Oliver Stewart
RAIB Recommendation Handling Manager

31 March 2023

Mr Andy Lewis
Deputy Chief Inspector of Rail Accidents

Dear Andy,

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

I write to provide an update[1] on the actions taken in respect of recommendations 2 - 7 addressed to ORR in the above report, published on 7 December 2017.

The annex to this letter provides details of actions taken in response to the recommendations and the status decided by ORR. The status of recommendations 2 - 7 is **'Closed'.**

We do not propose to take any further action in respect of the recommendations, unless we become aware that any of the information provided has become inaccurate, in which case I will write to you again.

We will publish this response on the ORR website on 5 April 2023.

Yours sincerely,

Oliver Stewart

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

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. LRSSB has provided a detailed response setting out how each part of the recommendation has been addressed. LRSSB has developed an industry risk model based on individual network risk profiles. The risk profiles are being reanalysed to take into consideration risk controls introduced since Sandilands.

2. LRSSB has reissued the Tramway Principles and Guidance document (TPG) and a growing portfolio of sector guidance documents based on the output of the risk model, including speed control and detection of driver inattention.

3. In addressing the recommendation, LRSSB have engaged with other industries with similar risks to identify areas of best practice.

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

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

Status: Closed.

Previously reported to RAIB

5. The link to the previous response on 14 May 2021 is as follows: RAIB Report: Overturning of a tram at Sandilands junction, Croydon, 9 November 2016 (orr.gov.uk)

Update

6. 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

7. As previously reported, our overall objectives with the Sandilands recommendations were to ensure that the sector make reasonably practicable safety improvements, with a focus on improving risk control and preventing, rather than simply mitigating, further accidents. Recommendations 3 and 4 were key to delivering a preventative approach.

8. LRSSB has produced guidance on Automatic Vehicle Speed Management (AVSM)[2] and detection of driver inattention[3], based on independent research by Ian Rowe Associates.

9. All networks have now either fitted equipment to control the speed of a tram and detect driver vigilance, or have provided a timebound plan to so. ORR has issued improvement notices against Transport for Greater Manchester (owner of the Manchester Metrolink system) as TfGM are currently considered to be in breach of duties under Sections 2(1) and 3(1) of the Health and Safety at Work etc. Act 1974. The intent of the Notices is to ensure that measures which are effective to improve the reliability of line of sight driving through engineering/technological means are implemented on all Manchester Metrolink trams in as short a timescale as reasonably possible.

Summary of end implementer responses

End Implementer	Summary of response	Status
Tram Operations Ltd (TOL)	Reported as implemented 5 April 2019. A physical prevention of overspeed system in in place, supplemented by a speed monitoring system.	Implemented (previously reported to RAIB on 3 March 2020)
London Trams (LTL)	Reported as implemented 5 April 2019	Implemented (previously reported to RAIB on 3 March 2020)
Transport for West Midlands (TfWM)	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 (WMM)	As per TfWM response.	Implemented (previously reported to RAIB on 3 March 2020)
Blackpool Transport Services (BTS)	BTS have provided a timebound plan for the fitment of a system to identify overspeed and obstacle detection. The timescale is currently 15 months, with the possibility this will be reduced to 8 months.	Closed

[2] LRSSB AVSM guidance: LRSSB Reference Library | LRG 18.0 - Speed Management Systems Guidance
[3] LRSSB driver inattention systems guidance: LRSSB Reference Library | LRG 17.0 - Driver Inattention Systems Guidance

Blackpool Borough Council (BBC)	As per BTS response.	Closed
Edinburgh Tram (ET)	Edinburgh Trams is installing the LeadMind AVSM system, with completion expected by October 2023.	Closed
City of Edinburgh Council (CofEC)	As per ET response.	Closed
Transport for Greater Manchester (TfGM)	TfGM have identified a supplier and agreed a plan for fitment of a system to detect driver vigilance and control the speed of a tram. Significant progress towards complete fitment is planned by December 2024.	Closed
Manchester Metrolink (KAM)	As per TfGM response.	Closed
Nottingham Council (NCC)/ Tramlink Nottingham Ltd (TNL)	An overspeed detection system has been identified, with fleet fitment expected by January 2024.	Closed
Nottingham Trams (NET)	As NCC/TNL response.	Closed
South Yorkshire Mayoral Combined Authority (SYMCA)	South Yorkshire Mayoral Combined Authority (SYMCA), replacing South Yorkshire PTE (SYPTE) have agreed a programme of work to fit and AVSM system by April 2024	Closed
South Yorkshire Supertram Ltd (SYSL)	As per SYMCA response.	Closed

Previously reported to RAIB

10. The link to the previous response on 14 May 2021 is as follows: RAIB Report: Overturning of a tram at Sandilands junction, Croydon, 9 November 2016 (orr.gov.uk)

Updates from end implementers

11. 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

12. LRSSB has issued guidance on devises to monitor driver attentiveness, based on independent research by Ian Rowe Associates Ltd. 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.

13. As reported in our last update, 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.

14. We welcome the continued research by LRSSB and individual networks into new technology that may further reduce the risk of driver inattention not being detected.

