

Bus Safety Standard 2

Our roadmap from 2027



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Introduction

Defining the next phase of the Bus Safety Standard



Director's foreword

We remain resolutely committed to eradicating all deaths and serious injuries from the transport network

Reducing road danger and the risk posed by buses is fundamental to supporting a high-quality, attractive bus network where people feel safe and confident travelling. Our world-leading bus safety programme is turning our Vision Zero ambition into action. Since it launched in 2018, our Bus Safety Standard has been at the forefront of this programme, helping improve bus vehicle safety in London and beyond.

Through the Bus Safety Standard, we have exceeded regulatory requirements, implemented new and innovative technologies, and transferred systems from other vehicle sectors to ensure London's buses meet the highest safety standards. This means we continually improve the safety of London's buses, working with bus manufacturers, their suppliers, bus operators and other stakeholders including customers, disability groups, trade unions and independent research specialists to develop and implement the latest safety features and technologies.

Though the Bus Safety Standard was developed in London, many of the challenges it is addressing are not unique to our city. We have been encouraged by the interest from other bus operators and transport authorities outside London,

including internationally, and we are pleased to see some of the changes we have pioneered being rolled out elsewhere. We will continue to engage with these groups as well as regulatory bodies to share our experiences of driving evidence-based change. But we cannot stop here. Achieving our goals will require continued innovation and long-term planning. Therefore, this roadmap outlines requirements for the second phase of the Bus Safety Standard, for vehicles entering our fleet from 2027, 2030 and 2033.

'Through the Bus Safety Standard, we have exceeded regulatory requirements, implemented new and innovative technologies, and transferred systems from other vehicle sectors to ensure London's buses meet the highest safety standard'

I am particularly pleased that this roadmap includes measures dedicated to improving the driver's cab. Our highly skilled drivers are central to ensuring safe journeys for our customers and we must do everything we can to make sure their workspaces are safe, comfortable and attractive.

This roadmap reflects our shared commitment to make our buses safer for all and provides a clear direction for the bus industry. We know that achieving Vision Zero requires continued dedication from stakeholders across the industry, and we must continue to remind ourselves of the core principle of Vision Zero – that no death or serious injury is either inevitable or acceptable – as we shape a safer bus network for everyone. I am pleased that this roadmap supports this ambitious vision.



Lorna Murphy
Director of Buses



Executive summary

The Bus Safety Standard is a central part of delivering our Vision Zero targets

We have made considerable progress towards our Vision Zero targets for no one to be killed on, or by, a bus by 2030 and to eliminate all deaths and serious injuries from the transport network by 2041. There has been a 28 per cent reduction in the number of people killed or seriously injured in collisions involving a bus and a 40 per cent reduction in the number of people killed or seriously injured on a London bus from the [2010-14 baseline](#). Continued investment, collaboration and a range of measures are needed to achieve Vision Zero for buses.

Delivering world-leading vehicle safety to reduce the road danger posed by buses through our Bus Safety Standard is a central part of our work on bus safety. The Bus Safety Standard contractually requires the use of safer vehicles by specifying safety requirements that new buses entering service in London must meet, both ahead of and in addition to regulation.

The first suite of safety requirements for new buses was introduced through our Bus Safety Standard, which was launched in 2018 and contained requirements for buses entering the London fleet from 2019, 2021 and 2024. This Bus Safety Standard has pushed boundaries in bus vehicle safety

through a range of new safety features and technologies, many of which have also become standard features for new vehicles outside London. Our work on the Bus Safety Standard is recognised in the national [Road Safety Strategy](#). This highlights the additional powers through the Bus Services Act 2025 for local authorities to specify safety measures as part of franchising contracts, Enhanced Partnerships agreements or through local authority bus companies.

Collaboration with bus manufacturers, their suppliers, bus operators, research specialists and other stakeholders including bus customers has been fundamental to our success in driving innovation and ensuring a robust and evidence-led approach.



34%

reduction in the number of people killed or seriously injured in, or by, a bus in 2024 against the 2010-2014 baseline



We continue our work to improve safety across our bus fleet

The Bus Safety Standard is a long-term commitment, delivered in phases to bring forward the greatest safety benefits as soon as technology and other developments enable us to. This Bus Safety Standard 2 roadmap is the next step, building on the progress and setting out new requirements for buses entering service in 2027, 2030 and 2033 to ensure buses in London continue to meet the highest safety standards.

The key areas of focus are:

- Improving bus customer safety, reducing the risk of slips, trips and falls, which make up a significant proportion of serious injuries
- Implementing technology to support safer driving and help drivers avoid or mitigate collisions
- Improving data collection from collisions and near misses to learn from incidents and inform future changes
- Reimagining the driver's cab to ensure it is designed holistically as a workplace that is safe, inclusive, comfortable and secure for all bus drivers

This document includes a series of measures aimed at supporting these objectives, brought together in two roadmaps. The first contains measures to support safer driving and collision avoidance, reduce customer injuries and protect other road users. The second roadmap includes more detail on the

driver's cab. A holistic approach to the driver's cab is needed to ensure it provides an inviting and comfortable workplace, supports drivers in their role, and reinforces that they are valued.

This document aims to ensure that the bus industry, particularly bus manufacturers, their supply chain and bus operators, have a clear view of future requirements for buses and areas of further research, development and trials.

Vision Zero is a shared commitment and responsibility to address the sources of road danger and ensure our transport system accommodates human error and unpredictability to realise our goal of eliminating deaths and serious injuries on London's roads.

'This document aims to ensure that the bus industry, particularly bus manufacturers, their supply chain and bus operators, have a clear view of future requirements for buses'

Key themes of the Safe System



The Bus Safety Standard

Going further to ensure London's bus network meets the highest safety standards

Our world-leading Bus Safety Standard is driving real change across the bus industry, with the measures increasingly being adopted by other transport authorities and bus operators across the UK and worldwide, and informing regulations and standards.

We published our [first roadmap](#) in 2018 as a key tool to enable bus manufacturers, suppliers and operators to understand and plan for future vehicle requirements. The implementation was informed by research, trials and engagement, ensuring it was flexible, practical and evidence-led. Industry liaison was particularly important for longer-term measures that were not available immediately and required further development, and stakeholder engagement.

Once fully rolled out, we forecast that the delivery of the 2019, 2021 and 2024 Bus Safety Standard requirements will contribute to a significant reduction in the number of people killed or seriously injured. There are also other, less easily quantifiable benefits such as on safety culture and behaviours.

Continued commitment, research and a range of interventions are crucial to ensuring we achieve, and importantly maintain, our Vision Zero ambition on the London bus network. The Bus Safety Standard is a key part of this, and through this next phase we will build on the progress we have achieved to ensure buses entering service in London meet the highest vehicle safety standards.



Working together to improve front-end design

Since our first roadmap was published, we have worked with bus manufacturers and operators on the development of the requirements for optimised front-end geometry and frontal crashworthiness to help protect vulnerable road users in the event of a head-on collision. This has been a requirement for new buses entering service since 2024.

We developed the specification and testing protocols by working with bus manufacturers on physical tests

with prototype bus front-ends, and considered the operational impacts of design changes for operators in space-constrained bus garages.

This has been a significant area of work and has involved a complete redesign of the front of the bus, with bus manufacturers introducing a new category into their manufacturing process. This highlights the importance of the roadmap in ensuring the bus industry has notice and support to meet our requirements.

Vehicle requirements from 2027

Building on our progress to continue driving innovation and bus vehicle safety standards

This roadmap sets out our requirements from 2027, 2030 and 2033 to enable the industry to plan effectively. It has been shaped by a range of research and trials, and through engagement and collaboration with the bus industry, including bus operators, bus manufacturers, suppliers, trade unions and technical specialists.

The requirements will evolve to reflect technological progress and market readiness as not all the safety features and systems can be introduced immediately. Many are new and innovative, and bus manufacturers and their suppliers will need time to design, develop and implement the new technologies. We will work closely with the bus industry to develop and implement these new measures.

This roadmap aligns with the four stages of safety used by European New Car Assessment Programme (Euro NCAP) to make it more intuitive for all audiences. It helps make the Bus Safety Standard as easy as possible to adopt and align to national and international schemes to maximise impact and efficient investment. This document also includes a roadmap for improving the driver's cab.

The four stages of safety

Safe driving

Focusing on vehicle design, technology and information that supports relaxed and safe driving, and helps reduce human error to reduce the likelihood of a collision.



Crash avoidance

Focusing on preventing a collision or reducing the severity through timely warnings and interventions.



Crash protection

Focusing on the vehicle's structural design and passive safety systems to protect occupants and other road users during a collision.



Post-crash safety

Focusing on systems that facilitate effective emergency response after a crash and collect collision information to help inform future bus safety strategy.



2027

2030

2033



We have a detailed roadmap to improve the bus cab design

Supporting a safer bus network

Our Vision Zero targets are focused on reducing fatal and serious casualties as they represent the most harm. The Bus Safety Standard 2 measures in this roadmap will support an overall reduction in the number of people killed or seriously injured on, or by, a bus. They will also help reduce specific casualty types, including from incidents involving bus driver fatigue, pedal application error and customer slips, trips and falls. Alongside this there are wider

benefits including improved driver health and wellbeing, comfort and facilities, and improved data collection and analysis so that we can better learn from incidents and support safety culture across the industry.

We are also committed to reducing more minor injuries. The measures aimed at preventing fatal and serious injuries will also help reduce slight injuries where the causation and contributory factors are similar.

Minor collisions also cause disruption and cost for bus operators and Londoners. Therefore safety features that can reduce the frequency of 'damage only' or 'minor injury' incidents also form part of our roadmap.

Supporting an inclusive bus network

Inclusive design for bus drivers and bus customers underpins the development of standards and requirements for the bus network. As set out in our [Equity in Motion action plan](#), inclusive design is fundamental to ensuring fairness and equity on our transport network and making changes to improve opportunities for all. This includes addressing disparity in outcome in the context of Vision Zero. For example, older people and children have a higher risk of experiencing an injury on a bus. For more vulnerable customers, a slight injury may also have a greater effect on confidence and willingness to travel by bus in the future.

The measures in this roadmap to reduce and mitigate bus customer injuries are an important part of addressing this. They have been informed by extensive research and engagement to ensure they effectively support inclusion.

Our bus driver cab roadmap aims to support an inclusive and ergonomic cab that puts drivers at the heart of design. This will ensure the safety of drivers, support safer driving, and improve health and wellbeing.

We will continue to monitor and feed into any changes to accessibility standards to ensure that the requirements are aligned.

Our roadmap to 2027, 2030 and 2033

The following sections set out the Bus Safety Standard 2 roadmap covering 2027, 2030 and 2033. We have also set out a separate roadmap covering improvements to the bus driver's cab on page 33. We have included a preferred and required date for each measure in the roadmap. The preferred date reflects when the market leader is expected to first bring a vehicle or system to the market and aims to encourage early adoption. The required date represents when multiple bus models are expected to be available to the market and so only the use of buses equipped with the feature can enter the bus fleet.

These dates have been developed with input from the bus manufacturers and their supply chain. Our requirements are based on a three-year period to ensure that requirements remain deliverable. Introducing new measures annually or more frequently would place unrealistic pressures on bus manufacturers and limit the industry's ability to respond effectively. We will continue to collaborate with industry and pull forward these implementation dates wherever possible.

For bus manufacturers and operators, it is important to note that the preferred and required dates are not the tender date, which will come before the buses become operational.

This roadmap covers only new buses entering service and all requirements will apply to all new buses. The potential retrofit of these measures to existing buses will be considered separately, where feasible and where funding enables.

