Press release: Report 18/2017: Overturning of a tram at Sandilands junction, Croydon

In its investigation into the overturning of tram 2551 in Croydon on 9 November 2016, the Rail Accident Investigation Branch (RAIB) found that the risk of trams overturning on curves was not properly understood by the tramway and so there were insufficient safety measures. All of the passengers who were killed, and many of those who were seriously injured, fell through the windows or doors as the tram tipped over. Today, the RAIB has made 15 safety recommendations to improve safety on UK trams.

Simon French, Chief Inspector of Rail Accidents said:

> The RAIB's report into the accident at Sandilands will stand as the record of the events that led to the tram overturning and the terrible human consequences. Our careful analysis of the evidence, and identification of the causal and underlying factors, has enabled us to make a number of far-reaching recommendations. These will have a lasting impact on the way that the tramway industry manages its risk.
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> We are recommending action in five main areas. The first is the use of modern technology to intervene when trams approach hazardous features too fast, or when drivers lose awareness of the driving task. Tramways need to promote better awareness and management of the risk associated with tramway operations. Work needs to be done to reduce the extent of injuries caused to passengers in serious tram accidents, and to make it easier for them to escape. There need to be improvements to safety management systems, particularly encouraging a culture in which everyone feels able to report their own mistakes. Finally, greater collaboration is needed across the tramway industry on matters relating to safety.
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> UK tramways have been aware of our key findings and the focus of our recommendations for many months now. I am very encouraged by the progress that has already been made in addressing the recommendations and the collaborative approach that is being taken.
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> It is vital that the right action is taken to stop such a tragic accident from ever happening again.

Summary

On the morning of 9 November 2016, tram 2551 reached the maximum permitted speed of 80 km/h as it entered the first of three closely spaced tunnels, which together extended for about 500 metres. When leaving the tunnels, the

tram should have been reducing speed significantly as it was approaching the sharp curve round to Sandilands junction, where there is a 20 km/h limit. This was marked by a speed limit sign at the start of the curve. On the day of the accident, the tram was travelling at 73 kilometres per hour when it reached this sign.

The excessive speed caused the tram to overturn as it passed through the curve. Passengers were thrown around inside the tram and the tram slid along the ground on its side. Of the 69 passengers involved in this tragic accident, seven died and 61 were injured, 19 seriously.

Investigation methods included:

- obtaining data from the tram's onboard recorder and the tramway's signalling system
- conducting tests on the tram's safety systems
- using computer modelling to understand the minimum speed that would overturn a tram on the curve at Sandilands
- reviewing the design of the infrastructure
- reviewing the tramway's safety and risk management systems
- interviews with people and organisations involved
- surveying tram drivers to understand how trams were being driven on that route

The RAIB's investigation concluded that it is probable that the driver temporarily lost awareness on a section of route on which his workload was low. The investigation has found that a possible explanation for this loss of awareness was that the driver had a microsleep, and that this was linked to fatigue. Although it is possible that the driver was fatigued due to insufficient sleep there is no evidence that this was the result of the shift pattern that he was required to work.

It is also possible that, as he regained awareness, the driver became confused about his location and direction of travel through the tunnels. The infrastructure did not contain sufficiently distinctive features to alert tram drivers that they were approaching the tight curve.

The investigation found that:

- there was no mechanism to monitor driver alertness or to automatically apply the brakes when the tram was travelling too fast
- there was inadequate signage to remind drivers when to start braking or to warn that they were approaching the sharp curve
- the windows broke when people fell against them, so many passengers were thrown from the tram causing fatal or serious injuries

Recommendations

The RAIB has made 15 recommendations intended to improve safety. Recommendation areas include:

- technology, such as automatic braking and systems to monitor driver alertness

- better understanding the risks associated with tramway operations, particularly when the tramway is not on a road, and the production of guidance on how these risks should be managed
- improving the strength of doors and windows
- improvements to safety management systems, particularly encouraging a culture in which everyone feels able to report their own mistakes
- improvements to the tram operator's safety management arrangements so as to encourage staff to report their own mistakes and other safety issues
- reviewing how tramways are regulated
- a dedicated safety body for UK tramways

Video summary and animation

Overturning of a tram at Sandilands junction, Croydon

Explanation of RAIB's investigation following a fatal accident involving a tram near Sandilands junction, Croydon, 9 November 2016. (This video is narrated and captioned.)

Animated recreation of Sandilands derailment

Animation explaining the derailment sequence following a fatal accident involving a tram near Sandilands junction, Croydon, 9 November 2016.

[Microsleep – Unintentional periods of sleep lasting anywhere from a fraction of a second to a few minutes. They are often, but not always, characterised by the closing of eyes or head nodding actions.]

Notes to editors

1. The sole purpose of RAIB investigations is to prevent future accidents and incidents and improve railway safety. RAIB does not establish blame, liability or carry out prosecutions.
2. RAIB operates, as far as possible, in an open and transparent manner. While our investigations are completely independent of the railway industry, we do maintain close liaison with railway companies and if we discover matters that may affect the safety of the railway, we make sure that information about them is circulated to the right people as soon as possible, and certainly long before publication of our final report.
3. For media enquiries, please call 01932 440015.

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