

Chris O'Doherty
RAIB Relationship and Recommendation Handling
Manager

Telephone: 020 7282 3752

E-mail: chris.o'doherty@orr.gsi.gov.uk

18 September 2014

Ms Carolyn Griffiths
Chief Inspector of Rail Accidents
Cullen House
Berkshire Copse Rd
Aldershot
Hampshire GU11 2HP

Dear Carolyn,

**RAIB Report: Fatal accident at Bayles and Wylies footpath crossing,
Bestwood, Nottingham, 28 November 2012**

I write to report¹ on the consideration given and action taken in respect of the recommendations addressed to ORR in the above report, published on 26 September 2013.

The annex to this letter provides details of the consideration given/action taken in respect of each recommendation. The status of each recommendation is:

Recommendation 1:

- Blackpool Transport Services Ltd: *In-progress*
- Metrolink RATP DEV UK: *Implemented*
- Tram Operations Limited: *Implemented*
- National Express Midland Metro: *Implemented*
- Stagecoach Supertram Ltd: *Implemented*
- Nottingham Trams Limited: *In-progress*

Recommendation 2:

- ***In-progress.*** *Tram operators have to take account of the findings of RSSB's research project T984 which is expected to be published by 30 September 2014.*

Recommendation 3:

- **Implemented**

¹ In accordance with Regulation 12(2)(b) of the Railways (Accident Investigation and Reporting) Regulations 2005

Recommendation 4:

- Network Rail: *Implementation on-going*
- Blackpool Transport Services Ltd: *implemented*
- Metrolink RATP DEV UK: *In-progress*
- Tram Operations Limited: *In-progress*
- National Express Midland Metro: *Not applicable*
- Stagecoach Supertram Ltd: *In-progress*
- Nottingham Trams Limited: *In-progress*

Tram operators have to take account of the findings of RSSB's research project T984 which is expected to be published by 30 September 2014.

Recommendations 1, 2 and 4: *ORR will update RAIB by 19 December 2014 on action being taken to address these recommendations*

We will publish this response on the ORR website on 2 October 2014.

Yours Sincerely,

Chris O'Doherty

Initial Consideration by ORR

1. All 4 recommendations contained in the report were addressed to ORR when RAIB published its report on 26 September 2013.
2. On 22 October 2013, ORR passed: Recommendations 1 and 2 to tram operators²; and Recommendation 4 to Network Rail & tram operators. Asking them to consider and where appropriate act upon them.
3. Details of consideration given and any action taken, in respect of these recommendations are provided below.
4. RAIB directed recommendation 3 to the ORR.
5. ORR also brought this report to the attention of: the Heritage Rail Association and Edinburgh Trams, as it was concluded that there are equally important lessons for them. ORR did not ask these organisations to provide a reply.

Action taken since the incident

6. A pedestrian bridge has been installed across both the tramway and the adjacent Network Rail Robin Hood Line. The Bayles & Wylies crossing was closed in November 2013.
7. The Nottingham Coroner held an inquest in January 2014 and arrived at a verdict of Accidental Death with no recommendations to prevent future deaths.

Recommendation 1

The intent of this recommendation is that a review is carried out to determine the most effective means of warning persons who may be in the path of a tram.

Where not currently the case, tram operators should review whether it is practicable and appropriate for a series of short, urgent, danger warnings, or other audible warning, to be sounded when there is a person on or close to the line who does not appear to be responding to a tram's approach. The review should take account of the human factors implications such as the method of operating the warning. Instructions to drivers should be updated accordingly and briefed as necessary.

Details of steps taken or being taken to implement the recommendation

8. **Blackpool Transport Services Ltd** in its initial response on 3 December 2013 stated that:

Blackpool Transport already train the drivers to sound their bell if there is a pedestrian close to the crossing and they have not shown any sign or acknowledgement of the tram's presence. Following that the horn is sounded (as it is not a compressed horn it only makes one long blast rather than being able to be depressed again and again – we have requested that Blackpool Council discuss this and the recording of both the bell and the horn with Bombardier. Blackpool Council own the trams and are responsible for any authorising/agreeing of any technical

² Stagecoach Supertram; National Express Midland Metro; Nottingham Trams Ltd; Blackpool Transport Services Ltd; Tramlink Operations Ltd; Metrolink RATP DEV UK.

changes with Bombardier. We are waiting for feedback from Blackpool Council on this issue).

9. On 14 April 2014 ORR wrote to Blackpool Transport Services Ltd seeking details of its discussions with Bombardier. On 30 April 2014 Blackpool Transport Services Ltd stated that:

Blackpool Transport Services Ltd has had a number of meetings between Blackpool Council Officers and the tram manufacturer Bombardier and all are in agreement that the modification to alter the bell and horn operation to be monitored by the on tram data recorder.

The current situation at present is that Bombardier are proposing the alterations to the software and hardware suppliers and Blackpool Transport are awaiting confirmation and details of the exact modification and timescales.

We will provide you with a further update in relation to recommendation 1 as soon as the tram manufacturer supplies us with the required details.

10. On 19 August 2014, Blackpool Transport Services Ltd provided an update:

BTS has met with Bombardier's on site manager to get some information and time scales regarding the modification to monitor both horn and bell signals with the on tram data recorder.

BTS has also been sent information on the modification to monitor both horn and bell signals, this includes updated schematic drawings, list of wiring alterations schedule.

A bill of materials to complete a trial and subsequent fleet modification has been sent to Bombardier's store and is expected to be delivered to site next week. BTS will then carry out the wiring modification to a tram, install software version 04 and carry out none passenger service testing.

Once the above is completed and trial successfully, hopefully in the next two weeks, BTS will be in a position to give an expected fleet completion date.

Status: In-progress.