Our roadmap for new-build buses

Our timeline for achieving the safety ambitions for new vehicles



Our roadmap

Setting the timeline to implement measures on new-build buses

Safe driving

Safety measure	Delivery timeline			
	2027	2029	2030	2033
Driver inattention from fatigue Driver fatigue and distraction prevention	●			
Bus customer injuries Interior monitoring for driver	●			
Bus customer injuries Customer safety enhancements (2028 preferred)			●	
Bus customer injuries Internal lighting improvements (2028 preferred)			●	
Safety, comfort and security Bus cab design (see roadmap on page 33)	●			

Crash protection

Safety measure	Delivery timeline			
	2027	2029	2030	2033
Frontal collisions with cars Vehicle-to-vehicle crash compatibility (2030 preferred)				●

Crash avoidance

Safety measure	Delivery timeline			
	2027	2029	2030	2033
Moving-off collisions Moving-off intervention (2030 preferred)				●
Side and turning collisions Advanced Emergency Braking enhancements (2030 preferred)				●
Collisions with bridges Bridge strike prevention			●	
Pedal application error Acceleration suppression (2028 preferred)			●	
Bus customer injuries Customer safety messaging (2028 preferred)			●	

Post-crash safety

Safety measure	Delivery timeline			
	2027	2029	2030	2033
Secondary collisions Post-collision braking (2030 preferred)				●
Collision investigation data Event Data Recorder (2026 preferred)		●		
Collision investigation data Telematics and CCTV integration			●	

Safe driving

Using design, technology and information to help reduce errors before incidents occur



Driver fatigue and distraction prevention

Monitoring the risk of fatigue and distraction to support drivers



Required date

We will align with General Safety Regulation 2019/2144 and EU Regulation 2023/2590, which cover technical requirements for Advanced Driver Distraction Warning systems. These systems assess the driver's alertness through vehicle systems analysis and warn the driver when necessary. This can include driver-facing sensors or cameras to detect distraction through eye movements or head position. They can then provide a visual warning, plus an acoustic and/or haptic warning whenever distraction is detected.

Our research and trial of fatigue detection technology on around 400 buses shows a clear safety benefit. To strengthen the effectiveness of the fatigue detection element for London's bus fleet, our requirements will exceed regulatory requirements in some respects, where evidence from our trials supports this. For example, we will require activation of fatigue detection from 5kph rather than the 20kph specified in the regulations. Our requirements will include:

- **Driver monitoring** – Using sensors or cameras to identify signs of fatigue based on factors such as eye movements, blinking rate and head position

- **Driver alerts** – The system should alert the driver via haptic and audible warnings when fatigue indicators are detected
- **Management alerts** – Details of the fatigue alert should be sent in near real time to the bus operator control team
- **Data dashboard** – Technology suppliers must make fleet-level alert data available to bus operators and us

Intended benefits

This requirement brings several layers of benefits. The in-cab alerts act as an immediate warning to the driver to take action to avoid a collision. Our initial experience shows that fleets with these driver alerts record far fewer fatigue events than those operating with fatigue detection technology in shadow mode, where no alerts are issued.

The management alerts will enable bus operators to better manage fatigue risk among their drivers. This may include short-term actions such as service controllers checking in with the driver to ensure they are fit to continue driving. Our experience shows that it also enables

supportive conversations with drivers to identify and address the root causes of fatigue. This will support wider efforts to develop a more open culture on fatigue reporting and management.

Finally, making the data available through a fleet-level dashboard will enable higher-level analysis, such as on the rate of fatigue incidents by route, time of day and shift pattern. This will give bus operators better insight into fatigue issues and help them manage policy and procedure to support drivers if needed.

Implementation

This technology is well-established and proven globally to be effective. We will continue to work closely with bus operators and trade unions to implement the technology and monitor the data.

We will also work with operators on ways to share a central, anonymised data dashboard. This will help us identify London-wide issues and trends and develop further fatigue-related measures if needed.

‘Our research and trial of fatigue detection technology on around 400 buses shows a clear safety benefit’

Interior monitoring for drivers

Ensuring drivers can monitor key customer areas



Required date

This measure will introduce a new standard for how CCTV images are presented to the driver through their in-cab monitor. This will help support them with monitoring the internal areas of the bus.

Our current Bus Vehicle Specification for in-cab CCTV only states that there must be a five-inch monitor that displays the exit platform and ramp deployment area when the centre exit doors open. There is no standard for multiple or split screens, or for switching images. This means that, while these features are available on some bus models, there is inconsistency across the fleet. Our updated requirements will standardise what views are presented to the driver.



We want drivers to be able to effectively monitor their buses

Intended benefit

This measure is designed to minimise the cognitive load for drivers while providing them with the necessary information to monitor and manage the customer areas. The requirements will take into account how the driver uses the in-cab CCTV monitor alongside other indirect vision features, such as internal mirrors and camera monitor systems.

It is important that the information is presented as consistently and intuitively as possible. The ultimate aim is to improve customer safety. This is particularly true for boarding and alighting incidents, door entrapments and slips, trips and falls including in the stairwell. Drivers' visibility of the wheelchair priority area will also be improved.

Implementation

Requirements will be informed by feedback from drivers and trade unions, as well as research to better understand the range of tasks for which drivers need to view different areas of the vehicle.

Customer safety enhancements

Exploring ways to improve safety, accessibility and comfort for bus customers

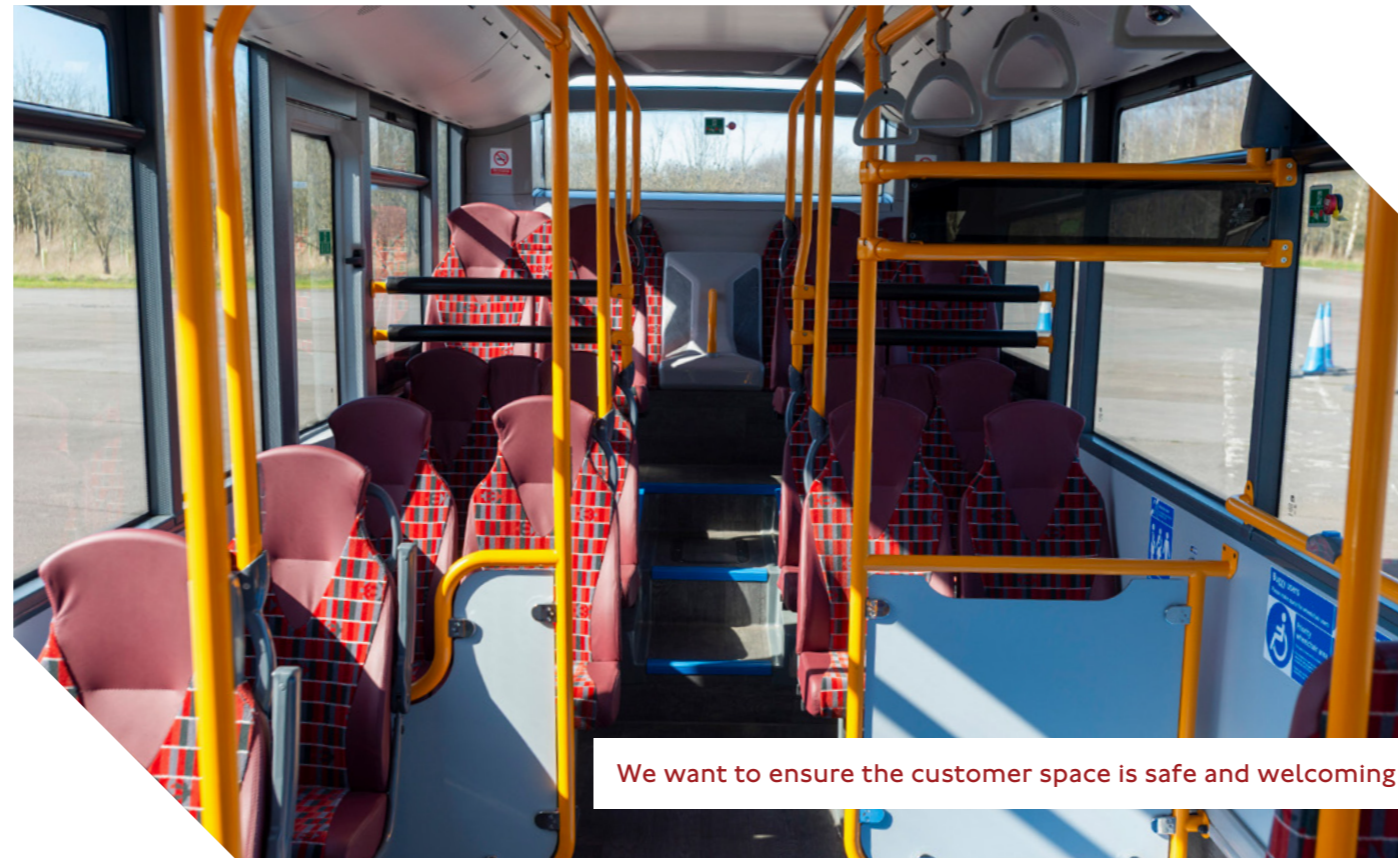


Required date

Our first Bus Safety Standard introduced a requirement for occupant-friendly interiors, with level 1 requirements coming in from 2021 and level 2 requirements in 2024. These requirements aim to ensure that the structures that customers come into contact with during collisions, and in non-collision incidents such as harsh braking, are designed to minimise injury. Harsh braking occurs for a number of reasons, including drivers responding to other road users, but these measures aim to reduce the risk of injury to bus customers. Further details of how we will improve data on harsh braking is outlined on page 28.

Building on this, we will introduce additional physical changes to the interior of the bus to further reduce the risk of customer injuries. One important change will be the introduction of tip seats with cushions, which will be required from 2030. These will be longitudinal seats fitted in the priority area, which can either be tipped down and used as a regular seat or perched on in a semi-standing position.

We will also continue to explore other interior design changes, including enhancements to vehicle accessibility, given the important crossover between accessibility and safety particularly for certain customer groups. This may include improvements to communication



We want to ensure the customer space is safe and welcoming

technology between wheelchair users and the driver, including an improved sound for the accessibility ramp deployment.

Intended benefit

The tip seats will provide additional seating capacity, which could be particularly useful for those travelling alongside wheelchair

or mobility scooter users, or parents or carers travelling with children in a buggy. When the priority space is not needed by wheelchair or buggy users, the seats will be available to other customers, either as a regular seat or as a leaning point. In either position, the occupant will be more stable than they would be standing, and therefore less likely to slip, trip or fall.

Improved ramp sounds and communication between wheelchair users and the bus driver are intended to improve accessibility, customer experience and safe and relaxed travel for those with additional access requirements.

Implementation

A trial of tip seats began in 2025 as part of the Bus Customer Injuries Innovation Challenge, which was launched in 2023 to support trials and evaluate new safety features to reduce the risk of on-board slips, trips and falls. Through the Innovation Challenge, we identified a supplier and we are working with a bus manufacturer to install them on a demonstration vehicle. This will enable us to gather feedback from different user groups to inform in-service trials and then a specification requirement, which is planned from 2030.

We will continue to improve customer safety and accessibility, and we remain open to trialling other features that could assist with these aims.

Internal lighting improvements

Considering all aspects of lighting to ensure safe, comfortable environments on buses



Required date

These cover requirements related to the position of lighting in customer areas of the bus, as well as other factors such as brightness, colour temperature and lighting type.

It follows research we commissioned by University College London's Person Environment Activity Research Laboratory (PEARL) facility, which tested and gathered feedback from drivers and customers on new interior lighting positions including around the doors, priority wheelchair area, stairwell and rear seating area on the lower deck. The research also looked at additional lighting aspects such as glare and diffusion, ambient lighting and colour temperature. This included exploring how customers and drivers feel about the use of coloured lighting to enhance the customer experience and encourage positive customer behaviour change.

Intended benefit

Lighting enhancements aim to reduce the risk of customer slips trips and falls by improving visibility.