Summary of end implementer responses statuses

End Implementer	Summary of response	Status
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.	Closed
Transport for West Midlands	As per WMM response.	Closed
Blackpool Transport Services	All trams have been fitted with Driver Vigilance Device (DVD) in line with LRSSB guidance. Upgrade to multi-input device under consideration. BTS is continuing to support UK Tram FOCUS+ trial.	Closed
Blackpool Borough Council	As per BTS response.	Closed
Edinburgh Tram	DVD system fitted in line with LRSSB guidance. ET is continuing to support UK Tram FOCUS+ trial.	Closed
City of Edinburgh Council	As per ET response	Closed
Transport for Greater Manchester (TfGM)	KAM and TfGM have identified a supplier and agreed a plan for fitment of a system to detect driver vigilance and control the speed of a tram. Fitment is planned to be completed by December 2024.	Closed
Manchester Metrolink (KAM)	As per TfGM response.	Closed
Nottingham Trams	DVD has been successfully trialled on a single tram and is being installed on the rest of the fleet by January 2024.	Closed
Nottingham Council/ Tramlink Nottingham Ltd	As per NET response.	Closed

South Yorkshire Supertram Ltd	DVD system fitted to all trams. A software change to reduce vigilance timing from 60 to 30 seconds (to bring in line with LRSSB guidance) and was planned to be completed by December 2022.	Closed
South Yorkshire Mayoral Combined Authority (SYMCA)	As per SYSL response.	Closed

Previously reported to RAIB

15. The link to the previous response on 14 May 2021 is as follows: RAIB Report: Overturning of a tram at Sandilands junction, Croydon, 9 November 2016 (orr.gov.uk)

Update

16. 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

17. When the RAIB report was published, all tram infrastructure managers took action to review signage and visual information cues. LRSSB has since produced

guidance, following consultation with DfT, on signing and marking of tramways. We asked tram infrastructure managers to review signage against the new guidance and to report any changes to us.

18. 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
- have taken action to close it

Status: Closed.

Previously reported to RAIB

19. The link to the previous response on 14 May 2021 is as follows:
RAIB Report: Overturning of a tram at Sandilands junction, Croydon, 9 November 2016 (orr.gov.uk)

Update

20. 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

21. LRSSB has issued sector guidance covering Fire and Rescue. While some tram manufacturers concluded it would be possible to fit laminated glazing to existing trams, it could import risk and engineering challenges associated with significantly increasing the mass of vehicles. A number of operators have chosen to fit a film to the external side of windows. Although this does not offer any improvements in containment, it does offer other safety benefits, such as mitigating the effect of projectiles being thrown at the tram windowpane. In addition, some operators will consider including laminated glazing in the specification when procuring new vehicles.

22. The impracticability and potential negative consequences associated with fitting laminated glazing to existing vehicles, together with more robust risk controls (recommendations 3&4) aimed at preventing an overturning incident, lead us to conclude that no further action should be taken in response to this recommendation.

Summary of end implementer responses statuses

End Implementer	Summary of response	Status
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	No changes to glazing planned	Closed
West Midlands Metro	As above	Closed
Blackpool Transport Services (BTS)	No changes to glazing planned	Closed
Blackpool Borough Council (BBC)	As above	Closed
Edinburgh Tram (ET)	No changes to glazing planned	Closed

City of Edinburgh Council CofEC)	As above	Closed
Manchester Metrolink (KAM)	No changes to glazing planned	Closed
Transport for Greater Manchester (TfGM)	As above	Closed
Nottingham Council (NCC)/ Tramlink Nottingham Ltd (TNL)	No changes to glazing planned	Closed
Nottingham Trams (NET)	As above	Closed
South Yorkshire Mayoral Combined Authority (SYMCA)	The Citylink fleet is fitted with laminated glass; and concluded that it is not possible to retrofit laminated glass to the Siemens fleet. No changes to glazing planned	Closed
South Yorkshire Supertram Ltd (SYSL)	As above	Closed

Previously reported to RAIB

23. The link to the previous response on 14 May 2021 is as follows: RAIB Report: Overturning of a tram at Sandilands junction, Croydon, 9 November 2016 (orr.gov.uk)

Update

24. 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

25. 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.	Closed
Transport for West Midlands	As per WMM response.	Closed
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.	Closed
Blackpool Borough Council	As per BTS response.	Closed
Edinburgh Trams	A programme to instal emergency lighting which will operate without connection to remote power	Closed

	has been started and is expected to be completed by November 2023.	
City of Edinburgh Council	As per ET response.	Closed
Transport for Greater Manchester	Reported as implemented 5 April 2019	Closed
Manchester Metrolink	Reported as implemented 5 April 2019	Closed
Nottingham Trams	We have not had a detailed update yet due to the impact of COVID-19. Based on what NET reported a year ago, the engineering change to vehicles to improve the UPS may have been completed.	Closed
Nottingham Council/ Tramlink Nottingham Ltd	As per NET response	Closed
South Yorkshire Supertram Ltd	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. On Citylink vehicles, the risk of interruption to the emergency lighting is considered less likely, so no modifications are planned.	Closed
South Yorkshire PTE	As per SYSL response.	Closed

Previously reported to RAIB

26. The link to the previous response on 14 May 2021 is as follows: RAIB Report: Overturning of a tram at Sandilands junction, Croydon, 9 November 2016 (orr.gov.uk)

Update

27. See Annex B

End Implementer updates

Recommendation 2

1. On 29 September 2022 LRSSB provided the following update:

Recommendation 2 – Bullet point i *- examination of the differing risk profiles of on-street, segregated and off-street running.*

LSSB can advise that it commissioned the development and production of risk models for the light rail sector to identify and better understand the differing risk profiles that each individual light rail network presented. Each network is in receipt of their individual risk profile, that provides, both typical outcome and worst-case scenarios with associated precursors, including system layout/design, maintenance, and operation. Additionally, a national sector risk profile has been produced by the consolidation of individual network data. Initial results of the sector profile have been presented to ORR's Health and Safety Regulatory Committee, in addition to being published as part of the LRSSB's annual report in May 2020 and 2021 following an interim update.

