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

Dear Carolyn,

RAIB Report: Lebanon Road - Tram running with doors open on London Tramlink, Croydon

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 6 March 2014.

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

We expect to update you on progress with regard to recommendation 5 by 2 October 2015 and recommendation 8 by 29 May 2015.

Where recommendations are being reported as 'Implementation on-going' ORR will continue to monitor progress and will advise RAIB when actions being taken to address this recommendation have been completed.

We do not propose to take any further action in respect of recommendations that have been reported as implemented unless we become aware that any of the information provided becomes inaccurate, in which case we will write to you again².

We will publish this response on the ORR website on 17 March 2015.

Yours sincerely,

Russell J Keir

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

² In accordance with Regulation 12(2)(c)

Initial consideration by ORR

1. All 8 recommendations were addressed to ORR when the report was published on 6 March 2014.
2. After considering the report/recommendations, ORR passed recommendations to the following asking them to consider and where appropriate act upon them and advise ORR of its conclusions.
 - Recommendations 1, 2, 6 & 8 – Tram Operations Ltd.
 - Recommendations 3 & 7 – London Tramlink.
 - Recommendation 4 – UK Tram Operators.
 - Recommendation 5 was addressed to The Office of Rail Regulation.

The consideration given to each recommendation is included below.

Recommendation 1

The intention of this recommendation is to minimise driver distraction from communicating or attempting to resolve faults while on the move, and to improve safety-critical communications in abnormal working conditions.

Tram Operations Ltd should revise its policy on verbal communications to:

- reinforce rules on the avoidance of communicating with drivers by mobile phone while trams are moving (paragraph 104);
- minimise, where possible, communication by radio while trams are moving particularly for complex issues (such as the resolution of faults) and
- enhance the use of read backs for safety-critical communications in abnormal, degraded and emergency scenarios.

Steps taken or being taken to address the recommendation

3. In its response of 1 May 2014 First Tram Operations Ltd provided the following information:

The procedure for use of mobile telephones in the event of the degradation (or failure) of the tram radio system has been reviewed and revised in draft form. The section prohibiting the use of mobile phones when trams are moving has been reinforced with one exception remaining in a separate procedure, namely, that relating to Tram recovery (where cab to cab communication is required by means of back to back radios or mobile phones).

The procedure for the use of the radio system has been reviewed and revised in draft form. This now includes a requirement to minimise communication, where possible, while trams are moving: in particular that a tram should be stopped if the complexity of the communication is likely to give rise to pressure or risk of distraction upon the driver.

The draft procedure is also now more specific about the circumstances when 'read backs' are required in abnormal, degraded and emergency conditions; namely, in the description of such conditions and any ensuing safety-critical instruction. These revisions will be formally issued and briefed to controllers and drivers by July 2014.

4. First Tram operations Ltd provided the following update on 29 August 2014.

The amended procedure (as described above) for the use of mobile telephones in the event of the degradation (or failure) of the tram radio system has been re-issued and briefed to Control Room staff. Minor amendments have been made since and the procedure issued again, prior to the briefing of drivers which should be completed by the end of September [2014].

The amended procedure (as described above) for the use of the radio system has been re-issued and briefed to Control Room staff. Minor amendments have been made since and the procedure issued again, prior to the briefing to drivers which should be completed by the end of September [2014].

6. On 18 December 2014 First Tram Operations Ltd confirmed that the briefings to drivers on the amended procedure had been completed on 2 October 2014.

ORR decision

7. ORR, in reviewing the information provided by First Tram Operations Ltd, has concluded that in accordance with the Railway (Accident Investigation and Reporting) Regulations 2005, it has:

- taken the recommendation into consideration; and
- has taken action to implement it.

Status: Implemented

Recommendation 2

The intention of this recommendation is to improve the fault handling responses of drivers and controllers by providing them with a better understanding of fault modes, overrides, and resolution options.

Tram Operations Ltd should revise its training modules and procedures on fault handling to achieve:

- improved awareness amongst drivers and controllers of critical fault modes, the effects of operating override switches (including the fault override and the driver's emergency door release) and how to respond to faults, including guidance on co-operation between drivers and controllers; and
- clarification of the procedure for handling critical faults such as Alpha faults, including explicit guidance for defined circumstances (such as how many attempts should be made to rectify a fault and when the tram should be taken out of service).

Steps taken or being taken to address the recommendation

8. In its response of 1 May 2014 First Tram Operations Ltd provided the following information:

A technical advisor, with experience in fault modes relating to both the Bombardier CR4000 and Stadler SVT fleets, has been appointed by Tram Operations Ltd to undertake a revision of its training modules and procedures on tram fault handling.

These revisions are not expected to be complete until March 2015, which period allows time to liaise with London Tramlink (the owner of both fleets) and/or Bombardier (the maintainer of both fleets). Tram Operations Ltd will be largely reliant upon the technical understanding of others. Once completed and formally issued, these revisions will be briefed to controllers and drivers.

However, following the incident, controllers and drivers were re-briefed on the correct procedure to follow in the event of a status message indicating that a fault override switch has been operated. Controllers have also recently been re-briefed on the current Control Room procedures for tram fault handling.

9. First Tram operations Ltd provided the following update on 29 August 2014:

First Tram Operations Ltd's technical advisor has been redrafting the manual of fault modes, overrides and resolution options relating to fault codes on the Bombardier CR4000 tram. There will be a version for the driver as well as for the controller. They will be validated by London Tramlink (owner of the fleet). Once formally issued, there will be briefings to drivers and controllers. The same exercise will then be undertaken for the Stadler SVT tram. As previously reported the whole process is expected to be completed by March 2015.

ORR decision

10. ORR, in reviewing the information provided by First Tram Operations Ltd, has concluded that in accordance with the Railway (Accident Investigation and Reporting) Regulations 2005, it has:

- taken the recommendation into consideration; and
- is taking action to implement it (March 2015).

Status: Implementation on-going: *ORR will continue to monitor progress and will advise RAIB when the actions to address this recommendation have been completed.*

Recommendation 3

The intention of this recommendation is for improvements to be made to the driver's cab displays and labelling to minimise the chance of the driver not noticing that the doors are open and of misunderstanding the operation of override switches.