Implementation

The outcomes of this research, alongside further trials and stakeholder engagement, will inform the development of new internal lighting requirements from 2030.



We trialled interior lighting options at the PEARL facility

Crash avoidance

Preventing a collision or reducing the severity through timely warnings and interventions



Moving-off intervention

Protecting other road users by ensuring vehicles can pull away safely



Required date

A Moving-Off Information System, as defined in [UNECE Regulation I59](#), is designed to inform the driver of pedestrians or cyclists in immediately front of the vehicle when it is stationary. If the driver attempts to move off, it will warn them of the potential collision risk.

Our requirements will extend this functionality to include an interlock. This means that as well as warning the driver, the system will intervene to prevent the bus from moving off if a pedestrian or cyclist is immediately in front of the bus.

Intended benefit

Regulation I59 was largely designed for trucks, where there is often a large blind spot at the front of the vehicle where pedestrians and cyclists can be hidden from the driver's direct view. This is not generally the case with city buses, but some similar collisions still occur when the driver is looking in a different direction and so does not see the person when they enter the space in front of the bus. For example, as they are moving off at a bus stop, they might be looking at the driver's side mirror or over their right shoulder to merge into traffic, just as a person steps from the kerb at the left. In such situations, it is less clear that a non-urgent information signal will be effective, and warnings may leave very little time for the driver to react.

The benefit of this measure will therefore be the inhibition of moving off when a pedestrian or cyclist is in close proximity, to prevent these incidents from occurring.

Implementation

This system is not yet available in any vehicle market and will require development. Euro NCAP has it on its roadmap for implementation in heavy goods vehicles (HGVs) in 2028 and it is likely that some manufacturers will be developing this. However, the system will need adapting for buses, so while preferred under this roadmap from 2030, it will not be required until 2033, to enable time for research, trials and development.

Manufacturers and their supply chain will need to develop the system to determine whether implementation by acceleration suppression or application of the brakes will be the most effective method. Alongside this, trials will be needed to test the system with bus drivers to aid the development of an appropriate override function so that the driver is not prevented from carefully pulling away in busy areas. We will work closely with bus manufacturers and operators on this research, and the development and definition of the requirements for 2033.



An interlock will protect people immediately in front of the bus

Advanced Emergency Braking enhancements

Supporting drivers in more situations



Required date

Advanced Emergency Braking is a driver assist system that uses forward-looking sensors to monitor other road users and detect the risk of an imminent collision. If a driver does not act to prevent a collision, then the brakes are automatically applied to avoid or mitigate the impact of a collision. We introduced Advanced Emergency Braking in our first Bus Safety Standard as a requirement for new buses from 2024, and we continue to work with bus manufacturers to implement this technology.

The existing requirements for Advanced Emergency Braking address frontal collisions when the bus is going forward. Our next phase of requirements aims to extend the current capability to include collision risks when the bus is turning. This may include collisions with people walking and cycling at the front or side of the bus, but all while the bus is turning.

Intended benefit

A substantial proportion of collisions involving buses occur when the bus is turning. The geometry of buses, namely the front overhang and wheelbase, means that the vehicle has to start turning some distance beyond a junction to prevent the rear axle cutting the corner. The front end sweeps outside the front wheel paths and

the rear wheels cut inside the path of those at the front. While the driver is responsible for ensuring safe manoeuvring, it is not physically possible to check for potential hazards in all directions simultaneously, particularly when turning.

A person walking or cycling might not be aware of the turning vehicle or may misinterpret its manoeuvre and cross the road as the bus sweeps into a junction. The driver may be checking the front where the bus may cross into an opposing position or to the nearside rear to check the rear wheel will clear the kerb. Therefore, they might not see a person in that critical moment. In combination, this can result in collisions between the person walking and the bus.

These collisions typically occur at low speed but there is a substantial risk where a person walking or cycling may be trapped or run over by the bus. Extending our Advanced Emergency Braking requirements to cover turning scenarios aims to address this.

Implementation

These capabilities have been available in the car market since 2018, and on HGVs for collisions with cyclists when turning since 2023. A key challenge for buses is the robust identification of an imminent collision in

turning manoeuvres because of the highly dynamic pedestrian motion and the rapid collision risk escalation. Sensor fusion, combining camera and radar technology, will help identify incidents using all available situational information. While collisions typically occur at low speeds, the window of opportunity for effective intervention can be small, requiring strong braking intervention to avoid the collision or prevent a person walking being run over after being knocked to the ground.

We will work with bus manufacturers and their supply chains on research, trials and the development of the detailed requirements for these enhancements, building on the progress to date on the development of Advanced Emergency Braking for buses in London. This includes in-depth research on the benefits and disbenefits, particularly the challenge posed to standing customers from braking combined with the vehicle turning.

Testing will likely follow existing Euro NCAP protocols for Advanced Emergency Braking turning tests for cars and HGVs, with scenarios adjusted to represent typical London bus and pedestrian turning collisions. It will also accommodate any difference in cornering characteristics between buses and trucks.

Track testing will be conducted to develop and refine these tests to ensure they are relevant for the bus scenarios, and to establish the performance of prototype systems in collaboration with manufacturers. The complexities of developing a commercial system for buses with this capability, combined with the challenge of developing a specification to achieve the desired performance, mean that it will take a number of years to develop. These enhancements will therefore be a requirement from 2033.

‘Our next phase of requirements aims to extend the current capability to include collision risks when the bus is turning’

Bridge strike prevention

Helping reduce the risk of buses colliding with bridges



Required date

When a vehicle collides with an overpass, tunnel or bridge, it can cause severe harm to people and damage to both the vehicle and the infrastructure. The entirety of the bridge structure might be too low for a vehicle to safely pass underneath, or, in the case of arched bridges, the vehicle needs to be in the right lane to have enough room to pass. Bus routes are planned and vehicles allocated to prevent bridge strikes, but there are still around five incidents reported in London each year on average because of navigational errors, route diversions or failing to recognise the hazard.

London's buses use the iBus automatic vehicle location system, which includes a low bridge warning to alert drivers to a potential collision when approaching an overhead structure. This technology fuses GPS and vehicle motion sensor data to estimate how close the bus is to low bridges, with two default warnings when it is 90metres and then 50metres away.

The current system is due to be replaced with iBus2 from 2028, which will improve low bridge warnings by integrating a three-stage information and warning strategy. Information on limited height structures in the vicinity will be made available via the Driver Display Unit screen, with both warnings and a collision alert issued if the direction of travel intersects with a limited

height structure and gets closer than the configured warning distance or distances. It is anticipated that this will improve the accuracy and reliability of the low bridge warnings.

The Driver Display Unit will provide drivers with diversion route information to reduce the chance of drivers accidentally turning onto roads with low bridges. The new low bridge alerts will also be provided on rail replacement buses, and we are investigating the potential to include them on training buses through an iBus2 'light' solution.

However, bridge strikes still occur even where a warning system is in place. There are several reasons for this including human error, inaccurate warnings failing to alert a driver to a low bridge, and false positive warnings that undermine confidence in and therefore adherence with the system. This can be compounded if other systems are also warning the driver, particularly if the sounds are similar. See page 52 for details.

Therefore, we will require a system that intervenes in the last seconds before an impact, if the driver does not take action to avoid the imminent collision. This will likely include either acceleration suppression or Advanced Emergency Braking to prevent the collision or mitigate the severity of impact if occurs.

Intended benefit

While relatively rare, bridge strikes pose a severe safety risk, particularly for customers on the upper deck, bus drivers and other road users. They are also costly to repair, involve insurance claims, and traffic and rail disruption.

Bridge strike prevention systems will supplement the warnings given to drivers that are sometimes ignored or missed, to intervene in the last seconds to help prevent collisions.

There are also benefits for other industries, particularly the rail industry, where bridge strikes cause service disruption and have the potential to derail trains with catastrophic consequences. It may also be feasible to cascade this technology across to the truck industry, which suffers more frequent bridge strikes, although they carry freight rather than customers, so the injury risks are much lower for trucks.

Implementation

The new iBus2 software, which will include improved low bridge warnings, will be implemented from 2028. For the intervening prevention system, development of suitable technology is required by vehicle manufacturers and

their suppliers. Solutions could build on existing GPS-based systems to intervene through acceleration suppression or Advanced Emergency Braking. Alternatively, additional sensors could be installed to identify or help verify the presence of low-clearance infrastructure, such as bridges, to supplement GPS-based identification.

Development and testing will need to consider different bridge types, including arch bridges where buses can travel through the centre successfully, but where a bridge strike can occur if they do not steer the correct course beneath the bridge. The approach to the bridge will also need to be considered. A long, straight road gives more time for warnings to be effective, for the driver to react, and for an intervention system to identify and intervene if the driver does not. However, some bridges are close to bends or junctions, and therefore an immediate intervention might be required. Operational scenarios such as a bus route that runs towards a bridge, but turns before reaching it, will also be considered.

We will work with bus manufacturers, their supply chain and bus operators on research and trials to develop the specification for the intervening requirements.

Acceleration suppression

Mitigating the impacts of the accelerator pedal being pressed in error



Required date

Acceleration suppression is intended to limit vehicle acceleration where that acceleration is the unintended result of pedal application error. The system shall activate when the accelerator pedal is fully depressed with extreme force, as can happen when drivers think their foot is on the brake pedal. Using force-based activation means it will only activate in these cases and not affect normal pedal usage.

Intended benefit

Acceleration suppression will reduce the likelihood and severity of collisions, particularly in cases where there is a longer time between the pedal error and impact.

As a minimum, acceleration suppression will activate in cases where there is a longer time between the pedal error and impact, reducing the likelihood and severity of collision. Even in cases where a collision cannot be avoided, acceleration suppression may act as a haptic warning to the driver that enables them to realise the error and take action to recover from it.

Implementation

Our [initial research](#) shows that there is potential for a system designed to limit acceleration when the pedal is pressed with a sudden, high force.* This could be implemented with minimal risk of interfering with a driver's legitimate need for power in normal driving.

While acceleration suppression is a relatively simple system to implement, further research and testing is required to specify activation criteria. Further consideration is also needed regarding the system logic with Advanced Emergency Braking override. Although no solution is currently available for buses, a regulation has been developed in the car market, although compliance is not yet mandatory in the UK or European Union.



We want to mitigate the impacts of pedal application error

* Dodd, 2025, Assessing the feasibility of a force-based acceleration suppression system. Apollo Vehicle Safety, AVS242

Customer safety messaging

Providing timely information to customers to help avoid injuries



Required date

These measures are focused on providing timely messages and warnings to bus customers to help them avoid injuries. This will include a display that will show customers if there are seats available on the upper deck. This will be based on information from an automated customer counting system. There will also be sensor-activated audible safety messaging, such as an alert in the stairwell that reminds people to hold the handrail on the stairs. Reintroducing the 'ding ding' bell sound from old Routemaster buses will give customers an audible cue that the bus is about to move off.

We will continue to look for other improvements in this area. This will include a review of audible and visual messaging for customers, with the aim of standardising and optimising sounds and alerts.

Intended benefit

These measures are intended to provide information to customers so that they are more aware of risks and can take action to avoid incidents.

The upper deck seat counter display has a dual safety benefit. First, it encourages customers to move upstairs when seats are available, rather than standing downstairs. Although this will mean some additional



Safety messaging can help customers avoid injuries

people going up the stairs, which is an area prone to trips and falls, this is outweighed by the fact that the risk is much lower for a seated customer upstairs than for a standing customer downstairs.

The secondary benefit is that there will be fewer unnecessary journeys to the upper deck. If customers can see that there are no free seats upstairs, they will stay

downstairs. This will eliminate the potential of them tripping or falling either on the way up or back down.