11. **Metrolink RATP DEV UK** in its initial response on 26 November 2013 stated that:

Metrolink RATP DEV UK acknowledge that a series of short sharp blasts are to be used in an emergency situation and this is incorporated in the Rule Book, section J Street Running (J.5 Use of the Whistle) and section D Signalling (D.14.4 Tram Horn). Excerpts from the sections are included below:

J.5 Use of the whistle

The whistle must be used by the Driver when necessary to safeguard the safety of:

- *Passengers*
- *Other road users*
- *Pedestrians; and*
- *Himself*

More specifically the whistle must be used:

- *In compliance with any fixed warning signs*
- *On the approach to a crowded platform*
- *Entering or leaving an enclosed area*
- *When passing another tram, or passing or overtaking other road vehicles*
- *When passing through an area of intense pedestrian activity*
- *When moving off from a stand*
- *When entering a sharp curve*
- *To attract the attention of the driver of a road vehicle obstructing the passage of a tram ; and*
- *In an emergency – a series of short blasts*

Drivers must avoid unnecessary use of the tram whistle

D.14 Tram Horn

D.14.4 A series of short sharp blasts on the horn will indicate a warning of danger.

A reminder will also be issued to driving staff that if there is a person on or close to the line who does not appear to be responding to the tram's approach that a series of short sharp blasts are to be sounded as per the Metrolink RATP Dev UK Rule Book. This action will be completed by 23rd November 2013.

Timescale: End of February 2014

Status: Implemented

12. **Tram Operations Limited** in its initial response on 4 December 2013 stated that:

Tram Operations Limited's review noted that, as operators of a highway vehicle, tram drivers are taught to use the bell or horn in accordance with the Highway Code (Rule 112):

The horn: Use only while your vehicle is moving and you need to warn other road users of your presence. Never sound your horn aggressively. You MUST NOT use your horn

- *while stationary on the road*
- *when driving in a built-up area between the hours of 11.30 pm and 7.00 am except when another road user poses a danger.*

Tram Operations Limited noted that, as operators of a highway vehicle, tram drivers are taught to slow down and always to be prepared to stop safely in the distance that can be seen to be clear, as also in accordance with the Highway Code (Rule 126):

Stopping Distances: Drive at a speed that will allow you to stop well within the distance you can see to be clear."

Tram Operations Limited noted that this principle is expressed as 'line-of-sight' operation, as defined by ORR in its Guidance on Tramways (RSP 2), Paragraph 22:

- *... In this mode, a tram should be able to stop before a reasonably visible stationary obstruction ahead from the intended speed of operation, using the service brake ...*

Tram Operations Limited confirmed that its tram drivers are taught to identify potential hazards ('hazard perception') and then to respond ('hazard drill', including the use of audible warnings).

The principles are set down in a Lesson Plan. The document states with regard to the use of audible warnings:

Examples of Moving Hazards Variable: Animals startled by the tram and bolting (glass reflections startle the animal- avoid using the bell/horn).

Actions Approaching Hazards:

- *Cover the brake (apply 1st Brake Notch)*
- *Slow Down*
- *Sound a warning signal, if necessary*
- *Constantly re-assess the hazard*
- *Be prepared to STOP.*

Indicators to Use:

- *Indicators*
- *Brake Lights*
- *Headlights (flashing)*
- *Audible warnings*
 - *these are ONLY to let other road users know you are there*
 - *they must NEVER be used as a rebuke*
 - *ALWAYS USE THE HORN ON SEGREGATED SECTIONS.*

Tram Operations Limited noted that its tram drivers are currently subject to instruction in the Smith System (Advanced Driving Techniques). This addresses key issues relating to defensive driving but does not refer to the use of audible warnings.

On the line

Operations Limited believe that, if persons were already 'on the line', the driver (driving on 'line-of-sight') should have time to apply normal ('service') braking (and avoid collision). It is questionable then whether 'short, urgent' warnings would be appropriate given that this might prompt a sudden rash movement by the persons at risk, into the way of other harm.

If, nevertheless, it became necessary for some reason to apply the hazard brake in order to avoid a collision, then the horn would be activated automatically and would sound continuously.

Close to the line

If the persons at risk were 'close to the line', then in most circumstances the driver, having perceived a hazard, would be able to use an appropriate audible warning and adjust speed so as to mitigate the risk effectively.

Typically, the driver would reduce speed until the persons concerned confirmed by their behaviour (including, perhaps, eye contact) that that they were aware of the tram's presence. Again, it is questionable whether 'short, urgent' warnings would be appropriate given that this might prompt a rash response.

If the persons moved suddenly towards the path of an approaching tram (from a place of safety such as a pavement or at the edge of a footpath crossing), then

collision might be imminent and the driver should apply the hazard brake. In which case, the horn would be activated automatically and sound continuously.

However, there are situations when persons standing at the side of the line or even moving towards the side of the line, present no immediate risk despite their behaviour continuing to suggest that they were unaware of a tram's approach.

In these cases, the potential risk would be progressively mitigated by the use of an audible warning and adjustment of speed. There would be no reason, however, to resort to hazard brake (there being no transgression) but there might be a case for making a series of 'short, urgent' warnings.

However, Tram Operations Limited concluded that although these considerations should form part of driver training, it would not be simple (in the context of a tramway) to stipulate a set of conditions when such an audible warning were mandatory.

Instructions to drivers should be updated accordingly and briefed as necessary.

Tram Operations Limited is therefore still considering how practicable it would be to issue 'instructions' to drivers on this issue. Tram Operations Limited expects that it shall reach a settled view within the next two months.

The review should take account of the human factors implications such as the method of operating the warning.

As noted above, the situations in which there might be a case for drivers to make a series of 'short, urgent' warnings are limited because of the automatic, continuous sounding of the horn when the hazard brake is applied.

Tram Operations Limited's review concluded, however, that when such warnings might be effective, there might be an associated risk that conscious repeated applications of the horn (in order to comply with an 'instruction') might detract from the driver's attention to other, more immediate actions in terms of defensive driving.