London Tramlink, in conjunction with Tram Operations Ltd, should improve cab displays and labelling in all of its trams. This should include, but not be limited to:

- a prominent indication of the status of the doors (for example, by changes to the cab panel indicator light, or by introducing an audible warning); and
- information provided to the driver about the fault override function and other safety-critical overrides (such as the emergency door release), including the switch label and the associated alert on the message display, to clarify its purpose and effects of its operation.

Steps taken or being taken to address the recommendation

London Tramlink

11. In its response of 30 April 2014, London Tramlink provided the following information:

London Tramlink will undertake a Human Factors review to understand what improvements can be made to improve cab displays and labelling. A separate work stream has already identified some improvements in labelling and the location of door controls on the Stadler trams – a similar review will take place for the CR4000s. This will be complete by September 2014. We will then review the findings and before any changes are made we will ensure that we are not contradicting any existing European norms or standards

London Tramlink will review and update the fault code books for both types of trams. These will then be reissued to First Tram Operations Ltd. This will be complete by the end of July 2014.

12. On 28 August 2014 London Tramlink confirmed that the review for the CR4000s is still planned to be completed by the end of September 2014. It also confirmed that the review of the fault code books has been completed. And the data has been issued to First Tram Operations Ltd for inclusion in the re-drafting of the manual of Fault Modes, Overrides and Resolution Options. First Tram Operations Ltd has undertaken to complete this work by March 2015 as outlined on its response to recommendation 2.

13. On 3 December 2014 London Tramlink provided the information below in relation to the proposed human factors review:

A human factors review was completed by the end of September 2014. This included a practical site review in both Stadler (SVT) and Bombardier (CR4000) tram cabs. The report provided a number of possible options for the improvement of displays / labelling.

An initial meeting was held with all interested parties in October to ‘sense check’ the options. On the CR4000s we have agreed to introduce an additional audible warning to alert the driver if an inadvertent attempt is made to move a tram when the passenger’s doors are open after the fault override switch has been operated. Although it is no longer possible to inadvertently operate the fault override switch, the new audible warning will be an aide to the driver in the event that the fault override was operated for reasons other than a door fault. In the case of the SVT vehicle, there is a specific override switch for door faults.

These changes need to be worked up into a feasible design solution and then need to go through our internal change assurance arrangements. At this stage we estimate that the change could be implemented by end of June 2015.

We have identified some opportunities to improve labelling for some controls within the CR4000 cab. Some of these can be implemented by the end of February 2015 whilst others may be dependent upon a review of the messages displayed on the BISS monitor which is being undertaken with the assistance of the Original Equipment Manufacturer (OEM).

First Tram Operations Ltd

14. In its response of 1 May 2014 First Tram Operations Ltd provided the following information:

While we will be assisting London Tramlink in considering improvements in cab displays and labelling for both fleets, we are not sure that it is always feasible for such recommendations to be followed in every respect.

Trams, like other classes of road vehicle, are produced for the European and global market and fundamental items such as driving controls, indications and displays are already developed to meet established criteria for road vehicles, and where appropriate, rail vehicles.

While certain features can be sensibly varied for individual customers, any modifications made in the context of one vehicle type may well have to be applied to tramcars of different design or manufacture, albeit that they have formally met current established criteria.

It might not be appropriate, effectively, to create standards that may not be recognised by whatever harmonisation requirements evolve for Urban Rail and, particularly for tramways and tramcars.

Where there is a case to challenge principles of generic vehicle design, the appropriate place to direct recommendations for change might be the established EU or international forum responsible, in the same way as for other classes of vehicle such as bus and coach.

First Tram Operations Ltd will however seek to reach a common position with London Tramlink. Again, we will largely be reliant upon the technical advice of others. We understand that London Tramlink intend that this be completed by September 2014.

15. First Tram operations Ltd provided the following update on 29 August 2014: *Proposals for joint review (and reaching a common position with London Tramlink) are expected in September 2014. Improvements, arising from a separate work stream activity, have already been jointly agreed regarding the re design, location and labelling of the door controls on the Stadler SVT tram.*

ORR decision

16. ORR, in reviewing the information provided by London Tramlink and First Tram Operations, has concluded that in accordance with the Railway (Accident Investigation and Reporting) Regulations 2005, it has:

- taken the recommendation into consideration; and
- is taking action to implement it by the end of June 2015.

Status: Implementation on-going. *ORR will continue to monitor progress and will advise RAIB when the actions to address this recommendation have been completed.*

Recommendation 4

The intention of this recommendation is to minimise the risk of incidents involving accidental operation of safety override devices occurring elsewhere on UK tram networks.

UK tram operators should conduct an assessment of controls in driving cabs in their current and future fleets to identify those which override safety systems, the risk of drivers inadvertently operating those controls and, where reasonably practicable, design and implement solutions to minimise such risk based on the lessons from this investigation.

Steps taken or being taken to address the recommendation

Blackpool Transport Ltd

17. In its response of 8 May 2014 Blackpool Transport Ltd provided the following information:

Company policy and training indicates that prior to activation of override switches passengers will be alighted.

The Blackpool Flexity 2 tram has been designed and built to meet all current regulations.

The cab design is such that all the override switches are located on a single panel to the left of the drivers seating position. The top row is all override switches plus one at the bottom left.



Each has a spring loaded cover which locates over the correctly positioned override switch. The cover is held in position with a seal that must be physically removed for the cover to lift, to allow operation the override switch.



Correctly positioned
override switch



Seal removed from
override switch cover



Switch in override
position

The current design of the Flexity 2 makes it impossible to inadvertently override a safety system without physically removing the seal first.

To operate an override switch, permission must be obtained via the vehicle radio from the depot controller or vehicle engineering department before the seal is broken and switch operated.

Drivers and engineers are aware that if any of the override switches are activated passengers will be alighted.

A fault prompting an override switch to be activated would be a category (A) fault which means "Stop the vehicle immediately and contact depot". Once permission has been given to operate an override switch, the driver must remove the seal (indicated above) before the switch can be activated. Once the switch has been activated the driver will receive an audible warning in the drivers cab. There will also be a message on the IDD indicating which override switch has been activated. Once the override switch is activated the fault category will be reduced to a (B) fault which means "Return to depot without passengers"

The B and C fleet vehicles do not have any override switches fitted.

