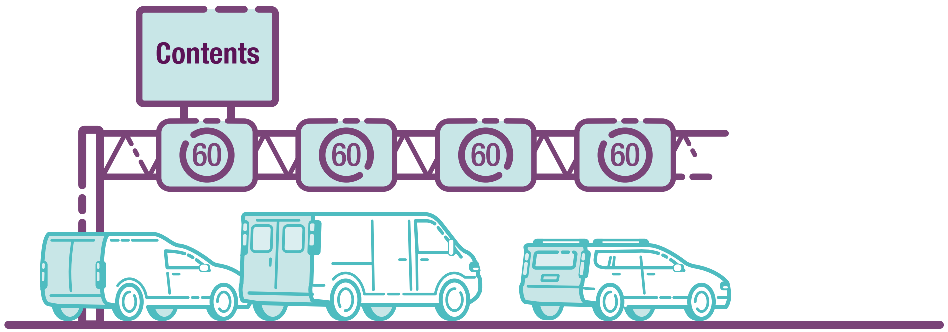
Smart motorways stocktake

Third year progress report: September 2023

Contents



Foreword

Safety is my highest priority. England continues to have some of the safest roads in the world and, compared to other roads, motorways remain the safest roads to travel on. But there is always more that can be done and that is why our ambition continues to be that nobody should be harmed using, or working on, our network.

Nick Harris
National Highways Chief Executive

In April 2023 the government announced that plans for new smart motorways would be cancelled in recognition of the lack of public confidence felt by drivers, and cost pressures. This followed a pause in the rollout of new smart motorways previously announced, in January 2022.

As well as being safe, drivers deserve to feel confident using any of our roads, including smart motorways. Since the pause we have been delivering on our commitments to further enhance safety on smart motorways. We continue to work with the Department for Transport (DfT) to deliver £900 million in further safety improvements on existing smart motorways, and to give motorists clear advice when using them.

Smart motorways were introduced to increase capacity on our busiest motorways, routes which help keep our country connected. I very much recognise that collisions involving stopped vehicles on smart motorways without a permanent hard shoulder remain a key concern for some drivers. Many of the interventions we have taken since 2020, when the government set out an action plan to raise the bar on smart motorway safety, directly address these concerns.

I am pleased to say we have delivered the vast majority of the actions. Importantly we have delivered all those which were due to have been completed by this time. This includes making emergency areas more visible, and greatly reducing how long it takes for our traffic officers to attend incidents on all lane running (ALR) motorways (which do not have a hard shoulder) where emergency areas are more than a mile apart.

We have also rolled out technology to detect vehicles which have stopped in live lanes. The additional technology we have installed on ALR motorways is already detecting around 1,900[1] stopped vehicles a month, enabling us to respond more quickly than before. We have made positive progress on our programme to improve the performance of stopped vehicle detection on ALR motorways and have successfully completed our upgrades. We committed to measuring the performance of this technology.

We are investing £105 million on ALR motorways, to further improve our operational technology

Our work is not complete. We are also investing £105 million on ALR motorways, to further improve our operational technology, such as CCTV, variable message signs, signals, and the system which detects slow moving traffic and automatically sets appropriate messages for drivers. This will both enhance our management of the network and further improve drivers' experience on these motorways.

This year, as in previous years, our report includes an analysis of the latest safety data. Each year, to get an increasingly comprehensive picture of smart motorway safety, we have expanded the depth and range of evidence presented. This year is no exception, as our overall analysis also includes scheme by scheme data, showing how safety compares on smart motorway sections before and after they were upgraded. It also includes even greater road user insight through work led by Transport Focus. This is particularly important, as we recognise there continues to be a discrepancy between drivers' feelings of safety, and the safety data of the respective roads. We will take further action to improve driver confidence.

No one type of motorway, smart or conventional, is ranked best against every safety metric. The latest safety data (2017-2021) continues to show that overall, all three types of smart motorway are safer than conventional motorways in terms of deaths or serious injuries. The majority of collisions on our network involve moving vehicles. The minority involve stopped vehicles, and the risk of this continues to be higher on motorways without a permanent hard shoulder. Most of the interventions we are making such as introducing stopped vehicle detection, and enabling increased enforcement of Red X signals, are designed to reduce the risk of a collision between a moving and a stopped vehicle. It remains too early to see the impact of the actions we have delivered, as they were largely completed in 2022. But we continue to monitor the impact of the actions.

We will also continue to collect and monitor safety, economic, environment and capacity data. Significantly, we appreciate that more work is needed to help ensure everyone feels confident when using existing smart motorways. So we will continue to listen to what the public and stakeholders tell us and take any appropriate action, and to work with the government to track public confidence in smart motorways.

We will work with the DfT, the Office of Rail and Road, and Transport Focus, to further improve both the safety of smart motorways and road users' perceptions of safety.

Every road death is a tragedy and every serious injury is a changed life. For everyone affected, we will never cease to strive for the safest network in the world.

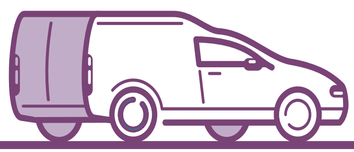
Nick Harris
Chief Executive

Executive summary

Introduction:

Our roads are vital for the running of the country. The strategic road network (SRN) makes up 2.4% of England's roads and is able to carry a third of the country's traffic[2]. To do this our roads have evolved to meet the needs of a growing population, an increase in vehicle numbers and changes in transport use. Motorways are crucial in many ways, including to the economy, providing the arteries for goods to be moved for trade and manufacturing, for people to access tourism and leisure opportunities, and for friends and family to meet each other. Motorways are our safest roads, with better safety records than A-roads, but with millions of people using our roads, it's imperative that we continue making them even safer, and that drivers have confidence in them.

Smart motorways were introduced to provide extra capacity on some of our busiest and congested sections of motorway



Smart motorways were introduced to provide extra capacity on some of our busiest and most congested sections of motorway. There are three types:

- controlled, which have hard shoulders
- dynamic hard shoulder (DHS) which use the hard shoulder as a running lane at the busiest times; when the hard shoulder is operating as a live lane, the speed is set at a maximum of 60mph
- the latest type, all lane running (ALR) where the hard shoulder is permanently converted to a running lane.

At the end of 2021 there were 256 miles of ALR and DHS motorways, representing 5.6% of the 4,542 miles of SRN.

We want our roads to work for communities in harmony with the built, natural and historic environments that surround them. DHS and ALR motorways, with the use of technology and additional roadside features, have increased the capacity of key sections of the motorway network, without the disruption and significant environmental impact of physically widening the road. By the end of 2021, just over 500 miles[3] of additional motorway capacity had been created through ALR and DHS motorways. These approaches also reduce carbon emissions associated with construction compared to conventional widening.