The sensor-activated messaging feature and the reintroduction of the bell sound have similar aims. They encourage customers to brace themselves for the bus's movement, such as by holding onto the handrail.

Implementation

The automated customer counting system that gathers the information for the upper deck seat counter display is already available on the market.

We have partnered with a supplier to trial the technology as part of the Bus Customer Injuries Innovation Challenge. This includes testing the counting system for accuracy and engaging with customers and other stakeholders to understand how best to display the information. The next stage will be an in-service trial, which will inform requirements for this measure from 2030.

In-service trials have already been completed for the sensor-initiated messaging and Routemaster bell sounds, alongside customer engagement. Initial results are promising, with independent evaluation showing respective statistically significant increases in handrail usage in the stairwell and customers holding on before the bus moves off. Further testing, including wider-scale trials, will be done before these measures become requirements on new vehicles.

Crash protection

Improving the vehicle's structural design and passive safety systems to protect occupants and other road users during a collision



Vehicle-to-vehicle crash compatibility

Reducing injuries to car drivers and customers



Required date

Crash compatibility is concerned with the interaction between vehicles in a crash, particularly different vehicles such as a bus and a car. This can substantially influence safety outcomes. Incompatibility can lead to greater forces being passed to the vehicle occupants, and therefore greater injury risks, particularly when a larger vehicle collides with a smaller one.

Specifically, the measure being implemented for 2033 on London's buses is front underrun protection. This is a device at the front of the bus to help to absorb greater impact energies and prevent smaller vehicles, such as cars and light vans, going under the bus during impact.

Intended benefit

This measure is intended to reduce fatal and serious injuries involving car drivers or customers in a head-on collision with the front end of the bus.

There are two key incompatibilities between buses and cars that can strongly affect the severity of collisions, which could be addressed by this measure.

Geometric incompatibility concerns the stiff, strong structures of a bus, which may be higher than the structures forming the 'crumple zone' of a car or may be in different positions across the front. This means the car can run underneath the bus or that the bus does not engage the crumple zones of the car very well so that its safety systems cannot work as effectively as intended. This can be addressed by adding structures, often referred to as front underrun protection, at the front of the bus to improve the structural interaction between vehicles.

Stiffness incompatibility concerns buses, which may need very stiff chassis structures to support their extra weight. If these are much stiffer than the car structures they interact with in a collision, then the amount to which each vehicle crushes will not be even. All the crush energy will be applied to the car, which can cause serious customer cell intrusion in severe cases. Designing the front of the bus to have a stiffness that is well matched to cars can spread that deformation more evenly and better cushion the car from the impact.

Implementation

Basic front underrun protection has been mandatory in HGVs since 2003, with standards defined by UNECE Regulation 93. This provides a strong start to correcting the geometric incompatibility of vehicles but does little to address the stiffness incompatibility.

There have long been initiatives to try to improve this, and Euro NCAP is currently assessing the potential for improving structural interaction and energy management in its rating for HGVs.

Although the principles and physics are the same, buses are typically lower than trucks and they tend to operate in an environment where high-speed, head-on collisions are less frequent. For example, most HGV collisions occur on two-way rural A-roads with 60mph speed limits. As such, the same regulatory requirements have not been applied to buses. Some manufacturers, such as Mercedes, offer a product for coaches and buses so there is some availability. However, most manufacturers will need to do research, testing and

development to provide front underrun protection. The impacts of the additional weight will need to be considered, and manufacturers must ensure it does not affect the existing front-end geometry requirements that were introduced in the first Bus Safety Standard.

We will also investigate the feasibility of rear underrun measures, because these are the next largest scenario that causes car occupant injuries.

'This measure is intended to reduce fatal and serious injuries involving car drivers or customers in a head-on collision with the front end of the bus'

Post-crash safety

Enabling effective emergency response and collecting information to inform future safety strategies

Note: Some measures to support emergency access to the driver are defined in the Drivers' cab roadmap section



Post-collision braking

Mitigating and preventing further risks after a collision



Required date

A post-collision brake system applies the brakes automatically when a vehicle is involved in a collision to prevent or mitigate subsequent impacts. It automatically activates flashing hazard lights.

Intended benefit

This measure will help prevent follow-on collisions. Depending on the initial impact, the bus may be harder to control, safety systems less likely to perform and the driver may be incapacitated. The bus may have some residual momentum and continue rolling. All of these factors increase the risk of a follow-on impact. There is also the rare but high-risk potential of a pedal application error incident, in which a driver may not correct their error after the initial impact.

It is important to apply the brakes automatically following a collision to help prevent further impacts where the bus driver and occupants could be injured again. It will also prevent secondary impacts with other vehicles or vulnerable road users near the initial collision. By applying the flashing hazard lights, it can help to warn other vehicles and give them a chance to avoid a collision with the bus.

Implementation

The post-collision brake system is not yet available in the bus market and will require development, hence it is not required until 2033. The system has been available for several years in the car market, where it is often called a multi-collision brake. Euro NCAP also recently developed a test procedure to be implemented in 2026 for trucks. This will provide a basis for developing a test procedure that will be adapted for buses.

The biggest technical challenge is the detection of the collision to use as the trigger to activate the system. Cars typically use the signal from the airbag system, but these are not fitted in city buses. Development will be needed to identify appropriate triggers for bus collisions, and these might include some of the triggers for the Event Data Recorder, which is covered on page 27.



Post-collision braking will help mitigate subsequent impacts

Event Data Recorder

Ensuring detailed information is recorded following an incident to help inform future decisions



Required date

The data, information and images gathered after a collision are essential to understanding the causes of the crash and then identifying which safety measures might help to prevent it from happening again.

The Bus Safety Standard 2 will align with UNECE Regulation 169 (R169) on the use of Event Data Recorders for heavy vehicles. These are devices or functions in a vehicle that record its dynamic, time-series data in the period just before and after an event. This includes information such as speed versus time.

R169 outlines the data that must be captured and stored, what constitutes an event in which this must happen, and survivability requirements for the Event Data Recorders.

Intended benefit

By improving the data collected by Event Data Recorders, as well as telematics and CCTV systems, which we cover on page 28, we can improve our understanding of what happens in collisions.

These systems can help us understand what happened in the seconds before a collision and help us to identify causal and contributory factors. This can inform future vehicle safety measures, as well as measures from other Safe System pillars including safe behaviours, safe speeds and safe streets.

Identifying what safety measures would help to prevent similar collisions in the future is an essential part of our ongoing progress towards our Vision Zero targets.

Implementation

Event Data Recorders are required under R169, so the bus manufacturers that supply to the European market will already be supplying or developing them in readiness to meet the regulatory deadlines. It is already mandatory in EU type approval for new types, and will be on all new vehicles from 7 January 2029.

It assumes a police officer will attend the scene, download the data and provide the chain of evidence that links the data recorded to the crash. In practice, that will only happen in crashes where the trained collision investigator gets called. These are likely to be only fatalities, which limits

the data that can be gathered. In addition to the regulatory requirements therefore, we will consider additional requirements for data collection to cover a wider range of circumstances.

Our long-term aim is to move towards a more centralised driving data and collision database, which will require a standardised data format, and appropriate data sharing and protection controls. We will consider what level of data is shared and how it would be used. This is a longer-term development, the timescale of which is as yet unknown, and it will require close collaboration with the bus operators to develop a shared strategy.

‘Identifying what safety measures would help to prevent similar collisions in the future is an essential part of our progress towards our Vision Zero targets’

Telematics and CCTV

Integrating technology to record and collect data



Required date

CCTV systems have long been required on our buses. In 2025, we introduced a requirement for telematics systems that collect data on harsh acceleration, braking, cornering and speeding. This measure will look at how these technologies can be used to gather data for strategic network monitoring and risk management.

Intended benefit

While Event Data Recorders will record very detailed information on a relatively small number of events, mainly those which involve crashes, telematics systems gather slightly less detailed data but from a greater number of events. These two data sources can be complementary in informing future safety initiatives.

Implementation

Telematics and CCTV systems are already required in our Bus Vehicle Specification. Future developments are likely to relate to triggers for capturing and recording information and given the well-established supply chain for these systems, any improvements required are expected to be quick to implement.

Integration of telematics with CCTV can be beneficial as it provides context around events registered on the telematics system, such as harsh braking. Although operators can do this manually by looking up CCTV for a particular event, some telematics providers now offer solutions that automatically capture CCTV footage when an event occurs and upload it to an online platform in near-real time for the operations manager to review.

A similar approach is currently being used in Advanced Emergency Braking testing and monitoring, where we require CCTV from the periods immediately before and after activation to be captured – and could be extended to other features in this roadmap, such as acceleration suppression.

Of particular interest from a risk management standpoint is the potential for telematics systems to be integrated with CCTV to provide enhanced data on near misses. We know that near misses are under-reported but could be a valuable source of data, which could be mapped and overlaid with collision data to inform our overall picture of risk across the network. We are keen to see innovation in this area,

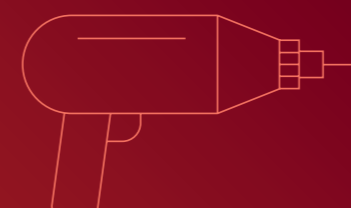
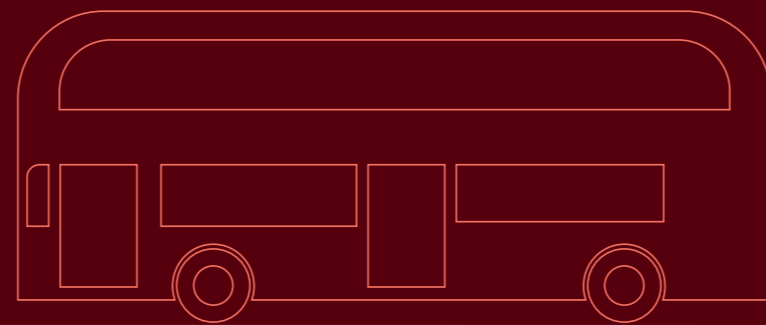
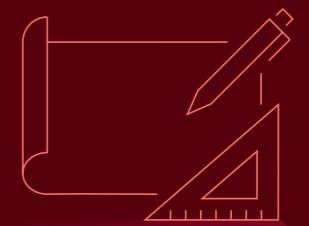
to support automated detection of near-miss incidents using existing telematics-based triggers or new technologies such as artificial intelligence.

This is included in the roadmap as a 2030 measure to enable options to be assessed and develop a strategic approach to setting requirements. Part of our goal is to be able to share learnings across the industry. For example, we regularly contribute to the [Bus Knowledge Sharing and Incident Network](#) to share knowledge and information about incidents involving buses, and to identify trends and areas of common interest for further research.

Learning is more impactful with real examples, so systems that help us anonymise additional copies of incident data and footage will be encouraged.

Improving cab designs

Creating safe, comfortable and appealing work spaces where our bus drivers can thrive



Our work to improve cabs

Creating safe, comfortable and inviting spaces for bus drivers

As set out in our [Bus driver's cab design](#) vision document, an ergonomic and user-friendly cab design is a critical part of delivering a safe and secure bus network. This helps support safer driving, as well as ensuring the safety of bus drivers.

A renewed focus on cab design also has the potential to deliver much wider, non-safety related benefits. Just as in any other workplace, the quality of employees' surroundings matters for inclusion, wellbeing, recruitment, retention, job satisfaction and comfort.

We have therefore developed a roadmap of measures dedicated to making improvements to existing cab designs alongside further research, development and trials to inform longer-term changes.



Bus driver cab roadshows

We worked in partnership with Women in Bus and Coach on an extensive engagement programme with bus drivers to better understand how we can improve bus cab designs.

This involved visiting bus garages across the UK and Ireland, including all London bus operators. We also went to bus operators in Edinburgh, Glasgow, Manchester, Belfast and Dublin. In addition, Women in Transport's Diversity & Inclusion Bus Group hosted an event in Leicester.