Following the development and issue of all individual network risk profiles LRRSB are currently undertaking a full sector re-analysis of risk profiles anticipated for completion during March 2022. This re-analysis will consider risk reduction measures implemented post Sandilands and their impact on both individual and national sector risk profiles.

A review of the Tramway Principles and Guidance document (TPG) has been undertaken with its re – publication during March 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 year.

Using the output of this review of risk LRSSB has progressively developed and published an evolving suite of guidance documentation in consultation with the sector and relevant stakeholders, pertaining to ways of mitigating the risk associated with the design, maintenance, and operation of UK tramways.

Recommendation 2 - Bullet point 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.*

LRSSB commissioned independent research associated to both Automatic Vehicle Speed Monitoring systems (ASVM) and Driver Inattention Technologies conducted by Ian Rowe Associates Ltd (IRAL).

Following conclusion of this research, reports were published in relation to both areas in 2020.

LRSSB has subsequently published guidance documentation informed by the research reports and system trials conducted. Ref:

- *LRG 17.0 Driver Inattention Systems Guidance*

- *LRG 18.0 Speed Management Systems Guidance*

Recommendation 2 – Bullet point iii *- current practice world-wide and the potential of recent technological advances to help manage residual risk.*

In collaboration with the sector LRSSB has developed various platforms following assessment of worldwide best practice in addition to drawing from other industries methods employed to effectively manage risk.

These platforms have been consolidated into a sector risk management framework that integrates:

- *Standardised data collection and collation -TAIR database*
- *Risk profiling and analytics - Individual and national risk models*
- *In depth risk assessment and process analysis - Bowtie database*
- *Measurement and monitoring - RM3 Assessment tool*

Recommendation 2 - Bullet point iv - *safety learning from bus and train sectors that may be applicable to the design and operation of tramways.*

LRSSB undertook trials in conjunction with Sheffield Supertram of the BOSH obstacle detection system. Following this trial LRSSB are producing a technical report into the findings and results. LRSSB are talking with Blackpool City Transport to undertake evaluation of the proprietary obstacle detection system being installed on the Blackpool tram fleet.

Recommendation 2 - Bullet point v - *consideration of the factors that affect driver attention and alertness across all tram driving scenarios in comparison to driving buses and trains; and*

As previously covered under point ii, LRSSB commissioned independent research associated Driver Inattention Technologies compiled by Ian Rowe Associates Ltd (IRAL).

On conclusion of this research, a report was published in 2020.

LRSSB has subsequently published guidance documentation informed by the independent research report and system trials conducted. Ref:

- *LRG 17.0 Driver Inattention Systems Guidance*

The factors associated to driver inattention have also been integrated into the analysis of risk within the risk models produced for the sector, in addition to the publication of other guidance associated to fatigue and medical fitness that are considered factors of driver inattention.

LRSSB has now developed and delivered to the sector a software-based hazard perception tool, whereby drivers are evaluated and assessed on their awareness of hazards based on a digital representation of their existing network routes within the full spectrum of on-street, segregated and off-street running.

***Recommendation 2 – Bullet point vi -** guidance on timescales for implementing new control measures (e.g., whether retrospective or only for new equipment).*

Not applicable to LRSSB, all timescales for the introduction of new control measures within the sector associated to recommendation 2 point vi above will need to be confirmed with individual networks.

Recommendation 3

2. On 18 August 2022 Blackpool Transport provided the following update:

Alstom (previously Bombardier) have concluded their testing of the Obstacle Detection Assistance System (ODAS) and Collision & Overspeed Prevention Assistance System (COMPAS) and have received independent verification. This, and the completion of official testing, allowed Alstom to offer the system to the market. In December 2021Blackpool Transport Services Ltd (BTS) & Blackpool Council (BC) received a quotation for the design and installation of the overspeed and collision avoidance systems, BC confirmed acceptance and placed orders for the system(s) on 03 February 2022.

The intention is that the first tram should have the systems installed in January 2023 and the programme rollout is planned to be completed within 15 months.

3. On 8 September 2022 Edinburgh Trams provided the following update:

ET and the City of Edinburgh Council (CEC) are progressing the installation of the LeadMind solution to control over speeding.

Proof-of-Concept

CAF has installed a LeadMind PC on six trams 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 has been continuously monitoring the speed of each tram and provide a warning if a speed limit is exceeded and subsequently, when we are satisfied to enable the braking functionality, apply the emergency brake if the speed exceeds pre- determined thresholds.

We are currently fine tuning the monitoring points to optimise the efficacy of the speed monitoring and associated alarm points. The outputs can also be used to review driver behaviour and inform subsequent training. When the optimised set of monitoring points has been uploaded to the Proof-of-Concept tram we will activate the full functionality in that tram and so validate the LeadMind solution.

On completion of the Proof-of-Concept trial, we will issue a CONDITIONAL Safety Validation of Change (SVoC) certificate to permit activation in other trams.

The CONDITIONAL SVoC certificate is scheduled for sign off in August 2022.

Fleet Implementation

Following a period of 6 months for safe operation and driver training, we will issue a FULL SVoC certificate. This will facilitate activation of the full functionality across the 27 tram fleet. We may activate the vehicles in a phased approach starting with the operational trams and then others as they become available.

