

Ian Prosser CBE
HM Chief Inspector of Railways
Railway Safety Directorate



14 May 2021

Simon French
Chief Inspector
Rail Accident Investigation Branch
Cullen House
Berkshire Copse Road
Aldershot
GU11 2HP

Dear Simon,

RAIB Report: Overturning of a tram at Sandilands junction, Croydon, 9 November 2016

I wrote to you on 4 December 2018 setting out our initial response to the recommendations in your investigation report *Overturning of a tram at Sandilands junction, Croydon* and subsequently provided further updates on 5 April 2019, 25 June 2019, 3 March 2020 and 6 August 2020.

In line with our agreement when you published your report and as you requested at the Annual Review meeting on 24 February 2021, I am writing to provide you with an update on recommendations 2 to 7 that we have not yet reported as “implemented”. Annex A and B contain full details on progress since March 2020.

The tram sector has responded well to the challenges presented by the COVID 19 pandemic, putting in place arrangements to ensure the safety of their passengers and employees. However, the pandemic has had impact across all systems and the scope and timescales of some of the actions to address the recommendations have changed.

Significant progress continues to be made since our last substantial update in March 2020. The industry risk model is now in place (recommendation 2); LRSSB has published guidance for signage and marking of tramways (recommendation 5); and LRSSB plan to publish guidance on detection of driver inattention and speed management (recommendations 3 and 4) this Spring/Summer.

To ensure these changes have impact, we have asked all tramways to confirm they have reviewed signage against new the guidance and have arrangements in place to make any changes; and will take similar action when the inattention guidance is published.

Recommendation summary

Recommendations 8-15 have already been reported as implemented.

Re c	West Midlands	Blackpool	Croydon	Edinburgh	Manchester	Nottingham	Sheffield
1	Implemented	Implemented	Implemented	Implemented	Implemented	Implemented	Implemented
2	Implementation on going - awaiting TPG validation	Implementation on going - awaiting TPG validation	Implementation on going - awaiting TPG validation	Implementation on going - awaiting TPG validation	Implementation on going - awaiting TPG validation	Implementation on going - awaiting TPG validation	Implementation on going - awaiting TPG validation
3	Implemented	Implementation on going	Implemented	Implementation on going	Implementation on going	Implementation on going	Implementation on going
4	Implementation on going	Implementation on going	Implementation on going	Implementation on going	Implementation on going	Implementation on going	Implementation on going
5	Implementation on going	Implementation on going	Implemented	Implementation on going	Implementation on going	Implementation on going	Implementation on going
6	Implementation on going	Implementation on going	Implemented	Implementation on going	Implementation on going	Implementation on going	Implementation on going
7	Implemented	Implemented	Implemented	Implementation on going	Implemented	Implementation on going	Implemented
8	Implemented	Implemented	Implemented	Implemented	Implemented	Implemented	Implemented

ORR is a risk based health and safety regulator and as such our broad objective for these recommendations continues to be to ensure that tram dutyholders take the right actions in the right order with suitable pace. We are committed to ensuring that:

- a. Reasonably practicable safety improvements are made, with a focus on improving control of risk and preventing (rather than simply mitigating) further accidents;
- b. Decisions are made based on sound evidence of the level of risk and the costs of intervention;
- c. Collaboration continues to occur to support consistent adoption of good practice and consensual decision-making around safety data, risk profiling and standards;
- d. Tram duty holders take collective ownership of the recommendations, but we hold them individually to account to make demonstrable progress.

Next steps

The sector continues to respond positively to the RAIB recommendations and has taken significant steps to improve the identification and control of risk.

Our programme approach to managing these recommendations has enabled us to consider the end implementer responses as part of their system approach to managing risk, and we believe this will provide a more effective approach to managing risk than considering each recommendation in isolation.

In response to the output from the industry risk model, LRSSB has identified a number of other areas where guidance is needed to help improve risk control by individual systems. Although LRSSB has introduced a number of revisions to the Tramway Principles and Guidance document (TPG) since 2017, they have commenced work to undertake a fundamental review of the document to ensure it reflects recent developments and is adequately supported by subsidiary guidance.

The next steps for recommendation 2 are for each network to fully adopt the Tram Accident and Incident Reporting database (TAIR). If our validation of the Tramway Principles and Guidance document (TPG) shows it to be satisfactory, we expect to be in a position to report the recommendation as 'Implemented' later this year.

We expect each system to act upon the guidance being issued by LRSSB in relation to recommendations 3, 4 and 5. The decision taken on the detection of driver inattention and speed management will inform our decision on the response to recommendations 6 and 7. We will provide RAIB with further updates when action is taken by industry to move the recommendations to a position where we consider them to be implemented.

Yours sincerely

A handwritten signature in blue ink, appearing to read 'Ian Prosser', is written over a light blue rectangular background.

Ian Prosser CBE
HM Chief Inspector of Railways

Recommendation 2

The intent of the recommendation is to better understand all safety risk associated with tramway operation and then provide updated guidance for the design and operation of tramways (this could be achieved by issuing an updated version of the 'Guidance on tramways' with expanded coverage of operational matters). Particular attention will be required to recognise risks from low frequency / high consequence events which may not be apparent from precursor incidents on existing UK tramways. Identifying such events is likely to require input from specialists outside the UK tram community, including specialists with knowledge of main line rail and bus environments. Consideration of main line rail and bus issues is intended to inform evaluation of tramway risks; it does not imply that all heavy rail and bus requirements should be applied to tramways.

UK tram operators, owners and infrastructure managers should jointly conduct a systematic review of operational risks and control measures associated with the design, maintenance and operation of tramways. The review should include:

- i. examination of the differing risk profiles of on-street, segregated and off-street running;
- ii. safety issues associated with driving at relatively high speeds in accordance with the line-of-sight principle in segregated and off-street areas, particularly during darkness and when visibility is poor;
- iii. current practice world-wide and the potential of recent technological advances to help manage residual risk;
- iv. safety learning from bus and train sectors that may be applicable to the design and operation of tramways;
- v. consideration of the factors that affect driver attention and alertness across all tram driving scenarios in comparison to driving buses and trains; and
- vi. guidance on timescales for implementing new control measures (eg whether retrospective or only for new equipment).

Using the output of this review UK tram operators, owners and infrastructure managers should then, in consultation with ORR, publish updated guidance on ways of mitigating the risk associated with design, maintenance and operation of UK tramways.

ORR decision

1. The Safety risk model has now been implemented and rolled across all 7 tramway networks in the UK. LRSSB has developed a process for proposing and developing standards based on the output from the risk model and plan to issue guidance for operations as well as design.

2. LRSSB is reviewing the standards framework and Tramway Principles and Guidance (TPG). Whilst the document has been subject to several reviews since 2016, most recently in March 2021, LRSSB have included in their annual plan for 2021/22 a comprehensive revision and restructuring that reflects recent developments in several areas, including risk profile, RAIB recommendations, innovation, research and supporting LRSSB guidance. We will monitor the

management of risk and development of standards as part of our 2021-22 work programme.

3. The Tram Accident and Incident Reporting database (TAIR) is being introduced to the different tram networks. Compatibility issues with existing incident recording systems on some networks have been identified, but are being addressed.