ORR decision

18. ORR in reviewing the responses and considering provided Blackpool Transport Ltd has concluded that in accordance with the Railway (Accident Investigation and Reporting) Regulations 2005, it has:

- taken the recommendation into consideration; and
- has taken action to implement it.

Status: Implemented.

London Tramlink

19. In its response of 30 April 2014 London Tramlink provided the following information:

As a result of this incident, the switch concerned was quickly modified to ensure it could not be inadvertently operated. London Tramlink has now identified all controls within the drivers cab on both types of trams that could be used to override safety systems. On the Variobahn trams there are six buttons which already have caps and seals fitted to ensure they cannot be switched. There are two further switches which are key operated. There are no other switches that can override safety systems that could be inadvertently operated.

On the CR4000 we have identified three switches which will have a new, more robust seal fitted by the end of June 2014 and then a permanent modification of a cap by the end of August 2014.

20. On 28 August 2014 London Tramlink confirmed that the tags on the CR4000 have been modified on the three switches that were highlighted as having the ability to override the safety systems. London Tramlink also stated:

A decision will be taken on whether further modifications will be undertaken following the completion of the Human Factors review as caps may not be the optimal solution.

21. The following update from London Tramlink was received on 3 December 2014:

Robust tags have been fitted to the three remaining switches; we believe that these tags will prevent the switches from being inadvertently moved. However, the Human factors review identified that one of these switches has a single position (of 5 possible positions) that under specific circumstances allows for the release of the brakes on all three bogies.

Although application is by way of a spring-return switch (requiring manual retention), the review concluded that this particular function should be protected by being 'segregated' to a single purpose switch (capped and sealed).

The proposal is that another of the remaining switches (Emergency Door Release) be removed to facilitate this change which will align the operation of this function to that of the SVT tram (the switch being removed has no useful function). This change needs to be worked up into a feasible solution and then go through our internal change assurance arrangements. At this stage we estimate that the change could be implemented by the end of June 2015.

ORR decision

22. ORR in reviewing the responses and considering provided by London Tramlink and First Tram Operations has concluded that in accordance with the Railway (Accident Investigation and Reporting) Regulations 2005, it has:

- taken the recommendation into consideration; and
- has taken action to implement it.

Status: Implemented.

First Tram Operations Ltd

23. First Tram Operations Ltd provided the response below on 29 August 2014:

The RAIB report confirmed that Bombardier had already installed a modified fault override switch in the cabs of the CR4000 tram fleet. This modification (completed in August 2013) provided for a cover (with a robust seal) protecting a key operated switch (replacing the former rotary switch). London Tramlink has since identified three other switches in the CR4000 tram which it proposed should also be provided with covers (protected by robust seals). However, this proposal, for joint agreement, will be subject to the Human Factors review being undertaken by London Tramlink in relation to recommendation 3.

24. ORR, in reviewing the information provided by London Tramlink, has concluded that in accordance with the Railway (Accident Investigation and Reporting) Regulations 2005, it has:

- taken the recommendation into consideration; and
- has taken action to implement it.

Status: Implemented.

Metrolink RATP Dev UK (Manchester Metrolink)

25. In its response on 5 May 2014 Metrolink RATP Dev UK provided the following information:

Metrolink RATPDEV UK carried out an assessment of the cab controls of a current M5000 tram. Although additional M5000 trams have been ordered by Transport for Greater Manchester (TfGM), the design of the cab controls remains the same. With the last of the T68 fleet being removed from passenger service in spring 2014, the assessment concentrated on the M5000 tram.

It was found that the override switches are a vertical line in comparison to the CR4000 tram but even though all switches are sealed with lead seal, all are black with black shrouds with no clear differentiation other than the function label below the switch.

In order to learn from the lessons of the investigation, Metrolink RATP Dev UK have looked at a number of options to reduce the risk of drivers inadvertently operating the safety override switch, these included replacing the switch with a key switch; fitting a key switch with sealed cover; a replacement switch with a shorter finger that allows the switch to be covered and a coloured shroud for the base of the switch.

Metrolink RATP Dev UK proposes that the replacement switch with cover will be fitted to the fleet by the end of August 2014 subject to component delivery. The modification will be completed during the M5000 'C' examination which is carried out at 20,000km intervals. If it is identified that a tram modification may not be completed within the timescale, it will be carried out as a special item to ensure completion by the end of August 2014. Should there be a delay in the delivery of the parts, Metrolink RATP Dev UK will advise ORR of any impact there will be to the

completion date. The change will be implemented through the change control procedure which will require approval from TfGM.

26. On 2 December 2014 Metrolink RATP Dev UK confirmed that the switches had been received but due to a 12 week lead time on the shroud covers, the delivery date was expected to be mid-September. This had impacted the original target date for completion of the works and a revised date of end of October 2014 had been set. Work has now taken place to fit switches and shroud covers and to date 67 trams have been fitted with a further 25 requiring the work. It is now intended to fit all switches and shrouds by the end of 2014.

ORR decision

27. ORR, in reviewing the information provided by MetroLink RATP Dev UK, has concluded that in accordance with the Railway (Accident Investigation and Reporting) Regulations 2005, it has:

- taken the recommendation into consideration; and
- has taken action to implement it.

Status: Implemented.

National Express Midland Metro (NXMM)

28. In its response received on 30 April 2014 NXMM provided the information below in italics:

With regard to the existing fleet of Ansaldo T69 trams, these trams are programmed to be removed from service by Q1 2015. NXMM will undertake to review its incident history to ascertain whether any related incidents have occurred during the operation of the T69, and if such incidents have occurred, consider any relevance to this report and its findings. Target completion date: 31 May 2014.

29. On 7 August 2014, NXMM confirmed it had completed the review above with the result that no related incidents were believed to have occurred during the life of the T69 tram fleet according to the records available.

NXMM will also inspect the interior of the T69 tram cab to ascertain the correct installation of security tags on switches and circuit breakers to prevent their accidental operation. It will also ensure that these controls are accurately labelled with descriptors accurate to their function. Target completion date: 31 May 2014.