This engagement with key stakeholders gave us comprehensive information on the safety and security of current cab designs, bus driver experiences and what improvements they would like to see take place. This includes measures such as seat adjustability, material comfort, safety belt usability, dashboard layout and visibility.



Our strategic aims

We have seven key areas of focus to improve cab designs, which have fed into the creation of our roadmap

Inclusivity

A comfortable, user-friendly and adjustable driver's cab will help us to attract and retain bus drivers, particularly more women.

Driver assistance

Designs can help provide the right warnings and interventions to support the driver in protecting other road users.

Customer benefits

The cab design can support an improved bus customer experience and communication between the driver and customers.

Health

Cab designs can help reduce issues from poor ergonomics and elevate the driver's status.

Security

We can improve bus driver security to ensure they feel protected.

Safety

Better cab design can also provide better protection for the driver in a collision.

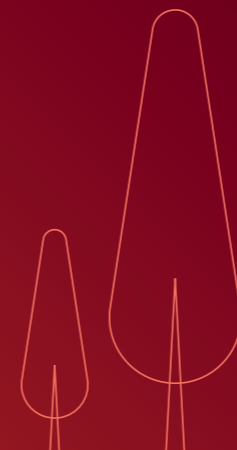
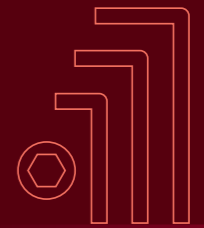
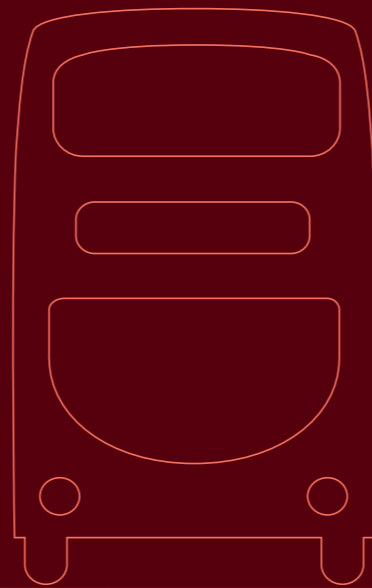
Impairment

We can help mitigate risks including physical fatigue, cognitive overload and distractions.



Drivers' cab roadmap for new-build buses

Our timeline for improving the design of bus cabs to enhance safety, security and comfort



Our roadmap for bus cabs

Setting the timeline to implement measures on new-build buses

Driver safety and security

Safety measure	Delivery timeline		
	2027	2030	2033
Driver seatbelt (Level 1)	●		
Driver seatbelt (Level 2)			●
Driver head restraint	●		
Cab structural integrity			●
Emergency access and equipment (level 1)	●		
Emergency access and equipment (level 2)			●

Driver comfort and facilities

Safety measure	Delivery timeline		
	2027	2030	2033
Cab access and dimensions	●		
Seat construction, dimensions and adjustability	●		
Seat thermal comfort	●		
Personalisation settings for seat and other controls (2029 preferred)		●	
Storage provision	●		
Lighting, glare and reflections	●		
Side sun blinds and visors	●		

Driver controls

Safety measure	Delivery timeline		
	2027	2030	2033
Pedal standardisation	●		
Layout and interface standardisation (Level 1)	●		
Layout and interface standardisation (Level 2)			●

Warnings

Safety measure	Delivery timeline		
	2027	2030	2033
Information, warning and intervention strategy (2029 preferred)			●

Overall design

Safety measure	Delivery timeline		
	2027	2030	2033
Design guidance and principles (2028 preferred)		●	
Inclusive design (using anthropometric data)		●	

Driver safety and security

Protecting bus drivers and
reducing the risk of severe injuries
if a collision occurs



Driver seatbelts

Ensuring drivers are better protected in a collision



Required date



Required date

It is not currently a legal requirement to fit seatbelts for bus drivers. However, if they are fitted then the driver is legally required to wear them. This roadmap will require driver seatbelts to be fitted to all new buses and worn by drivers.

Our approach will introduce requirements in two stages. The first level will require a three-point inertia reel belt to be fitted to comply with UNECE Regulations I4, I6 and I7 for anchorages, belt performance and structural strength respectively. This will ensure that the design, anchorage and dynamic behaviour of the system meet at least minimum safety standards for heavy vehicles. We will also make additional requirements such as belt colour, maintenance and operational use.

Feedback from drivers has shown that, although drivers of buses without seatbelts were concerned about them reducing comfort and restricting ability to move, drivers who were used to driving with seatbelts said they were easy to use and adjust. The belt should be anchored on the left-hand side of the driver, so that their movement is less restricted when turning to deal with customers.

The second level will develop further requirements to improve the safety and comfort of drivers. These requirements will be developed through further research and engagement and will consider additions such as pre-tensioners and load limiters, which are widely found in other transport sectors.

Pre-tensioners retract the webbing of the seatbelt if a vehicle detects that it is in the early stages of a collision. This reduces the slack to ensure the occupant is in an optimal position so that the belt is most effective. It also ensures early engagement between the belt and chest to reduce peak loads and thoracic injury risks. After the belt retracts, a load limiter may gradually release the webbing if the occupant chest loads exceed a pre-determined threshold, to reduce the severity of any injuries caused by the seatbelt. This will need to be tuned for the city bus context.

Intended benefit

Seatbelts are long-established and highly effective for reducing injuries across all other road vehicle types. The driver is the only person guaranteed to be on the bus, and they are responsible for their own and all the customers' safety, so it is essential to protect them.

Seatbelts are most effective in frontal high-energy collisions, and some impacts to the rear. For example, if the bus is impacted at the front, then the driver will keep moving forwards until they collide with something else, often the steering wheel and instrument panel. They may even be ejected through the front windscreen. Seatbelts are designed to protect the driver from injuries in a frontal collision by restraining the forward movement of the driver and keeping them in their seat.

The second level advanced seatbelts can remove slack and help optimise the driver's position in the seat. Therefore, these belts can help in high-energy nearside and offside impacts.

Implementation

Seatbelts are already commonly available in the bus market, so the first level seatbelts are required from 2027.

Second level advanced seatbelts are required from 2033, given that they will need some development time. They are widely available in other transport modes, but are commonly triggered by an airbag module, which is not present in current buses. A suitable trigger mechanism will need to be developed, and the logic tuned to the bus cab collision context.

‘Seatbelts are long-established and highly effective for reducing injuries across all other road vehicle types’

Driver head restraint

Providing further protection for drivers to prevent head and neck injuries



Required date

Most driver seats currently have a fixed head restraint. Importantly, these are not head rests, but rather restraints for supporting the head and neck during a collision to help minimise injury risk. This measure covers the dimensions and adjustment, if available, of the head restraint.

Intended benefit

This measure will address issues with current head restraints, which were rated poorly – especially by female drivers – in the cab roadshows. Designs often failed to align with drivers' head positions, were seen to offer little support or were misunderstood as comfort features rather than safety devices.

Perhaps surprisingly given the high mass of a bus, which would limit the change of velocity of the bus in any rear impact, research in our first Bus Safety Standard on driver collision restraint systems show that 34 per cent of all driver injuries occurred in rear impacts. The majority of driver injuries in rear impacts were neck injuries.

Implementation

There are existing standards set by ISO 16121 for head restraint dimensions and adjustability, if fitted, that can be adopted for a 2027 requirement.

Further research will consider whether an adjustable head restraint is required. Options to improve the dynamic protection offered by seat and head restraints in a collision will also be investigated. If they are feasible, these requirements would not be required until 2033 because of the development time needed.

‘Importantly, these are not head rests, but rather restraints for supporting the head and neck during a collision to help minimise injury risk’



Head restraints provide protection during collisions

Cab structural integrity

Improving the structure of bus cabs to help better protect drivers and other road users



Required date

This measure aims to strengthen the vehicle body and chassis structures for the driver's cab to maintain the survival space and integrity of the anchorage structures in a collision. It may also include active elements that move elements of the cab, such as the steering wheel and seat, to better protect drivers.

Intended benefit

If the driver's cab is deformed in a collision, key cab components or anchorage structures may move out of position or break off entirely, vehicle parts may intrude into the cab survival space and injure the driver, and safety measures may no longer restrain or deploy as intended making them less effective. This measure aims to mitigate these risks.

This measure will need to complement the crash compatibility developments covered on page 24. This is an improved structure at the front of the bus that can protect the driver and other vehicles. Similarly, the cab structural integrity improvements must be carefully considered with the existing crashworthiness and front-end geometry requirements for vulnerable road users already implemented as a 2024 Bus Safety Standard requirement to ensure there is no reduction in the benefits to pedestrians and cyclists.



Cab structure will be strengthened to protect drivers

Implementation

A [study from Norway](#) highlighted the need for improved cab structural integrity by examining European casualty data for bus and coach collisions similar to the scenarios tested in UNECE Regulation 29 (R29) (front impact test, front pillar impact test and roof strength test). Norway has required buses to comply with R29 since October 2023, but proposes further developments. The report analyses three collision types and suggests several measures, including crash compatibility, driver position, structural reinforcement, and reinforcement of the front grille, floor and roof.

We will work closely with bus manufacturers to review the feasibility of improvements focused on better structural protection for drivers, alongside the crash compatibility measure. This includes a review of the evidence from other studies, including from Norway, noting that its crashes were on rural higher-speed roads rather than a city environment, and analysis of driver injuries to ensure any changes are relevant to London.

We will ensure that the safety benefits of the 2024 Bus Safety Standard crashworthiness and front-end geometry requirements are not reduced. The outcome of this further research and engagement will inform the specific requirements for 2033.

Emergency access and equipment

Supporting better access for emergency services following a collision



Required date



Required date

The provision of fire extinguishers and first aid kits is already mandated under UNECE Regulation 107 and is currently met. Therefore, no additional measures are proposed. The Bus Safety Standard 2 level one requirements for 2027 cover the following areas:

Standardised cab T keys

A manual T key is an important requirement for the cab door to enable the emergency services to access the bus cab following a collision. Currently, different keys are used for different cabs. We will introduce a standardised requirement for a manual T key to simplify access for the emergency services.

Seat adjustment controls information

There is an existing requirement for the provision of rescue sheets for first responders. This measure will add information about the location and operation of the seat adjustment controls to the rescue sheets, to aid the quick access by the emergency services. This information is also to be printed on the inside of the cab door, or equivalent suitable position, so that phone or internet access is not required.

Contrasting colours

The controls used for adjusting the seat position should be highlighted in a contrasting colour. This will help emergency services staff identify and operate the controls more quickly, to aid in an emergency extraction of the driver.

As a 2033 level two requirement, we will look at additional measures where needed to support emergency access and equipment including post-collision cab door unlocking, an additional system that automatically unlocks the cab door following a collision. It would not open the door because that might impede the emergency exit of bus customers, but would reduce the risk of driver entrapment and give emergency services faster access. We will explore this in the longer term, working with bus manufacturers. This function may be integrated with the post-collision brake system covered on page 26.

Intended benefit

The automated cab door unlocking and standardised key measures are designed to help the emergency services gain access to the cab more quickly so that they can give care to an injured driver faster.

Contrasting colours and improved information on seat and steering wheel adjustability will help emergency services locate and understand the seat and steering wheel adjustment controls, to help them extract an injured driver more quickly.

Implementation

Emergency access and equipment measures will be required from 2027 because they are already available and are relatively simple to implement. We will engage with emergency services on the implementation of these measures to ensure they are effective and properly communicated.

The post-collision automatic cab door unlocking will be linked to the requirements for the development of post-collision brake systems, and so this requirement will be aligned for 2033.