4. The status of the recommendation remains 'implementation on-going', but significant progress has been made in the last year. If our validation of TPG shows it to be satisfactory, we expect to be in a position to report the recommendation as 'Implemented' later this year.

5. After reviewing the information provided ORR has concluded that, in accordance with the Railways (Accident Investigation and Reporting) Regulations 2005, UK tram owners, operators and infrastructure managers, working in conjunction with LRSSB have:

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

Status: *Implementation ongoing.* ORR will advise RAIB when actions to address this recommendation have been completed.

Previously reported to RAIB

6. The link to the previous response on 3 March 2020 is as follows:
<https://www.orr.gov.uk/sites/default/files/om/raib-sandilands-junction-annex-a-c-2020-03-03.pdf>

Update

7. See Annex B

Recommendation 3

The intent of this recommendation is to prevent serious accidents due to excessive speed at higher risk locations on tramways. These locations are likely to include all locations where a substantial speed reduction is required for trams approaching at relatively high speed. Implementation of this recommendation may be assisted by work in this area already underway by Croydon tramway organisations.

UK tram operators, owners and infrastructure managers should work together to review, develop, and provide a programme for installing suitable measures to automatically reduce tram speeds if they approach higher risk locations at speeds which could result in derailment or overturning

ORR decision

8. Our overall objectives with the Sandilands recommendations are to ensure that the industry make reasonably practicable safety improvements, with a focus on improving risk control and preventing (rather than simply mitigating) further accidents. Recommendations 3 and 4 most clearly illustrate this preventative approach. We believe that a systems approach to managing the risk of a tram driver becoming inattentive in a 'line of sight system' is the most effective solution to securing reliable increased levels of safety. This includes ensuring that the risk of driver inattentiveness is tackled by, amongst other things, good fatigue management and task design, provision of systems intended to increase the likelihood of detection of inattentiveness (e.g. DSD, DVD, facial monitoring type systems); and ensuring the reduction of impact of inattentiveness by introducing (for example) overspeed prevention systems. Clearly as emerging technology provides new reliable solutions, we expect tramway organisations to consider their potential. LRSSB have a key role in this area.

9. We are therefore considering recommendations 3 and 4 together. During 2020, LRSSB continued to fund independent research by Ian Rowe Associates (IRAL) to examine driver inattentiveness monitoring systems and potential options to provide Automatic Vehicle Speed Monitoring (AVSM). This work was informed by, amongst other things, the SIMOVE AVSM continuous system trial over the summer of 2020 and operator's experiences of 'balese' systems. The output of this work is informing guidance that LRSSB plan to publish in Spring 2021.

10. In parallel, a number of individual tram systems continued to undertake their own research into driver inattentiveness and speed monitoring systems as they developed system specific solutions that reflect the characteristics of their network and tramcars. We welcome this work in these areas, and expect individual systems to consider the LRSSB guidance as they finalise/update their risk control arrangements, so as to demonstrate that risk is controlled as low as reasonably practicable.

11. We expect that the actions taken by individual systems will be supported by suitable and sufficient risk assessment; drawing on the output of the sector risk model and guidance as necessary; and taking account of the effectiveness of other risk controls that are in place.

12. It is our view that addressing the recommendations in this way considers the intent of recommendations 1 and 2. We will ask each tramway system to describe their finalised plans for addressing recommendations 3 and 4 once the LRSSB guidance has been published.

Summary of end implementer responses

End Implementer	Summary of response	Status

Annex A

Tram Operations Ltd	Reported as implemented 5 April 2019. A physical prevention of overspeed system in place, supplemented by a speed monitoring system.	Implemented (previously reported to RAIB on 3 March 2020)
London Trams	Reported as implemented 5 April 2019	Implemented (previously reported to RAIB on 3 March 2020)
Transport for West Midlands	A Balogh tag based system will be fitted which will be able to control the speed of a tram at high-risk locations. The system will be fitted to new trams due to be delivered in April 2021 and retrofitted to the existing fleet at the same time.	Implemented (previously reported to RAIB on 3 March 2020)
West Midlands Metro	As per TfWM response.	Implemented (previously reported to RAIB on 3 March 2020)
Blackpool Transport Services (BTS)	A first active trial of an AVSM system (with obstacle detection capability) was completed in Oct 2020, and data being reviewed. A second trial planned for April 2021 has been rescheduled to summer 2021 due to COVID. BBC/BTS expect to make a decision in summer 2021 once the trial has been completed and LRSSB guidance issued.	Implementation on going
Blackpool Borough Council (BBC)	As per BTS response.	Implementation on going
Edinburgh Tram (ET)	ET plan to procure and install LeadMind (a type of AVSM) by the end of 2021, and have instructed the tram manufacturer to commence work. Once proof of concept has been demonstrated, we expect to be in a position to report that the recommendation has been implemented.	Implementation on going
City of Edinburgh Council CofEC)	As per ET response.	Implementation on going
Manchester Metrolink (KAM)	KAM/TfGM have committed to procuring and installing either a balise-based system or a tram only system	Implementation on going
Transport for Greater Manchester (TfGM)	As per KAM response.	Implementation on going
Nottingham Council (NCC)/	As previously reported, NTL/TNL are developing an AVLS system to be fitted to both tram fleets. The	Implementation on going

Tramlink Nottingham Ltd (TNL)	system will automatically apply the brakes if overspeed is detected. Discussion with NET to understand the functionality of the proposed system is on going.	
Nottingham Trams (NET)	As NCC/TNL response.	Implementation on going
South Yorkshire PTE (SYLTE)	As previously reported, SYSL/SYPTE are monitoring the development of the Simove system on the Manchester network and are waiting the LRSSB guidance before making a firm decision on what action to take with the existing vehicle fleet. SYSL/SYPTE are also exploring opportunities as part of the business case for fleet renewal, which DfT has asked them to review due to the impact of COVID-19.	Implementation on going
South Yorkshire Supertram Ltd (SYSL)	As per SYPTE response. They have also received costing for installation, and are waiting the LRSSB guidance	Implementation on going

Previously reported to RAIB

13. The link to the previous response on 3 March 2020 is as follows:
<https://www.orr.gov.uk/sites/default/files/om/raib-sandilands-junction-annex-a-c-2020-03-03.pdf>

Updates from end implementers

14. See Annex B

Recommendation 4

The intent of this recommendation is to reduce the likelihood of serious accidents due to tram drivers becoming inattentive because of fatigue or other effects. Existing tram systems relying on drivers applying forces to driving controls (driver safety devices) do not necessarily detect an inattentive driver. Implementation of this recommendation may be assisted by work in this area already underway by Croydon tramway organisations.

UK tram operators, owners and infrastructure managers should work together to research and evaluate systems capable of reliably detecting driver attention state and initiating appropriate automatic responses if a low level of alertness is identified. Such responses might include an alarm to alert the tram driver and/or the application of the tram brakes. The research and evaluation should include considering use of in-cab CCTV to facilitate the investigation of incidents.

If found to be effective, a time-bound plan should be developed for such devices to be introduced onto UK tramway.

