was aware that his view of the railway would be obscured as he returned to the car and drove it towards the crossing. A curve in the railway meant that
the train involved in the accident was not visible to the car driver when he was at the crossing, and could only be seen from this location after the driver had begun to return to his car. The driver did not become aware of the train until he had driven his car into its path.

RAIB’s investigation has found that instructions given to car drivers using this, and similar, level crossings were inadequate. It also found that Network Rail’s method for ensuring that vehicle drivers have an adequate view of approaching trains was incompatible with the characteristics of both the car involved in the accident and many of the vehicles expected to use crossings of this type. Furthermore, RAIB notes that the train driver did not sound the train horn at the whistle board. If he had done so, it is possible that this would have prevented the accident.

RAIB list the following underlying causes:

- Network Rail standards did not adequately specify the locations at which sighting distance should be measured.
- Network Rail’s staff may have sometimes incorrectly interpreted ORR’s guidance to mean that a three-metre decision point is normally adequate at UWCs.

**Action taken**

Telephones have been provided at Jetty Avenue, and the signage has been changed to require all road vehicle drivers to telephone the crossing operator before using the crossing. RAIB has not assessed whether this is the most appropriate solution at this location, but notes that providing telephones at level crossings can have drawbacks: it increases the workload of the level crossing operator (normally the signaller), and some vehicle drivers may not use the telephone, despite being required to do so. The installation of ‘WaveTrain’ equipment has not progressed at Jetty Avenue due to the proximity of the level crossing to Woodbridge station. This makes it difficult for the system to predict a train’s location accurately.

From mid-2012, the management arrangements for level crossings changed. The position of Level Crossing Manager was introduced to replace the Operations Risk Control Co-ordinator (ORCC). This role brings together the duties of undertaking site visits and managing the crossing, and is intended to clarify responsibility and eliminate problems caused by poor communication between different departments within Network Rail.

Level crossing inspection checklists have been replaced by an ‘app’ for use on a smartphone.

The Route Level Crossing Manager, who leads the team of level crossing managers on Anglia route, has informed RAIB that additional resources are now being provided to allow work identified to be done. Anglia route has introduced an events register to enable it to identify recurring events such as this regatta. It is also trialling the provision of ‘sighting marker’ signs at five level crossings including Jetty Avenue (footpath crossing). These markers are installed adjacent to the railway tracks at the required sighting distance + 20% to assist with checking sighting distances from the decision points.

The Anglia route has restarted its programme for installing level crossing information signs (showing the crossing name and telephone details) at UWCs where such signs had not been provided. Note that this will not include Jetty Avenue UWC, which now has telephones.

RAIB has written to Network Rail, the Office of Rail Regulation, and Northern Ireland Railways to inform them that sighting criteria based on a three-metre decision point at user worked crossings are not sufficient to provide a safe crossing method for many cars in the UK.

RSSB is undertaking research into signs at private level crossings (project T983). This work was sponsored by the Road-Rail Interface Safety Group (now known as the Level Crossing Strategy Group). T983 is a ‘root and branch’ review of signs at private crossings and is similar to the T756 project on

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1 WaveTrain operates a red light when it is not safe to cross the line. The system is sound-based using microphones attached to the rails to detect trains, and is not part of the signalling system. Jetty Avenue UWC had been selected as a trial site for this equipment, but it was not in use when the accident happened.
signs/signals at public crossings. The findings from T983 are expected to be published in early 2015. (RSSB has also undertaken other research projects relating to level crossings which, although not targeted at vehicular use of UWCs, include findings which could assist in identifying measures which would improve the safety of such use.)

Network Rail is continuing to develop its strategy for level crossings. This includes developing relatively low cost systems to give crossing users audible and visual warnings of an approaching train. Systems currently under development use a range of technologies to determine when a train is approaching a level crossing. The technologies include fitting GPS equipment to trains and mounting train detection devices (eg axle counters, treadles and radar) near crossings.