30. On 7 August 2014 NXMM confirmed that the T69 fleet was subject to a full fleet check of the miniature circuit breakers that are accessible. These circuit breakers are labelled with their appropriate function. All of the safety critical switches located in the drivers cab are wire and lead sealed. This has to be physically removed to operate the switch. Driver training details all of these switches and drivers are instructed not to operate them unless instructed by the control room staff via the engineering team leader. Drivers carry out a check of these switches on preparation of the vehicle before service and report if any of the lead seals are broken.

NXMM does not intend to carry out any changes to the cab controls on the T69 (because of their imminent withdrawal from service) unless a particular risk is

identified through the incident review detailed above. NXMM will seek to mitigate any identified risk appropriately.

NXMM will make Centro (the fleet owner) aware of this response, and request that the RAIB report is taken into account should these trams be either sold on or returned to service on the Midland Metro at some point in the future. Target completion date: 31 May 2014.

31. On 7 August 2014 NXMM confirmed it had sent a copy of the above response to Centro on 30 April 2014.

With regard to the new 'CAF Urbos 3' fleet, that is due for implementation by Q1 2015. These trams were procured and owned by Centro. NXMM was not party to the initial design of the cabs of these trams, which are an established product compliant with all applicable standards for tramcar design. NXMM was party to a subsequent design review process to tailor the design of the product to the specific operational requirements of the Midland Metro and as part of this fed back its views for consideration. The initial design solution has also been reviewed by ORR as required under the legislative framework for Midland Metro, and the trams and infrastructure are subject to ORR approval prior to entering public service.

Considering this context, NXMM will undertake to carry out a review of the switches and circuit breakers on the tram that enable it to be operated with overridden safety systems and ensure that they are accurately labelled, with the labelling accurately describing the operation of each switch or circuit breaker. Target completion date: 31 July 2014.

32. On 7 August 2014 NXMM confirmed it had completed the above review and is satisfied that the relevant switches and circuit breakers are labelled clearly and appropriately by means of an engraved aluminium panel located adjacent to the equipment.

NXMM will also undertake to prepare a document designed to control the operation of any such switches or circuit breakers for the purposes of recovery in the event of a tram failure. Target completion date: 31 July 2014.

33. On 7 August 2014 NXMM reported it was preparing a document drawn from the recently supplied drivers operation and engineering maintenance manuals. This was expected to be completed and issued in time for the trams entry into public service on 5 September 2014.

34. On 4 December 2014 NXMM confirmed that a document has been produced from the supplied CAF documentation relating to the new fleet entitled 'HMI Event Specification' (Document No. Q39.98.212). This document details error and failure codes displayed on the tram control desk touch screen computer and details the actions to be taken to either recover from the failure or the methodology for recovery of the tram off the main line. The document is contained in the Metro Control Room and drivers are instructed to contact the Duty Controller if their tram displays an error code. The controller will then refer to the above document in order to instruct the driver on the appropriate action to recover the tram. This includes the requirement to refer to the Engineering Department for specific faults to enable recovery or rectification.

NXMM will also undertake to carry out a review of the driver's ability to access and operate these devices. Target completion date: 31 July 2104.

35. On 7 August 2014 NXMM informed us that this action was still on-going. NXMM has also applied to obtain the relevant approvals from Centro to commission CAF to replace a number of driver's key access locks with engineer's key access locks to limit access to safety critical switches and circuit breakers, and to secure the relevant selector switches and circuit breakers located behind these panels with a wire tag seal. Discussions relating to this are on-going at this time. NXMM has mitigated the identified risk of incorrect operation by procedural controls, equipment access door labelling and staff training. This will remain in place until (if) an engineered solution is implemented.

36. On 4 December 2014 NXMM confirmed it had reviewed the methodology for access and operation of MCB's and switches related to degraded safety critical systems and as a result, the following control measures were implemented prior to the first CAF Urbos 3 trams entering service in September 2014.

- All panels in the tram cabs with MCBs and system isolators inside have been fitted with a triangular panel lock. The keys for these locks have been issued to engineering staff only to prevent unauthorised access by drivers and other operational staff. Note: drivers are issued with an 8mm square key only to allow for access to emergency equipment contained in panels located in the tram passenger saloon. There is one safety critical switch located behind one of these saloon panels and this has been wire locked to prevent unauthorised operation
- All safety critical system switches and isolators (all located behind panels fitted with triangular keys with the exception of the one detailed above) have been wire locked in their normal operating position.
- The condition of all the wire locks is checked on the 15 day routine exam.

37. In respect of the T69 tram the safety critical switches were checked on a fleet check between the 19 and 22 June 2014 for the integrity of the wire locks installed and any identified non-compliances were rectified. This check related to a series of isolation switches for various systems and one MCB relating to the door safety loop. These wire locks are checked on the routine 14 day exam. Drivers are trained that they are not to access or operate any of these switches or the MCB under any circumstances.

ORR decision

38. ORR, in reviewing the information provided by NXMM, has concluded that in accordance with the Railway (Accident Investigation and Reporting) Regulations 2005, it has:

- taken the recommendation into consideration; and
- has taken action to implement it.

Status: Implemented

Nottingham Trams

39. In its response on 6 May, 2014 Nottingham Trams provided the following information:

NTL operate 15 Bombardier Incentro trams and are currently commissioning a further 22 Alstom Citadis trams.

Incentro Tram

The Incentro trams are provided with safety override switches positioned on the dashboard to left hand side and slightly to the rear of the driver's seat. Each is clearly labelled with its function and operating positions.

Each has a hinged cover that is secured in place by a seal that requires breaking and removing to allow the cover to be opened. In each case the override function is gained by rotating the switch through 90 degrees from its normal position. The override switches utilise the same keyway as the driver's key. To activate the override switch the driver must first stop the tram, remove their key from the Main Switch (the direction controller) and then use it to rotate the switch and then return it to the Main Switch to re-activate the tram for the onward journey.

The design and process described above precludes accidental activation of any emergency override switch.

When an override switch is deployed a message appears on the drivers control screen providing a continuous warning on the degraded status of the relevant system. This is located on the driver's dashboard in the normal sightline. The driver must acknowledge the warning in order to continue and a reminder message is then continuously displayed. The warning message is repeated each time the Main Switch is turned off and on and then the fault clearance process must be repeated until the isolation switch in question is returned to normal. Additionally, the event is recorded in the vehicle data logger to provide a history of the isolation.