Again we are still considering the issue. Again, Tram Operations Limited expects that it will reach a settled view within the next two months.

The operation of the horn (by foot pedal on the Bombardier CR4000 vehicle and by foot pedal or arm rest button on the Stadler SVT) has been proven satisfactory by experience and we would be reluctant to recommend modifications to the fleet owners (London Tram/ink).

13. On 14 April 2014 ORR wrote to Tram Operations Limited seeking the outcome of its considerations. On 9 May 2014 Tram Operations Limited stated that:

The review was carried out on the basis that, as operators of a highway vehicle, tram drivers are taught to use the bell or horn in accordance with the Highway Code and are taught to slow down and always to be prepared to stop safely in the distance that can be seen to be clear, as also in accordance with the Highway Code.

Tram Operations Limited concluded that, although there might be a case for making a series of 'short, urgent warnings', it would not be simple (in the context of a tramway) to stipulate a set of conditions when such an audible warning were mandatory.

The review also concluded that when such warnings might be effective, there

might be an associated risk that conscious repeated applications of the horn (in order to comply with an 'instruction') might detract from the driver's attention to other, more immediate actions in terms of defensive driving.

Tram Operations Limited said that the operation of the horn (by foot pedal on the Bombardier CR4000 vehicle and by foot pedal or arm rest button on the Stadler SVT) had proven satisfactory by experience and we would be reluctant to recommend modifications to the fleet owners (London Tramlink).

As you note, we said that we expected to be able to reach a settled view within a period of two months.

On 18 December 2013, we re-issued our Lesson Plan relating to the approach of hazards, to include the following point:

- *Sound a warning (Bell or Horn). The way in which the bell and horn are used may change with the circumstances of the hazard; for example:*
 - *A series of short, urgent, danger blasts or rings may be more effective when persons close to the tramway do not appear to be responding to the approaching tram;*
 - *A long single sounding of the bell or horn may be more effective to warn a distant work party of a tram's approach.*

The revision was then briefed to drivers.

Status: Implemented

14. **National Express Midland Metro** in its initial response on 5 December 2013 stated that:

National Express Midland Metro considers it is practicable to implement a series of short, urgent danger warnings, sounded by tram drivers on the approach to pedestrian crossings on segregated sections of the tramway only, where a pedestrian does not appear to be responding to a trams approach.

The process of implementation will commence by consideration within the companies safety validation of change process. This will consider the type of warning believed to be most effective in the context of Midland Metro, the method of operation and any associated human factors considerations.

Revisions to staff training processes, the roll out of specific training and the inclusion of the revised method of operation in training documentation will be carried out subsequent to safety validation.

- *Target completion date for safety verification and design: 30 January 2014*
- *Target completion date for implementation: 30 April 2014*

15. On 14 April 2014 ORR wrote to National Express Midland Metro seeking the outcome of its considerations. On 30 April 2014 National Express Midland Metro Ltd stated that:

NXMM has implemented changes to its documentation relating to driver training to include the requirement for a driver to sound a series of short, urgent danger warnings on the tram horn where they are approaching a pedestrian crossing and a pedestrian has not appeared to notice the

approach of an oncoming tram, or has placed themselves in a position of danger. This is to be implemented on the segregated section of the tramway only.

This requirement is to be trained out to tram drivers during training on the new CAF Urbos 3 tram fleet. This training is scheduled to commence on 12th May and is programmed to be completed 12 weeks from that date

Revised target completion date for implementation: 1 August 2014.

Status: Implemented

16. **Stagecoach Supertram Ltd** in its initial response on 11 December 2013 stated that:

- a) *A full review of the audible warnings applied has been carried out*
- b) *The current driver training assessment sheets regarding audible warnings has been reviewed. These are covered as an assessment requirement and the assessor must observe them being carried out to warn pedestrians and other road users. Drivers are questioned on when a horn as opposed to a bell warning should be given (high noise areas etc.) as well as observing the compliance with the compulsory warning boards. As well as the assessments, audible warnings are also checked on driver monitoring checks, which take place every 6 months. In immediate response to the receipt of the investigation a notice was posted on 16th September on the driver notice boards.*
- c) *This is an area we continue to monitor closely through our driver Competency Management System and believe that the continuation of this approach satisfy the requirements of the recommendation.*

17. On 14 April 2014 ORR wrote to Stagecoach Supertram Ltd seeking the clarity if the review had considered the use of short urgent danger warnings. On 9 May 2014 Stagecoach Supertram Ltd stated that:

All our drivers are trained to sound the Tram bell and/or Horn when a person is on or close to the line and do not respond.

A full review of the controls at pedestrian crossings has been carried out, which has result in compulsory warning notices being placed on the approach to crossings where the line of sight of the driver may be restricted due to curvature of the track.

This review has also raised a recommendation for the volume level of the bell to be reviewed in order to ensure that this can be heard by pedestrians; however, the horn is of a level that can be heard and the instruction to sound the horn if the pedestrian does not appear to acknowledge the use of the bell.

The review assessed the drivers' line of sight and ability to stop, with action being taken to improve vegetation management, signage and introduction of barriers to reduce the risk further.

18. On 28 July 2014 ORR wrote to Stagecoach Supertram Ltd seeking the outcome of its consideration of the practicability of short sharp blasts being sounded. On 28 July 2014 ORR Stagecoach Supertram Ltd stated that:

Stagecoach Supertram Ltd has reviewed this and has concluded that its current method of alerting pedestrians is suitable and sufficient: In areas of high noise or

open ground the horn should be used, however, this is at the drivers' discretion except at Sheffield Road bridge where the horn must be used. If a pedestrian does not appear to acknowledge the warning and stop the Tram must stop immediately, however the driver is trained to be prepared to stop at sight of hazard. We believe this approach is suitable and sufficient in relation to the nature of our operations.

