

Passenger dragged at Beeston Centre tram stop, Nottingham, 22 February 2023

Important safety messages

This accident demonstrates the importance of:

- tram drivers completing an effective final visual safety check, using CCTV and other equipment to the best possible extent, to ensure it is safe to depart from a tram stop
- tram drivers not relying on door closed indications as confirmation that it is safe to move a tram – obstacle detection systems are not always capable of detecting objects trapped in a closed and locked door
- tram operating companies effectively monitoring compliance with operating rules.

Summary of the accident

At around 18:04 hrs on Wednesday 22 February 2023, a passenger was dragged alongside a departing tram at Beeston Centre tram stop, on the Nottingham tram network.

Shortly before the tram departed, the passenger had placed a hand and a walking stick into the closing doors of the tram, in an unsuccessful attempt to prevent them from closing. Once the doors closed, the walking stick became trapped. The driver was unaware that the stick was trapped and started the tram. The passenger held onto their walking stick as the tram departed and was pulled alongside the tram for around three seconds, before falling against the tram and landing on the edge of the tram stop. This resulted in serious injuries to the passenger.



Beeston Centre tram stop.

Cause of the accident

The accident occurred because the tram driver was not aware that the walking stick was trapped in the doors, and that the passenger was holding on to the stick, when the driver made the decision that it was safe to start the tram.

Tram stop CCTV footage shows that the tram arrived at Beeston Centre tram stop and its doors became fully open at 18:04:09 hrs. This footage also shows that the doors started to close again at 18:04:19 hrs, meaning that they were fully open for about 10 seconds. The passenger involved in the accident had waited to cross the tramway behind the arriving tram before walking up to the tram stop and activating a travel card. CCTV shows that, by the time the passenger attempted to board at the rearmost doors, the tram's doors were already starting to close. Closing tram doors are accompanied by an audible warning.

The tramway operator Nottingham Trams Limited (NTL, who trade as Nottingham Express Transit) stated that it trains drivers to allow a dwell time of around 15 to 20 seconds at tram stops.

The tram's doors were fully closed by 18:04:21 hrs and the tram started to move three seconds later, at 18:04:24 hrs. The walking stick was not detected by the tram's door obstacle detection system once the doors had closed. This system works by sensing an increased electric current being drawn by the tram's door motors and is designed to detect obstructions greater than 30 mm wide. If no obstacles are detected, the closed doors will lock and an electrical interlock circuit will be completed which permits the driver to take traction power to move the tram. The driver will also receive audible and visual indications that the doors have closed and locked.

After the accident, NTL tested the tram's doors and found that they met the relevant detection requirement. The walking stick was not recovered by RAIB and its diameter remains unknown. However, a survey of the type of walking stick apparently used, showed that they typically have a diameter of less than 1 inch (25.4 mm) and so are unlikely to trigger the tram's door obstacle detection system.

Before commanding the doors to close, NTL's driving policy requires tram drivers to use their in-cab CCTV screens to check that the doors are clear. The policy advises them that 'it is important to keep a good lookout for vulnerable passengers that may become separated or articles protruding through the doors'. Once the doors are closed and locked, drivers are required to carry out a final visual check using the CCTV screens, to ensure it is safe to depart.

On 15 December 2017 an empty pushchair became trapped in tram doors and dragged at Radford Road tram stop on the Nottingham tram network. RAIB investigated this incident and issued [urgent safety advice](#) in February 2018 relating to the importance of tram drivers carrying out an effective final visual check. This included advice about tram drivers not relying solely on the door closed indications when deciding whether anything outside the tram is trapped in the doors.

RAIB published its investigation report into this incident in September 2018 ([report 15/2018](#)). This made recommendations intended to reduce the risk of someone being dragged by a tram, including a recommendation to NTL to make 'CCTV modifications to ensure a good view during the final visual door check of all areas where items could be trapped in closed and locked doors'. This recommendation arose because the investigation found that the only view available to the tram driver after the doors had closed was a 'wing mirror' view on their in-cab CCTV screens. This made it difficult to discern what was happening on the platform at the far end of the tram.