In April 2023, the government announced that new smart motorways would be cancelled

This report builds on the first[4] and second[5] year smart motorway progress reports. It provides details of the work we have done in delivering the actions of the *Smart motorway safety evidence stocktake and action plan*[6] (referred to as the 2020 Stocktake or 2020 Action Plan), published in March 2020, and more recently the actions taken in response to the 2021 Transport Select Committee (TSC) report into *The rollout and safety of smart motorways*[7]. It also includes updated safety data for smart motorways, including performance against key safety metrics, as well as, for the first time, further data comparing the safety of motorway sections before and after they were converted to their current form of smart motorway.

In its response to the TSC report, in January 2022, the government paused the rollout of new ALR motorways[8], yet to start construction. In April 2023, the government announced[9] that new smart motorways would be cancelled in recognition of the lack of public confidence felt by drivers, and cost pressures.

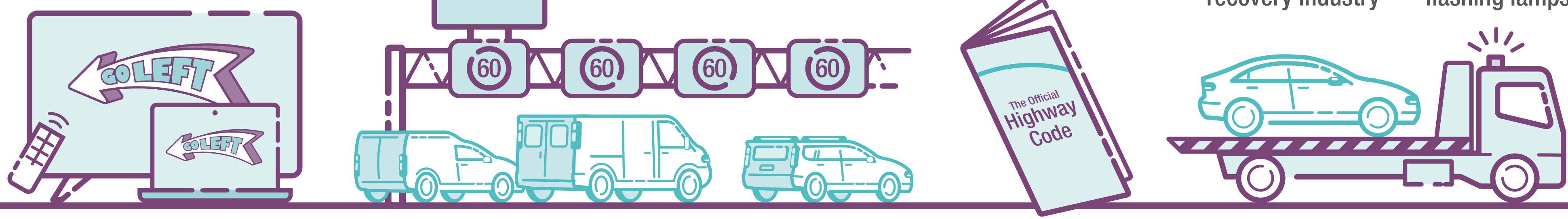
Following the pause, construction continued on six new schemes because they were more than halfway completed. Of those, five have now opened. Each of these schemes opened with stopped vehicle detection (SVD) technology in place[10], more signs than originally planned to show the distance to the next place to stop in an emergency and upgraded enforcement cameras to enable police to take action against drivers who ignore Red X signals. Where possible, additional emergency areas have been added. In line with the 2023 announcement, while no new stretches of road will be converted into smart motorways, the M6 junctions 21a to 26 will be completed given it was already over three quarters constructed.

M62 in West Yorkshire near Bradford

Delivering improvements - progress made on 2020 Action Plan

Giving clarity to drivers

- Delivered breakdown advice campaign
- Cancelled DHS* conversion to ALR**
- Enabled update of The Highway Code
- Worked closer with the recovery industry
- DfT reviewing use of red flashing lamps

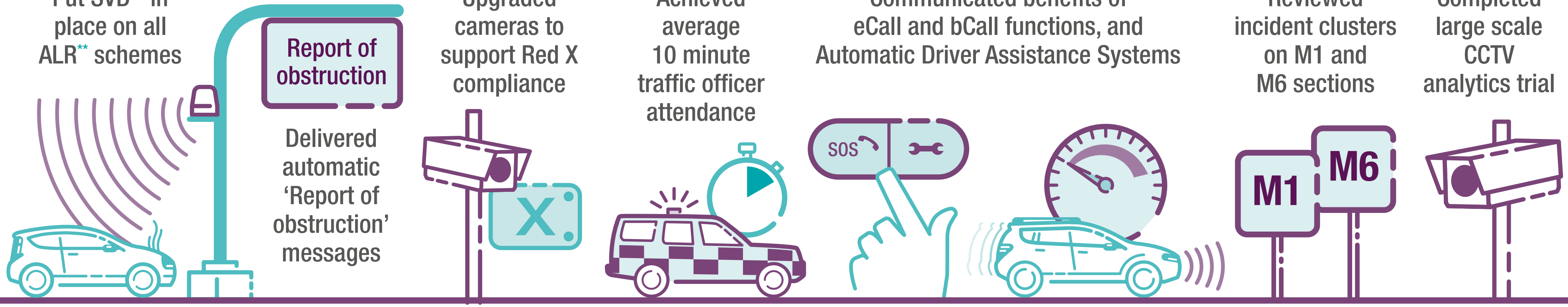


Finding a safe place to stop

- New 'places to stop in an emergency' spacing standard
- More signs showing distance to next emergency area
- Shared emergency area information with sat nav companies
- 10 extra emergency areas on the M25
- Considered national emergency area programme
- Made emergency areas more visible
- Reviewed emergency area widths

Being safer in moving traffic

- Put SVD*** in place on all ALR** schemes
- Delivered automatic 'Report of obstruction' messages
- Upgraded cameras to support Red X compliance
- Achieved average 10 minute traffic officer attendance
- Communicated benefits of eCall and bCall functions, and Automatic Driver Assistance Systems
- Reviewed incident clusters on M1 and M6 sections
- Completed large scale CCTV analytics trial



*DHS: Dynamic hard shoulder **ALR: All lane running ***SVD: Stopped vehicle detection

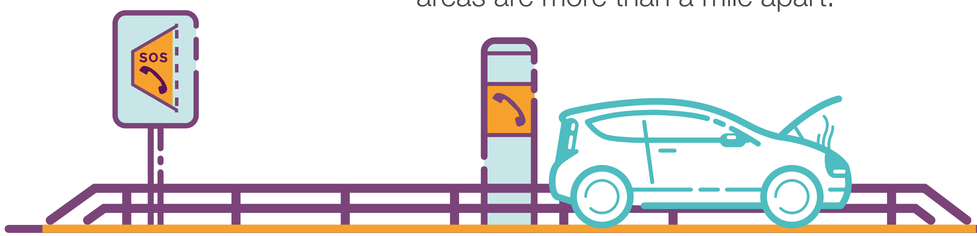
Delivering improvements

Besides being safe, drivers deserve to have confidence in the roads they use, including smart motorways.

Since the government published the 2020 Stocktake, we have worked to improve safety and public confidence in smart motorways. We recognise we need to continue to invest in this area.

We have now delivered the vast majority of the actions set out in the 2020 Action Plan, including all those which were due to have been completed by this point in time. This includes installing additional technology on existing and new ALR motorways to further improve our ability to detect stopped vehicles and achieving a national average traffic officer attendance time of 10 minutes on ALR motorways, where emergency areas are more than a mile apart.