‘The automated cab door unlocking and standardised key measures are designed to help the emergency services gain access to the cab more quickly’

Driver comfort and facilities

Providing in-cab facilities to support safe driving with a focus on comfort and adjustability



Cab access and dimensions

Improving access to the cab area and ensuring there is enough space



Required date

This measure concerns the design of the cab door, including minimum dimensions for access, cab height and step access. It will also cover requirements for ease of access into the seat. This is important to enable drivers easy and comfortable access to their workplace.

Bus designers are under pressure to maximise space for customers and to minimise weight, which can put pressure on the space available for the driver's cab. This measure also concerns the definition of overall cab dimensions, including the footwell, so that the space available is not eroded. This is important to give enough space for taller or larger drivers to comfortably drive throughout their shift.



We want to make it easy for drivers to access their cab

Seat construction, dimensions and adjustability

Creating the optimum seating for all drivers



Required date

We will introduce standardised requirements for the seat construction, materials, suspension and weight limit to ensure best practice based on internationally recognised standards and the capability of the market.

The seating requirements will be based on existing standards from ISO and the Association of German Transport Companies (Verband Deutscher Verkehrsunternehmen, [VDV](#)), which develops standards in public transport across Germany, combined with input from bus manufacturers and their supply chains. The aim is to maintain best practice and improve inclusion and comfort where possible.

The seat materials/upholstery will be defined, including cleaning methods. Some drivers at the roadshows, particularly women, expressed concerns about the maintenance of some fabric materials, perceiving them as more difficult to keep clean and therefore less hygienic. Additionally, some women noted that menstrual leaks could occasionally stain fabric seats, rendering them difficult to clean and creating hygiene and comfort concerns for other drivers. Materials must therefore be robust in operational use, and easy to clean and maintain.



It is important that the driver feels comfortable and secure in their seat

We will also introduce requirements for seat pan and back dimensions, including the type and range of adjustment such as forward and backward seat inclination. Feedback from drivers suggests different preferences for the type of seat adjustment, including knobs, levers or buttons. Older and female drivers more commonly indicated that they typically found the knobs too tight, and thus more difficult to adjust the seat to their liking. Newer buses with new seats tend to be easier to adjust compared with older buses as the adjustment gear may be worn over time, making it difficult to precisely adjust the seat. Whichever is used, parts must be easy to maintain and enable easy, precise and repeatable adjustment by the driver.

The adjustment ranges will include the lumbar region, which is of particular concern to drivers, with feedback from the roadshows showing drivers reporting back pain owing to inadequate lumbar support causing fatigue during long shifts and suggested improved seat adjustability for a personalised fit. Drivers also noted that lumbar support is typically comfortable when a bus is fitted with a new seat, however the seat no longer provides the same level of cushioning and support as it wears out. It is important, therefore, that lumbar support is resistant to wear from use over time.

Seat thermal comfort

Providing a comfortable environment for drivers



Required date

The driver's cab area is heated and cooled, but it can still be challenging to keep cool or warm in extreme weather. The cab is a relatively large space and heating and cooling the air can be slow.

A potential solution is to supplement this through heating and ventilation of the seat itself. Heating and ventilating the seat can represent a much more direct and controllable way of enabling the driver to regulate their temperature. The seat material selection will need to enable effective heating and cooling, as well as considering other hygiene and comfort requirements.



Temperature is a key part of a comfortable working environment

Personalisation settings

Enabling drivers to adjust their workspace to better suit their needs



Required date

Many transport sectors have developed seats with electronic adjustments that are controlled by buttons or a memory function. For example, there are many cars that store seat settings, such as seat back inclination and air conditioning settings on their keys. We want seat and bus manufacturers to develop similar memory systems, to remove the effort of seat adjustments from the driver and ensure that the seat is positioned optimally for each individual driver whenever they get in the cab.

We will develop this requirement in close collaboration with bus operators to ensure that the seat memory data is stored on an appropriate device, such as the driver's fob. This will ensure it can be used on every shift and ensures personal data is secure. Interoperability is an important consideration, given that drivers often drive multiple models, as is storing the data.

We will work with bus manufacturers and operators to research and develop the requirements for personalisation of other controls, including lighting, steering wheel adjustment, and heating, ventilation and cooling levels.



Drivers should be able to better personalise their workspace

‘We will develop this requirement in close collaboration with bus operators to ensure that the seat memory data is stored on an appropriate device, such as the driver's fob’

Storage provision

Enabling drivers to safely and securely store their items while driving



Required date

This measure is concerned with providing areas for the driver's belongings to be stored securely while driving. This includes drivers' bags, coats, water bottles and valuables.

Around a quarter of drivers at our roadshows were dissatisfied with current storage options. They highlighted the lack of space for personal belongings, making it difficult to store items safely and conveniently.

Adequate storage is necessary to prevent items moving around and causing distraction, or being placed in positions that affect the driver's visibility. In some cases, secure lockable storage is needed for the driver's valuables.

Manufacturers often supply storage options, though these are not always selected by operators. Further, existing storage options are not always used even if fitted, perhaps owing to design and maintenance issues.



‘Adequate storage is necessary to prevent items moving around and causing distraction’

Lighting, glare and reflections

Reducing the dangers of light issues for drivers



Required date

Glare can obstruct a driver's view of the road ahead, making it difficult to drive safely and increasing the risk to customers and other road users. Glare can come from many sources, including bright headlamps, light from buildings or directly from the sun. Buses have very large windscreens, as well as transparent security screens and significant amounts of glass in doors and side windows. The surface of the glass can often carry reflections, which can make it harder for drivers to see through.

London's Bus Vehicle Specification already requires some consideration of glare and reflections, with existing requirements for matt finishing surfaces on all internal ceiling side panels and glass-reinforced plastic parts in the bus cab. The Bus Safety Standard 2 will expand on this by considering the flooring and the cab interior surfaces, specifying the types of materials and colours that should be avoided. It will also set some minimum requirements for the light levels in the cab.



Our requirements will minimise glare and reflections

Side sun blinds and visors

Protecting bus drivers from glare and reflections



Required date

London's bus specification already requires tinting and a sun blind for the front windscreen to reduce glare and reflections. However, glare and reflections can also come from side windows.

Feedback suggests drivers' heads can get too hot in the sunlight from the side window. Our interviews showed it is also common for drivers to struggle with visibility when the sun is low.

This measure will require sun blinds or a suitable equivalent to be installed on the driver's side window. Side window blinds need to be carefully designed to prevent any reduction in direct vision around the bus.

Intended benefit

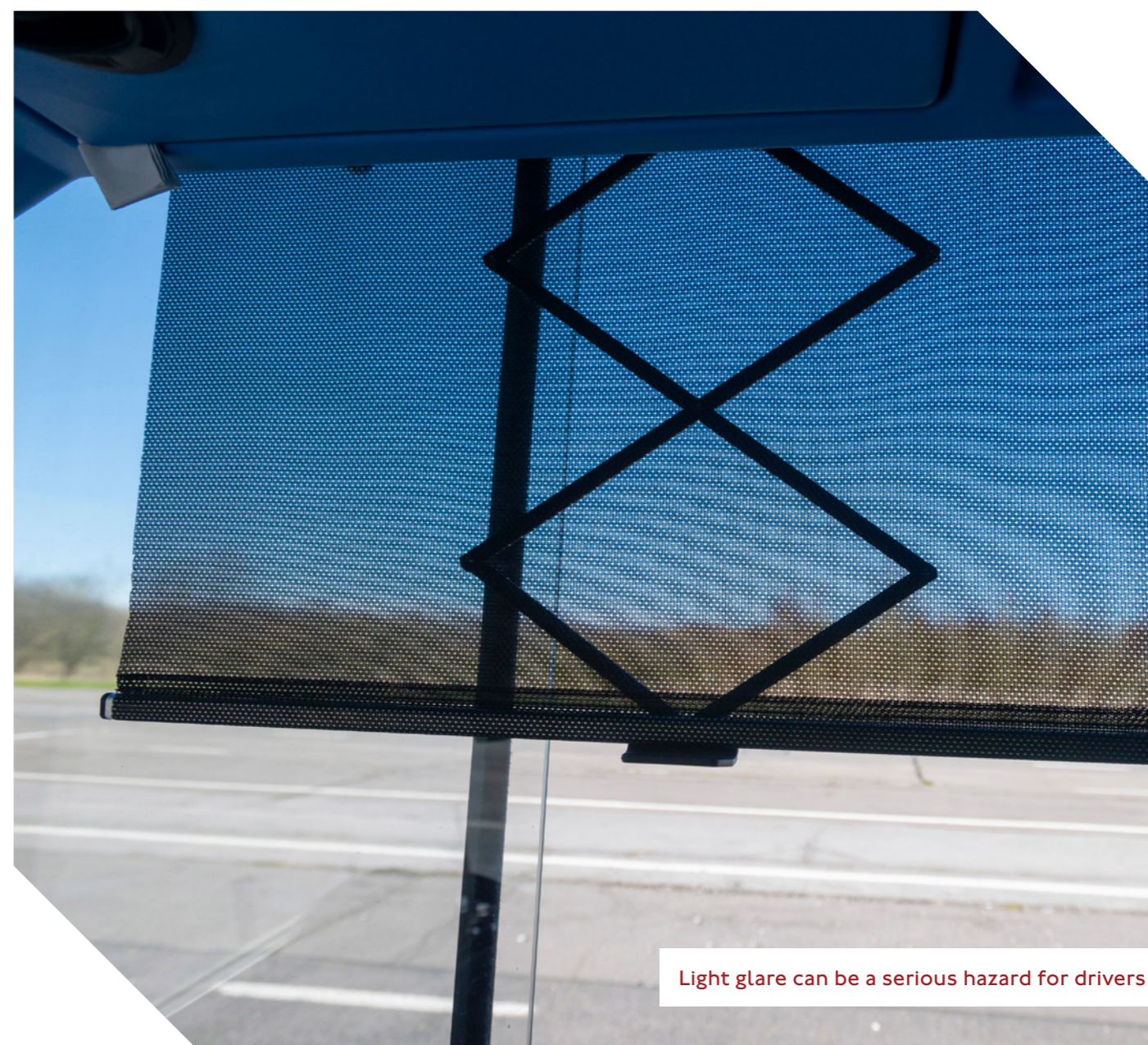
All the comfort and facilities measures outlined in this section will ensure drivers are seated comfortably and adequately supported for safe driving. They focus on a minimum provision, with adjustability where feasible.

The goal is to provide a comfortable, user-friendly and adjustable driver's cab that is designed for different body types to support a more inclusive workforce. This will improve driver health and wellbeing by reducing issues like musculoskeletal conditions.

Implementation

We anticipate that manufacturers will be able to comply with these requirements without any substantial design changes. Therefore, most of the comfort and facilities requirements will be implemented from 2027. They will be minimum requirements, and we encourage manufacturers to go further to better support drivers where they can.

The exception is for personalisation systems for seat settings. We acknowledge that this will likely take longer to design and implement, and so these requirements will be from 2030.



Light glare can be a serious hazard for drivers

Driver controls

Improving the positioning and interface of a range of controls used by bus drivers



Pedal standardisation

Ensuring standard pedal positions to improve consistency for drivers



Required date

Standardised pedal requirements will ensure consistency in the configuration of pedals on different bus models. We will require alignment with [ISO standard I6121-1](#), which defines the dimensions, positioning, spacing and angles of the accelerator and brake pedals.

The updated specification will include an option for manufacturers to use pedals that have a different feel and motion when applied, such as a treadle accelerator pedal and a top-hung brake pedal.

Intended benefit

Pedal standardisation forms part of a wider package of measures that are designed to help reduce the risk and mitigate the impacts of [pedal application error](#).