Status: Implemented.

19. **Nottingham Trams Limited** in its initial response on 6 February 2014 stated that

The ORR and police investigations into the accident found that the warning horns complied with relevant regulations. Further, when deployed on the tramway at the accident site, the horn was clearly audible over background noise levels before the vehicle reached its minimum braking distance.

Nottingham Trams Limited has reviewed changing driver practice from giving long blasts on the warning horn to rapidly toggling the horn in emergency situations. The risk of over complicating the driver's response to the emergency situation and potentially delaying emergency brake application was considered to be greater than any perceived improvement in the audibility of the horn.

It might be possible to provide the toggling facility through the horn control system. This would require a change to standard tram designs and the associated safety cases and would need to be developed in conjunction with regulatory bodies and manufacturers.

We would support any industry research into this provision for application in future vehicle standards.

20. On 14 April 2014 ORR wrote to Nottingham Trams Limited seeking the evidence to support its position. On 2 June 2014 Nottingham Trams Limited stated that:

Audible warning of approaching trams

Nottingham Trams Limited [NTL] has reviewed the work carried out at the time of the initial investigations and the subsequent discussions regarding horn usage during emergency situations.

The NTL operational concerns were around requiring drivers to apply emergency brakes with one hand and "toggle" the horn with the other while assessing the developing situation in front of them.

Operational staff were concerned that giving drivers a task that needed instant decision making (is this an emergency? is it deteriorating? should I toggle the horn?) gave drivers further complication at a critical time.

Drivers would have to decide what action to take when balanced against "aggressive, bullying or threatening driving".

Additionally, if the situation required the application of the security brake this was yet another action to be carried out by the driver beyond those described above.

In light of the ORR comments we are further reviewing this requirement from an engineering perspective.

There are two tram fleets to consider.

Existing Incentro trams.

NTL is working with its engineering and maintenance subcontractor to assess the feasibility of retrofitting a device to provide the toggling function.

New Citadis trams.

These are currently being supplied through the Design and Construct contract with over half the fleet having been delivered. They are currently undergoing acceptance testing.

NTL is requesting the manufacturer if the toggling requirement can be provided by the vehicle control system – either through hardware or software modifications.

NTL does not have timescales on these investigations and will advise by 4th July the progress on both these vehicle fleets.

21. On 25 July 2014, Nottingham Trams Ltd provided an update:

There are three aspects:

1. Driver horn control in relevant emergency situations.

Our Operations management and driver trainers remain concerned about unintended consequences arising from instructing drivers to continually toggle the horn in rapidly developing emergency situations. To assess the situation (and to get a broader input) we have asked our driver trainers to undertake trials. We are currently in the Testing & Commissioning [T&C] phase of the new Citadis tram fleet and, in parallel, are fitting AVLS [Automatic Vehicle Location System] and associated systems to the existing Incentro fleet. The T&C programme requires various braking tests to be undertaken under controlled test conditions. These will be undertaken by various drivers on all trams in numerous locations. Where the environment and location allow (i.e. without causing a nuisance to the public or our neighbours) the drivers will toggle the horn and report back. Our driver trainers are our most experienced drivers, they deal day-to-day with all our drivers from first day novices to very experienced. Importantly they accompany drivers following operational incidents where they get first-hand information on various emergency situations and build up our corporate knowledge on driving related incidents. The horn trials will continue through August and September.

2. Citadis tram fleet.

When the traction / brake controller is placed in emergency brake position the warning bell is sounded continuously. The driver can simultaneously sound the tram horn as in normal operation. In this way it is possible for the horn to sound continuously with the rapid sounding of the bell over the top. Trialling this in the depot appears very effective and we will test and monitor this on-track alongside the trials described above.

3. Incentro tram fleet.

When the bell switch is pressed and held the bell is sounded continuously but, unlike the Citadis tram, this function is not linked to the traction / brake control emergency position. Engineering change will be required to reconfigure the Incentro fleet to reflect the Citadis bell and horn controls. Should the service trials of the Citadis trams demonstrate clear benefits of combined bell and horn

sounding in emergency situations we will investigate the technical implications on the Incentro fleet. This will necessarily follow the trials described in (2) above.

Once the above activities have been completed we expect to be in position to decide the best way forward.

Status: In-progress

Recommendation 1, Summary of Statuses:

- Blackpool Transport Services Ltd: *In-progress*
- Metrolink RATP DEV UK: *Implemented*
- Tram Operations Limited: *Implemented*
- National Express Midland Metro: *Implemented*
- Stagecoach Supertram Ltd: *Implemented*
- Nottingham Trams Limited: *In-progress*

ORR will update RAIB by 19 December 2014 on action being taken to address this recommendation.

Recommendation 2

The intent of this recommendation is to improve the safety of pedestrian crossings crossed by tramways on segregated lines and where trams run at relatively high speed.

Tram operators should review the marking of the boundary of pedestrian crossings crossed by segregated tramways where trams run at relatively high speeds. The review should assess the effectiveness of the means of demarcation in the following respects:

- indicating that a pedestrian is entering into a higher risk area; and
- prompting pedestrians to look for approaching trams.

Where appropriate, the review, which should also take account of the emerging findings of RSSB's research project T984, should include identification of proposals to improve the effectiveness of the means of demarcation. Improvements that are appropriate and practicable should be implemented.

Details of steps taken or being taken to implement the recommendation

22. **Blackpool Transport Services Ltd** in its initial response on 3 December 2013 stated that:

The Blackpool system mainly has gates that put a physical block before someone can enter the tramway and also endeavour to make pedestrians face the oncoming trams. Any that do not have gates have alternating pens or other arrangements to ensure that pedestrians look towards oncoming trams or moves them into a better position for the driver to see them. All crossings are clearly signed. All the crossings have been individually risk assessed. Physically and visually challenged pedestrians have been considered including the provision of tactiles. Having recently been upgraded and approved by ORR to operate the system we believe all comply with

RSP2 and we await with interest the outcome of the RSSB research project T984 and in particular paragraph 96.