> **We have now delivered the vast majority of the actions set out in the 2020 Action Plan, including all those which were due to be completed by this point in time**



We have installed more than 700 extra signs so drivers are almost always able to see a sign informing them of the distance to the next place to stop in an emergency. And we have upgraded all enforcement cameras on smart motorways with the technology necessary to enable police to enforce Red X signals, to help keep drivers and those who work on the road safe.

We are committed to going even further than the 2020 Action Plan, and have been working closely with the DfT, our monitor, the Office of Rail and Road (ORR), and Transport Focus, the independent watchdog for transport users, to progress the commitments made by the government in response to the 2021 TSC report.

We have provided more clarity for drivers on smart motorways. We have delivered several national awareness campaigns, including our *'Go Left' breakdown campaign*[11]. We also launched a *Driving on motorways*[12] hub on our website, providing a central point for all our information and advice on motorway driving, including smart motorways. We also worked with DfT and the Driver and Vehicle Standards Agency to update *The Highway Code*[13] to include more information about smart motorways.

We remain focused on improving our operational technology systems on ALR motorways. In December 2022, the ORR published its *First annual assessment of safety on the strategic road network*[14] which included an assessment of the performance of technology of smart motorways. The report recognised the SVD system had improved the detection of stopped vehicles with a further likely positive impact on reducing the duration of live lane stops, but that SVD performance was falling short of the performance requirements we set ourselves. We have since made positive progress on our programme to improve the performance of stopped vehicle detection on ALR motorways and have successfully completed our upgrades.

We committed to measuring the performance of this technology.

It's right that road users expect high performance standards, which is why we have ring-fenced £105 million to improve our operational technology on ALR motorways by the end of March 2025. This includes upgrading CCTV, variable message signs, signals and the system which detects slow moving traffic and automatically sets appropriate messages for drivers (MIDAS[15]).

We have also started to add more emergency areas to ALR motorways. We are delivering a £390 million programme to construct over 150 additional emergency areas by the end of the second road investment period. We have already constructed 13 additional emergency areas, which are available for use, on the M1 and M6. Next we are adding extra emergency areas on the M1 and M25. Work started on the first of these schemes in winter 2023. We are also delivering enhancements to sections of DHS motorway across the country, including upgrading central reservation barriers.

Overall, all three types of smart motorway are safer than conventional motorways in terms of deaths or serious injuries

Safety evidence headlines

No one type of motorway, smart or conventional, is ranked best against every safety metric.

The latest safety data continues to show that overall, all three types of smart motorway are safer than conventional motorways in terms of deaths or serious injuries. Most incidents (96.1%) across the SRN are single vehicle collisions or incidents involving two or more moving vehicles. The rest of the collisions, which form a small proportion of all incidents (3.9%), involve moving vehicles colliding with stopped vehicles. These types of collision happen on all roads.

The risk of a collision and the risk of a serious injury or death due to a stopped vehicle collision is lowest on conventional and controlled motorways. As reported in the second year progress report, the risk of a collision between a moving and a stopped vehicle is greater on ALR and DHS motorways than on other motorway types, but the risk of a collision involving only moving vehicles is lower. This continues to be the case based on the latest safety data.

The majority of the stocktake actions, such as introducing SVD, and enabling increased enforcement of Red X signals, are designed to reduce the risk of a collision between a moving and a stopped vehicle, and to address remaining concerns about smart motorways without permanent hard shoulders.

Due to the time lag between the actions being delivered and the data being available, it will be later in 2023 before we can start assessing and understanding the impact of the actions. We will continue to assess the data in line with our monitoring and evaluation processes.

This year we have undertaken deeper safety analysis supported by broader safety evidence, such as scheme

Free flowing traffic on an all lane running motorway

For the high-level statistics, ORR found that the analysis is clear and transparent, and the conclusions are appropriate

comparisons and road user insights. We have continued to monitor and evaluate the performance of our network. We have also continued to take considerable steps to increase transparency, both in how we have communicated new methods (eg for statistical significance testing) and by publishing more detailed collision and casualty data alongside our report.

Based on the current evidence available, the comparisons of smart motorway sections before they were constructed and afterwards, show that in most cases smart motorways are safer than the roads they replaced. While safety on all smart motorway types is overall better compared to the roads they replaced, there may be specific locations where safety could be further improved. We are taking additional action to assess safety in these locations.

To support the safety conclusions of this report, we have worked closely with ORR, who undertook additional independent assurance for the supporting analysis. For the high-level statistics, ORR found that the analysis is clear and transparent, and the conclusions are appropriate. For the scheme safety - 'before' versus 'after' assessment, the ORR noted that we have gone beyond its recommendation from the 2021 *Quality assurance of all lane running motorway data*[16] report to update and extend the analysis, we have continued to follow appropriate analytical assurance processes, and our conclusions are appropriate for this stage of the analysis.

It is important that drivers feel safe and confident on all our roads, including smart motorways, and we recognise we need to do more in this area. We have already started working with other organisations including Transport Focus to improve our understanding of what influences these feelings.

We have also conducted our own research, involving responses from more than 20,000 adults in England between May and December 2022. This includes drivers and riders who do not travel on the SRN or in parts of the country where smart motorways are located. Just over half (54%) of those questioned said they were very or fairly confident in smart motorways, while 25% reported that they were not very or not at all confident. Among those who had recently[17] driven or ridden on a smart motorway, 82% reported that they were very or fairly confident when travelling on smart motorways and 16% reported that they were not very or not at all confident.

We will continue to invest to improve understanding of how to drive safely on all our roads, including smart motorways.

Conclusion

The 2020 Stocktake provided a comprehensive summary of the safety of smart motorways, considering all data sources available at the time. The report concluded 'overall, what the evidence shows is that in most ways, smart motorways are as safe as, or safer than, the conventional ones. But not in every way'. It set out an action plan to further improve safety on the smart motorway network.

The first and second year progress reports built on that evidence base. And this third year report continues to show that overall, all three smart motorway types remain better than conventional motorways for those safety metrics which consider the most significant impacts, such as deaths or serious injuries. The risk of a collision and the risk of a serious injury or death due to a stopped vehicle collision is lowest on conventional and controlled motorways. As reported in the second year progress report, the risk of a collision between a

M62 junction 26 dynamic hard shoulder motorway

Traffic officer vehicle in an emergency area

Safety remains our highest priority and in line with the 2023 announcement we will continue to deliver further safety improvements on existing smart motorways

moving and a stopped vehicle is greater on ALR and DHS motorways than on other motorway types, but the risk of a collision involving only moving vehicles is lower. This continues to be the case based on the latest safety data.