ORR decision

15. LRSSB continued its January 2020 research work during the year to further understanding of the capability of various systems to monitor driver inattentiveness, including comparing the efficacy of driver vigilance device (DVD) systems operating in the tramway environment with facial monitoring systems. Both types of system exhibit advantages and disadvantages around detection capability and how they respond. Following independent research carried out by IRAL, LRSSB has concluded that a well-adjusted DVD system with multiple regular inputs linked to the tram braking system is the most reliable way of addressing the risk of driver inattentiveness on a line of sight system when taking into account other risk management systems also present. We have discussed this conclusion with LRSSB, and have provided further feedback on areas that require further detail or clarification. LRSSB plan to publish guidance on driver inattentiveness systems during Spring 2021.

16. We continue to recognise that the emerging technologies intended to monitor driver inattentiveness and driver fatigue management arrangements offer potential benefits that will improve the management of risk, but may also present new risks that could reduce those benefits of the change if not properly controlled. We also recognise that the efficacy of facial monitoring systems continues to develop, and that none can currently be linked to the tram braking system. For this reason and in accordance with our Health and Safety Strategy for Tramways, we believe the tramway sector should continue to investigate emerging technologies to identify reasonable practicable solutions to improve the management of risk, particularly associated with line of sight operation.

17. We continue to be of the view (based on current evidence available) that a well-adjusted DVD system linked to the braking system, or a facial monitoring system improves the level of risk control against driver inattentiveness. In reaching this conclusion, we have considered the other available technological controls, such as overspeed prevention (recommendation 3), that should also be fitted where it is reasonably practicable to do so.

18. We will ask each tramway system to set out their plans for addressing recommendations 3 and 4 once the LRSSB guidance has been published; to inform our final decision for each system.

Summary of end implementer responses statuses

End Implementer	Summary of response	Status
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Annex A

Tram Operations Ltd	Reported as Implemented on 6 August 2020.	Implemented (previously reported to RAIB on 6 August 2020)
London Trams	Reported as Implemented on 6 August 2020.	Implemented (previously reported to RAIB on 6 August 2020)
West Midlands Metro	TfWM/WMM have introduced a DVD system, but do not consider it to be reasonably practicable to use multiple inputs.	Implementation on going
Transport for West Midlands	As per WMM response.	Implementation on going
Blackpool Transport Services	BTS/BCC use a DVD system which they believe reflects the risk profile of their system. They continue to support Edinburgh Tram's FOCUS+ initiative.	Implementation on going
Blackpool Borough Council	As per BTS response.	Implementation on going
Edinburgh Tram	ET use a well-adjusted DVD system that takes multiple feeds from the driver's controls. The tramway continues to develop its FOCUS+ device which is now at Pilot stage	Implementation on going
City of Edinburgh Council	As per ET response	Implementation on going
Manchester Metrolink	TfGM / KAM are in the process of procuring a modification to the traction brake controller to provide a DVD functionality. Due by end 2021.	Implementation on going
Transport for Greater Manchester	As per KAM response.	Implementation on going
Nottingham Trams	NET have a programme in place to reinstall and adjust the timings of the DVD system on the Citadis fleet. For the older Incentro fleet a new DVD system with equivalent functionality is planned.	Implementation on going
Nottingham Council/ Tramlink	As per NET response.	Implementation on going

Nottingham Ltd		
South Yorkshire Supertram Ltd	<p>SYSL/SYPTE plan to fit a DVD system to the Siemens fleet. Progress was disrupted by COVID 19; trial testing is now scheduled to commence in 2021 with a view to roll out by end 2021.</p> <p>The Citylink fleet (tram-train) has a DVD system fitted.</p> <p>The system is also participating in the Edinburgh Trams FOCUS+ initiative.</p>	Implementation on going
South Yorkshire PTE	As per SYSL response.	Implementation on going

Previously reported to RAIB

19. The link to the previous response on 3 March 2020 is as follows:
<https://www.orr.gov.uk/sites/default/files/om/raib-sandilands-junction-annex-a-c-2020-03-03.pdf>

Update

20. See Annex B

Recommendation 5

The recommendation is intended to provide tram drivers operating on line-of-sight with signage giving visual information cues comparable to those for bus drivers. This recommendation builds on the RAIB's Urgent Safety Advice issued in November 2016 and recognises that driving a tram on line-of-sight has considerable similarities with driving a bus on a public road.

UK tram operators, owners and infrastructure managers, in consultation with the DfT, should work together to review signage, lighting and other visual information cues available on segregated and off-track areas based on an understanding of the information required by drivers on the approach to high risk locations such as tight curves. Comparison should be made with the cues provided to road vehicle drivers on highways that are designed in accordance with current UK highway standards. Prior to the installation of suitable measures to automatically reduce tram speeds at higher risk locations (Recommendation 3) consideration should also be given to providing in-cab warnings to tram drivers on the approach to high risk locations.

The findings of this review should then be used by UK tram operators and tramway owners to improve the information and/or warnings provided to drivers at high risk locations in segregated and off-track areas.

ORR decision

21. We note that all the tram infrastructure managers we addressed this recommendation to have taken action to review existing signage, and made improvements where necessary.

22. LRSSB published guidance document LRG 4.0 Signing & Marking of Tramways in February 2021. We will ask all tramways to confirm they have reviewed signage against new guidance and have arrangements in place to make any changes.

23. After reviewing the information provided ORR has concluded that, in accordance with the Railways (Accident Investigation and Reporting) Regulations 2005, UK tram operators, owners and infrastructure managers have:

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

Status: *Implementation ongoing.* ORR will advise RAIB when actions to address this recommendation have been completed.

Previously reported to RAIB

24. The link to the previous response on 3 March 2020 is as follows:
<https://www.orr.gov.uk/sites/default/files/om/raib-sandilands-junction-annex-a-c-2020-03-03.pdf>

Update

25. See Annex B

Recommendation 6

The intent of this recommendation is to reduce the likelihood of people being seriously injured or killed by being ejected through tram doors and windows (i.e. to provide better containment). Although it is not expected that ejection can always be prevented in case of overturning, the improvement of containment will deliver improved safety in a range of different scenarios such as collision with road vehicles. Any improvement to containment is dependent on the ability of passengers to easily open doors in an emergency. It is expected that implementation will build on similar research already undertaken by RSSB in respect of railway carriage windows.

UK tram operators and owners should, in consultation with appropriate tram manufacturers and other European tramways, review existing research and, if necessary, undertake further research to identify means of improving the passenger containment provided by tram windows and doors. The findings should then be used to:

- i. provide a time-bound plan to modify doors and windows on existing trams when practical to do so (e.g. during planned refurbishment);
- ii. promote changes to the specifications and standards governing the doors and windows of new trams; and
- iii. inform the Department for Transport of the findings to allow implementation of the safety advice at paragraph 492.

ORR decision

26. The level of additional risk reduction achieved by increasing tram vehicle containment capability will be influenced by other engineering / technological controls that reduce the need for a high level of containment, and impact on evacuation arrangements. All tram operators and owners have now completed their review work into assessing opportunities for improving passenger containment and have concluded it not reasonably practicable to take any further action associated with existing fleets.

27. LRSSB is developing tram sector guidance covering escape and rescue requirements in conjunction with the emergency services along side assessing the enhanced performance requirements for window and door system integrity for future design specifications.