Status: In-progress. Still to take account of the findings of RSSB's research project T984.

23. **Metrolink RATP DEV UK** in its initial response on 26 November 2013 stated that:

All new segregated crossings have been signed and marked in accordance with Highway standards and ORR guidance in RSP2 and site specific risk assessments have been carried out for pedestrian crossings on the Metrolink system. However, Metrolink RATP DEV UK will revisit these risk assessments in light of this recommendation, in particular whether any hatch markings, additional lines or tramway 'look both ways' signage marked on the ground would further enhance safety.

The action will be completed by the end of February 2014. This timescale should allow us to take account of the emerging findings of RSSB's research project T984 which we believe will be released by the end of 2014.

When the review is complete Metrolink RATP DEV UK will share the findings with UK Tram in order for the wider tramway community to have access to the report and take action accordingly.

Timescale: End of February 2014

24. On 14 April 2014 ORR wrote to Metrolink RATP DEV UK seeking clarity if all segregated crossings had been reviewed and details of the outcome of its review. On 7 May 2014 Tram Operations Limited stated that:

All existing segregated Metrolink crossings have also been subject to risk assessment review.

It was found that all signage at the Dolly Molly foot crossing was correct and compliant with Highway standards and ORR Guidance RSP2. Each side of the foot crossing is fitted with a "kissing gate" and the risk assessment identified that no additional safety enhancements were required. This crossing differs from the Phase 3 crossings, which have reflective markers attached to the side of the crossing boards, in that Dolly Molly is painted yellow in its entirety. This, therefore, was found to negate the need for reflective markers being used at this crossing.

The risk assessment review of Hagside Level Crossing, which is a full barrier level crossing, concluded that the signage was correct and compliant. Work to the infrastructure in the location of the level crossing was planned to be carried out in late February and completed in March 2014. The work included the renewal of track fixings, installation of outbound road drainage and relaying the road surface up to the kerb lines.

Once the work was complete, road markings were painted and included white STOP lines marked one metre in front of the primary stop signal at each side of the crossing; pedestrian white lines painted to both sides of the carriageway and at either side of the carriageway and a short section of carriageway centre line was marked on the approach to the STOP line.

There are a further two level crossings on the existing system which are shared with Network Rail and are on Network Rail infrastructure.

Status: In-progress. *Still to take account of the findings of RSSB's research project T984.*

25. **Tram Operations Limited** in its initial response on 4 December 2013 stated that:

Tram Operations Limited's believes that, at system level, review of design relating to infrastructure should involve the Infrastructure Manager (in our case, London Tram/ink).

However, a review of the design of boundary markings at pedestrian crossings might better be led by UK tram systems acting together and, on this point, it is my understanding that UK Tram is intending to write to you.

Our view that this matter should be considered at a national level is reinforced by Recommendation 3 which states that the ORR should review its own guidance to tram operators.

We are not therefore in a position to indicate a timescale.

26. On 14 April 2014 ORR wrote to Tram Operations Limited seeking details of how Tram Operations Limited has been working in partnership with London Tramlink to carry out risk assessments at Level crossings. On 9 May 2014 Tram Operations Limited stated that:

Tram Operations Limited's view (letter dated 4 December 2013) is that, at system level, review of design relating to infrastructure should involve the Infrastructure Manager (London Tramlink).

Risk assessments at pedestrian crossings were undertaken by London Tramlink in response to a previous recommendation made by RAIB in relation to a pedestrian collision at Sandilands tram stop (Croydon) on 16 May 2012.

Tram Operations Ltd was involved throughout and fully endorsed the process adopted.

The approach taken gave consideration to (amongst other controls) signage, 'look left/right/both ways' instructions at ground level, tactile paving at a distance outside the kinematic envelope and edge markings to the crossings themselves.

The review therefore included an assessment of "the effectiveness of the means of demarcation in the following respects:

- indicating that a pedestrian is entering a high risk area; and*
- prompting pedestrians to look for approaching trams."*

Where the assessments of individual crossings found such measures inadequate or missing, recommendations were made to provide them. The recommendations are being implemented.

This process commenced prior to the RSSB publication of its report into 'decision points' at foot crossings (research project T984). Tram Operations Limited note the recommendation that "marking the 'Danger Zone' rather than the decision point would better support user decision making at passive

crossings ..." but that the "impact of a marked 'danger zone' should be trialled prior to implementation and [that] the best ways of doing this [are] currently being explored within RSSB".

We have discussed the report's findings with London Tramlink and we shall be giving them further consideration when the current improvement works have been completed.

Status: In-progress. *Still to take account of the findings of RSSB's research project T984.*

27. **National Express Midland Metro** in its initial response on 5 December 2013 stated that:

National Express Midland Metro has carried out a review of its pedestrian crossing infrastructure on the segregated section of the system. NXMM has no record of there ever being a pedestrian/tram collision on one of its segregated section crossings, however it is recognised that there may have been near misses that were not reported by either driver or pedestrian.

The review includes a current risk rating and a post mitigation risk rating based on the resolution of identified shortfalls in either the installation or the equipment condition on each crossing. This document details a series of actions to be completed by NXMM in order to bring its crossing infrastructure up to an acceptable standard.

Further works to provide markings to the crossing boundaries as detailed in paragraph 96 (ii) of the RAIB report will be considered in conjunction with other system operators and within the context of UK Tram. Any identified improvements will be adopted as appropriate.

28. On 14 April 2014 ORR wrote to National Express Midland Metro seeking the outcome of its review. On 30 April 2014 National Express Midland Metro Ltd stated that:

NXMM has carried out a review of its pedestrian crossing infrastructure on the segregated section of the system. This has been supplied previously.