The scheme-level safety data suggests that while most smart motorway schemes see fewer collisions and fewer deaths and serious injuries in proportion to the traffic they carry, there is always scope for further improvement. This is consistent with our findings from evaluation activities.

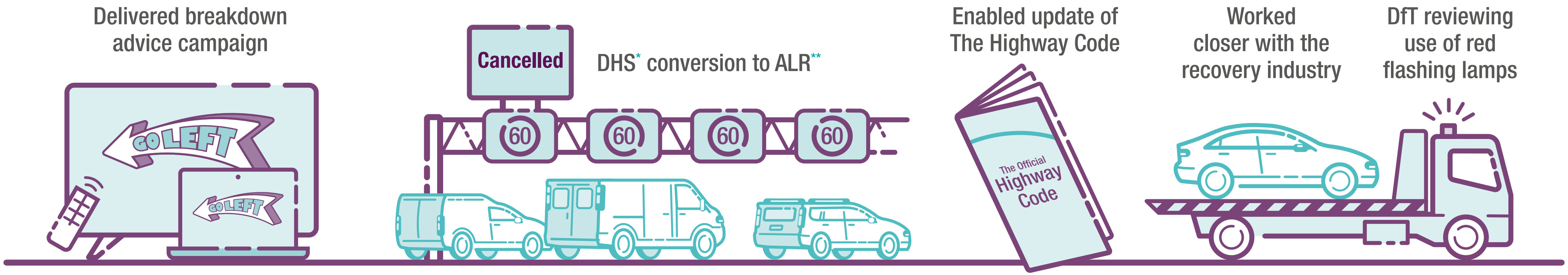
Safety remains our highest priority and in line with the 2023 announcement we will continue to deliver further safety improvements on existing smart motorways. With support from our supply chain, partners and government departments, and by working with a range of road user groups, we will continue striving to deliver the safest road network drivers expect. Having delivered the majority of the actions from the 2020 Stocktake, we will keep working hard to deliver the commitments made to the TSC, and to improve the reliability of our operational technology systems on ALR motorways.

However, drivers need to feel confident using our roads and we acknowledge we have more work to do in this area. We will continue to invest to improve understanding of how to drive safely on all our roads, including smart motorways.

It remains too early to see the impact of the actions we have delivered so far, and we will continue to build an evidence base of safety, economic, environment and capacity data. We will also work with DfT to track public confidence in smart motorways.

As we continue our work to further improve the safety of all our roads, including smart motorways, we will continue to listen to the public and stakeholders, and take any necessary actions as a result.

Giving clarity to drivers



*DHS: Dynamic hard shoulder **ALR: All lane running

CRE23_0104 Stocktake progress – Last updated 29/09/2023

We understand that drivers want more information about how smart motorways work and how to use them. We have continued to listen to feedback from members of the public and stakeholders and we have been working to increase awareness and understanding. The 2020 Action Plan committed to give clarity to drivers. We have delivered a range of education campaigns, updated guidance and worked with stakeholders and partners to further increase confidence in smart motorways.

Communicating with drivers

We committed to an additional £5 million for national and targeted communications campaigns to further increase awareness and understanding of smart motorways, how they work and how to use them confidently. **We have completed this commitment.**

Since 2020, we have launched several campaigns providing advice and guidance. This has included our *'Go Left' campaign*[11], providing advice to drivers on what to do in the event of a breakdown on all motorways, including smart motorways.

We have set out (right) the advice for what to do if your vehicle has a problem or you get into trouble on a motorway.

We also went further by launching our *Driving on motorways hub*[12] which includes information and videos on how smart motorways work, their features and breakdown advice. One of the videos is a three minute film showing how to recognise when you're on a smart motorway, taking you through their features and explaining how they help you with your journey.

In summer 2022, we delivered further phases of our campaigns focused on the importance of *regular vehicle checks*[18] and raising awareness of the dangers of *close following*[19]. And in November 2022 we updated our eCall campaign, highlighting that the function can be used to help both the driver and the passengers of a vehicle which has eCall, and to help other road users in difficulty. Besides updating our campaign, we did this via the *Driving for Better Business*[20] programme. In April 2023 we delivered further eCall campaign activity.

If you get into trouble on a motorway - go left

If your vehicle has a problem, or you get into trouble on a motorway, stay calm and try to exit at the next junction or motorway service area. If that's not possible:

1. Put your left indicators on.
2. Move into the left lane.
3. Enter the next emergency area, or hard shoulder.
4. Put your hazard lights on.
5. Get behind a safety barrier where there is one - keep well away from moving traffic.
6. Call National Highways on 0300 123 5000, then a breakdown provider for help.

If you are unable to exit your vehicle and get to a safe place, have stopped in a live traffic lane or feel your life is in danger:

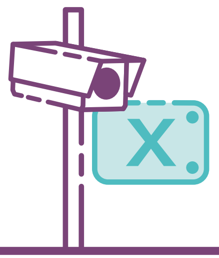
- **stay in your vehicle with your seatbelts and hazard lights on**
- **call 999 immediately or press the SOS button in your car**

We evaluate our campaigns to understand if they have been effective. Evaluations show that over 60% of people who recognised the Driving on motorways campaign were more likely to take the correct steps if their vehicle breaks down in a live lane. Of the drivers who watched the Driving on motorways safety video, 97% of respondents felt confident about what to do when encountering variable speed limits, and 90% felt confident about what to do when encountering a Red X signal.

Following the February to March 2022 close following campaign, our evaluation showed that 71% of drivers who viewed the campaign took action including speaking to friends and family and thought about their or other people's driving behaviours. In addition, approximately three in four were familiar with the two second rule[21], with 84% stating they felt capable of consistently using the two second rule.

In line with the 2023 announcement, we will continue to develop and deliver campaigns, and use other appropriate channels to provide more information to road users to help improve their understanding and confidence when driving on all road types, including smart motorways.