Recommendations

- Network Rail should implement a time-bound plan for the re-assessment of the sighting of approaching trains at all user worked crossings where safe use depends on vehicle drivers sighting approaching trains. The time-bound plan should also cover implementation of any mitigation needed to permit safe use of such crossings. The objective of the re-assessment process shall be to verify that drivers seated in the normal driving position of their vehicle have sufficient sighting of approaching trains when the front of their vehicle is stopped a safe distance clear of the line. In providing guidance to staff, Network Rail should consider:
  - The range of vehicle stopping positions;
  - The types of vehicles likely to use each crossing (particularly the distances of the driver’s eyes from the front of the vehicle); and
  - Any effects due to crossing gates being open, including obstruction of sighting by signs on the gate, when vehicle drivers are looking for trains.

- Network Rail should commission research into measures to improve the safety of UWCs where vehicular users are reliant on sight to detect the approach of trains. This should utilise and, as necessary, extend existing research findings to include consideration of:
  - The ways in which the behaviour of vehicle drivers can be influenced by the design of the crossing to use the crossing as intended including stopping and looking for trains at an appropriate location;
  - Use by different types of vehicle, including heavy commercial and agricultural vehicles;
  - Use of the crossing by persons other than those briefed by the authorised user (eg unexpected visitors or delivery vehicles);
  - Instructions and/or guidance given to users, including signs and road markings where appropriate; and
  - Instructions and guidance provided to those assessing, maintaining and modifying UWCs.

  This research should take into account the safety of pedestrians (including vehicle occupants when opening gates), cyclists and equestrians who may use UWCs.

  The findings of this research should be used by Network Rail to improve/clarify existing standards related to the design (including gates, signage and road markings), management of user worked crossings, guidance provided to users and training/briefing to relevant staff. Network Rail should also identify the need for any modification to the legal requirements relating to level crossing signage requirements, and make suitable representations to government that this be done.

- Network Rail should review, and if found necessary, modify its processes so that staff checking level crossing signage have a practical and easily used means of establishing the signage required at each crossing they are inspecting.
• Network Rail should, in consultation with ORR, review and if necessary, amend the criteria used to calculate crossing times with reference to vehicle speed, the time taken to reach a decision when to start crossing and vehicle length.

• The Office of Rail Regulation should provide duty holders with enhanced guidance which:
  - Reminds duty holders that, when determining the position of decision points at user worked crossings, they must take due account of the characteristics of vehicles likely to use the crossing and recognise that a minimum dimension of 3 metres from the nearest rail is insufficient for most vehicles; and
  - Takes account of outputs from the research and review undertaken in response to Recommendations 2 and 4, above.

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**22 December**

**UK: Double SPAD at Greenford, 20 March 2014**

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

At around 11:55, the 11:36 Paddington–West Ruislip, operated by Chiltern Railways, passed two consecutive signals at danger near Greenford. It was stopped when a signaller sent an emergency radio message to the driver. Although no-one was hurt in the incident, the unauthorised entry of a train onto a single line creates the potential for a serious collision.

A freight train had passed the junction at Greenford shortly before the passenger train was due. Because the freight train was still occupying the line between Greenford and South Ruislip, the signaller at Greenford kept the signal at the junction at danger. The passenger train, travelling at about 20 mph, passed this signal and the next one, 142 yards further on, which was also at danger. It passed over the junction and onto the single-track section towards South Ruislip, which was still occupied by the freight train. The train had travelled about one mile beyond Greenford by the time that the driver received the emergency radio message.

The investigation found that the driver of the passenger train did not react to the two signals at danger, for reasons which are not certain. It is possible that he had formed the impression that the train had been given clear signals through Greenford, because of his interpretation of the meaning of the signal preceding those that he passed at danger, and he had not been stopped by signals at Greenford in the recent past.

The Train Protection and Warning System (TPWS) was fitted to the train and to both the signals, but it did not intervene to apply the brakes of the train, as it was intended to do. This was because the on-train TPWS equipment had self-isolated when the driver prepared the train for departure from Paddington while it was standing over a TPWD trigger loop. The isolation of the equipment was indicated by a flashing light in the cab, but the driver still drove the train.

Although the signaller at Greenford wished to stop the train by sending an emergency call on the GSM-R radio system, he did not attempt to do so because the information presented by the radio equipment in the signal box suggested to him that any message he sent would not reach the train. Instead, he contacted Marylebone signal box, which was able to send a message to the train.