The indicators described above provide a constant reminder to the driver so that they remain alert to the condition of the vehicle.

Citadis Tram

The Citadis isolation switches are located in the same general area of the cab as the Incentro devices. They are protected by sprung covers held in place by seals that must be broken and removed to access the rotary isolation switches below. The switch position can be seen through the cover in normal running and cover must be open to deploy the switch into the isolate position. This combination precludes accidental operation and provides a continuous visual indication of the switch position. In a similar way to the Incentro a message is given to driver on the dashboard mounted information display.

ORR decision

40. ORR, in the information provided by Nottingham Tram, has concluded that in accordance with the Railway (Accident Investigation and Reporting) Regulations 2005, it has:

- taken the recommendation into consideration; and
- has taken action to implement it.

Status: Implemented

Stagecoach Supertram Ltd

41. In its response on 24 March 2014, Stagecoach Supertram Ltd provided the following information:

A full risk assessment of the current Fleet's controls in the driving cabs which override Safety Systems will be carried out in order to assess, where reasonably practicable, design and implement solutions to minimise risks of accidental activation. The details of the measures to be implemented will be confirmed following the assessments. The assessments will be carried out by 31 May 2014.

42. Stagecoach Supertram Ltd provided the following update on 16 July 2014:

Current Fleet

A full review of our current fleet and the driver cabs was conducted on Wednesday 16th July 2014. The review found the following to be in place:

Override Safety Systems (See Picture 1)

Supertram current fleet have 6 safety override switches which are situated to the right hand side of the driver's seat, of which have the following functions:

Converter Start (Emergency) – Requires addition of a battery pack. Drivers are not able to access areas to rectify fault.

Door Proving Loop Cut Out – Bypasses door safety systems. Tram could be driven with doors open when switch has been operated. **DOOR** will be illuminated on the Annunciator panel.

TCU 1 (Traction Control Unit) – This switch may be activated if the tram has a drive fault on the traction control unit at No1 end. The switch will only be activated on instruction from the control room. Operation of the switch will restrict the maximum tram speed. Additional disc braking applies due to regenerative braking not in operation on the isolated end.

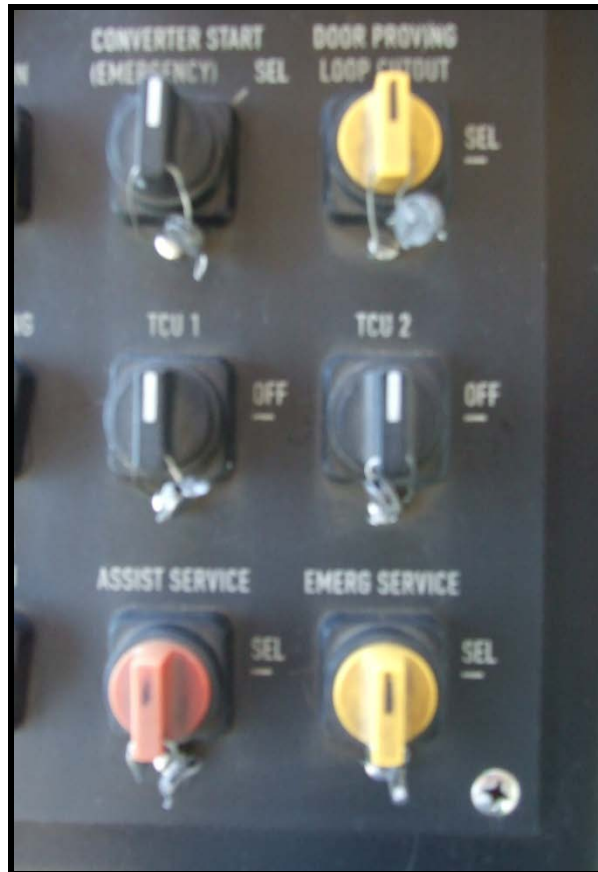
TCU 2 (Traction Control Unit) – As above but applies to the No2 end of the tram.

Assist Service–Used when the coupling of trams is necessary. Provides tram to tram communication plus extra torque and braking properties.

Emerg Service (Emergency) – Used to recover a tram with a major fault. Not essential items are inoperative, interior emergency lighting only. Passengers are not transported when in operation. Driver must be accompanied.

As a result of these functions all of the switches are fitted with metal switch seals, which need to be physically broken in order to enable. As a result the switches cannot be accidentally activated. In addition the clear labelling of the override switches helps provide clear communication to the driver regarding what the switch relates to.

Picture 1 – Override Safety System



Drivers must only activate the switches on the instruction from OCC. If this communication was to be misunderstood and the driver enabled the incorrect switch by accident, there are further controls in place to alert the driver of this. The Annunciator Panel as seen in Picture 2 provides a visual indicator and audible alarm to the Driver in the event of the enabling of Override Safety System switches. The Drivers receive Fault finding training that outlines the meaning of each indication.

Whilst conducting the review, concerns were raised with the strength of the panel lighting due to fading of the section colour and strength of lighting behind screen. Although the light could be seen, this most definitely could be improved. As a result a further action has been raised in order to review the panel display to ensure the control works as designed and remains suitable and sufficient.

In addition the testing of the Override System, the visual indicators and audible alarms are to be included on a Scheduled Vehicle Maintenance regime going forward to ensure the controls continue to work as per the original design.



Tram Train

The Tram Train assessments are still in progress with a request made that this investigation is reviewed when considering cab layout. Currently awaiting drawing of cab layout, including system override switches.

The review has found that the Override Safety System Controls that are currently in place are suitable and sufficient to prevent accidental activation of the switches. Following the implementation of the actions outlined these controls will; further be enhanced to ensure they continue to work as designed and clearly communicate to the driver what Override Safety System they have enabled.

ORR decision

43. ORR, in reviewing the information provided by Stagecoach Supertram, has concluded that in accordance with the Railway (Accident Investigation and Reporting) Regulations 2005, it has:

- taken the recommendation into consideration; and
- has taken action to implement it.

Status: Implemented

Conclusion

44. ORR has concluded that all tram operators have taken all reasonable measures to address the associated risk with this recommendation.