In our last letter we envisaged that the fleet will be modified throughout 2021, with completion anticipated by December, however the implementation has been delayed by 9 months due to issues with supply of hardware and systems, we now anticipate full introduction to all 27 trams by October 2023 subject to delivery of key long lead time materials.

4. On 14 September 2022 Edinburgh City Council provided the following update:

As previously noted in my earlier responses, to satisfy this recommendation, this Council, in partnership with Edinburgh Trams, is funding the implementation of LeadMind. I am pleased to inform you that it is currently programmed that LeadMind will be installed across the fleet by the end of October 2023

5. On 30 September 2022 Transport for Greater Manchester and Keolis Amey Metrolink provided the following joint update:

Metrolink are committed to addressing recommendations 3 and 4 by fitting a driver vigilance device and a system to prevent a tram over speeding at, as a minimum, high risk locations. Our own risk assessment recommends implementing this technology subject to the market being able to do this.

Earlier this year we engaged the market and after a lengthy procurement process, we were unable to agree a contract with a preferred supplier for the driver vigilance device. This has unfortunately required us to revisit our implementation plan.

Our plan is to award one contract to fit both systems with the aim of being in contract by the end of 2023. Following contract award, it is expected that both systems will be fully installed and operational by 2026 to 2027. Metrolink will be looking to better these provisional dates, however, until a supplier has been formally engaged this cannot be confirmed.

Until these systems are installed Metrolink is planning additional mitigations to manage the risks associated with line of sight operation. These are summarised in the table below with planned timescales to implement.

Mitigation	***Implementation date***

Reinforce the speed monitoring programme through the use of mobile speed guns at high risk locations.	*Provisionally planned to commence before end of 2022.*
Radar warning speed signs displaying to tram drivers their current speed to be installed at location across the network identified as having a high risk of derailment.	*Pending feasibility, provisionally planned for February 2023.*

6. On 19 September 2022 Nottingham Trams Limited (as duty holder for the operations of the Nottingham Express Transit (NET) system) provided the following update:

The system design and installation program was presented to the ORR on their visit on 8th February 2022. The new overspeed system design has been completed and has been installed on a single tram and successfully tested in service. The fleet is now commencing with a completion date of January 2024.Our tram simulator, demonstrated to Dominic Long on 26 May this year, has been updated to reflect new functionality for overspeed and driver vigilance modifications. A full driver training programme has been implemented to support this.

7. On 30 September 2022 Stagecoach Supertram provided the following update:

In addition to regular spot checks across the system, Supertram now have invested in the ability to covertly monitor speed en mass at key locations across the system. This method allows us to monitor speed on a much larger scale without influencing the behaviour of the drivers with the aim of identifying any areas of interest or further interventions required. During testing, we were able to collect over 1,300 instances of speed data in a two-week period.

With regards to the tram fleet, SYMCA have appointed SNC-Lavalin Atkins to undertake a review of the existing fleet condition, options for a future fleet, and a separate review of Tram Overspeed Protection options available. Following receipt of a draft copy of the report, SYMCA have advised that an internal review will convene in October to select an appropriate option for the overspeed protection to be fitted to the Siemens and Citylink vehicles.

Supertram will continue to monitor speed across the system both covertly and overtly to measure compliance and take actions where appropriate, until an appropriate speed monitoring system is selected for retrofit to the Siemens and Citylink fleets during retrofit.

8. On 30 September 2022 South Yorkshire Mayoral Combined Authority (SYMCA) provided the following update:

The existing Siemens fleet is approaching 30 years old. Since the submission of our last response on 20 August 2021 we appointed SNC-Lavalin Atkins to undertake a

review of the existing Siemens fleet condition along with an assessment of the options and costs for a future fleet refurbishment programme.

SYMCA also engaged SNC-Lavalin Atkins to provide an Advisor's review of the available Tram Overspeed Protection options available for retrofit on the existing fleet of Trams and Tram-Trains, and how these might be cascaded to a new fleet. The draft report was received on 22 September 2022 and sets out a number of options and associated costs for SYMCA to consider in line with the future fleet strategy.

SYMCA understand the need to implement a speed control system as soon as reasonably practicable in line with the requirements of the LRSSB LRG 018 Speed Management Systems Guidance. An internal review of these reports to develop our fleet strategy will take place during early October and the outcome will then need to follow our internal governance protocols. However, the funding for any fleet modifications is subject to DfT approval for early draw down of SYMCA grant allocation of City Regional Sustainable Transport Settlements (CRSTS).

This is an important matter and will be dealt with as expeditiously as possible.

SYMCA will provide a status update to the Office of Road and Rail (ORR) in due course.

South Yorkshire Supertram Limited (SYSL) set out in their response the control measures they are taking.

9. On 19 December 2022 South Yorkshire Mayoral Combined Authority (SYMCA) provided the following further update:

Thank you for your time on Friday 16 December 2022 and allowing us to discuss with you our revised programme for implementation of a speed control system on South Yorkshire Supertram. As requested, a copy of our proposed implementation programme is attached.

Rec3 Programme 1.3 v2.pdf

As we discussed in the meeting, this is our best estimate at present based on initial discussions with potential suppliers. As we progress through the project stages, we have agreed to meet with you and update you on progress as a minimum every two months. We will also provide you a written update on progress against plan ahead of each of these meetings.

