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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- Track maintenance – management and regulation
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UK: Pedestrian struck by tram at Sandilands tram stop, Croydon, 16 May 2012

For the full report, click here: LINK

At 09:44 on Wednesday 16 May 2012, a pedestrian was struck by a tram as she crossed the tramway via a foot crossing near the Sandilands stop in Croydon. The impact resulted in the pedestrian falling into the space between the platform and the tram. She remained trapped in that position as the tram continued into the platform. Her injuries were serious.

RAIB’s investigation found that the pedestrian had not looked for an approaching tram before she crossed the line. However, there was a possible obstruction to her view as she walked towards the entrance to the tram stop. The configuration of the crossing also meant that she approached it with her back to trams running on the nearest line.

RAIB found two factors affecting the consequences of the accident: first, the tram driver did not apply the hazard (ie, ‘emergency’) brake after the tram struck the pedestrian; secondly, there was enough vertical and horizontal clearance to create a survival space for the pedestrian in the position where she fell.

The immediate cause was the pedestrian walking onto the crossing as the tram was approaching. However, RAIB also listed the following causal factors:

- The pedestrian did not look for approaching eastbound trams as she hurried from the tram stop entrance to the foot crossing. Had she done so, she would have seen that the approaching tram was close to the crossing.
- The methodology adopted by London Tramlink in 2008/2009 to assess the risk at all foot crossings on the Croydon tram network did not provide an accurate basis for doing so, and did not enable easy identification of crossings where risk mitigation should be provided. It resulted in the risk at Sandilands being under-estimated and its foot crossing not being prioritised for risk mitigation measures.
- The foot crossing at Sandilands was not prioritised for risk mitigation works after May 2011, despite a further risk assessment identifying that it was the highest risk crossing at a tram stop outside the town centre.

RAIB found the following causal factors to be ‘probable’:

- The approach to the foot crossing at the west end of Sandilands tram stop had not been configured to encourage pedestrians to look both ways before crossing or to make it easy for them to do so.
- London Tramlink did not prioritise work to reduce risk at foot crossings in accordance with the results from the 2008/2009 assessment of risk, which meant that Sandilands was not considered as a priority for the application of risk mitigation measures.

RAIB considers the following factor to be ‘possible’:

- The pedestrian may not have been able to see the approaching tram as she walked from the bus stop to the entrance to the tram stop, because her view could have been obstructed by lineside equipment cabinets.

There were also two underlying factors:

- The possible role played by the configuration of the infrastructure had not been considered in previous accidents that had occurred in similar circumstances at Sandilands.
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- London Tramlink's processes for managing the risk associated with foot crossings on its network were not effective.

In addition to its recommendations, RAIB noted the following learning point:

- Tram Operators should use the circumstances of this accident in their training and briefing material for tram drivers to illustrate the importance of using the hazard brake in circumstances where a pedestrian has been struck and to highlight the consequences of not doing so.

Recommendations

- London Tramlink, in conjunction with Tram Operations Ltd, should continue to develop its process for periodically assessing risk at all foot crossings, taking into account the findings from this report in relation to factors that could affect all aspects of the safety of crossing users. The process should include the requirement to use the findings from the periodic risk assessments to identify those crossings where there are reasonably practicable measures that can be taken to reduce the risk and to produce and update a prioritised programme for safety improvements. The process should include a reference to a range of possible safety improvement measures, which should take account of good practice from elsewhere in the rail and tram industry and good practice in highway design.

- London Tramlink should:
  - Taking into account the improvements made to the configuration of the approach to the foot crossing at the west end of Sandilands, consider whether further action is desirable to improve pedestrians’ view of approaching trams as they walk from the bus stop towards the entrance to the west end of Sandilands tram stop, and implement any changes that they deem to be reasonably practicable;
  - Conduct a review of the approaches to all other foot crossings on the system from all credible directions to determine whether similar obstructions exist elsewhere, and if so, whether they can be removed; and
  - Embed within its processes for new works in and around the tramway the requirement to consider pedestrian sight lines from all credible approaches to the crossing before approving the positioning of equipment.

- ORR should re-evaluate and revise its guidance to tramway operators on:
  - The need for operators to take into account pedestrian and tram driver sight lines from all credible approaches to foot crossings when planning new works on tramways;
  - The optimum angle of approach for pedestrians at crossings over the tramway; and
  - The need for a recess under tram stop platforms and the desirability of paving up to rail level between the platform-side rail and the platform face.