Of the drivers who watched the 'Driving on motorways' safety video 90% felt confident about what to do when encountering a Red X signal



Improving guidance

We committed to work with the Department for Transport and the Driver and Vehicle Standards Agency to update The Highway Code to provide more guidance for motorists driving on high-speed roads, including smart motorways. The updated Highway Code was published in September 2021. **We have completed this commitment.**

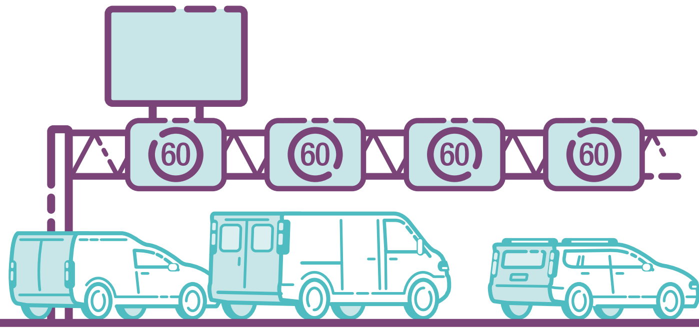
Specific content was added to *The Highway Code*[13] to help improve driver understanding and confidence when driving on a motorway. This included the correct and lawful usage of hard shoulders and emergency areas, clarification on what a Red X signal is and what to do in the event of an emergency. This included advising the use of eCall, which aligns with our campaign activity.

Going beyond the 2020 Stocktake and starting in September 2022, we began work on a study exploring additional actions that could be taken to further increase awareness among the public of what they can do if they spot someone in difficulty on any road. We aim to complete the study by late summer/autumn 2023.

Converting dynamic hard shoulder to all lane running motorways

The 2020 Stocktake committed to ending the use of dynamic hard shoulder motorways by converting them to all lane running sections, to simplify the types of motorways on the network and reduce the potential for driver confusion. **The 2023 announcement resulted in the cancellation of new smart motorways, including the seven projects to convert dynamic hard shoulder (DHS) sections to all lane running (ALR). In its response to the 2021 Transport Select Committee (TSC) report, the government committed to explore alternative DHS operating regimes to assess if they would reduce the potential**

Smart motorway guidance in The Highway Code



We, along with the government, will continue to invest £900 million in further safety improvements on existing smart motorways

for driver confusion. In addition we, along with the government, will also continue to invest £900 million in further safety improvements on existing smart motorways, including DHS motorways.

We have completed the first phase of the DHS alternative operating regime work via an initial desktop options study.

As committed to in the government response to the 2021 TSC report, and the 2023 announcement, we continue to enhance safety on DHS motorways and have started a programme of installing further measures.

For example, to date we have begun to:

Emergency area and sign

- install new lighting, upgrade the central reservation barrier and construct three additional emergency areas between junctions 4 and 5 of the M6 along with drainage surveys and repairs
- upgrade sections of the central reservation barrier, install new lighting and construct one additional emergency area on the M62 between junctions 26 and 29
- build three new emergency areas, upgrade the central reservation barrier, upgrade traffic signs, improve drainage, renew lighting and install additional CCTV cameras on the M4 and M5 around Bristol.

We continue to consider further potential safety measures for DHS sections, including the option of adding technology to improve the detection of stopped vehicles on the M6 between junctions 5 and 6 at Bromford Viaduct.

We continue to collect and monitor safety, economic, environment and capacity data of smart motorways (including DHS).

Working with partners

We committed to working closer with the recovery industry. **We have completed this commitment.**

On any motorway, smart or not, recovery vehicle operators are never required to recover a broken-down vehicle from a live lane. Traffic officers or the police physically close the lane first before recovery takes place, or they tow the vehicle to an emergency area or another place to stop in an emergency before the recovery operator begins their work.

Since 2020 we have increased our engagement with the recovery industry. This has included signing three unifying strategic agreements with the independent recovery industry, their work providers and the National Tyre Distributors Association. Our involvement in several shared forums such as the Smart Motorways Advisory Panel, Recovery Executive Committee and regional recovery groups has continued to help stakeholders identify and share safety initiatives.

While our stocktake action is completed, we will continue to work with our strategic partners to share information and identify potential areas for improvement. And we will continue to identify opportunities to work with the recovery industry to support the sector and improve our knowledge of recovery operators working on the strategic road network (SRN).

Emergency roadside telephone in use

M25 junctions 5 to 6 all lane running motorway

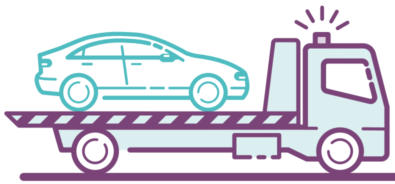
Red flashing lamps

DfT committed to reviewing the use of red flashing lights for recovery vehicles. **This commitment is ongoing and will continue to be managed by DfT outside of the scope of the 2020 Stocktake.**

DfT commissioned a study to determine if there is available evidence to support a change in law allowing the use of red flashing lamps on recovery vehicles. These lamps are already permitted for use on police and some emergency service vehicles. Our traffic officer vehicles also use red flashing lamps when they are operating on the network.

The review study recognised that while there is recovery industry support for the use of red flashing lamps, little evidence was found on the effects of lamp colours on road user understanding and behaviour. Further research is being undertaken by DfT, focusing on activities such as vehicle trials, simulator trials and a guidance document on warning lamps.

It is recognised that this is an important area of work, so DfT are committed to reviewing the findings of all research conducted so far. This work will continue to be led by DfT and managed outside of the scope of the 2020 Action Plan.



Finding a safe place to stop

- New ‘places to stop in an emergency’ spacing standard
- More signs showing distance to next emergency area
- Shared emergency area information with sat nav companies
- 10 extra emergency areas on the M25
- Considered national emergency area programme
- Made emergency areas more visible
- Reviewed emergency area widths

CRE23_0104 Stocktake progress – Last updated 29/09/2023

We want drivers and their passengers to feel confident driving on all our roads. We have listened to the concerns raised by stakeholders and the public about the spacing of places to stop in an emergency.

Emergency areas are safer than hard shoulders, where one in 20 motorway deaths happen. They have orange surfacing, are set back from live traffic lanes and have an emergency phone which connects directly to our regional control rooms, so help can be arranged. Based on the latest safety data, there have been no deaths in emergency areas. This is the same position reported in previous annual progress reports.

M56 junctions 6 to 8 all lane running motorway

Emergency areas

Emergency areas are spaced regularly along motorways with no hard shoulder or where the hard shoulder can be used as an extra lane. They MUST only be used in an emergency. They are clearly marked by blue signs featuring an orange emergency area shape and SOS telephone symbol.

Emergency areas provide a safer place to stop than a hard shoulder; they are set back from the carriageway and are also wider than a hard shoulder. They are designed to a standard 100 metres in length, with a 30 metre central stopping area.

You MUST use the emergency telephone provided and follow the operator's advice for exiting the emergency area.