Recommendation 5

The intention of this recommendation is to ensure that appropriate guidance on ergonomics principles for cab interface design is constantly available to tram operators, particularly in terms of protecting safety-related controls from accidental operation.

The Office of Rail Regulation should ensure that UK tram operators publish suitable guidance on ergonomics principles for cab interface design (with reference to appropriate tramway, railway and European standards), and identify where such guidance is to be found in the long term. This shall include guidance on protecting safety-related controls from accidental operation.

Steps taken or being taken to address the recommendation

ORR met with RAIB on 21 January 2015 to discuss the background to the recommendation. RAIB confirmed that the issue it had identified is that ORR's guidance on Tramways refers to the withdrawn Principles and Guidance Part 2 section F Trains (RSPG Part 2F) for 'further guidance' (section 263). That document contained specific recommendations at sections 303 to 306:

- 303:** Where facilities exist to override any safety system, they should not be readily accessible under normal operations. These facilities should only be available under a sealed release system. When override facilities are in use, there should be clear visible warning that this is the case. Appropriate functional limitation may be required to ensure safety is maintained.*
- 304:** Where appropriate, controls should be interlocked to prevent damage or danger.*
- 305:** Controls that may need to be operated to prevent or minimise danger, should not be locked in the potentially unsafe position.*
- 306:** Controls should be positioned so that train crew are unlikely to move them accidentally to an unsafe position.*

RAIB made the recommendation because RSPG 2F is no longer available from ORR's website; if it had been they confirmed that it would not have made the recommendation.

It was agreed that ORR could discharge this recommendation by either returning the RSPG documents to some sort of Historical Guidance section on the public website, or publishing a one page supplementary guidance note to sit alongside our other existing Tramway Technical Guidance Notes.

Or,

By amending the existing Tramway technical Guidance Note 'Tram Design and Construction, Supporting Guidance to RSP2 – Section 8'.

ORR is considering publishing a separate one page note including the text formerly contained in RSPG 2F sections 303 to 306.

Status: In-progress. ORR will update RAIB by 2 October 2015.

ORR also wrote to UK tram operators to consider and where appropriate act upon them and advise ORR of their conclusions. Their considerations can be found at Annex B.

Recommendation 6

The intention of this recommendation is to improve the design of passenger controls and displays (emergency alarms, intercoms etc.), through shape, colour, symbols and/or signage, so as to make their operation more obvious and intuitive to the user in the event of an emergency.

Tram Operations Ltd should take steps to improve the clarity and consistency of passenger controls and displays on its trams, taking into account the findings of RSSB project T052c as appropriate.

Steps taken or being taken to address the recommendation

45. In its response of 1 May 2014 First Tram Operations Ltd provided the following information:

Whilst First Tram Operations Ltd may recommend improvements to passenger controls and displays on the trams it operates, it will not necessarily be in a position to implement them, both tram fleets being owned and maintained by others.

First Tram Operations Ltd has, however, arranged to meet London Tramlink with a view to discussing the findings of RSSB project T052c (Signage and illumination of Emergency Door Release mechanisms in passenger vehicles).

By way of comment at this stage, we would point to the same concerns as above under recommendation 3; that is, regarding recommendations to modify fleets of different design and manufacture which thereby effectively set a standard which new designs for the European market neither meet nor are required to meet. First Tram Operations Ltd is unable at this stage to offer a timescale for the conclusion of its deliberations on this recommendation or, thereby, for the implementation of any agreed way forward.

46. First Tram Operations Ltd provided the following update on 29 August 2014:

London Tramlink has conducted a review of passenger controls; namely the Passenger Intercom and the Emergency Door Release (on both the Bombardier CR4000 tram and the Stadler SVT tram) and the Emergency Alarm (on the Stadler SVT tram only).

Proposals have been submitted for joint approval, which relate to the colour, symbols and signage for these controls. It has been thought feasible to modify the design (shape) or functionality of the controls.

Arising from a separate work stream activity, London Tramlink has also proposed, for joint approval, the fitting of a flap over the Emergency Door Release on the CR4000 tram in order to prevent inadvertent use by young children (typically) and deter misuse by others. The revised signage takes this change into account. First Tram Operations Ltd is unable at this stage to offer a timescale for implementation of the way forward.

47. On 7 January 2015 we received the following update from First Tram Operations Ltd:

The Emergency Door Release on both the Bombardier CR400 tram and the Stadler SVT tram will be painted green. The associated symbols and signage (instructions on use) have been redesigned and will be on a green background.

A flap (painted green) will be fitted over the Emergency Door Release on the CR400 tram in order to prevent inadvertent use by young children (typically) and deter misuse by others. The revised signage takes this change into account.

The passenger intercom on the Bombardier CR400 tram will be painted red as it is on the Stadler SVT tram. The associated symbols and signage (instructions on use) have been redesigned and will be on a red background. Signage for both trams will use the term 'Driver Alert' (rather than 'Passenger Intercom').

There is a third passenger device on the Stadler SVT tram: an alarm handle. This will remain coloured red. The associated symbols and signage (instructions on use) have been redesigned and will be on a red background.

It has not been thought feasible to modify the design (shape) or functionality of the passenger controls

London Tramlink has confirmed that the new signage is planned to be fitted by the end of March 2015 and the repainting of the devices by the end of July 2015. The new flap over the Emergency Door Release on the CR4000 tram is also planned to be fitted by the end of March 2015.

ORR decision

48. ORR, in reviewing the responses and considering provided by First Tram Operations Ltd, has concluded that in accordance with the Railway (Accident Investigation and Reporting) Regulations 2005, it has:

- taken the recommendation into consideration; and
- is taking action to implement it by the end of July 2015.

Status: Implementation on-going: *ORR will continue to monitor progress and will advise RAIB when the actions to address this recommendation have been completed.*

Recommendation 7

The intention of this recommendation is to minimise the potential for miscommunications on London Tramlink by enhancing the quality of the radio system.

London Tramlink should develop and implement a programme to prioritise and expedite the planned upgrade of the radio system, to achieve an improvement in signal coverage and strength across the whole network (including tunnels) and reliable operation in adverse weather conditions (paragraph 102b).