Pending the re-issuing of guidance, ORR should consider how modified advice should be provided to tram operators.

- London Tramlink and Tram Operations Ltd should jointly review and amend their procedures and/or practices for investigating accidents and incidents on the Croydon tram system so that joint investigations are always carried out if there is any possibility that the infrastructure might have contributed to the circumstances of the accident. Joint investigations should be mandatory for all significant incidents involving pedestrians being struck by trams.
London Tramlink should conduct a review of its arrangements for taking and prioritising safety decisions and take any necessary steps to secure for the organisation sufficient competence in safety and risk management techniques so that key personnel have a clear understanding of the factors that affect risk, the constituent elements of a competent risk assessment and how to use the results to prioritise actions.

Sweden: Near miss with track workers on Stockholm–Uppsala line, 17 November 2010

At 03:23 (local time) on 17 November 2010, two track worker contractors working under an ‘A-protection’ were mounting snow protection on a set of points when a passenger train began to approach rapidly on the same line. The driver saw the track workers and sounded the horn. They jumped out of the way just before the train passed.

The investigation revealed that no track circuit clips had been used, meaning that signals remained green, allowing the train to pass the through the site of work.

The following underlying causes were also listed:

- The work was not planned according to accepted routines concerning the risk analysis of track maintenance.
- Neither the infrastructure manager nor the direct managers of the contractor (Infranord) knew about the practice of not using track circuit clips for ‘A-protection’ within a ‘D-protection’ area, something that was accepted as common practice within Infranord.
- The infrastructure manager’s safety management system did not detect the lack of compliance with routines and rules for track work. Nor has its incident reporting system detected these deviations.
- The supervision of the Swedish regulator has not detected Infranord’s non-compliance to track maintenance rules and routines.
- The infrastructure manager’s system for detecting deviations from track work rules did not detect the deficiencies at Infranord.

Recommendations

- The Swedish Transportation Authority should analyse and evaluate the supervision practices it applies in order to increase its ability to detect where rules are not being followed.

Norway: Derailment at Dombås station, 13 January 2012

At 22:44 (local time) on 13 January 2012, a double-headed 16-wagon CargoNet AS freight train derailed on a set of points at Dombås station. There were two drivers on board; neither was injured.

It was the second locomotive and five wagons that actually left the rails. Prior to the incident, there had been other problems reported with this same locomotive. The story began when it was stopped at Dovre with an in-cab error message. The driver explained that there had been some vibration in the locomotive at speeds over 60 km/h. The first error message was noted at 17:02 (local time) and the train stopped at Dovre approximately four minutes later. The error message suggested that there was a problem with the rearmost bogie (in the direction of travel). The problem was that this bogie was not receiving traction power, thus forcing the train had to remain stationary, blocking any traffic past Dovre.
The driver contacted the Duty Officer at CargoNet AS, but as neither could find a solution to the problem, the driver continued with his duties. The locomotive still had traction at the other bogie, but was not capable of moving under its own power. At the time, heavy snow was falling and this contributed to making driving conditions difficult.

The signaller agreed to allow a passenger train to push the stalled freight train onto track no: 2 at Dovre. When this had been achieved, the freight driver was relieved.

At 21:35 (local time), a rescue locomotive arrived. After the train was coupled and the brakes tested, the combined consist was given clearance from the signaller to proceed north towards Trondheim.

Shortly after the train left Dovre, the driver was contacted by the signaller who reported a ‘fault in points’ alarm from a set of points after it had passed. As this message can indicate a derailment, the train was brought to a stand. The driver was then told to make an external examination of the train whilst in deep snow, but he was unable to find any fault. He contacted the signaller and reported the results of the investigation. He was then given the tip to proceed.

At 22:44 (local time), the train arrived at Dombås and, just as it passed points no. 3, the driver felt a jerk and heard a bang. At that point, the train had separated between the first and second locomotives. It was at this point the train derailed.

The investigation found the direct cause to be that the primary support (torque link) for one of the locomotive’s engines failed. After that, the engine was held in place by the emergency support, which is the final barrier before it comes lose. After a while, this support also failed, so that the engine dropped towards the track and derailed the locomotive.

**Action taken**

- Bombardier, the locomotive manufacturer, is carrying out work to ascertain the expected service life and loads on the torque links and emergency supports of its engines.

**Recommendations**

- CargoNet AS should document that the railway legislation's requirements are met as far as supports and emergency supports for engines are concerned, based on actual loads.