- use the free emergency telephone, which connects directly to our control room and identifies your location
- our operator will give you further advice based on your circumstances and can help arrange further assistance for you
- the control room operators have a better view of the approaching traffic via CCTV, and they can help you safely re-join the carriageway; this may involve temporarily closing lane 1 via a Red X, displaying a warning message or sending a traffic officer patrol to help

Emergency area signs

Additional M25 emergency areas

We committed to installing 10 additional emergency areas on the M25 and monitoring their impact on the level of live lane stops. We installed 10 additional emergency areas on the M25 and all were open to traffic by early December 2020. **We have completed this commitment.**

In 2021 we started monitoring the impact of the additional emergency areas. We monitored across two periods, one covering January to July 2021 and the other August to December 2021. We issued two monitoring reports to DfT, the first in August 2021 and the second in March 2022.

Both monitoring reports concluded there was not a strong link between the spacing of emergency areas and the number of live lane stops. However, it was also recognised the amount of data was limited, meaning monitoring would continue.

Next we are adding extra emergency areas on the M1 and M25

We also recognise the monitoring completed to date has not included any assessments of the perception of safety, eg whether the emergency areas improve drivers' feelings of safety.

We are continuing to monitor the impact of all additional emergency areas through our programme to retrofit emergency areas. This is in addition to monitoring whether additional emergency areas influence the experience of drivers, and to help us understand how these emergency areas are used.

Emergency area retrofit

We committed to consider, by April 2022, a national programme to install more emergency areas on existing smart motorways where places to stop in an emergency are more than one mile apart. **We have completed this commitment.**

Our work in considering such a programme focused on drivers' concerns about being able to find a safe place to stop in an emergency on all lane running (ALR) motorways.

In taking forward the 2021 Transport Select Committee (TSC) recommendations, the government announced in January 2022 it was committing £390 million to install over 150 additional emergency areas during the second road investment period on ALR motorways in operation and construction. This means drivers will have more places to stop if they get into difficulty. In comparison to January 2022 this will be around 50% more emergency areas, giving drivers added reassurance.

We published details of *the emergency area retrofit programme*[22] in December 2022, with a further update in Autumn 2023.

We have already constructed five additional emergency areas, which are available for use, on the M6 between junctions 13 and 15 and a further eight on the M1 between junctions 13 and 16. Next we are adding extra emergency areas on the M1 and M25. Work started on the first of these schemes in winter 2022/23.

Retrofitting more emergency areas across the remainder of ALR motorways is being considered as part of formulating the third road investment strategy. This will be based on evidence of the benefits of introducing them at locations across the network, and whether the additional emergency areas help drivers to feel safer.

We also committed to assess the potential for the removal of nearside barriers where they are not required for safety purposes. Safety reasons could include protecting vehicles (and their occupants) from any hazards that exist on the verge, such as steep slopes. We are doing this via a desktop assessment, which is ongoing and is expected to be completed by early 2024.

Sign showing the distance to an emergency area

Better signage

We committed to installing clearer, easier to understand and more frequent approach signs showing the distance to the next place to stop in an emergency. **We have completed this commitment.**

By the end of September 2022, we had installed over 700 extra signs so drivers are almost always able to see a sign informing them of the distance to the next place to stop in an emergency, giving them additional confidence.

New standard for spacing of places to stop in an emergency

We committed to a new standard for spacing of places to stop in an emergency. **We have completed this commitment.**

This commitment was completed, ahead of target, in October 2020 when we published a new standard. This requires places to stop in an emergency to be three-quarters of a mile apart where feasible, and a maximum of one mile apart on schemes designed after October 2020.

There are some exceptions where it is not feasible to construct additional emergency areas, such as where junctions intersect or on bridges.

We are delivering a £390 million programme to construct over 150 additional emergency areas over the duration of the second road investment period, on ALR motorways in operation and construction.

Although these schemes were designed before October 2020 the latest design standard is being used to inform the programme. A decision on whether to retrofit across the remainder of ALR smart motorways will be considered as part of the formulation of the third (2025-2030) road investment strategy.

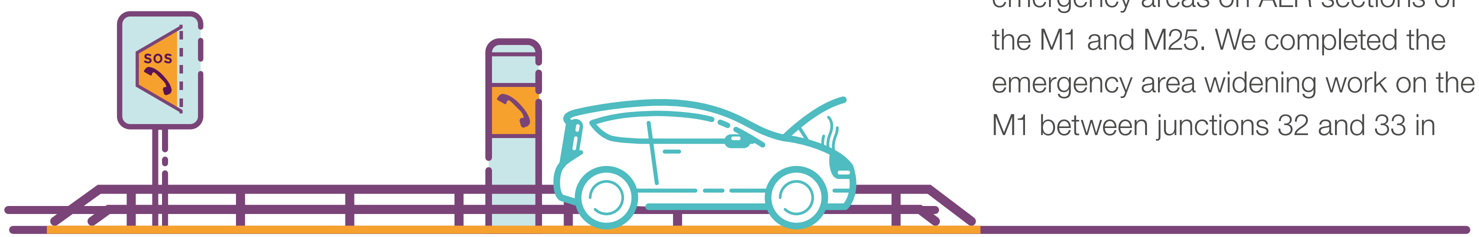
Making emergency areas more visible

We committed to make emergency areas more visible. **We have completed this commitment.**

In May 2020 we completed this commitment, with over 300 emergency areas made more visible. Emergency areas now have clearly visible orange surfacing and marked stopping areas with clearer, easier to understand and more frequent signage.

These emergency area enhancements are now standard on all existing schemes and will be on the remaining scheme in construction, which as of June 2023 is the M6 junctions 21a to 26[23].

Emergency areas now have clearly visible orange surfacing and marked stopping areas



Emergency area width

We committed to reviewing all existing emergency areas where the width is less than the current standard, and to widen those emergency areas that are less than the standard, if feasible and appropriate. **We have completed this commitment.**

An independent review was completed of the widths of 249 emergency areas across ALR and dynamic hard shoulder (DHS) motorways combined. This identified 13 emergency areas that were less than 4.4 metres wide (six on ALR and seven on DHS).

In September 2021 we published[24] a copy of the independent investigation report and our response to the independent review.

Our response to this review identified work was required to widen two emergency areas on ALR sections of the M1 and M25. We completed the emergency area widening work on the M1 between junctions 32 and 33 in December 2022 and in January 2023 on the M25 between junctions 5 and 6. For the other four ALR emergency areas, on-site measurements showed that three are greater than 4.4 metres wide and no widening is therefore required. At the fourth location widening would worsen the visibility to and from the emergency area and therefore have a detrimental impact on safety.