Many pedal application error incidents do not involve significant foot movement between the pedals, so we know that pedal standardisation will not be effective in all cases. However, there is a subset of pedal error incidents that do involve inaccurate foot placement. In these cases, standardised pedal layouts may help reduce errors by removing the need for the driver to adopt a slightly different foot position based on the model of bus they are driving.

Implementation

Although not currently mandatory, the ISO I6121-1 standard is well-established, and many bus manufacturers already use it as the basis for their pedal designs. Fully meeting this standard is therefore considered achievable for manufacturers, and a relatively straightforward way to ensure consistency in new models.

While we are standardising pedal positions, we are also interested in the potential for using different types of pedals, which have a different feel for the driver when operating them, such as a top-hung brake and treadle accelerator. This is currently optional but we will continue to review this as more evidence becomes available on whether differentiated pedals can help reduce pedal error risk.



We are working to reduce the risk of pedal application error

Layout and interface standardisation

Ensuring a standard approach to bus driver controls



Required date



Required date

This area is covered in two levels, with the first covering the positioning and interface for all bus controls that are used by hand. This includes controls on the instrument panel, the side console and overhead. Both the ISO 16121 and VDV 234 standards define zones in which certain controls should be positioned. We will align with ISO 16121 as the basis of our approach, with additions from VDV 234 if relevant. This will help maintain existing cab design standards by making them a requirement, rather than an optional standard.

The second level will see us use information from a driver task analysis to assess whether the most frequently used and safety-critical controls are close enough to the driver. This will include an anthropometric review of drivers' reach, covering different body sizes and proportions, such as people with shorter arms and longer legs, which is the most challenging combination.

The control layout review may indicate that no or minimal design changes are needed. However, if improvements can be made, then the Bus Safety Standard 2 will specify locations for the controls.

This measure also concerns the human machine interface of the controls. This includes what happens when the button is pressed, what the button looks like and how it is labelled. There are various standards that apply to the design of controls, which must be approved by the Vehicle Certification Agency. However, there might still be some variation between bus models, so there is potential to make improvements by standardising the interfaces. We do not anticipate having to make substantial changes, but, if necessary, this measure will specify the interface for the controls.



Drivers could benefit from more standardised layouts in cabs

Intended benefit

These level one and level two measures will ensure that drivers can reach all the safety-critical controls easily, and that all controls are easily understood and operated. This will improve the safety, efficiency and effectiveness of the controls, and could make driving simpler by reducing cognitive load for the driver.

Implementation

The level one measures will be required from 2027, as these are likely already widely available in the market.

The development of the level two requirements will be supported by research projects, including a bus driver task analysis and an anthropometric data review. While substantial changes to the layouts are not anticipated because bus manufacturers are highly experienced in this area, the outcomes of this research and engagement will inform longer-term changes.

Control layout changes might be complex to develop, given that changes may be needed for the plastic mouldings that they are mounted into. Therefore, these requirements will not be required until 2033. However, if changes are identified that could be implemented sooner, we will look to do this.

Other changes might be difficult if they are substantial, such as changing the type of switch used. Therefore, any changes will not be required until 2033. If it is changing the label or the colour of an LED, these might be much simpler and quicker changes that can be implemented sooner.



Developing iBus2

One important development that is separate to the Bus Safety Standard 2 but will unlock significant benefits for drivers is iBus2.

Once fully implemented, the driver's screen and interface will be moved to within the driver's natural field of view, rather than above their head as it is currently. Alongside this, iBus2 aims to reduce audio and visual distractions.

This includes replacing non-urgent audio messages with text-based messages that can only be viewed when the vehicle is stationary at a stop. It will also ensure that alerts only have audio elements when they are related to safety, such as low bridge warnings. Only the radio call buttons will be able to be interacted with when the bus is moving and the screen itself will be blank when the vehicle is in motion.

iBus2 is being rolled out in two phases. In the first phase, the driver's screen and interface will remain in the current location. The second phase after 2030 will include decommissioning the ticket machine to enable the screen to be relocated.

Warnings

Effectively alerting drivers to potential hazards while they are driving



Information, warning and intervention strategy

Ensuring drivers have efficient and effective warnings and information



Required date

Vehicles have always attempted to communicate information about their operation to the driver. In the early days, this may have been simply regarding the speed, oil pressure and water temperature, typically transmitted visually through mechanical dials. As technology has developed, vehicles have been able to provide more information about their status and even the wider driving environment using a range of audio, visual and haptic alerts.

A lot of this information relates to safety. Where driver error is one of the leading causes of collisions, then better information and warning is often considered an easy way of mitigating the problem. As such, there is now a huge quantity of information and warnings provided, using different methods.

In many vehicles, particularly buses, such systems are often developed in isolation, without considering the interaction with other systems that inform or warn drivers. For many years, ISO standards have provided guidance about when different types of information and warning should be used.



We will ensure drivers get the information they need

For example, audible warnings are generally better at gaining the driver's attention but can be more annoying. ISO standards suggest these warnings should be reserved for the most urgent situations. However, this guidance is not always followed, often resulting in lots of different audible alerts competing for the driver's attention.

In buses, many systems cannot be switched off, which leaves strong potential for drivers to subconsciously tune out warnings because there are too many, meaning they might not respond to something urgent. Research into one aftermarket collision warning system showed that it issued an audible alert every few minutes in normal driving, and appeared to have little to no effect on driver behaviour.

This measure is therefore concerned with the definition, rationalisation and prioritisation of the information and warnings, as well as considering where more advanced systems that simply intervene in the driving task could replace warnings for some important situations.

The information, warning and intervention strategy will consider the function of in-cab sounds and alerts from a driver's perspective (how, when and where); how information, warnings and interventions are activated; and which method is best, such as visual, audible (speech or tone) or haptic. It will also consider when interventions such as automated acceleration suppression, braking or steering should apply.

New ways of presenting information to drivers will also be considered, including head up display systems. These show safety-critical information on the windscreen, enabling drivers to keep their attention on the road. Head up display products are available in other transport sectors but are not commonly available on buses because the vertical windscreen makes it harder for traditional projector systems to be effective. New technologies, including holographic transparent displays, are now entering the market. However, it will take some time to develop the product, as well as the algorithms to control the content, timing, graphics and prioritisation of the warnings.

Intended benefit

Rationalising and prioritising alerts will ensure that the most critical safety alerts are prioritised, enabling the driver to take action where required to avoid a collision. It will also reduce the risk of overwhelming or distracting the driver to the point where they might not notice an important warning, rendering it useless.

Implementation

There will be a number of steps to define our information, warning and intervention strategy. This includes:

Audit

Reviewing the fleet to understand the current host of warnings given to drivers.

Definition

Describing the function, activation and interaction type of the various alerts in the strategy.

Rationalisation

Assessing where unnecessary warnings can be removed. This includes diagnostic information, which could be given straight to the engineering team, rather than the driver.

Prioritisation

Giving a clear set of priorities so that safety-critical information is always prioritised.

Intervention

Intervening in specific incidents, such as bridge strikes, where appropriate.

Our information, warning and intervention strategy review may indicate that no design changes are needed. However, if improvements can be made, then the Bus Safety Standard 2 will specify the new requirements. An audit of warnings and sounds on the London bus fleet is taking place. As this concerns holistic design, the development of requirements will take some time, and the industry will then need time to implement any changes. Therefore, there will not be any requirements until 2033.



Adaptive alerts and interventions

Although not a requirement in this roadmap, we will monitor the longer-term potential to adjust information, warnings and interventions based on integration with systems such as fatigue detection technology.

Advanced driver assistance systems currently function with limited knowledge of the driver's state,

typically only monitoring steering and pedal inputs. The integration of driver monitoring may enable the optimisation of warnings and interventions. For example, if driver fatigue is identified and there is a risk of a collision, Advanced Emergency Braking could activate earlier to counteract the driver's longer reaction time.

Overall design

This category covers ways to improve the holistic design of the overall cab



Design guidance and principles

Providing drivers with positive work environments



Required date

This measure will provide design guidance and principles to bus manufacturers to improve the overall look and feel of the cab. The focus will be on the hedonic (sensory, emotional and experiential) and symbolic design elements.

[Research by the Royal College of Art](#) shows the possibilities in bus cab design and how we can learn from trends in similar industries.* It highlighted the value in broadening the design lens beyond the current functional focus to include consideration of joy, dignity, and productivity. It also showed that there is an opportunity to improve drivers' satisfaction and wellbeing through improvements to their work space.

One of the key design challenges centres on how to make the entrance into the cab and the view of the whole cab more inviting. The guidance for bus designers will include use of colour, materials and finishes to promote a sense of prestige in the cab space, while still meeting functional requirements such as on robustness and maintainability.

Intended benefit

This guidance aims to inspire bus manufacturers to look beyond just the functional, and to provide ideas and principles for aspects of bus cab design. The changes are not intended to require high levels of investment or extensive technological changes. Relatively small design features can be used to inspire pride and elevate the status of the driver.

This links to the wider objectives outlined in our [Bus cab design document](#), including supporting the recruitment and retention of drivers, supporting drivers' health and wellbeing, and ensuring cabs are comfortable and support the driver in their role.

Implementation

This measure will provide guidance to bus manufacturers, which builds on insights from the research done by the Royal College of Art on bus cab design.

We will work closely with bus manufacturers on the development of the guidance for implementation in 2030.



We want drivers to feel positive while at work

* Royal College of Art, 2026

Inclusive design

Creating spaces that work for all bus drivers



Required date

We will require cabs to be ergonomic for all users, so that the diverse population of drivers can easily, efficiently and comfortably interact with the vehicle and its controls. To ensure that an appropriately wide range of driver sizes and body types are included in the design process, we will identify a range of anthropometric datasets. Manufacturers will need to demonstrate they have used these datasets to ensure their cab designs work well for all drivers.

This measure will describe the range of available datasets, with a description of their advantages and disadvantages, and what makes them suitable for different purposes in development. Manufacturers will need to provide evidence to show their approach in their design process.

Intended benefit

This measure will ensure drivers' cabs are designed for different body types to support a more inclusive workforce. With a shortage of bus drivers across the industry, inclusive and ergonomic cab design is vital to attracting and retaining bus drivers, particularly more women. It will also help to improve bus driver health and wellbeing through reducing health issues related to poor ergonomics.

Implementation

We will develop and provide sources of data alongside guidance for bus manufacturers on how they must demonstrate their approach to using this information to aid cab design. This will be required from 2030.

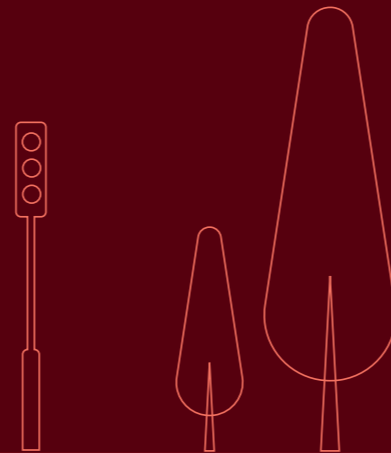
'To ensure that an appropriate range of driver sizes and body types are included in the design process, we will identify a range of anthropometric datasets'



Bus cab designs should work for all drivers

Delivering the roadmap

Introducing these measures and guidance in a timely way across London's bus network



Working together

We will continue to work with the bus industry to research, trial and develop the new safety measures

Engagement with bus operators, trade unions, manufacturers and their supply chain has helped to shape this roadmap. This includes providing input on the technical feasibility and timescales for new safety measures, requirements and testing protocols to ensure they are realistic and achievable yet also challenging.

Manufacturers have contributed their experience in developing safety systems and making design changes. They have also offered prototype buses for testing and we value this collaboration and encourage the industry to continue to engage and collaborate with us to develop the measures in this roadmap.

Specifications and testing protocols

To ensure clarity for bus manufacturers and suppliers, the specifications and assessment protocols for the 2027 requirements have been set out in our Bus Vehicle Specification.