Steps taken or being taken to address the recommendation

49. In its response of 30 April 2014 London Tramlink provided the following information:

London Tramlink has initiated a programme to introduce a new radio system across the network; this work stream has approved funding. The programme is at high level now with a projected completion date of the end of August 2015. We will be taking every opportunity to expedite the work.

50. On 28 August 2014 London Tramlink provided the update below:

The work is progressing, all ducting has been rodded and roped and work is currently being undertaken to clear the blocked ducts. Once this is completed it will allow the installation of the fibre cables which is a prerequisite for the introduction of the new radio system. The contract is due to be let to Team Simoco within the next 4 weeks for the provision of the new radio system. The programme for delivery will be agreed following award of contract.

51. On 19 December 2014 London Tramlink confirmed it had placed an order with Simoco, the radio provider, at the beginning of September 2014. The design has been developed to meet the requirements and is on schedule to be completed in early January 2015. Key dates for the programme are below:

- Completion of detailed design – January 2015;
- Simulated factory acceptance testing – February 2015;
- All fibre cable installed – June 2015;
- Commissioning tests – July 2015;
- Site acceptance testing – July 2015;
- Ready for use August 2015.

ORR decision

52. ORR, in reviewing the information provided by London Tramlink, has concluded that in accordance with the Railway (Accident Investigation and Reporting) Regulations 2005, it has:

- taken the recommendation into consideration; and
- is taking action to implement it by August 2015.

Status: Implementation on-going: *ORR will continue to monitor progress and will advise RAIB when the actions to address this recommendation have been completed.*

Recommendation 8

The intention of this recommendation is to enhance fault reporting between the operator, the infrastructure manager and the maintainer so that reported faults that could impact on safe running of the network are recorded properly and followed up within appropriate timescales.

Tram Operations Ltd should improve its fault reporting processes to ensure that faults are properly logged and tracked to resolution.

Steps taken or being taken to address the recommendation

53. In its response of 1 May 2014 First tram Operations Ltd provided the following information:

Currently First Tram Operations Ltd reports infrastructure faults to London Tramlink and tram faults to Bombardier, in both cases by means of bespoke database reporting systems.

Processes relating to the reporting of infrastructure faults will be enhanced such that First Tram Operations Ltd receives feedback relating to those faults which it has reported (actions and timescales). These will be reviewed by First Tram Operations Ltd. Any outstanding issues will be raised at formal periodic meetings (if not earlier).

Processes relating to the reporting of tram faults have been reviewed and are thought to be appropriate; timescales are reported to First Tram Operations Ltd on a daily basis and issues thereby reviewed at the same frequency. All these arrangements will be confirmed and briefed to appropriate staff by September 2014.

54. First Tram operations Ltd provided the following update on 29 August 2014:

We previously reported that processes relating to the reporting of tram faults had been reviewed and were thought to be appropriate. Bombardier timescales are reported to First Tram Operations Ltd on a daily basis and issues reviewed jointly with London Tramlink and Bombardier.

We also reported that the reporting of infrastructure faults (to London Tramlink) would be enhanced such that First Tram Operations Ltd receives feedback (actions and timescales) relating to those faults which it has reported. These would then be reviewed by First Tram Operations Ltd jointly with London Tramlink at periodic meetings.

These new arrangements have not been concluded; but it is still expected that they can be confirmed by formal procedure and briefed to the appropriate staff by September 2014.

55. On 23 January 2015, Tramlink confirmed that the systems were in place. However, the current system can produce the report data required, it is part of a much larger (100 page +) report. A new more specific report is to be generated on the asset management system.

The changes to the TfL SAP system are locked into a centrally controlled 12 week development and issue cycle for the software change so the new report is not yet live and a further update is expected at the end of April 2015.

ORR decision

56. ORR in reviewing the information provided by First Tram Operations Ltd has concluded that in accordance with the Railway (Accident Investigation and Reporting) Regulations 2005, it has:

- taken the recommendation into consideration; and
- is taking action to implement it.

Status: In-progress. ORR will update RAIB by 29 May 2015.

Recommendation 5

ORR also wrote to UK tram operators to consider and where appropriate act upon them and advise ORR of their conclusions.

Their considerations given to this recommendation are given below:

UKTram

5. No recommendations were directed to UKTram but as the industry body responsible for producing guidance UKTram provided the following information on 9 May 2014:

We note the recommendations made in the above report, dated March 2014 and would make the following comments from an industry viewpoint:

UKTram has no comments to make on Recommendations 1, 2, 7 and 8 but is concerned about the appropriateness of Recommendations 3, 4, 5 and 6 for the following reasons.

Tramcars like all classes of road vehicle are now produced for the European and global markets and whilst certain features can be varied to meet customer preferences, the fundamental items such as driver controls, indications and displays etc. are common and developed to meet established criteria for road vehicles and where appropriate, rail vehicles. There are two such criteria relevant to this report:

ROAD Directive 2001 85 EC PCVs Paragraph 7.6.5 for power operated doors and RAIL EN 14752 Body Entrance Systems 2005.

Both the EU Directives and national legislation for road vehicles give exemption to tramcars to take account of the fact that being rail borne and steered they cannot comply with all requirements, RSP2 recommends those parts of the criteria that are appropriate and should be followed.

In April 2011 the United Kingdom voted in favour of the adoption of the Urban Rail Survey Group final report proposals pursuant to the 'Urban Rail' mandate M/486 and it's "Proposed Programme for Standardisation in the field of Urban Rail". This includes the development of European Standards in response to the mandate which is being carried out by the relevant CEN or CENELEC technical committees including full involvement of RSSB through their UK Mirror Groups of which UKTram is a member. The broader perspective requested by the mandate includes the specific devices used in urban rail vehicles.

The Urban Rail Survey Group final report which was signed off this month contains appendices setting out the relevance of existing CEN/CENELEC standard to tramcars as well as to other modes of urban rail as determined by the appropriate experts from EU member states which included participants from TfL and UK Tram for Great Britain. Each standard is ranked according to the following criteria:

- 0 applicable to heavy rail only (High Speed and Conventional Rail)*
- 1 or 1G directly applicable to Urban Rail systems 1G is not limited to rail)*
- 2 applicable with adaptations to all or some categories of Urban Rail systems*
- 3 developed to Urban Rail systems only*
- 4 not suitable or important for Urban Rail systems*

The Urban Rail Survey Group concerned itself primarily with the analysis of CEN and CENELEC standards and produced 'fisches' setting out the need for new standards for each category of urban rail where gaps exist along with priorities for each. The process of developing the new standards is under way. The group also recognised and supported the application of UNICE road vehicle standards as being more appropriate for many tramcar applications and endorsed the continued use of these.