NXMM has prepared a capital programme of works to resolve the identified installation issues on its segregated pedestrian crossing infrastructure. This work is due to commence on 12 May and will continue for a period of 5 weeks. Upon completion of this programme, all NXMM pedestrian crossings shall be compliant with the relevant guidance.

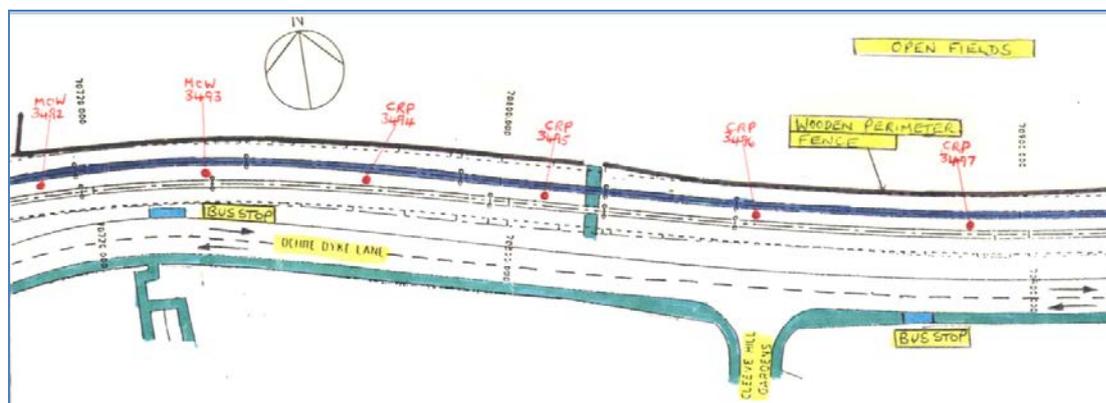
Further works to provide markings to the crossing boundaries as detailed in paragraph 96 (ii) of the RAIB report will continue to be considered in conjunction with other system operators and within the context of UK Tram as part of its working group 3a, which is considering the tram/pedestrian interface. This group's work is currently on-going and any identified improvements will be adopted as appropriate.

NXMM will write to ORR again when the actions have been completed or with a further update, as appropriate.

Status: In-progress. *Still to take account of the findings of RSSB's research project T984.*

29. **Stagecoach Supertram Ltd** in its initial response on 11 December 2013 advised that:

A full review of our route risk assessments has been carried out in order to establish any areas that required further review. This identified a pedestrian crossing crossed by segregated tramways where the tram speed is 40mph outbound and 30mph inbound.



This is an access path and although not a designated cycle path it is used by cyclists and currently there are no barriers in place.

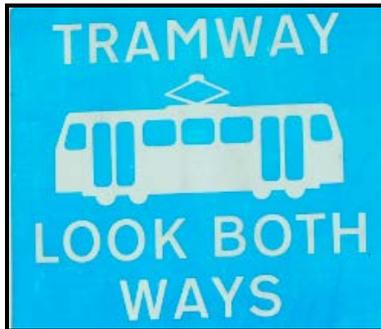
Due to this being classified as an access road we are currently in talks with the Sheffield City Council in order to agree what form of barriers, if any could be installed and if there is an alternative access point available for the tractor that uses it for access to the fields adjacent to the tramway. Timescales for update on this is 31st December 2013, with a view to have a solution in place early 2014. There is appropriate signage at this crossing to advise pedestrians of the tramway risks.

30. On 14 April 2014 ORR wrote to Stagecoach Supertram Ltd seeking the clarity if the review of markings at the boundaries of pedestrian crossings satisfactorily shows to a pedestrian that they are entering a high risk area. On 9 May 2014 Stagecoach Supertram Ltd stated that:

The Pedestrian crossing review found 5 Pedestrian crossings where the speed in the area is such that they fall into the category of high risk:

- Birley Golf Course (BIL6644), 40mph I/B and 35 mph O/B
- Mossway (CRA 3495), 30 mph I/B and 40 mph O/B
- Mossway field entrance (CRB 3495), 40mph both directions
- Beighton Drakehouse (BDH 3552), 40mph both directions
- Dakesquire and Alcrom Gardens (WAT 3556) 40mph both directions

All the above areas have the following signs either side of pedestrian crossing to prompt pedestrians to look for approaching trams:



The review found that all locations had the signs in place.

Recommendations have been made regarding these key areas about how the controls surrounding these areas can be improved further, in particular in relation to cyclists resulting in compulsory warnings, erection of barriers, improving the vegetation management and the repainting of faded cycle markings.

Status: In-progress. *Still to take account of the findings of RSSB's research project T984.*

31. **Nottingham Trams Limited** in its initial response on 6 February 2014 stated that:

Following both the 2012 and 2008 accidents system wide reviews of foot crossings were undertaken. The crossings were found to be compliant with relevant standards. However local improvements in signage were identified and, in conjunction with the highway authority, implemented within weeks of the accidents.

The RSSB research project T984 addresses main line railway crossings and their associated risks. At the time of writing it has not been published and is not available to non-railway group members. We cannot comment on its findings or relevance to tramways. Should it become publicly available we will review and consider its recommendations.

Status: In-progress. *Still to take account of the findings of RSSB's research project T984.*

Recommendation 2 summary Statuses:

Status: In-progress. *Tram operators have to take account of the findings of RSSB's research project T984 which is expected to be published by 30 September 2014.*

ORR will update RAIB by 19 December 2014 on action being taken to address this recommendation

Recommendation 3

The intent of this recommendation is that the ORR's guidance on tramways be amended so that it gives guidance to tramway operators on the design of pedestrian crossings crossed by segregated tramways where trams run at relatively high speeds.