28. Reflecting the action that has been taken, we have concluded that the operators who were at the status “Progressing” are now at “Implementation ongoing” (all systems except Croydon who are ‘Implemented”).

29. In line with our approach of focusing on ensuring all reasonably practicable measures taken to prevent overturning incidents, we will review the status of this recommendation once we are satisfied with the finalised action plans to address the requirements of recommendations 3 and 4.

30. After reviewing the information provided ORR has concluded that, in accordance with the Railways (Accident Investigation and Reporting) Regulations 2005, UK tram operators, owners and infrastructure managers have:

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

Status: *Implementation ongoing*. ORR will advise RAIB when actions to address this recommendation have been completed.

Summary of end implementer responses statuses

End Implementer	Summary of response	Status
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Annex A

Tram Operations Ltd	As per London Trams response	Implemented
London Trams	LT has fitted enhanced strength film to glazing across its fleet.	Implemented
Transport for West Midlands	TfWM/WMM have jointly produced a risk report informing their decision not to fit laminated glass to the CAF Urbos 100 fleet. The decision not to fit laminated glass is based on the decision to focus on prevention of an overturning incident (recs 3&4).	Implementation on going
West Midlands Metro	As above	Implementation on going
Blackpool Transport Services (BTS)	BTS/BCC consider installation of laminated glass may introduce other risks, such as making it harder to escape in the event of fire or other emergency. BTS/BCC are focussing on measures to reduce the risk of a tram overturning through detection of driver inattentiveness and speed control.	Implementation on going
Blackpool Borough Council (BBC)	As above	Implementation on going
Edinburgh Tram (ET)	ET/CofEC consider installation of laminated glass may introduce other risks, such as making it harder to escape in the event of fire or other emergency.	Implementation on going
City of Edinburgh Council CofEC)	As above	Implementation on going
Manchester Metrolink (KAM)	No update.	Implementation on going (as reported on 3 March 2020)
Transport for Greater Manchester (TfGM)	As above	Implementation on going (as reported on 3 March 2020)
Nottingham Council (NCC)/ Tramlink	NCC/TNL confirmed they have taken action to mitigate the effects of glazing breakage, but that their current fleet are not structurally compatible with upgraded glazing specification. They will	Implementation on going (as reported on 3 March 2020)

Nottingham Ltd (TNL)	specify laminated glazing when procuring new vehicles	
Nottingham Trams (NET)	As above.	Implementation on going (as reported on 3 March 2020)
South Yorkshire PTE (SYPTTE)	The Citylink fleet is fitted with laminated glass; and concluded that it is not possible to retrofit laminated glass to the Siemens fleet.	Implementation on going
South Yorkshire Supertram Ltd (SYSL)	As above	Implementation on going

Previously reported to RAIB

31. The link to the previous response on 3 March 2020 is as follows:
<https://www.orr.gov.uk/sites/default/files/om/raib-sandilands-junction-annex-a-c-2020-03-03.pdf>

Update

32. See Annex B

Recommendation 7

The intent of this recommendation is to provide emergency lighting which will operate without connection to remote power supplies such as the tram's main batteries and the overhead electrical supply. Implementation may involve tram operators seeking input from appropriate tram manufacturers.

UK tram operators and owners should install (or modify existing) emergency lighting so that the lighting cannot be unintentionally switched off or disconnected during an emergency.

ORR decision

33. All tram operators and owners have either modified emergency lighting to operate without connection to the main power supply or have a plan in place to provide that functionality. We are seeking clarification from West Midlands Metro regarding the scope of the change in the original 2nd generation CAF Urbos 100 fleet.

Summary of end implementer responses statuses

End Implementer	Summary of response	Status
Tram Operations Ltd	TOL is supporting LT's work to implement this rec.	Implemented
London Trams	LT have a plan to fit emergency lighting which meets the requirements of the recommendation by the end of March 2020. As per TOL response.	Implemented
West Midlands Metro	WMM have conducted a review of the planned design for the new 3GT fleet, concluding that the emergency lighting is not extinguished when the externally accessible isolation switch isolated due to a second uninterrupted power supply. WMM have clarified that this also exists to the older 2Gt fleet.	Implemented
Transport for West Midlands	As per WMM response.	Implemented
Blackpool Transport Services	BTS modify the emergency lighting in the current fleet of trams to ensure that the lighting cannot be unintentionally switched off or disconnected. This modification will be carried out with the planned refurbishment of the trams beginning November 2020.	Implemented
Blackpool Borough Council	As per BTS response.	Implemented
Edinburgh Trams	<p>ET has a programme of work to address the recommendation that expects to be complete by the end of 2022.</p> <p>We have encouraged them to review the timescale they have given and justify current programme duration.</p>	Implementation on going
City of Edinburgh Council	As per ET response.	Implementation on going
Transport for Greater Manchester	Reported as implemented 5 April 2019	Implemented
Manchester Metrolink	Reported as implemented 5 April 2019	Implemented

Nottingham Trams	NET consider existing arrangements to be sufficient for all credible scenarios. We are awaiting the LRSSB guidance on driver inattention detection and speed control before deciding if that position is acceptable to address the recommendation.	Implementation on going
Nottingham Council/ Tramlink Nottingham Ltd	As per NET response	Implementation on going
South Yorkshire Supertram Ltd	<p>SYSL have developed a secondary wiring loop to provide emergency lighting above exit doors in the saloon in the event of power disconnection from the battery. Following trials, SYSL intend to retrofit the tram fleet in 2020/21.</p> <p>On Citylink vehicles, the risk of interruption to the emergency lighting is considered less likely, so no modifications are planned.</p>	Implemented
South Yorkshire PTE	As per SYSL response.	Implemented

Previously reported to RAIB

34. The link to the previous response on 3 March 2020 is as follows:
<https://www.orr.gov.uk/sites/default/files/om/raib-sandilands-junction-annex-a-c-2020-03-03.pdf>

Update

See Annex B

End Implementer updates

Recommendation 2

1. On 24 January 2021 London Trams provided the following update:
We are about to launch a new Change Assurance process as part of our Safety Management System and contained within it is a new specific section on the Risk Model. You can see from the snapshot below the mandatory sections of the new process which requires the change sponsor to specifically identify what Hazardous Events which could be impacted, for better or for worse, by the proposed change. Whilst the current change process requires you to assess the risks, it was designed before the Trams Safety Risk model was introduced.

Initial Safety Risk Identification				
What safety risks are affected by this change? <i>Referring to the Trams Safety Risk Model and Hazardous Event List, identify the relevant hazardous events, indicate the likely impact of the change (better / worse / no change) and explain why the risk impact is better / worse / no change.</i>				
	HE Code	Hazardous Event Description	Risk Impact (better, worse or no change)	Explanation
1				
2				
3				
4				
5				
6				
7				
8				
9				
10		<i>Add more rows as applicable...</i>		
What other safety risks have been identified (e.g. not on the <i>Hazardous Event List</i>)?				
		Risk	Risk Impact (better, worse or no change)	Explanation
1				
2				
3				
4				
5		<i>Add more rows as applicable...</i>		

2. On 21 January 2021 Tram Operations Ltd provided the following update:
I have attached documentation from our Modification Panel which assures and authorises any changes within Tramlink in respect of both TOL and LT on the impact to the tramway. This informs you of the rationale of transferring the London Trams Joint Risk model that was introduced here in Croydon and moving to the LRSSB Light Rail Risk Model, which has been adopted and will be used going forward by the whole tram industry.