The assessment protocols and specifications for 2030 and 2033 requirements will be developed over

the next few years through ongoing research and trials. We are calling on bus manufacturers and their supply chains to support this work and get actively involved in the development of longer-term measures. This will include supporting research projects and the use of prototype buses to support the development and validation of new test and assessment procedures for each measure.

We also want technical feedback on the draft specifications and procedures. This collaboration is fundamental to ensure measures are deliverable, robust and mutually beneficial.

Regulations and standards

We will continue to review and monitor European and international regulations and standards to ensure our requirements for buses in London align. We will continue to engage with the Department for Transport and monitor proposals for a Great Britain type approval scheme for a series of safety technologies.



We will work closely with our partners to embed our safety improvements

Continuous innovation

Creating innovative solutions to bus safety measures through collaboration

While this roadmap aims to provide clear direction on future requirements for buses, we remain open to other innovations that are not included in this document, but that could help us achieve our Vision Zero goals for London's bus network.

The safety challenge on London's streets is constantly evolving. Since launching our first Bus Safety Standard in 2018, we have seen a number of changes, such as significant increases in people cycling, expansion of new modes like e-scooters and e-bikes, and the transition of our bus fleet to zero-emission vehicles. At the same time, there have been significant developments in emerging safety technologies, particularly around driver assistance systems.

We expect that the bus safety landscape, in terms of both challenges and solutions, will look very different again by 2033, the furthest point covered by this roadmap. We cannot predict exactly what will happen during that period, but technology is developing at an even greater pace than when we launched our first standard.

There are other areas not covered in the roadmap that have opportunities for progress, including emerging technologies and challenges that need solutions. We encourage the industry to bring forward ideas to help shape research and solutions in areas including, but not limited to, the following:

Swivel seats

The driver seats in bus cabs do not typically swivel. This is mainly because of the restricted space available and the risk of drivers' knees hitting the inner surfaces. However, a swivel seat could make it easier for drivers to be taken out of the cab by emergency services, particularly if the driver is unconscious.

The development of a swivel seat, with adequate room to minimise the risk of injuries caused by the swivelling, has potential safety benefits for bus drivers and we welcome development in this area.

Post-crash rear hazard lighting

Hazard lights should be activated after a collision and drivers will often turn them on too, if they are able. However, the emergency services report that other vehicles still park behind buses, despite the hazard lights, which can impede their access to the bus. We are calling for innovation to develop a way to discourage other road users from parking around the bus after a collision. For example, this could be an automatically activated light that projects on to the ground marking a warning zone.

Improving access for emergency services

The emergency services have highlighted that standardisation between bus models would make their ability to gain access to the vehicle, and to any injured drivers and customers, faster. When they arrive at a collision they must deal with different vehicle design every time.

We are calling for collaboration between manufacturers to identify improvements to standardise the safety critical systems, particularly the cabs and the high voltage equipment. For example, the location of the electrical isolation switch on the outside of the bus is currently being included in rescue sheets, but a standardised location for the electrical isolation switch would help.

Crush prevention systems

Drivers are trained to keep the engine turned on if there is a risk of someone being crushed underneath the vehicle. This is to help with getting the injured person out more effectively and quickly.

We are calling for technology development to help identify injured parties under the bus, and then suitable interlocks to prevent the bus from lowering or the engine from being turned off. Our aim is to help reduce the risk of rare but catastrophic crush injuries.

Monitoring, compliance and benefits

Ensuring that we continue to assess our roadmap to ensure the benefits are realised

The measures set out in this roadmap will be specified in our Bus Vehicle Specification, which details the requirements that new buses entering service must meet. This means that London bus operators are contractually required to purchase new buses for service in London from a bus manufacturer that meets these requirements. This is managed and monitored through the route contracts we hold with bus operators.

We monitor the bus fleet through our Engineering Quality Monitoring, which assures that vehicles comply with our agreed standards set out in our Bus Vehicle Specification, and that all bus operators maintain buses to the standard we contractually require. It also ensures they are operating in line with Driver and Vehicle Standards Agency regulatory requirements.

Engineering Quality Monitoring includes vehicle inspections for London buses and rail replacement buses. The scheme also involves examination of regular maintenance service intervals, maintenance facility examinations if required and the production of trend analysis. This also enables bus operators and us to identify and address vehicle defects and deficiencies in garage processes, comparing their performance against other operators.

Realising the benefits

As more buses enter service that meet the Bus Safety Standard, we will continue to monitor the impact of the measures through ongoing research and analysis to understand their impacts, both individually and combined. This is important to ensure our Bus Safety Programme is always evidence-led in terms of further improvements or changes and provides the safety benefits we expect.

‘London bus operators are contractually required to purchase new buses for service in London from a bus manufacturer that meets these requirements’



We will continue to monitor the measures as new vehicles enter service

Delivering world-leading safety standards for buses

Providing the industry with the information they need to ensure the highest standards of safety

This roadmap gives bus operators, manufacturers and their supply chain a clear view of future requirements for buses, as well as areas of further research, development and trials. It ensures that buses in London will continue to meet the highest safety standards, which is fundamental to meeting our shared commitment and responsibility to achieve our Vision Zero ambitions and running a bus network that is safe, inclusive and provides the highest customer experience.

Putting bus drivers at the heart of the design process is a central part of the Bus Safety Standard 2. Bus drivers are our biggest ambassadors. They perform a highly skilled role that involves navigating London's complex streets, managing a range of attentional and cognitive demands, and supporting customers.

We must ensure the driver's cab is comfortable, inclusive and designed holistically. We also need to ensure drivers are better protected in a collision and that we support safe driving through robust, evidence-led driver assistance systems. We will also see measures to reduce driver impairment, including mental and cognitive overload, and changes to improve driver health and wellbeing.

The Bus Safety Standard 2, including the bus cab roadmap, sets out the measures we will be requiring from 2027 to support these aims along with further research, innovation and changes in 2030 and 2033. We will work closely with the bus industry to develop and implement these changes.

The Bus Safety Standard applies only to buses in London and has been unique to London as a result of our route contracting model. However, as recognised in the national [Road Safety Strategy](#), the Bus Services Act 2025 increases the range of tools available to local authorities. This means that safety measures can be specified as part of franchising contracts, enhanced partnerships agreements, or a local authority bus company.

The Bus Safety Standard measures have been increasingly adopted by other local authorities across the UK and around the world, and we are keen for this to continue. Longer term, it is also our ambition that the Bus Safety Standard measures will be adopted in regulations and standards for buses. The wider adoption of the Bus Safety Standard will improve safety across the industry and reduce the investment costs for bus manufacturers.



We want to continue to work with the wider bus industry

Acknowledgements

Our partners have supported the development of this roadmap

Delivering the Bus Safety Standard 2 can only be achieved in partnership with the bus industry. We gratefully acknowledge the valuable input from bus manufacturers and their supply chains on the technical feasibility and timescales for this roadmap, and support for much of our research programme. Their continued collaboration is essential in ensuring the roadmap remains practical, achievable and aligned with industry capabilities.

We want to thank the London bus operators: Arriva, First Bus, Go Ahead, Metroline, Stagecoach, Transport UK and Uno, who continue to be key partners in the research, development and trials for the measures set out in this roadmap. We also recognise the essential contribution of trade unions and bus drivers, who actively participate in research, development and trials, and whose ongoing engagement, expertise and frontline experience have been fundamental to informing and shaping this work. The ongoing support from and collaboration with the London bus industry are fundamental and reflect our shared goals of achieving Vision Zero and a quality bus network for all Londoners.

We extend our sincere appreciation to the independent research specialists for their significant contributions and expertise. In particular, we thank Apollo Vehicle Safety for its support in developing this roadmap and through ongoing research to support the implementation of the Bus Safety Standard. Additionally, we recognise AECOM, Arup, Hawkins, Mott MacDonald, the Royal College of Art's Intelligent Mobility Design Centre, SoMoCo and TRL for their research initiatives and projects that have informed the measures outlined in this roadmap.

Women in Bus and Coach, a national network dedicated to encouraging, representing, supporting and retaining women in the industry, has played a pivotal role in advocating for an inclusive cab design. Working in partnership with us, they delivered the National Bus Cab Roadshows, driving awareness and engagement across the industry. Alongside this, the Women in Transport Diversity & Inclusion Bus Group has been a key partner and influential voice in pushing for cab design improvements.

Finally, sharing research, ideas and learnings provides an important opportunity to improve bus safety across the whole bus industry. We are proud to support the Bus Knowledge Sharing and Incident Network, part of the Bus Centre of Excellence, to help lead the improvement of bus safety across the country. Alongside this, we continue to engage with transport authorities internationally and across the UK including leading a national bus cab design forum to share ideas, research and encourage adoption nationally.

Our Bus Safety Development team lead the Bus Safety Standard, and we look forward to continuing to collaborate as we turn this roadmap into reality. To contact the team, email bussafetyprog@tfl.gov.uk

About us

As part of the Greater London Authority family led by Mayor of London Sadiq Khan, we are the integrated transport authority responsible for delivering the Mayor's aims for transport. We have a key role in shaping what life is like in London, helping to realise the Mayor's vision for a 'City for All Londoners' and helping to create a safer, fairer, greener, healthier and more prosperous city. The Mayor's Transport Strategy sets a target for 80 per cent of all journeys to be made by walking, cycling or using public transport by 2041. To make this a reality, we prioritise safety, sustainability, health and the quality of people's experience in everything we do.

We run most of London's public transport services, including the London Underground, London Buses, the DLR, London Overground, Elizabeth line, London Trams, the Woolwich Ferry, London Dial-a-Ride, Victoria Coach Station, Santander Cycles and the London Cable Car. We also operate London River Services, which includes licensing river boat operator services to use a number of piers. We manage the city's red route

strategic roads and are responsible for the maintenance, management and operation of more than 6,000 sets of traffic lights across the capital. The London boroughs are responsible for all the remaining roads within their boundaries.

The experience, reliability and accessibility of our services are fundamental to Londoners' quality of life. Safety remains our number one priority and we continue to work tirelessly to improve safety across the network for both colleagues and customers.

Our vision is to be a strong, green heartbeat for London. We are investing in green infrastructure, improving walking and cycling, reducing carbon emissions and making the city's air cleaner. The Ultra Low Emission Zone, and fleets of increasingly environmentally friendly and zero-emission buses, are helping to tackle London's toxic air. We are also improving public transport options, particularly in outer London, to ensure that more people can choose public transport or active travel over using their vehicles. We introduced

the Superloop bus network, providing express bus routes circling the entire capital, connecting outer London town centres, railway stations, hospitals and transport hubs.

We have constructed many of London's most significant infrastructure projects in recent years, using transport to unlock economic growth and improve connectivity. This includes major projects like the extension of the Northern line to Battersea Power Station and Nine Elms in south London, as well as the completion of the London Overground extension to Barking Riverside and the Bank station upgrade.

The Elizabeth line, which opened in 2022, has quickly become one of the country's most popular railways, adding 10 per cent to central London's rail capacity and supporting new jobs, homes and economic growth. We also use our own land to provide thousands of new affordable homes and our own supply chain creates tens of thousands of jobs and apprenticeships across the country.

We are committed to being an employer that is fully representative of the community we serve, where everyone can realise their potential. Our aim is to be a fully inclusive employer, valuing and celebrating the diversity of our workforce to improve services for all Londoners.

We are constantly working to improve the city for everyone. This means using information, data and technology to make services intuitive and easy to use, and doing all we can to make streets and transport services accessible and safe to all.

We reinvest every penny of our income to continually improve transport networks for the people who use them every day. None of this would be possible without the support of boroughs, communities and other partners who we work with to improve our services. By working together, we are creating brighter journeys and a better city.