The Office of Rail Regulation should, in conjunction with the UK tramway industry, ensure that its current guidance to tram operators on pedestrian crossings crossed by segregated tramways where trams run at relatively high speeds is reviewed and amended as necessary. The review should include consideration of the following factors:

- The means of indicating that a pedestrian is entering into an area of higher risk; and
- The means of prompting pedestrians to look for approaching trams.

Details of steps taken or being taken to implement the recommendation

32. On 28 July 2014, ORR wrote to UK Tram stating that it has discussed this recommendation both with individual tramways and at cross-industry meetings and has reviewed the content of RSP2 and is confident that the existing text along with the separate supporting guidance note on 'Pedestrian Safety' does already provide adequate guidance.

33. On 7 August UK tram stated that it was content with the response.

ORR's Railway Safety Directorate has reviewed the text of RSP2 and believes that the present text does deliver the appropriate level of guidance to the industry.

http://orr.gov.uk/data/assets/pdf_file/0018/2637/rspg-2g-trmwys.pdf

In respect of 'the means of indicating that a pedestrian is entering into an area of higher risk' the document currently addresses this in sections: 59, 60, 62, 63 & 68.

In respect of 'the means of prompting pedestrians to look for approaching trams' the document currently addresses this in the note to section 65, and in sections 68 and 69.

These issues are also addressed in the specific ORR publication "Tramway Technical Guidance Note 2".

http://orr.gov.uk/data/assets/pdf_file/0020/5069/ttqn2-ped_sfty.pdf

ORR has tentative agreement to transfer the management of RSP2 and the related guidance notes the industry body UK Tram. We currently await the restructuring of that body before handing over the documents. Once this occurs we expect there to be a review of the content to update it and bring it in line with current best practice, which will include reviewing RAIB findings.

ORR consulted UK Tram on the proposed response.

Status: Implemented

Recommendation 4

The intent of this recommendation is for Network Rail and tram operators to issue guidance to their staff and contractors on the best way to illuminate pedestrian crossings while minimising any visual impairment of pedestrians when looking out for approaching trains/trams.

Network Rail and tram operators should provide guidance to their staff or other third party on the best means to illuminate pedestrian crossings, when necessary, taking into account the following factors:

- Sufficient illumination of the crossing surface to enable pedestrians to see it;
- The possible impact on the visual capabilities of pedestrians using the crossing, in particular with respect to glare affecting their ability to detect approaching trains/trams; and
- Relevant findings from RSSB research project T984.

Details of steps taken or being taken to implement the recommendation:

34. **Network Rail** in its initial response on 27 November 2013 stated that:

Research into the causes of pedestrian accidents at level crossings and potential solutions (T984) is currently being undertaken by RSSB.

The Network Rail National Level Crossing Team are working with the Network Rail Ergonomics Team to determine the users' needs for lighting at level crossings and best means to illuminate pedestrian crossings taking into account the following factors:

- *Sufficient illumination of the crossing surface to enable pedestrians to see it;*
- *The possible impact on the visual capabilities of pedestrians using the crossing, in particular with respect to glare affecting their ability to detect approaching trains/trams; and*
- *Relevant findings from RSSB research project T984.*

The research and human factors work will be used to create guidance taking into account the issues identified in the recommendation. Suitable identified mitigations will be included in the Level Crossing Risk Management Catalogue [LCRMTK].

Timescale: 31 August 2014

35. On 27 August 2014, Network Rail notified ORR that the timescale to address this recommendation had been extended to 30 June 2015:

Reason for Extension: A review of the emerging results of RSSB research project T984 'The causes of pedestrian accidents at level crossings and potential solutions' and desktop research have not identified any existing directly applicable research findings. Therefore specialist consultants in the field of railway optical issues, who assisted RAIB in their investigation into this accident, were asked to prepare a proposal to address the requirements of the recommendation. The proposal has been received; its outputs will include developing guidance for use by Network Rail staff in determining the best means of providing lighting at pedestrian level crossings. It might also result in updates or inclusions to RSSB's Level Crossing Risk Management Toolkit. It is anticipated that suitable lighting solutions identified during the research will be included in the Network Rail Level Crossing Risk Management Catalogue.

Note: The consultants undertaking the research are also conducting the research to address Beech Hill RAIB recommendation 2. Network Rail believes that it is appropriate to use the same Consultancy due to its recognised expertise in the field of optical issues in relation to railway infrastructure and the likelihood of overlap and efficiencies that can result.

The extension request takes in to account the time to go to contract, conduct the research and update the Level Crossing Risk Management Catalogue.

Original Planned Completion Date: 31 August 2014

Revised Planned Completion Date: 30 June 2015

Status: Implementation on-going.

36. **Blackpool Transport Services Ltd** in its initial response on 3 December 2013 stated that:

All isolated crossings are lit and audited by Blackpool Council with Blackpool Transport drivers reporting any non-functioning lights. In relation to crossings at platform ends then there is still upgrade work taking place and when all the platforms lights are fully functional a further light level survey will take place to ensure that they are up to the required lux levels. All crossings are clearly signed. All the crossings have been individually risk assessed. Physically and visually challenged pedestrians have been considered including the provision of tactiles. Having recently been upgraded and approved by ORR to operate the system we believe all comply with RSP2 [ORR; Guidance on Tramways; Railway Safety Publication 2] and we await with interest the outcome of the RSSB research project T984 and in particular paragraph 98.

37. On 14 April 2014 ORR wrote to Blackpool Transport Services Ltd asking if it had guidance on the best means to illuminate pedestrian crossings. On 30 April 2014 Blackpool Transport Services Ltd stated that:

The works information that all the new crossings and platforms have been built to states;

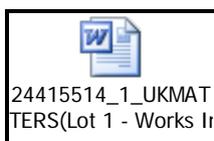
2.5.6.2 Lighting

The Contractor shall determine the requirement for lighting at each tram stop location. The lighting levels at the tram stop locations shall be in accordance with the European Standard PRM TSI: 4.1.2.10 – platforms and other external station passenger areas shall have a minimum average illumination level of 20 lux measured at floor level, with a minimum level of 10 lux.