LT-Mods-20-028 -
London Trams LRSSI Submission LT-Mod:



Appendix A to

3. On 19 January 2021 West Midlands Metro and Transport for West Midlands provided the following joint update:

It is West Midland Metro's understanding that all operators have received their copies of the industry risk model. West Midland Metro are utilising their risk model and have adapted this within their safety management system. West Midland Metro believe that the fully completed sector risk profile has been delivered by the LRSSB.

4. Blackpool Transport provided the following update dated 14 January 2021 (Blackpool Council are in agreement with the response):

I can confirm that Blackpool Transport have provided the risk model with their historic data and a system risk profile has been produced. Blackpool Transport will continue to provide data into the TAIR database and continually review the outputted system risk profile.

LRSSB have now procured Bowtie XP software. The software package preliminary consists of BowTieXP Advanced Addition as well as the Bowtie Server Central Repository. This will allow the production, sharing and direct access to generic industry assessments relevant to specific risks.

Our Head of Safety and Facilities and his team attended the software training course in December 2020 and will use this to review our highest risks.

5. On 15 January 2021 Edinburgh Trams provided the following update:

Edinburgh Trams (ET) continues to fully support UKTram through representation on:

- *UKTram Safety and Assurance Group (Heads of Safety).*
- *ET has provided expertise to support the systematic review of industry operational risks and provided historical incident data for the industry risk model to support development and rollout of the Tramway Accident & Incident Reporting (TAIR) database*
- *Support for optimisation improvements to TAIR database.*
- *ET is working with UKTram/LRSSB to deliver the industry Risk Model through the TAIR.*
- *ET will help LRSSB to create model templates, using Bowtie techniques, for the top industry operations risks based on outputs from the TAIR Risk Model.*

- *ET will further support LRSSB with their aspiration to train the industry in the use of Bowtie techniques for modelling risk.*

6. On 22 January 2021 Edinburgh City Council provided the following update:

The City of Edinburgh Council are a member of UKTram and are represented at the Owner Authority Meetings and at the Light Rail Safety Standards Board Duty Holder Meetings. My staff work closely with Edinburgh Trams to implement revised safety guidance issued by LRSSB.

7. On 29 January 2021 Transport for Greater Manchester and Keolis Amey Metrolink provided the following joint update:

Metrolink have completed all work associated with this recommendation. Once LRSSB have completed their update to the TAIR model with Atkins it will then become a business-as-usual activity for Metrolink to submit safety information into the TAIR database and to review the output of this when LRSSB publish it.

8. On 30 March 2021 Nottingham Trams Limited provided the following update:

NTL, working with the LRSSB and its consultants Atkins, has completed the SRM. The SRM provides direction to assist in ranking, controlling and mitigating risks associated with design, maintenance, and operations of the tram network.

The resulting model is being used to map the overall safety risk profile and to identify low frequency and potential high impact hazards prioritising the implementation of control measures.

Priority has been given to evaluating the risks identified in the Sandilands report.

NTL continue to work with LRSSB in developing “bow-tie” models for light rail application.

NTL utilise the LRSSB Taking Safe Decisions Tool in assessing proposed vehicle and system changes.

9. On 27 January 2021 Stagecoach Supertram provided the following update:
A copy of the final Risk Model for Supertram was received on Friday 22nd January 2021, having previously received a draft copy. There were no unacceptable risk categories identified.

We understand the intention is for an Industry Top 10 risks to be produced, which will allow comparison and sharing of best practice for these risks. This output will continue to drive areas for consideration at the UKTram Heads of Safety meetings.

10. On 28 January 2021 South Yorkshire Passenger Transport Executive provided the following update:

Our Concessionaire South Yorkshire Supertram Limited (SYSL) received a copy of the final risk model on Friday 22nd January 2021, having previously received a version in draft.

We will continue to support where requested the work of the Light Rail Safety and Standards Board (LRSSB) to develop the necessary standards. We understand that the UKTram Heads of Safety plan to risk assess the top 10 industry risks and we will support this work where we can.

11. On 8 February 2021 LRSSB provided the following update:

LRSSB can advise that all networks are now in receipt of their individual risk profiles and training. A sector risk profile has also now been produced and Initial results presented to the ORR's Health and Safety Regulatory Committee (HSRC) on 23rd March 2020, in addition to being published as part of the LRSSB's annual report in May 2020.

Following the development and issue of all individual network risk profiles LRSSB are currently arranging for a full sector reanalysis of risk profiles to be initiated in March/April 2021. This is in order to take into account risk reduction measures implemented post Sandilands and their impact on both individual and sector risk profiles.

In addition, the Tramway Principles and Guidance document (TPG) is currently being reviewed and it is anticipated for re - publication during Q1 2021. Furthermore, it is also LRSSB's intention to conduct a detailed "re-fresh and renew" of this document as part of the 2021/22 business planning.

Recommendation 3

12. Blackpool Transport provided the following update dated 14 January 2021 (Blackpool Council are in agreement with the response):

The trialling by BTS of the Bombardier Collision and Over speed Monitoring and Prevention Assistance System is currently ongoing. An active trial was completed in October 2020 and was attended by the ORR. The trial was a success and Bombardier have taken away the data collected.

Due to Covid 19 restriction, a second trial has been pushed back to provisionally April 2021 with a final trial in the summer 2021. These timescales are dependent on Covid restrictions.

On successful completion of the trial BTS will consider the practicability of installing on the tram fleet.

BTS through UKTram will continue to assess the availability and practicability of other systems in order to address this recommendation.

13. On 15 January 2021 Edinburgh Trams provided the following update:

ET and the City of Edinburgh Council (CEC) have completed a review of the options available (which were SIMOVE and LeadMind) and agreed to pursue Leadmind as our preferred solution to control over speeding.

On 3 December 2020, CEC issued a contractual change to CAF to commence the formal design, procurement and installation stages.

As part of this process, CAF has already installed a Leadmind PC on a single tram to gather data in real time to allow proof of concept to be confirmed for alarm alerts and to allow access to the web-based portal to review the live data received.

The speed management module will continuously monitor the speed of each tram and provide a warning if a speed limit is exceeded and subsequently apply the emergency brake if the speed exceeds pre-determined thresholds. The outputs can also be used to review driver behaviour and inform subsequent training.

The proof-of-concept will be further developed throughout the first quarter of 2021 to include visual/audible warning indicators to the driver for over speeding and then the automatic breaking elements. Once the proof-of-concept process is completed and agreed, it is envisaged that the fleet will be modified throughout this year, with completion anticipated by December, however we have requested to CAF that this be installed as soon as possible following proof of concept.

14. On 22 January 2021 Edinburgh City Council provided the following update:

In consultation with Edinburgh Trams, LeadMind was chosen as the preferred method to reduce excessive speed at high risk locations.

CAF have carried out live testing of the LeadMind System on an operational tram to demonstrate the potential functionality of the full system and the data it provides. This Council has provided full funding for installing LeadMind to the fleet and it is anticipated that works will be complete by December 2021.