Recommendation 4

10. On 18 August 2022 Blackpool Transport provided the following update:

Blackpool Transport Services Ltd operate Bombardier Flexity 2 trams. All trams are fitted with a Drivers vigilance Device (DVD) This device is a lift and drop and has a time out feature. We have checked our settings against the standards laid down in

LRSSB guidance document 17.0, and therefore believe at this time we have met Recommendation 4. We are however consulting with Alstom to explore the potential of upgrading the DVD system so that it will require multiple inputs by the drivers. This is on-going.

BTS is continuing to support UK Tram with their FOCUS+ trial. We have five drivers currently signed up to the phase 4 trial. We will also continue to support LRSSB in investigating emerging technologies and will consider the practicalities of implementing each new technology.

11. On 8 September 2022 Edinburgh Trams provided the following update:

The risk-based evidence as to how the timings of the DVD fitted to the Edinburgh trams has been optimised was provided in response to our 4th letter dated 15th January 2021.

We note your non-Objection to our configuration of DSD/DVD in your email from Dominic Long dated 5th March 2021 stating your "opinion that Edinburgh has a DSD system in place that provides a safety function as intended." (Appended herein)

Edinburgh Trams asks your consideration to declare this recommendation implemented based on that evidence.

We will of course continue to work with LRSSB to understand emerging solutions and their efficacy (e.g. FOCUS+) however this is an ongoing process, not limited to this recommendation and therefore we will assure any adopted emerging solution separately through our Safety Validation of Change process.

12. On 14 September 2022 Edinburgh City Council provided the following update:

I note that Edinburgh Trams has previously provided evidence of the optimisation of the DVD system fitted to the Edinburgh trams and has asked that you consider that this recommendation has now been implemented. I sit on the board of the D.I.S.C. project, which concluded that there is no system currently available that can accurately monitor both fatigue and wellbeing issues. This project is now developing a solution (named Focus+) which is expected to monitor the biorhythms of drivers and issue alerts if the driver is becoming inattentive or at risk of becoming incapacitated.

13. On 30 September 2022 Transport for Greater Manchester and Keolis Amey Metrolink provided the following joint update:

See response to Rec 3 above.

14. On 19 September 2022 Nottingham Trams Limited (as duty holder for the operations of the Nottingham Express Transit (NET) system) provided the following update:

The system design and installation program was presented to the ORR on their visit on 8th February 2022. The new vigilance system design has been completed and

installed on a single tram and successfully tested. The fleet is now commencing with a completion date of January 2024.

15. On 30 September 2022 Stagecoach Supertram provided the following update:

Supertram's Siemens fleet is now fully fitted with the driver vigilance device referred to in our last update. All units, apart from tram 105 which is currently off the system for extensive repairs due to RTC damage, are fitted with the device and fully functional.

Following the release of the LRSSB Guidance 17.0, Supertram is bringing the DVD device on the Citylink vehicles into line with the guidance. Current vigilance timing on the Citylink vehicles is 60 seconds and this will be reduced to 30 seconds. Supertram expects this to be implemented before the end of the year; the change requires a software update by the supplier.

16. On 30 September 2022 South Yorkshire Mayoral Combined Authority (SYMCA) provided the following update:

SYSL have now implemented a Driver Vigilance Device on the Siemens fleet (excluding Tram 105 which is under significant repair off site). As detailed in SYSL's response they are also working with Stadler to reduce the time on the existing Driver Vigilance Device from 60 seconds to every 30 seconds.

Recommendation 5

17. On 19 July 2022 Blackpool Transport provided the following update:

Blackpool Transport Services Ltd have reviewed the signage against LRG 4.0 Signing & Marking of Tramways in conjunction with our Shareholder, Blackpool Council.

Blackpool Tramway operates a line-of-sight system with only two significant tight curves. One being the terminus at Starr Gate and the other the terminus at Fleetwood Ferry. Due to the tight radius of these curves, a permanent speed restriction of 15 km/h applies at this location.

Blackpool Tramway has several generic speed restrictions at specific locations e.g. through tram platforms, vehicle assess points and turnouts. (Please see the attached diagrams).

Line Information updated SB 17-05-22.

Line Information updated NB 17-05-22

The review has shown that all existing tramway signage complies with the mandatory requirements set out in the Traffic Signs Regulations and General Directions 2016 as amended1 (TSRGD).
All signs are retroreflective and comply with BS EN 128993. Guidance on the reflection and angle of reflection is given in Chapter 1 of the TSM.

As a result of the review, it was agreed to introduce one additional hazard warning sign on the approach to an NMU crossing and some speed limit signs in areas where it was felt step down speeds were appropriate.
These step downs allow to driver to progressively reduce the speed of the trams.

18. On 22 July 2021 Edinburgh City Council provided the following update:

As you know, we work closely with Edinburgh Trams Ltd to review emerging guidance. I support their position that existing signage has been provided in accordance with Traffic Signs Regulations and General Directions. When any changes are being progressed, these will be done following a Safety Validation of Change review. In our opinion the existing Amber and Red markings on our OLE poles for Coast and Brake do provide the same benefit as Diagrams 823, 824 and 825 from the Signing and Marking of Tramways and Highway Interface Guidance (LRG 4.0). This Amber and Red signage will be implemented to the on-street areas on approach to bends, over the next 6 months.