It was also recognised that urban rail, unlike main line railways, will remain outside the mandatory application through TSI's of railway standards and is already exempted from the road vehicle UNICE standards which are incorporated in EU law for other classes of road vehicle. Mandate M/486 sets out the clear intention of harmonising requirements for Urban Rail and particularly tramways and tramcars by identification and development of commonality in the use of EN and other standards to avoid obstacles to trade and promote common best practice. Agreement was reached that voluntary adoption of this approach would suffice and that any future changes would be through the mechanism set out in the mandate. Furthermore, existing national guidance and practice such as that in RSP2 was recorded and commitment was given to avoid development of any further bespoke requirements by the member states. UK Tram is in the process of taking ownership and development of RSP2 from the Office of Rail Regulation and is determined to keep to this approach and is now joined to the VDV in Germany in order to help this process.

Were recommendations made following isolated incidents such as that at Lebanon Road to be accepted by the duty holder, potentially it may undermine this agreed national position as well as creating expensive changes to tramcars which may render them out of line with others of the same type in use across the EU and create a bespoke solution on Tramlink.

It may be that some minor changes could be made to address some parts of the recommendations, but very careful judgement will be required to avoid non-standard solutions such as that of an audible warning in recommendation 3.

However, well-meaning recommendations may be, it is of concern that the wider implications of such changes do not seem to be taken into account. Where principles of generic vehicle design are being challenged, the appropriate place to direct the recommendation for change would seem to be the established EU or international forum responsible in the same way as for other classes of vehicle such as bus and coach.

Metrolink RATP Dev UK (Manchester Metrolink)

57. In its response of 5 May 2014 Metrolink RATP Dev UK provided the following information:

A new fleet of M5000 trams has been purchased by TfGM and are still in the process of delivery (as of 5 May 2014, 82 of the 104 trams have been received). On 30 April 2014 the remaining T68 trams were removed from service; therefore the Metrolink now only consists of M5000 trams.

It was identified that there were differences in the cab layout that could influence human factors with the emergency stop button being in a different location in the cab of the new trams. Although only a minor modification, the cost for the manufacturer

to modify the M5000 controls so they were in the same location was extremely costly, resulting in the modification being applied to the T68 trams.

Metrolink RATP Dev UK is fully supportive of the UK Tram approach for this recommendation. Tram design and manufacture is a European and global industry. UK Tram and TfL have collaborated with Europe in Brussels attending the European Survey Group which has also involved tram manufacturers as a means to harmonise standards. The work carried out has led to the manufacturers considering ergonomics as part of the design and supporting safe design. The group has moved forward considerably and the UK is more in line with Europe than ever before. We would not want to do things unilaterally; this would make the UK market bespoke in tram design, resulting in great cost, time and effort to change items. We can only influence the manufacturer's design; it would be unrealistic to think differently.

National Express Midland Metro (NXMM)

58. In its response received on 30 April 2014 NXMM provided the following information:

Individually, UK tram operators would not publish guidance (or have the legal ability to do so) outside of their own Safety Management Systems. On a national level, UKTram is about to take responsibility for RSP2 from the ORR under a memorandum of understanding, and it is here that guidance (or a reference to other standards) would eventually lie under a collective responsibility.

In 2011 the UK voted in favour of the adoption of the Urban Rail Survey Group's final report proposals resulting from the 'Urban Rail' mandate M486. This included the development of European Standards in response to this mandate. This work is currently being carried out by the relevant CEN or CENELEC technical committees. The final report contains appendices setting out the relevance of each existing CEN and CENELEC standard to trams as determined by the appointed experts from the EU member states, which included participants from UKTram. As part of this process, and to enable consistent on-going arrangements a commitment was given by the member states not to develop any further domestic standards or guidance pending eventual publication of standards and/or guidance by CEN or CENELEC or their partners. UKTram has stated its intention to comply with this agreed approach.

As a result of these current and intended future arrangements NXMM does not consider it is able to meet the requirements of the recommendation other than to participate fully in the related activities of UKTram.

Nottingham Trams

59. In its response on 6 May 2014 Nottingham Trams provided the following information:

While specific ergonomic studies of the Incentro trams as supplied to Nottingham are not available they were designed and manufactured to the relevant European and UK standards applicable at the time and were subject to HMRI approval before entering into operational service. The Incentro trams have now been in operational use with NET for over ten years. During the period of operation there have been no

occurrences of inadvertent operation or use of emergency override devices. During the period of operation large numbers of drivers have been trained, re-qualified and undertaken supervised driving and at no point has there been any evidence to call into question the location, function and usage of the isolation devices.

The new fleet of Citadis trams are based on the standard design of tram supplied by Alstom in large quantities throughout Europe and worldwide. The cab is designed to the latest European standards and has, additionally, taken into account the design of the current Incentro fleet to ensure the compatibility, as far as possible, with that design and equipment layout. Because of the satisfactory service record of the Incentro fleet it is believed that the Citadis tram design will prove to be likewise. Regarding industry guidance; Nottingham Trams Limited would welcome the opportunity to participate in studies with other UK Tram operators and the ORR leading to guidance on cab design and ergonomics.

Stagecoach Supertram Ltd

60. In its response on 24 March 2014 Stagecoach Supertram Ltd provided the following information:

Through our attendance at UKTram forums, Stagecoach Supertram Ltd will be part of the processes developing and reviewing the guidance to be issued. The timescales for this will be reviewed by UKTram. Stagecoach Supertram Ltd are unable to directly implement this recommendation, however once UKTram have issued guidance on ergonomic principles, it will be internally document controlled in order to ensure the guidance is clearly communicated and followed.

61. Having considered the responses from UK Tram and the individual tram operators we feel more clarity is needed on expected outcomes of this recommendation, particularly how European development work is likely to affect any possible actions. To this end we have suggested a meeting with RAIB to take place on 21 January 2015.