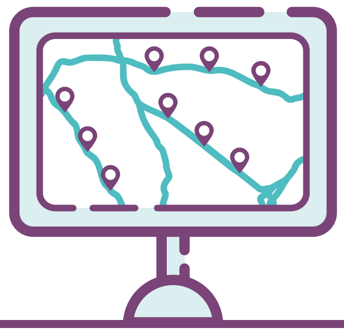
Our response also confirmed that emergency areas on DHS sections would be assessed via the DHS to ALR conversion work. The government's response to the 2021 TSC report pasued this conversion work, and it has subsequently been cancelled as a result of the 2023 announcement. In response to the pause, we committed to update our plans as soon as possible for re-examining the seven emergency areas on the DHS sections.

We have completed this work, which has determined that one emergency area on the M42 remains behind a full-time hard shoulder and therefore does not need to be widened.

Of the remaining six, on the M5, M6 and M42, the emergency areas will not be widened as it would either require land take to extend the highway boundary, or significant engineering works. Widening would therefore not be proportionate as the safety benefit from widening the emergency areas would be negligible compared to the safety impact to the workforce and road users during construction, potential disruption to journeys while completing the work and significant cost.

The six emergency areas are all at least four metres wide, which was the minimum dimension at the time they were constructed and are wider than a conventional hard shoulder, which is 3.3 metres.

We have shared emergency area information with sat nav companies



Sharing information with sat nav companies

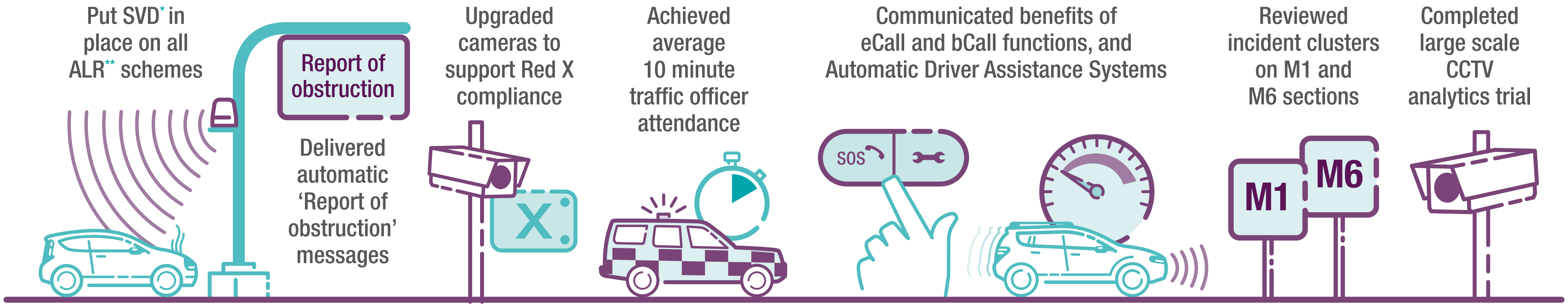
We committed to sharing information with sat nav companies that showed places to stop in an emergency on sat navs. **We have completed this commitment.**

We launched our *Open Data Site*[25] in March 2021. This site enables sat nav companies to access National Highways' geographical datasets, including the location of all emergency areas. In 2021 we informed sat nav companies of the available data and completed discussions with them and the DfT to understand uptake.

We have continued to update the emergency area information and work with sat nav providers to see what other information we can provide to help road users. This has included how we can collectively improve and share real time operational information so road users are provided with accurate, up-to-date information.

Emergency roadside telephone

Being safer in moving traffic



*SVD: Stopped vehicle detection **ALR: All lane running

CRE23_0104 Stocktake progress – Last updated 29/09/2023

The technology currently used on smart motorways, all focused on drivers, is made up of a system of different features so that there’s no over-reliance on a single feature.

It includes:

- variable speed limits to help keep traffic moving, reducing frustrating stop-start traffic
- a detection system to monitor traffic for changes in flows and speeds, which is known as MIDAS
- CCTV cameras that our operators can remotely move and zoom to monitor and manage congestion and incidents, where notified. The system has the ability to see 100% of the carriageway
- enforcement cameras to deter the minority who break speed limits and ignore Red X signals
- signs and signals to provide better information, which can alert drivers to hazards ahead and display Red X signals to close a lane or lanes to other traffic when a stopped vehicle is identified in them
- clearly signed and orange-coloured emergency areas set back from the road with telephones linking directly to our regional control rooms.

On all operational all lane running (ALR) motorways radar stopped vehicle detection (SVD) technology is also in place[10]. It was introduced as an enhancement to the system of features to help further reduce the risks associated with live lane stops, and to enable us to respond more quickly. ALR schemes are designed to operate safely without the need for SVD technology, which they do.

All of these features are overseen by our dedicated National Highways teams, both in control rooms and on-road 24 hours a day, 365 days a year.

Our operational data for every ALR section of motorway in April 2023 shows that CCTV availability[26] was over 97%, speed control signal availability[27] was over 94% and warning sign availability[28] was just over 91%. These are all assessed against a 95% availability target.

We are investing £105 million on ALR motorways by the end of March 2025 to further improve our operational technology, such as CCTV, variable message signs, signals and the system which detects slow moving traffic and automatically sets appropriate messages for drivers. This will enhance our management of the network and improve drivers' confidence and experience on these motorways.

Identifying stopped vehicles quicker

We committed to putting radar SVD in place[10] on every existing ALR motorway by the end of September 2022. **We have completed this commitment.**

We also committed, via the first year progress report, that new ALR schemes will open with SVD in place[10]. **We remain committed to this, meaning the remaining scheme in construction[29] will open with SVD in place.**

The 2020 Action Plan set a challenging target for us to install radar SVD technology on 21 schemes by March 2023. In our first year progress report we accelerated this commitment to install radar SVD technology on every existing ALR scheme by the end of September 2022.

We have put radar SVD in place on every existing ALR motorway

We delivered our commitment by the accelerated date, and we remain committed to adding SVD to the remaining ALR scheme still under construction[29], so when complete, it has it in place. This scheme was already over three quarters constructed when the 2023 announcement was made. SVD is currently in place on over 250 miles of ALR motorway.

SVD identifies a stopped vehicle, providing an alert to our regional control room. This enables us to respond quickly by setting a Red X signal to close one or more lanes, and to adjust speed limits and deploy traffic officers. When SVD provides the alert, the system also automatically sets a message sign to warn of a report of obstruction while the alert is verified by an operator. On average, SVD has enabled us to respond more quickly than we could previously have done to around 1,900 stopped vehicles a month[30].