19. On 31 May 2021 Edinburgh Trams provided the following update:

Edinburgh Trams has reviewed the LRG 4.0 Signing & Marking of Tramways guidance and would offer the following summary:

1. *Existing street signage is in line with the Traffic Signs Manual and Drawing ULE90130-SW-DRG-00828 (attached)*

   
   ULE90130-SW-DRG-00828 Rev 5.pdf

2. *Where changes are being progressed, these will be done following the Safety Validation of Change process and Engineering Change (attached ET/SM/1.5 and ET/EM/010)*

   
   ET.SM.1.5 ~ Safety Validation of Change

   
   ET.EM.010 ~ Control of Engineering Chang

3. *We have considered the benefit of changing from our current approach regarding early warning to prepare for significant speed changes and have decided that our Amber/Red markings on OLE poles for Coast/Brake respectively provide the same benefit as Figure 4.3: Diagrams 823, 824 and 825 (LRG 4.0).*

   
   Tramway Signage and OLE Poles Locatic

We intend to use the Amber/Red system in on-street areas on approach to bends. This will be carried out over the next 6 months."

20. On 30 July 2021 Keolis Amey Metrolink provided the following update:

I am writing to provide you with an update on the action taken by KAM's following the publication of the LRSSB's Light Rail Guidance 4.0 'Signing and Marking of Tramways'.

A cross-functional KAM team, involving HSQE and Driver Management teams, have undertaken a desktop review of the guidance document to compare against existing signage and have confidence that we are in the main compliant.

One area we have identified for further review is in relation to the colour of countdown signage on approach to curves in segregated areas (Metrolink's being red against a white background, rather than black as specified by the guidance). A risk assessment will be undertaken to establish if further action is required, however as they are only located in off-street segregated areas, they are not relevant to road users and therefore considered as low risk.

21. On 28 July 2021 London Trams provided the following update:

Following on from your email, I can confirm that we have reviewed the LRSSB Guidance Note and I am pleased to confirm that we comply with the guidance contained therein. There are a few areas however that I would like to draw your attention to as to how we have interpreted the guidance note in respect of the signage in place.

In section 4.4 of the document it states "For curves with limited visibility of approach and where an assessment has identified that additional warning is required, the advance warning signs to TSRGD Diagram 512 should be installed…..". On the London Tram network, rather than install fixed signage as per Diagram 512, we have chosen to install electronic signage which is activated when a tram approaches. The graphic on the sign is the same as Diagram 512, but it is not permanently on display. I do not believe this means we are not following the guidance in the document.

Section 4.8 details what provision of signage is required on the approach to a curve to give additional visual trigger to the driver. These signs are similar in nature to what you see on a highway. We do not have these signs installed on the London Tram network, instead we have chosen to install step-down signage on the approach to curves and these act as a trigger to the driver of an approaching curve. We also have the other signage on the approach to curves detailed above (as well as chevron signs at selected locations). At this stage, we do not intend to install signs as described in this section of the guidance note as we believe the risk is adequately mitigated by the step down signage.

Section 5.4 contains examples of other signs to be installed on the network to give information to drivers. We are compliant with this type of design, however there is one area where we have taken additional measures over and above what the guidance note requires. At certain locations on the network, in order to make the speeds signs more visible we have included a yellow border around the sign. An example of this can be seen in the picture below. Whilst this is not mentioned within the Guidance, we believe this provides an important visual enhancement to the drivers.

Further, in addition to the signs contained in figure 5.1, we have the following:

- *To give advance warning of a Temporary Speed Restriction (TSR), we display a 'W' (in red), in addition to the red "T" to signify the end of a TSR; and*
- *SI signs are rectangular in shape and not a diamond as suggested. We believe that is appropriate given all other driver information signs (e.g. DNOD and PEDX) are rectangular in shape so this is consistent.*

22. On 28 July 2021 Nottingham Trams Limited (as duty holder for the operations of the Nottingham Express Transit (NET) system) provided the following update:

With reference to your email of 14 May 2021, regarding LRG 4.0 Signing and Marking of Tramways I am able to furnish you with the following: Our Network has been inspected by Operations Management, existing QHSE team in addition to our incoming QHSE officer and former tram driver of 2 years experience. Changes to document QP-OS-005 Tramway Signage have been made to include 2 curve speed warning signs for trams not on a highway. In addition, an assessment has been made regarding the use of inconsistent signage where we feel human factors may have impacted safe operations. This relates to a single track section between BU and HU, and HVB and PP. Signage has been place under signal heads to remind drivers of single line departure procedure. This is in keeping with 2.12 of LRG 4.0 p6 stating 'the use of non-consistent prescribed or non-prescribed signage'. As these non-consistent signs are on a tram only section of track there are no adverse effects for other road users.

23. On 29 July 2021 South Yorkshire Passenger Transport Executive (now South Yorkshire Mayoral Combined Authority) provided the following update:

I write in response to your e-mail dated the 14 May 2021 requesting confirmation that existing signage has been reviewed against the guidance LRG 4.0 Signing & Marking of Tramways.

South Yorkshire Passenger Transport Executive (SYPTE) has let a concession to South Yorkshire Supertram Limited (SYSL) for the operation and maintenance of the Supertram System. SYSL confirm that they have reviewed the signage against the guidance and full details can be found in their response dated the 22 July 2021.

24. On 22 July 2021 Stagecoach Supertram provided the following update:

Further to your email dated 14th May 2021 regarding the above, and the subsequent issuing of the LRSSB guidance LRG 4.0 Signing & Marking of Tramways, I can confirm that we have reviewed our signage against the guidance. We have identified and undertaken a number of sign changes, and have a small number of sign relocations to undertake to complete the work following a final system check. These will be undertaken shortly.