RAIB notes that the driver management process within Chiltern Railways did not address the driver performance issues which contributed to this incident. Furthermore, the signaller’s training on GSM-R had not equipped him adequately to deal with emergency situations.

RAIB identified the following learning points for the railway industry:

- At locations where the delayed clearance of signals is used to warn train drivers about the state of the line ahead, signallers must be confident that they know enough about the position and speed
of the train to judge accurately the moment when the signal should be cleared. This may mean waiting until they are certain that the train has stopped.

- Train operators are reminded of the need to assess periodically whether it is reasonably practicable to upgrade on-train TPWS equipment to address known shortcomings in the Mark 1 equipment identified in this investigation (such as the equipment self-isolating when a cab is opened with the receiver directly over an active loop, and the readiness with which it can be reset after an intervention). Such upgrades should be planned and take place during maintenance interventions, as part of life extension works, or in a phased programme.

**Action taken**

On 24 March 2014, Chiltern issued a briefing notice to its drivers on 'Checking and Responding to TPWS Indications on Cab Mobilisation', describing how TPWS should behave when a driver is setting up the cab, highlighting the meaning of the flashing yellow light, and setting out the action to take if the flashing or steady yellow light appears.

Network Rail has modified the configuration of the GSM-R radio system at Greenford, so that trains travelling between Greenford and Northolt Junction will appear on the train list on the terminal in Greenford signal box for the whole of the time that they are on the single line.

Network Rail has adjusted the timer on the approach release for signal GE57 to its designed value of 43 seconds, and cut back the vegetation which obscured the view of signal GE56 from the signal box (although this was not likely to have been directly linked to the causes of this incident) (paragraph 125a).

**Recommendations**

- Chiltern Railways should conduct a review of its driver management processes to confirm that the training and briefing given to drivers is comprehensive as regards the equipment and systems that drivers use, and that assessment of drivers covers the identification of, and response to, TPWS fault warnings as well as drivers' response to other unusual or emergency situations, and make changes in accordance with the findings of the review. As part of its review, Chiltern Railways should consider whether there is a role for more regular use of its driving cab simulator in the assessment of its drivers' competence, to achieve a more systematic approach, and whether it has adequate systems in place for periodically reviewing and revising its competence management processes and training material.

  This recommendation may be applicable to other train operating companies.

- Network Rail should conduct a review of its implementation of GSM-R, particularly in respect of its configuration where signal boxes which have no GSM-R train describer feed adjoin signal boxes that automatically send train description data to GSM-R, and in areas of enhanced risk such as the entrances to single lines. The review should cover the visibility of trains on signallers' terminals as trains traverse signalling boundaries. Changes should be implemented where necessary so that signallers are able to directly contact all trains that are within, or leaving, their area of control, and are aware that although trains may no longer be shown on the terminal, it may still be possible to contact them by use of a railway emergency call.

- Network Rail should review and modify as necessary the training given to signallers in the use of GSM-R, so that signallers are given adequate opportunity to become familiar with the use of railway emergency calls, by practice, simulation or any other appropriate means.
23 December

Romania: Passenger train derailment at Hunedoara, 27 January 2014

For the full report, click here: [LINK](#) (requires translation from Romanian)

At 21:00 (local time) on 27 January 2014, a push-pull passenger train running in pull mode derailed at Hunedoara station.

There were no reported injuries.

The investigation found the immediate cause to be that the leading left-hand wheel on the locomotive fell between the rails on a set of points which were not correct to gauge.

It added that the poor condition of the sleepers was a contributory factor.

Recommendations

- None listed.

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23 December

Italy: Collision between train and motorcycle at a level crossing between Cremona and Mantova, 25 February 2014

For the full report, click here: [LINK](#) (requires translation from Italian)

At 16:00 (local time) on 25 February 2014, a passenger train struck a motorcycle that had zig-zagged between the barriers at a level crossing on the Cremona - Mantova line. The rider and his passenger were both killed.

The investigation found the immediate cause to be user behaviour.

Recommendations

- The infrastructure manager should reassess the risk at the crossing to determine if the half-barriers should be replaced by full barriers.

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