However, the Contractor should note, that at certain locations, adjacent highway or area lighting may satisfy the minimum lighting levels required at the tram stop. At these locations, it will not be necessary to provide additional lighting at the tram stop.

All the crossings on the Blackpool Tramway are or will be at the required standards once the full upgrade of the system has been completed.

We have attached a copy of the works guidance.



Works Information Track Works, Highway Works and Tram Stops

Status: Implemented

38. **Metrolink RATP DEV UK** in its initial response on 26 November 2013 stated that:

Metrolink RATP DEV UK shared crossings with Network Rail are full barrier crossings so pedestrians cannot cross whilst trams or trains are approaching.

There is also a tramway only level crossing which again is currently a full barrier level crossing. As such time that some or all of these crossings become tramway road crossings, we will fully review the lighting in these locations. The timescale for the change to tramway road crossings is envisaged to be the end of 2014.

Metrolink RATP DEV UK has a number of rural crossings which are remote from stops and platforms and are unlit, but all have reflective edges and countdown markers to alert the tram driver of their position. These crossings will be reviewed as part of recommendation 2 with the action due for completion by the end of February 2014.

Status: In-progress

39. **Tram Operations Limited** in its initial response on 4 December 2013 stated that:

Tram Operations Limited considers that the drafting of such guidance should be led by UK tram systems acting together and believes that UK Tram is intending to write to you.

We believe that the view that this recommendation be dealt with at a national level is reinforced by the fact that it is addressed also to Network Rail and that it requires RSSB research (not yet concluded) be taken into account.

Tram Operations Limited is not therefore in a position to indicate a timescale.

40. On 14 April 2014 ORR wrote to Tram Operations Limited seeking details on its approach to providing adequate pedestrian lighting at level crossings. On 9 May 2014 Tram Operations Limited stated that:

Tram Operations Limited's view is that, at system level, a review of design relating to infrastructure should involve the Infrastructure Manager.

London Tramlink is now piloting the introduction of LED lighting at tram stops and footpath crossings. The current standard of lighting remains unchanged from that as originally installed at the time of construction in line with the Performance Specification.

The LED project has been deemed acceptable and the decision to replace all current lighting will be subject to another submission for Modifications Panel approval. It has been agreed with London Tramlink that the submission will need to "take into account the following factors:

- sufficient illumination of the crossing surface to enable pedestrians to see it;*
- the possible impact on the visual capabilities of pedestrians using the crossing, in particular with respect to glare affecting their ability to detect*

approaching trams."

Tram Operations Limited has yet to consider any RSSB research findings into these aspects of foot crossing safety.

Status: In-progress

41. **National Express Midland Metro** in its initial response on 5 December 2013 advised that:

National Express Midland Metro does not have specific lighting installed on its pedestrian crossings. In the absence of recorded incidents, NXMM does not consider it is appropriate at this time to install lighting on its pedestrian crossing infrastructure. As a result the issue of guidance is not relevant in this instance. NXMM will however, continue to review the emerging findings of the RSSB research project T984 and will consider the adoption of industry best practice when it becomes apparent.

[National Express Midland Metro has no pedestrian crossings on its segregated tramway.]

Status: Not applicable

42. **Stagecoach Supertram Ltd** in its initial response on 11 December 2013 stated that:

- a) *This is currently under review; areas have been identified where additional lighting is required. This lighting has been procured and fitted in line with our internal guidance on lighting.*
- b) *A further review of the route risk assessment in relation to lighting will be conducted on receipt of the industry guidance.*

43. On 14 April 2014 ORR wrote to Stagecoach Supertram Ltd asking if it had guidance on the best means to illuminate pedestrian crossings. On 9 May 2014 Stagecoach Supertram Ltd stated that:

Stagecoach Supertram Ltd currently has no guidance in place regarding the best way to illuminate pedestrian crossings. Further to our previous correspondence, additional areas have been identified where lighting can be improved and we are currently working with the PTE to implement the changes required. In terms of the guidance required, we will continue to review and will discuss further with UKTram regarding the standards other operators for reference going forward.

44. On 28 July 2014 ORR wrote to Stagecoach Supertram Ltd seeking an update on progress on action being taken. On 28 July 2014 ORR Stagecoach Supertram Ltd stated that:

Stagecoach Supertram Ltd expects UK Tram to lead on this and not the operator, as this should be industry agreed guidance.

Status: In-progress

45. **Nottingham Trams Limited** in its initial response on 6 February 2014 stated that:

The reviews and risk assessments undertaken following the 2008 and 2012 accidents considered crossing illumination. These comply with relevant regulations and planning requirements. They strike the appropriate balance between illuminating the crossings while avoiding glare and introducing light pollution to the environment.

The high level floodlight discussed in the 2012 RAIB accident report was installed by Network Rail in response to the 2008 fatal accident where the low level of lighting was considered as a causal factor.

We will cooperate with industry investigations and any resulting guidance into appropriate crossing illumination.

Status: In-progress

Recommendation 4 Summary Statuses:

- Network Rail: *Implementation on-going*
- Blackpool Transport Services Ltd: *implemented*
- Metrolink RATP DEV UK: *In-progress*
- Tram Operations Limited: *In-progress*
- National Express Midland Metro: *Not applicable*
- Stagecoach Supertram Ltd: *In-progress*
- Nottingham Trams Limited: *In-progress*

Tram operators have to take account of the findings of RSSB's research project T984 which is expected to be published by 30 September 2014.

ORR will update RAIB by 19 December 2014 on actions being taken to address this recommendation.