

# Urgent safety advice 01/2019: Warning horns on Edinburgh trams

Published 14 February 2019

## 1. Safety issue

The warning horn on the Edinburgh tram fleet does not provide a sound pressure level in line with current industry guidance. Furthermore, it does not generate a greater sound pressure level than the tram bell.

## 2. Safety advice

Edinburgh Trams Limited is advised to increase the sound pressure level of the warning horn fitted to its trams. In the meantime, it should consider measures to mitigate risks at locations where audible warnings may be required. In particular, consideration should be given to the appropriateness of the current warning horn or bell as a method of warning to pedestrians using footpath crossings over off-street track sections with high line speeds.

## 3. Issued to:

- Edinburgh Trams Limited

## 4. Background

At about 12:10 hrs on 11 September 2018, a pedestrian who was using a footpath crossing located between Balgreen and Saughton tram stops, was struck and fatally injured by an outbound tram travelling from Edinburgh city centre towards Edinburgh Airport. The crossing, over two tram tracks on an off-street section, provides a pathway between Stenhouse Drive and Saughton Mains Street.

The tram driver had observed the pedestrian approaching the crossing and, in response, applied the service brake to reduce the tram's speed as well as sounding repeated warnings using the tram's bell. The pedestrian did not respond to these audible warnings and continued onto the crossing. Although the driver then operated the emergency brake (which automatically activated the warning horn) before arriving at the crossing, the tram was too close to be able to stop before reaching it. The tram's speed at the time of the collision was approximately 50 km/h, and the maximum line speed in this section is 70 km/h.

Since this accident, the RAIB has conducted acoustic measurements of both the bells and the warning horns fitted to the tram involved in this accident and on one other Edinburgh tram. Tests from 7 metres (the distance stated in the 70-388-EC specification, referred to by current tramway guidance) in a flat, open area over ballast, found that the arithmetic means of the sound pressure levels from nine tests of the warning horns were approximately 86 dB(A) and 85 dB(A) on the two trams tested. 70-388-EC specifies a level equal to, or greater than 93 dB(A) under these conditions. For context, it is generally recognised that a reduction of 10 dB is approximately equivalent to a halving in loudness as perceived by the human ear.

Sound pressure level measurements were also recorded for both trams in this location from a distance of 2 metres to compare sound pressure levels of the bells and the warning horns. It was found that the average sound pressure level of the bell was 95 dB(A) and the warning horn was 89 dB(A).

Further acoustic measurements were conducted with the incident tram at different distances on the approach to the footpath crossing. The sound pressure levels of both the tram's bell and warning horn were recorded from the footpath crossing for each distance, together with the typical background noise measured at the crossing at the same time of day as that of the accident, but on a different day.

These measurements indicate that:

1. Both the bell and the warning horn are not sufficiently discernible above the level of background noise at this footpath crossing to indicate the approach of a tram at a full service braking distance from the crossing at line speed (as is stated in the current tramway guidance).
2. The warning horn produces a lower sound pressure level than the bell and can therefore be regarded as quieter.

The RAIB are aware that at the time that the trams were procured and commissioned there were no specified numeric requirements for the sound pressure levels for tram audible warning devices. However, guidance existed at the time of procurement, and continues to exist, which states that there should be two levels of audible warnings; the lesser level for on-street use, and the greater for off-street sections and emergencies. It is common practice on tramways in the UK that the former is provided by a bell, and the latter by a warning horn.