15. On 29 January 2021 Transport for Greater Manchester and Keolis Amey Metrolink provided the following joint update:

During the course of 2020 Metrolink undertook their own market engagement exercise and spoke to 10 different companies that claimed to be able to address this recommendation. From this activity we have now confirmed our requirements for a system. A risk assessment of the network is due to be finalised by the middle of February that will quantify the number of locations that are deemed as high risk (with regards to this topic). This exercise is drawing in experience from across both businesses including driver safety representatives.

It is Metrolink's intention to begin procurement of a system in Spring of this year. Due to the complexity of such a system no deadline has yet been set for the completion of this project, however it is expected that this will be between the end of 2022 and the middle of 2023.

Our progress has been delayed during 2020 as our capital funding budget has been scrutinised and spending decisions delayed due to the impact of the COVID-19 pandemic.

16. On 30 March 2021 Nottingham Trams Limited provided the following update:

NTL have assessed the new requirement for over speed monitoring and control arising from this recommendation.

We are developing a solution based on the Automatic Vehicle Location System that is fitted to both Citadis and Incentro tram fleets.

This will provide both driver and Control Room warnings in the case of critical over-speeding. Where critical over speeding does occur, the system will apply a full-service brake to the tram bringing it to a halt. The driver will have to acknowledge and reset the system before being able to continue.

This is system wide application that will monitor all curves. Critical overspeed tolerances will be determined and set using the output from the SRM.

17. On 27 January 2021 Stagecoach Supertram provided the following update: *As was noted in your update of 3rd March 2020, we continue to monitor progress on systems being trialled or implemented, which would be used by SYPTE to inform fleet replacement specification, and also to identify any practical solutions for the limited remaining life of the existing fleet. This includes viewing update presentations on the SIMOVE system trial in Manchester and we intend to arrange a site visit post covid limitations. An indicative cost has been obtained for fleet implementation.*

A report has been commissioned by LRSSB to look at the available options to address this recommendation, which is expected to be available soon. This would be used to inform future fleet decisions.

18. On 28 January 2021 South Yorkshire Passenger Transport Executive provided the following update:

We continue to monitor progress on systems being trialled or implemented, including the work the LRSSB are progressing.

A draft Outline Business Case was submitted to the Department for Transport (DfT) in September 2020. This Outline Business Case included as its preferred option replacement of the existing Siemens tram fleet with a new fleet, which we would expect to specify to incorporate the necessary speed control system.

The Covid-19 pandemic has however affected the progress of this Outline Business Case and we have been asked by the DfT to consider the impact of Covid-19 on the Outline Business Case and opportunities to reduce cost. This may mean refurbishment rather than renewal of the existing Siemens fleet.

19. On 8 February 2021 LRSSB provided the following update:

LRSSB commissioned independent research associated to Automatic Vehicle Speed Monitoring systems (ASVM) that included the trial of the SIMOVE ASVM system in conjunction with Manchester Metrolink.

*Following conclusion of this research a report is now being finalised - **Automatic Vehicle Speed Monitoring (AVSM) System Trials and Research** compiled by Ian Rowe Associates Ltd (IRAL). The report is anticipated to be completed in March 2021.*

Subsequent and in tandem with the report, LRSSB will be producing guidance associated to the application of ASVM within the sector. This new guidance will cover the different approaches to AVSM to deliver the minimum requirement in order to address the RAIB recommendation as well as incorporating additional benefits and considerations associated with AVSM systems.

Recommendation 4

20. On 19 January 2021 West Midlands Metro and Transport for West Midlands provided the following joint update:

TfWM and West Midlands Metro continue to engage with the industry and look at all possible systems. However, West Midlands Metro still strongly believes that its current vigilance system combined with braking intervention is robust enough to satisfy resolution of recommendation 4 of the Croydon Sandilands report in that this system will identify and implement a positive intervention should it detect an inattentive tram driver.

21. Blackpool Transport provided the following update dated 14 January 2021 (Blackpool Council are in agreement with the response):

I acknowledge that the use of our DVD on Blackpool trams satisfies this recommendation at this current time.

BTS will continue supporting Edinburgh Trams with their FOCUS+ trial. We have five drivers currently signed up for the phase 2 trial. We will also continue to support LRSSB in investigating emerging technologies and will consider the practicalities of implementing each new technology.

22. On 15 January 2021 Edinburgh Trams provided the following update:

The risk-based evidence as to how the timings of the DVD fitted to the Edinburgh trams have been optimised was provided in risk assessment ET/RA/027 - Drivers Safety Device (DSD) Configuration change - v2.0 is appended to that letter [Ref. ET-2020-19-50 dated May 2020].

We continue to monitor its effectiveness through review of our Onboard Tram Monitoring Recorder outputs. We have also shared these outputs with Ian Rowe Associates to support the review into Habituation. Current indications are that our drivers are not suffering from habituation in relation to DVD/DSD optimisation. Other factors influencing attentiveness and reduced habituation risk of our drivers is the driving behaviour instilled as part of the DriveSmart training (see Rec 5 for more information).

Driver Innovation Safety Challenge (DISC)

The DISC project has now progressed to a Pilot stage with 12 ET staff wearing the FOCUS+ device throughout their working day. The Pilot is set to run until May 2021. Additional volunteers are currently being registered from all other UKTram operators. It is expected that the Pilot will have gathered data from 50+ volunteers by its conclusion.

The data being gathered will be compared with real medical data to develop robust interpretation of the attentiveness of users.

A solution for independent validation testing is expected to be delivered by July 2021.

Independent validation testing will be carried out by UKTram through Ian Rowe Associates.

We will however continue to work with LRSSB to understand emerging solutions and their efficacy.

23. On 22 January 2021 Edinburgh City Council provided the following update:

The risk-based evidence as to how the timings of the DVD fitted to the Edinburgh trams have been optimised is contained in risk assessment ET/RA/027 - Drivers Safety Device (DSD) Configuration change - v2.0 and I note that Edinburgh Trams have provided you with a copy of this document.

This council is part of the working group along with Edinburgh Trams, developing the Driver Innovation Safety Challenge (DISC), whilst continuing to monitor the effectiveness of other solutions being investigated by the LRSSB. I personally sit on the Board of this group.

24. On 29 January 2021 Transport for Greater Manchester and Keolis Amey Metrolink provided the following joint update:

TfGM are now in the process of procuring a modification to the Metrolink fleet to upgrade the traction brake controller (TBC) so it's functionality will incorporate a vigilance system. This will work by monitoring the movements of the TBC and where no movement is detected over a user defined period an input will be required from the driver.

Metrolink are engaging with ergonomics and human factors specialists to ensure that the modification is optimised for monitoring driver attentiveness while balancing the risk of driver distraction.

Metrolink have set an ambitious target of implementing this change by the end of 2021.

Metrolink are currently not intending to install a camera-based system to monitor the attention of the driver. The driver vigilance device and over speed prevention systems will be installed and then the effectiveness of these will be monitored.

25. On 30 March 2021 Nottingham Trams Limited provided the following update:

NTL operate two types of trams – the original Incentro trams (15 off) and the Citadis trams introduced as part of the NET Phase 2 extension (22 off).