We also have two chevron warning signs that were installed following the initial recommendation and prior to the issuing of the guidance, which do not have the yellow backing board, but we are comfortable that these are sufficiently visible in their current form.

25. On 28 July 2021 Tram Operations Ltd provided the following update:

With reference to your email dated the 14th May 2021, I confirm that London Trams and Tram Operations Ltd have reviewed the LRSSB published guidance document LRG 4.0 Signing & Marking of Tramways and I am pleased to confirm that London Trams have confirmed, we comply with the guidance contained therein. There are a few areas however that I would like to draw your attention to as to how we have interpreted the guidance note in respect of the signage in place.

In section 4.4 of the document it states "For curves with limited visibility of approach and where an assessment has identified that additional warning is required, the advance warning signs to TSRGD Diagram 512 should be installed…..". On the London Tram network, rather than install fixed signage as per Diagram 512, we have chosen to install electronic signage which is activated when a tram approaches. The graphic on the sign is the same as Diagram 512, but it is not permanently on display. I do not believe this means we are not following the guidance in the document.

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have the other signage on the approach to curves detailed above (as well as chevron signs at selected locations). At this stage, we do not intend to install signs as described in this section of the guidance note as we believe the risk is adequately mitigated by the step down signage.

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- *SI signs are rectangular in shape and not a diamond as suggested. We believe that is appropriate given all other driver information signs (e.g. DNOD and PEDX) are rectangular in shape so this is consistent.*

26. On 14 September 2022 West Midlands Metro and Transport for West Midlands provided the following joint update:

In November 2016 post Sandilands incident, at request of the ORR, The then operator of Midland Metro, National Express Midland Metro undertook a survey of all signage situated on our network, this survey and subsequent recommendations from the survey were implemented across our line 1 network, this included locations of step down signage as per the ORR safety advice note issued in November 2016, this was reviewed again in 2018 with evidence attached.

It was also identified and reported to the ORR in 2016 that West Midlands Metro has no similar geography to that of the Sandilands Curve where a high speed approach to a tight radii curve could cause a low frequency high consequence event of tram overturn.

In the Summer of 2017 Myself as NXMM QHSE Manager commissioned an independent mainline RSA 3 & 4 audit on behalf of the Operator and Owner across the whole line 1 infrastructure. The audit undertaken by BWB and SNC Lavalin specifically looked in to detail of tramway signage and the appropriateness of signage at high risk locations, the independent audit report is again attached to this email. I can confirm that all recommendations from this independent audit were implemented, actioned, and closed by NXMM's infrastructure team. Subsequently the MML QHSE team have then embarked on a 3 yearly audit schedule of West Midlands Metro tram network where signage is a key point amongst other survey items, to ensure visibility, condition and appropriateness of posted tramway signage.

In June 2018, MML Head of QHSE was installed as the lone point of contact for MML to the Midland Metro Alliance, my involvement along with the TfWM appointed

ICP within the MMA safety transportation team has ensured that tramway extensions are delivered to an ALARP status with tramway signage and RSA audit principles being applied to ensure robust design review and the addressing of arising issues during construction are remedied prior to operational services commencement. This process has placed MML and the owner in to robust acceptance process with safety being delivered as our number one priority this process achieves a full sign off of a safety case by the ICP prior to the commencement of driver training.

Most recently MML has reviewed its mainline audit processes to include LRSSB guidance document LRG 4.0 Signing and Marking of Tramways, MML are cognisant of this document and also apply where necessary to new and future tramway extensions via the transportation safety forum.

I see that MML and TfWM continues to challenge itself to maintain its current tramway network and produce tramway extensions that are safe for its passengers and highways affected users. MML and TfWM adopt and apply new guidance where appropriate.

Recommendation 6

27. On 29 September 2022 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 manufactures who in turn confirmed the general impracticability to undertake retrospective modifications to glazing pertaining to vehicle doors and windows on existing tram fleets.

It is considered that the safety mitigation controls implemented through recommendations 3&4 will provide sufficient prevention controls that in turn lower the risk of a vehicle overturning as a result of over speeding to within ALARP levels will no longer be vulnerable to overturning at speed.

LRSSB have now published tram sector guidance covering Fire and Rescue guidance taking account of enhanced performance requirements for window and door system integrity within new and future vehicle procurement and design specifications highlighting the requirement of suitable and sufficient risk assessment. LRSSB also continue to be active participants in the BSi/CEN Working Groups relating to design of vehicle crashworthiness, bodyside glazing and doors/entrances.

28. On 18 August 2022 Blackpool Transport provided the following update:

Blackpool Transport Services Ltd have liaised with Alstom and industry partners to review the means of improving passenger containment.

BTS concluded that the implementation of recommendations 3 & 5 will greatly reduce the likelihood of overturning. Anti-vandal film is fitted to inside of all tram saloon glass and therefore we believe that at this stage there is no further requirement for greater levels of containment.

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

29. On 8 September 2022 Edinburgh Trams provided the following update:

While it is physically possible to install the laminated glazing,

- *It would import significantly higher mass to the rail vehicle.*
- *It has the potential impose unsafe stresses to the tramcar chassis resulting in early life integrity failures.*
- *It would sit proud of the current fleet glazing openings as these were designed for single pain toughened glass.*
- *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 would render the vehicles inconsistent with PCV glazing standards*

With laminated glass it would be more difficult to escape importing safety risks in the event of:

- *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"

Having assessed the full implications of introducing a laminated glass solution, we have concluded that our preventative measures implemented through Recommendations 3 & 4 will provide sufficient mitigation, lowering the risk SFAIRP and that our trams will no longer be vulnerable to overturning at speed.