In response to this recommendation, modifications were made to NTL trams to provide drivers with a button to press to obtain an alternative 'rear view' once the doors are closed. This gives drivers images from the leading and trailing bodyside cameras which provides them with a better opportunity to carry out an effective final safety check before departure.

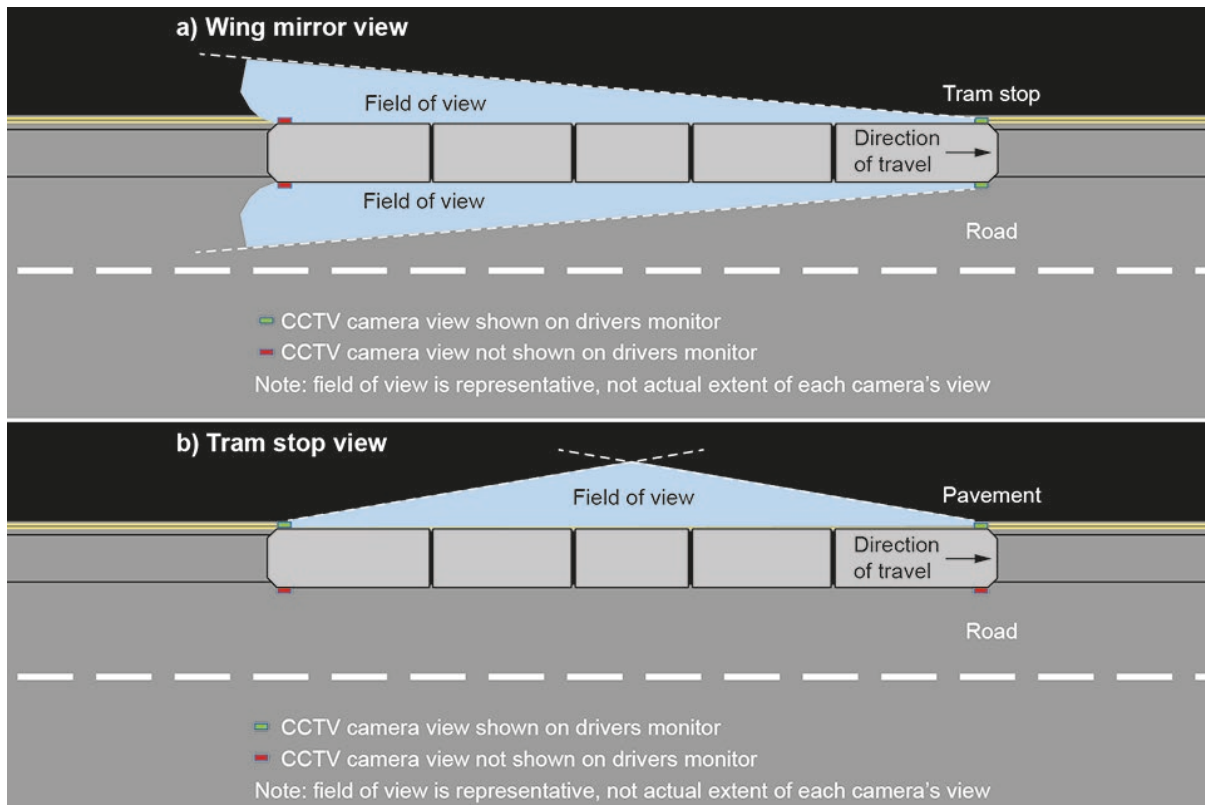


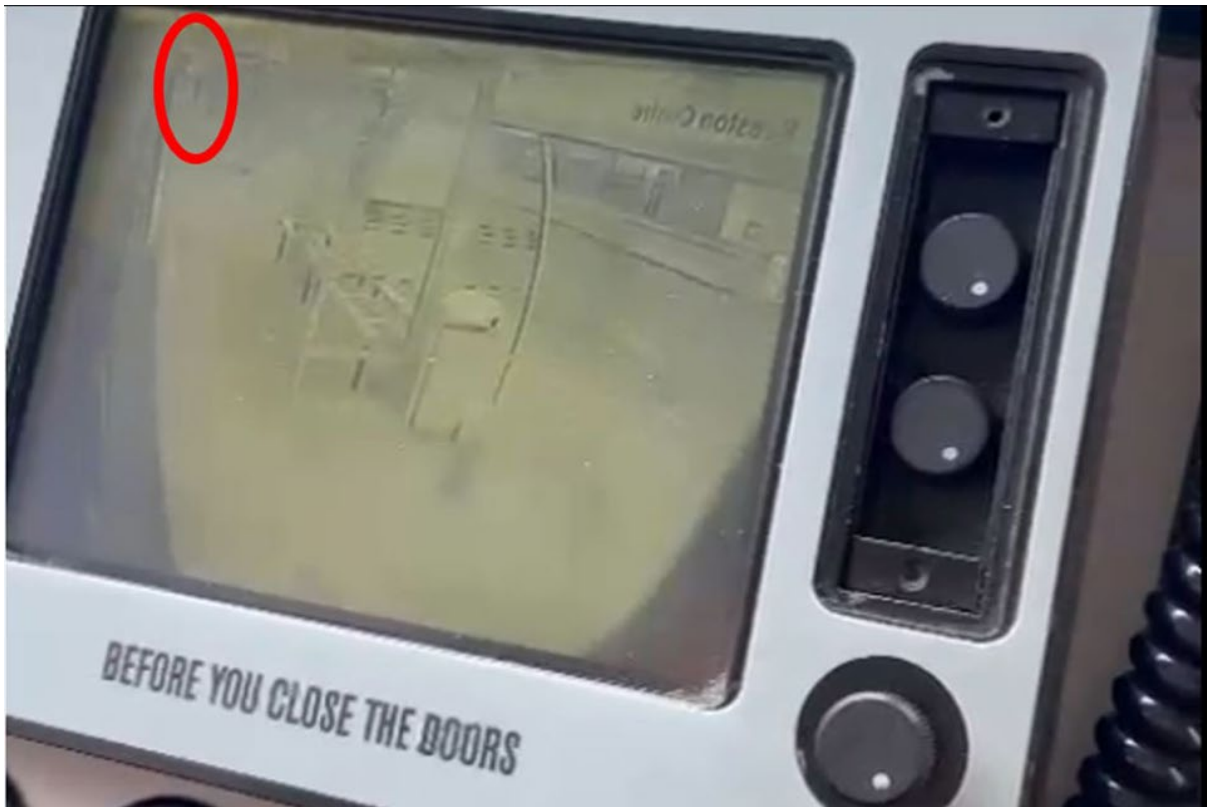
Diagram extracted from RAIB report (15/2018) which shows the different camera angles available to a tram driver, when selecting 'wing mirror' or 'rear view' (referred to as 'tram stop view' in the Radford Road investigation) settings. Note that the accident at Beeston Centre occurred to the right-hand side of the tram and that the 'tram stop/rear view' setting was not used by the driver.

The report also recommended that NTL improve initial training, refresher training and monitoring needed to ensure that drivers comply with tram stop procedures and understand the importance of undertaking an effective visual check of all doors after interlock is achieved. NTL stated that in response to this recommendation, training guidance documents were updated to read:

'The "Rear View" button is to be used once the doors have closed (...) a check on the platform side will be able to be viewed and this **must be done before departing all tram stops**'.

The driver involved in the accident at Beeston Centre tram stop told their employer that they did not use the 'rear view' button before departure. The driver acknowledged that they had been trained to use this view but did not do so on this occasion because they thought all the passengers were already on the tram. This means that the driver was relying solely on the 'wing mirror' view to conduct any final safety check.