Both vehicle types are fitted with Driver Safety Devices operated by sensors on the Traction Brake Controller but have different control systems and will require different solutions to implement a DVD system.

In order to meet the new requirement for Driver Vigilance Devices (DVD) arising from the RAIB recommendation significant changes to the tram control systems are required.

NTL will undertake a modification to reinstall the single input Citadis DVD system and design and install a single input DVD system on Incentro trams.

The DVD timings will be adjustable and will be developed using the output from the SRM.

26. On 27 January 2021 Stagecoach Supertram provided the following update:

As previously reported, progress had been disrupted by covid-19, including safely obtaining feedback from drivers on the proposed vigilance device for Siemens trams and availability of the technology suppliers for required bespoke components. However driver feedback has now been obtained following a cab mock-up, and we have an option of two possible locations for the vigilance device. A final decision is expected to be made in February 2021, and this will be fitted to a trial tram to allow a testing regime to be undertaken, including “live testing” (but with no brake application).

Following this testing, if successful we expect fleet-wide installation to progress during 2021 and be completed with full brake application enabled within the calendar year.

Additionally, we also have volunteer drivers who will participate in the Focus wearable technology trial led by Edinburgh Trams. We will follow progress with interest, as this system potentially offers wider health monitoring benefits too.

The Citylink fleet has a driver vigilance device installed.

As for Recommendation 3, a report has been commissioned by LRSSB to look at the available options to address this recommendation, which is expected to be available soon. This would be used to inform future fleet decisions.

27. On 28 January 2021 South Yorkshire Passenger Transport Executive provided the following update:

As noted in our response to recommendation 3, SYPTE are in the process of developing an Outline Business Case for funding to replace the existing Siemens fleet. As noted above the Covid outbreak has impacted on the development of this and the DfT have requested for us to look at opportunities to reduce cost.

SYSL as our Concessionaire continues work on the development of a Driver Vigilance Device to fit to the Siemens fleet. Progress on this can be found in SYSL's response.

28. On 8 February 2021 LRSSB provided the following update:

*LRSSB commissioned independent research associated to driver inattention technologies and subsequently published a report in February 2020 **Driver Inattention Report compiled** by Ian Rowe Associates Ltd (IRAL).*

At present LRSSB are currently finalising guidance on the application of driver inattentiveness systems that has been informed by the independent research report

and system trials conducted. The draft guidance document is anticipated to be released for sector consultation in March 2021.

Recommendation 5

29. On 19 January 2021 West Midlands Metro and Transport for West Midlands provided the following joint update:

West Midlands Metro continues to support the LRSSB with their on-going consultation with the DfT in regard guidance on signage and will re-evaluate our current system signage once this guidance is released.

30. Blackpool Transport provided the following update dated 14 January 2021 (Blackpool Council are in agreement with the response):

A guidance has been produced jointly between the DfT and LRSSB associated to signing and marking on tramways and was issued in December 2020. Blackpool Transport will review their current signage in line with this guidance.

31. On 15 January 2021 Edinburgh Trams provided the following update:

In late 2016 ET reviewed the locations where trams could potentially need to brake from 70kph to less than 40kph, of which there were three. Of these we were satisfied that existing measures were sufficient at two curves. At the third location (on the approach to Ingliston Park and Ride tram stop city bound) a red bordered '15 kph' sign with an attention plate above has been added as a visual reminder to slow down to 15 kph before the curve into IPR tram stop.

We are now comfortable that all speed limit signs are located sufficiently in advance of the curves to allow for reaction time and braking distance from the approach speed.

On the Inbound curve east of Gogarburn Underbridge, chevron signage, with a reflective yellow border, has been added to provide a visual indication of a tight bend to the driver.

Additionally, we have also trained and implemented DriveSmart in 2018. This has been developed in partnership with The University of Birmingham Centre for Rail Research and Education innovation project for More Energy Efficient Trams (MEET). MEET uses detailed route modelling analysis to identify optimum movement sequences, identifying points along the route where the driver should coast and brake, or be travelling at an optimum speed. MEET innovation completed successfully and was then taken to market by Ricardo Rail as DriveSmart. All tram drivers have now completed the training in the smart driving techniques, and this helps maintain their levels of focus in off-street areas.

Finally, ET is currently reviewing LRSSB's best practice guidance LRG 4.0 - Signing and Marking of Tramways Guidance in accordance with our risk process and will act on any outputs accordingly.

32. On 22 January 2021 Edinburgh City Council provided the following update:

I am aware that Edinburgh Trams has reviewed their off-street section to identify locations to provide sufficient warning to drivers to reduce speed on the approach to rail curves. I am satisfied that all bends are signed correctly, and appropriate training is in place to deliver safe driving practice.

The live data provided by the LeadMind outputs does provide data on the speeds that drivers approach bends on the system and this can be utilised to implement emergency braking and provide warning to the Operations Control Centre. These outputs can be used to review driver behaviour and inform subsequent training.

33. On 29 January 2021 Transport for Greater Manchester and Keolis Amey Metrolink provided the following joint update:

Metrolink have completed all work associated with this recommendation and have no further update beyond our last correspondence with you on this in December 2019.

34. On 30 March 2021 Nottingham Trams Limited provided the following update:

NTL have assessed the tramway for tight curves as described in the RAIB recommendation and have implemented countdown Speed Restrictions at three locations.

These locations have been further surveyed, in conjunction with the Highways Authority where appropriate, with a view to fitting high visibility chevrons to provide drivers with additional warning of low speed curves. The HA provided advice on suitable roadway designs for these applications.

35. On 27 January 2021 Stagecoach Supertram provided the following update:

We continue to highlight any particular risk areas in driver training, in addition to the system signage which was implemented.

36. On 28 January 2021 South Yorkshire Passenger Transport Executive provided the following update:

Please refer to SYSL's response.

37. On 8 February 2021 LRSSB provided the following update:

LRSSB have developed guidance document LRG 4.0 Signing & Marking of Tramways in conjunction with the DFT, local authorities and the tram sector. The guidance supports the high-level principles set out in LRG 1.0 Tramway Principles and Guidance (TPG) published by the Light Rail Safety Standards Board (LRSSB).

Additionally, this guidance document provides further advice on Signage and Marking of Tramways for 'line-of-sight' operations. This is additional guidance on selected signs used on the highway to supplement the advice in The Traffic Signs Manual (TSM).

LRSSB published the new guidance document in January 2021.

Recommendation 6

38. On 24 January 2021 London Trams provided the following update:

You have previously written to us to inform that you regard that this recommendation has being implemented on London Trams. To that end no additional work has been undertaken. I can confirm, however, that London Trams have kicked off work to look at the procurement of a new fleet of trams to replace the CR4000 Bombardier vehicles, and as per our previous commitments we will ensure that the option to specify laminated glass is fully explored as part of the procurement process.

39. On 21 January 2021 Tram Operations Ltd provided the following update:

As you are aware this recommendation is the responsibility of London Trams.

40. On 19 January 2021 West Midlands Metro and Transport for West Midlands provided the following joint update:

Transport for West Midlands and West Midland Metro have jointly produced a risk report attached to this correspondence. The report will demonstrate the decision not to fit laminated glass to the CAF Urbos 100 vehicle.