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

30. On 14 September 2022 Edinburgh City Council provided the following update:

As stated in my response to you in January 2021, I agree with Edinburgh Trams' conclusion that the mitigation measures proposed in response to Recommendations 3 and 4, does lower the risk of the overturning of an Edinburgh Tram Vehicle. This, we believe, should provide sufficient mitigation, and negate the need for additional

containment measures, however, through our continued liaison with LRSSB, we will monitor emerging advice on this issue.

31. On 30 September 2022 Transport for Greater Manchester and Keolis Amey Metrolink provided the following joint update:

With regards to recommendation 6, we have received information from glazing suppliers to allow us to complete the cost benefit analysis that accompanies our risk assessment. As we detailed in our previous letter, our tram manufacturer does think it is technically possible to change the glazing to a thicker laminate pane. They did stress to us that there may be other engineering challenges not yet known about and that detailed design work is required to fully understand the implications of changing the glazing. We were also made aware that using a thicker laminate glazing would result in the windows no longer sitting flush to the body of the tram. This would have safety implications and has been included in our risk assessment.

We progressed with undertaking a cost benefit analysis, combining costs, benefits, and safety considerations to see if we should progress to the next stage of design. We have used a conservative estimate (a low cost for the glazing change) so that we can have confidence in our decision. We also used an industry recognised tool for the cost benefit analysis.

Our conclusion is that it is not reasonably practicable to change the glazing in the Metrolink trams as the cost is grossly disproportionate to the benefit.

32. On 19 September 2022 Nottingham Trams Limited (as duty holder for the operations of the Nottingham Express Transit (NET) system) provided the following update:

As per our response of 30th March 2021 both types of NET trams are 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). In addition the introduction of the overspeed and vigilance modifications reduces the likelihood of overturning and thus overall risk magnitude is reduced. 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.

33. On 30 September 2022 Stagecoach Supertram provided the following update:

The update from January 2021 is still relevant, with regard to the Siemens fleet. The risks and timescales involved in a retrofit to the limited remaining life of this fleet prohibit this being undertaken. Our focus has been on prevention measures rather than mitigation.

Citylink vehicles are already fitted with laminated glass.

34. On 30 September 2022 South Yorkshire Mayoral Combined Authority (SYMCA) provided the following update:

The scope of fleet refurbishment currently under consideration would be to undertake a short life extension. As such changes to glazing would not form part of the scope due to the impact of any change on the vehicle structure.

SYSL's focus is on looking a prevention measures.

Recommendation 7

35. On 26 October 2022 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 has been completed on tram 255.

The implementation programme is underway for the rest of the fleet and is being progressed in a three phase approach:

***Phase 0 –** Install the lighting power supply units in the first 20 trams. (Complete)*

***Phase 1 –** Install associated spotlights and cable runs in the first 9 trams (Ongoing - 26% of Fleet Complete (7 Trams))*

***Phase 2 –** Implement Electrical Modification and Software Upgrade on all trams (Prog. 19/11/2023 to 27/11/2023)*

Note:
As hardware delivery for phase 2 will occur prior to completion of Phase 1, completion of Phase 1 & Phase 2 will run concurrently to the end of the project.

35. On 10 November 2022 Edinburgh City Council provided the following update:

I refer to your email of the 21 October 2022 requesting an update on the progress of implementation of Recommendation 7 from the above report.

I confirm that CAF were commissioned to develop emergency lighting which is powered independently from the main tram power supply. Following discussions with Edinburgh Trams, I am satisfied with the proposed solution, and this is being fully funded by CEC.

These works are being installed along with other renewal works to reduce costs and are programmed for completion by the end of November 2023.

Some of the tram fleet has already had the lighting installed and I was able to inspect this on a tram this week. That particular tram is also the test bed for the development of Leadmind and it was also good to see significant progress on this safety feature.

36. On 7 November 2022 Nottingham Trams Limited (as duty holder for the operations of the Nottingham Express Transit (NET) system) provided the following update:

As per our response of 30 March 2021, the current lighting configuration of both Incentro and Citadis trams provides emergency lighting levels should the main power supply fail. As per the tram design specifications, emergency mode is designed to meet all credible and foreseeable emergency situations. Both Citadis and Incentro comply with the requirements of EN13272-2 2019 Operation Category 1 (which is 30mins).

The battery isolation switch on the Citadis trams is mounted internally in the roof and on the Incentro within the roof mounted battery box, therefore do not have the same likelihood of inadvertent actuation as happened with the underframe mounted arrangement on the CR4000 trams. In conjunction with the additional measures taken, the risk has been significantly reduced and is considered ALARP.

Further, the introduction of the overspeed and vigilance modifications significantly reduces the likelihood of overturning and battery detachment, with a resultant reduction in risk magnitude. Three quotes were obtained from specialist providers to understand the feasibility and cost associated with protecting lighting continuity in the event of a tram overturning. The cost range was between £490,000 - £580,000 for implementation across the whole tram fleet.

With the introduction of the modifications detailed above the likelihood of a tram overturning is considered ALARP, as per the attached Risk Assessment:

RA-ENG-Sandilands Recommendation 7 2.

Therefore, the implementation costs associated with lighting protection were considered to be disproportionate, and ineffective in achieving any further risk reduction.