RAIB attended Beeston Centre tram stop in daylight and positioned a person, wearing a high-visibility vest, at the rearmost doors (at which the passenger attempted to board). The conspicuity of the person on the platform, in the most favourable conditions, was poor when the bodyside camera footage was displayed in 'wing mirror' view. When the cameras were commanded to display 'rear view' mode, the person on the platform became more visible.



Wing mirror view image from RAIB reconstruction.



Rear view image from RAIB reconstruction.

It was dark and raining at the time of accident, and the driver reported to their employer after the accident that the environmental conditions had impacted their ability to obtain a clear image on the in-cab CCTV screens. The driver reported that they had attempted to modify the settings at the previous terminus location, but that the varying brightness of different tram stops and water on the camera lens had made the use of these cameras difficult for them.

The footage from the tram bodyside cameras is not recorded on this type of tram and so it is not possible to say exactly what was shown on the CCTV system during the final visual check on the night of the accident. However, the combination of environmental factors, the use of only the 'wing mirror' view and the fact that other passengers were stood between the passenger and the camera, mean that it is unlikely that the passenger who was injured would have been clearly discernible to the driver when any final check was taking place.

RAIB observed during its site visit that drivers of trams do not always use the 'rear view' button to complete a final safety check before departing. This suggests that, although the training requires drivers to complete this check, drivers do not always comply with this requirement and the monitoring of drivers by NTL to ensure that they are driving to the relevant standard may not be completely effective.

As well as making recommendations about the use of CCTV during the final visual check, RAIB's report into the Radford Road incident made a recommendation to NTL which asked it to start investigating possible door seal modifications to reduce the risk of trapping items and, if appropriate, develop a programme for installation of improved door seals.

In response to this recommendation, NTL reported to the Office of Rail and Road (ORR) that:

'NTL are participating with the other operators in UK Tram to evaluate a potential new door seal for trams with pressure sensitive switches. It is unlikely however that the current tram doors could accommodate such a seal. It may be that any further trams be specified as having to incorporate door seals with pressure sensitive edges.'

In 2023, the Light Rail Safety and Standards Board (LRSSB) started to set the scope for research into technology which can more effectively detect obstructions in tram doors. Sensitive edge door technology is already used on other rail systems and can detect smaller obstructions more reliably.

Although the scope of the Rail Safety and Standards Board (RSSB) does not encompass tramway systems such as NET, the lessons learnt from its research project 'T1102 Optimising door closure arrangements to improve boarding and alighting' (2017) may be transferable to the tramway industry.

This research showed that some passengers believe train doors that are closing can be reopened like lift doors, by placing a hand between them. However, as this accident shows, a hand or an item being placed in the doors may not always activate obstacle detection systems or prevent door interlock circuits from being completed.

Previous similar occurrences

A number of 'trap and drag' incidents have previously been investigated by RAIB on both tramways and mainline railways. Some of these incidents have resulted in serious injuries, and many had the potential to result in fatalities.

Incidents with similarities to the accident at Beeston Centre tram stop which were investigated by RAIB include:

- At Radford Road, Nottingham, on 15 December 2017 ([RAIB report 15/2018](#)), an empty pushchair was dragged between tram stops after its plastic rain cover became trapped in the closed and locked doors of a tram on the Nottingham tramway. The tram driver, and other tramway staff, were not aware that small objects could be trapped but not detected by the door system.
- At Bury, Greater Manchester, on 30 May 2018 ([RAIB safety digest 08/2018](#)), a passenger was dragged along the platform when their hand was trapped in the closed doors of a departing tram. The tram driver was not aware that thin objects could be trapped in the closed doors and not be detected by the door system.
- At Shudehill, Manchester, on 27 May 2022 ([RAIB safety digest 04/2022](#)), a passenger became trapped in the doors of a tram and was dragged by the tram sustaining injuries to their face and hand. This accident occurred because the driver did not complete the final safety checks of the platform before moving the tram away from the tram stop.

A wider summary of previous RAIB learning, including further similar incidents relating to the risk at the platform-train interface, can be found on [RAIB's website](#).