Sandilands 3 GT
approach.pdf

41. Blackpool Transport provided the following update dated 14 January 2021 (Blackpool Council are in agreement with the response):

Blackpool Transport have worked with Bombardier and industry partners to review the means of improving passenger containment.

The risk of retrofitting with laminate glazing to vehicles such as trams introduces such significant risk to means of escape and rescue, in other scenarios (e.g. Vehicle Fire; Terrorist Attack; Road Traffic Accident; Chemical Spillage etc.), that Blackpool Transport Services Ltd does not agree that this solution should be installed on their fleet. We believe that by implementing solutions to other recommendations this will greatly reduce the chance of overturning.

42. On 15 January 2021 Edinburgh Trams provided the following update:

We confirm that we have had the opportunity to review the referenced document and its findings

While it is physically possible to install the laminated glazing,

- *It would sit proud of the current fleet glazing openings.*

- *It would import significant cost due to it being of a bespoke nature and the trams were not originally designed to include this*
- *It would therefore require manufacturer re-design and re-verifying*
- *It could render the vehicles inconsistent with PCV glazing standards*

Note:

We are aware of the installation of reinforced glass in trams in Jerusalem however this was to design in the functionality to resist bullets/IEDs.

The Citadis fleets on the LUAS were supplied with 5mm glass in the doors and 6mm glass in the saloon side windows and although of laminated form were only made to withstand the impact of a piece of ballast travelling at up to a speed of 80 km/h. The windows were therefore not designed to contain passengers in the event of overturning.

Safety risks include reduced ability to escape from trams

- *Vehicle Fire*
- *Terrorist Attack*
- *Road Traffic Accident*
- *Chemical Spillage*

In the spirit of Railways (Accident Investigation and Reporting) Regulations 2005” in Regulation 5 (4) (e) requires (in the context of “near misses”) an investigation to take place if “the extent to which an investigation will improve the safety of railways and prevent accidents and incidents” we have assessed the full suite of recommendations and concluded that the preventative measures provide sufficient mitigation without introducing the laminated glazing.

Note:

There are tram fleets with no windows and sliding windows and PCV in general have opening windows

Current expectation of cost for the laminate glazing solution provided by UKTram is that the laminate glazing solution could cost circa £200k per vehicle (avg. fleet cost £6m).

When considering the mitigation agreed to be implemented through Rec 3 & 4, the risk associated with overturning at speed on curves has been removed. Lowering the risk to this level means that the tram is no longer vulnerable to overturning at speed.

43. On 22 January 2021 Edinburgh City Council provided the following update:

My staff have worked closely with Edinburgh Trams on this issue and I would agree with their conclusion that the mitigation measures proposed above in response to Recommendations 3 and 4, does lower the risk of the overturning of an Edinburgh Tram Vehicle.

However, through our continued liaison with LRSSB, we will monitor emerging advice on vehicle containment.

44. On 29 January 2021 Transport for Greater Manchester and Keolis Amey Metrolink provided the following joint update:

Metrolink have completed their assessment of this recommendation and have no further update beyond our last correspondence with you on this in August 2020.

45. On 30 March 2021 Nottingham Trams Limited provided the following update:

Both types of NET trams are currently fitted with 3M Ultra S600 safety films to the inside of saloon windows. The films are certified to EN12600 2B2 (impact) and EN 45545-2: HL 1, 2, 3 (fire) and GSA TS-01 3B (blast). These mitigate the effects of glazing breakage and provide the same level of containment as per the current industry standard.

Existing Incentro and Citadis trams are not structurally compatible with the fitting of thicker and heavier laminated glazing.

Should new vehicles be procured they will be specified with laminated glazing.

46. On 27 January 2021 Stagecoach Supertram provided the following update: *The further clarification and update provided in June 2020 is still relevant, in that the Citylink fleet is compliant, but our considered view is that the risks and timescales involved in a retrofit to the limited life Siemens fleet prohibit this being undertaken.*

47. On 28 January 2021 South Yorkshire Passenger Transport Executive provided the following update:

Please refer to SYSL's response.

48. On 8 February 2021 LRSSB provided the following update:

LRSSB conducted a review of the requirements associated to RAIB recommendation 6, identifying that any improvement to passenger containment would be fleet dependent and subject to both the individual characteristics of vehicle design as well as ensuring a sufficient balance between containment and emergency egress or rescue. Subsequently network operators have reviewed the requirements of RAIB recommendation 6 in conjunction with vehicle manufacturers who in turn confirmed the impracticability to undertake retrospective modifications to glazing pertaining to vehicle doors and windows on existing tram fleets.

LRSSB are developing tram sector guidance covering escape and rescue requirements in consultation with the emergency services in addition to taking

account of enhanced performance requirements for window and door system integrity within new and future vehicle procurement and design specifications as considered necessary.

Recommendation 7

49. On 19 January 2021 West Midlands Metro and Transport for West Midlands provided the following joint update:

Transport for West Midlands and West Midlands Metro have jointly produced a risk report attached to this correspondence. The report will demonstrate how the CAF Urbos 100 and CAF Urbos 3 tram fleets meet the requirements for recommendation 7 of the Sandilands report.



Sandilands 3 GT approach.pdf

50. On 1 April 2021 West Midlands Metro provided the following update:

In response to your question, I can confirm that the existing CAF Urbos 3 tram fleet (21 Vehicles) and the incoming CAF Urbos 100 tram fleet (Initially 8 vehicles) are near identical in design in regard to recommendation 7 and I can also confirm the arrangements mentioned within the risk report applies to both vehicle fleets.

51. On 15 January 2021 Edinburgh Trams provided the following update:

ET and CEC have confirmed the scope of the provision of emergency lighting which will operate without connection to remote power supplies such as the tram's main batteries and overhead power supply.

On 3 December 2020, CEC issued a contractual change to CAF to commence the formal design, procurement and installation stages.

The proof-of-concept and an installation on one tram will be undertaken throughout this year and then it is envisaged that the fleet will be modified throughout 2022.

We are currently in discussions with CAF and CEC about reviewing the implementation programme of this, and a few other large modification programmes to determine if there are any efficiencies to be made in relation to time or costs if these projects were cojoined. Should this result in any changes to the delivery dates noted above then we will update you accordingly.

52. On 22 January 2021 Edinburgh City Council provided the following update:

I confirm that CAF were commissioned to develop emergency lighting, which is powered independently from the main tram power supply. I am satisfied with the proposed solution and we have provided full funding for this proposal to be completed in 2022. We are reviewing with Edinburgh Trams and CAF the proposed

upcoming obsolescence renewals to determine if these works can be progressed concurrently to reduce this implementation timescale.

53. On 30 March 2021 Nottingham Trams Limited provided the following update:

The current lighting configuration both Incentro and Citadis trams provides emergency lighting levels where the main power supply fails. Emergency mode is designed to meet all credible emergency situations.

Both Citadis and Incentro comply with the requirements EN13272-2 2019 Operation Category 1 (which is 30mins).

The risk assessment demonstrates that implementation of recommendations 3,4 & 5 reduces the risk of overturning and that the current lighting configuration is sufficient.

Should new vehicles be procured they will be specified with emergency lighting as required by the prevailing legislation.