As part of the government's response to the 2021 Transport Select Committee (TSC), our monitor, the Office of Rail and Road (ORR), conducted an independent evaluation of the effectiveness and operation of SVD and end-to-end systems. In December 2022 ORR published its findings and recommendations from this evaluation via its *First annual assessment of safety performance on the strategic road network*[14].

SVD is a relatively new technology and does not exist on other high-speed roads in the UK. We welcomed ORR's observation that the roll-out of SVD technology will have improved the detection of stopped vehicles, with a further likely positive impact on reducing the duration of live lane stops.

SVD is a relatively new technology and does not exist on other high-speed roads in the UK

We use a range of data, information, tools and processes to understand and manage network performance, including SVD.

SVD performance is measured against four main requirements:

1. minimum 95% coverage of the mainline carriageway and each of the emergency areas. Radar requires line of sight, so the design requirement accommodates for areas that cannot be captured, for example shadows from a sign. We check the placement of the radars against the requirements during the design phase. We then supplement this with post installation testing to confirm it picks up all the stopped vehicles used during the test

2. an 80% minimum detection rate of confirmed obstructions in live lanes

3. a maximum 20 second detection time, which is the time it takes for SVD to spot a stopped vehicle and create an alert. There is a concurrent maximum 30 second time, from the point of the vehicle being detected, for the alert to be presented to operators

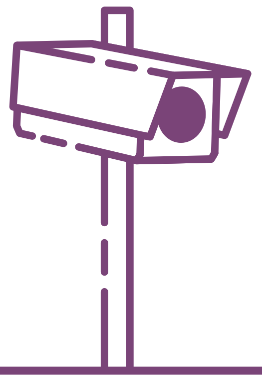
4. the proportion of times an alert is created but there is no confirmed stopped vehicle must be lower than 15%.

We recognised, as the ORR highlighted, that SVD was not meeting the high performance expectations we had set for it. We committed that, by the end of June 2023, we would aim to have met the performance expectations for SVD where it is in place, in a way which was manageable to our operators.

We set up a team of specialists to analyse every part of the system and determine the required improvements. We also worked with our operators to help ensure they could provide the best service to road users.

We piloted the improvements on three ALR motorways and based on the results on those schemes, we rolled out the improvements to other ALR motorways over a period of a month, concluding on 14 June 2023 (this includes the schemes that were built to the latest requirements. The legacy schemes which were installed as the pilot (M25) and an earlier version (M3) will be subject to a retrofit taking into consideration the lessons learned). Operational data from the first three schemes

Currently, radar SVD technology remains our primary approach for detecting stopped vehicles on ALR motorways



shows the technology has improved and is now meeting the performance specifications listed above. The operational data (dated 21 June) shows:

- SVD on the M20 junctions 3 to 5 was detecting 97% of stopped vehicles, within 9.6 seconds on average, with a false alert rate of 2%
- SVD on the M1 junctions 16 to 19 was detecting 91% of stopped vehicles, within 5.8 seconds on average, with a false alert rate of 10%
- SVD on the M6 junctions 2 to 4 was detecting 94% of stopped vehicles, within 9.7 seconds on average, with a false alert rate of 1%

For details see National Highways' letter to the ORR[31].

CCTV analytics trial

We committed to complete a large-scale trial of CCTV analytics. **We have completed this commitment.**

We conducted a large-scale trial of CCTV analytics (also known as video analytics), where CCTV images were analysed to detect stopped vehicles on the M4 near Bristol. The trial identified some limitations which required further testing and validation before a decision would be made to roll out the concept. Because of these limitations, and as the trial scope wasn't required to assess against the documented SVD requirements, it was acknowledged that further testing, validation and development would be required for a larger scale roll out.

As with any technology, all systems have their limitations. In light of the limitations of video analytics and of our own technology and systems to support its wider roll-out, at the time of the trial it was decided to continue to focus on the existing radar-based SVD solution.

The latter could be rolled out on the required scale to enhance the safety of road users on ALR motorways.

Currently, radar SVD technology remains our primary approach for detecting stopped vehicles on ALR motorways.

In January 2022, at the time of the government response to the TSC's report, we had started trials of the next generation of technology for detecting stopped vehicles, which is part of our continuous improvement approach. One potential solution included a form of video analytics and another combined video analytics and radar.

We remain open to exploring technologies which can enhance safety on the SRN. We are in the early stages of actively exploring the potential for video analytics to aid verification of radar SVD alerts. Once satisfied with this approach, the plan is to develop it with the ultimate aim of combining multiple data sources. This is drawing upon the findings of the M4 trial.

Report of obstruction

We committed, by March 2023, to automatically displaying a 'report of obstruction' message on electronic overhead signs on the motorway, to warn approaching drivers of a stopped vehicle ahead. **We have completed this commitment,** six months ahead of our original commitment.

Since September 2022, at locations which have SVD in place, 'report of obstruction' messages have been displayed each time our SVD system sends an alert. This sign warns approaching drivers of a stopped vehicle ahead and is displayed until it is verified and categorised by one of our regional control room operators. Once this has happened, operators will decide if further action is required, which could include updating the signs and signals to provide better information, such as Red X signals. If no further action is required, the report of obstruction sign is cleared.

Faster traffic officer attendance times

We committed to faster attendance by more National Highways traffic officer patrols where emergency areas are more than a mile apart on ALR sections, reducing the national average time it takes traffic officers to attend incidents from 17 to 10 minutes. We achieved this commitment in September 2022 with an average national attendance time of 9 minutes and 49 seconds[32]. **We have completed this commitment.**

Our traffic officers play an important role in helping to keep drivers safe and traffic moving across the patrolled sections of the SRN.

As part of the 2020 Action Plan we committed to achieve the national average 10 minute traffic officer attendance time by July 2021. While we made considerable progress in reducing our national average attendance time

An operator's desk in a National Highways' control room to achieve this, we set out an updated commitment in the second year progress report to achieve the 10 minute national average attendance time by the end of September 2022, which we achieved. Beyond the 2020 Action Plan we intend to maintain this performance until the end of March 2025. The third road investment period will set out our future operating requirements.

Upgrading enforcement cameras

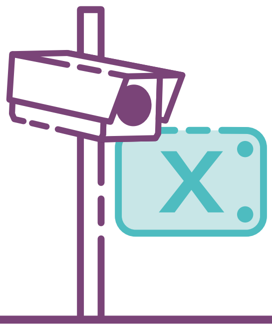
We committed to upgrade enforcement cameras by September 2022 to support improved compliance with Red X signals. **We have completed this commitment.**

To help improve the safety of drivers, their passengers, road workers and emergency services all enforcement cameras have been upgraded to enable the detection of vehicles that pass under a Red X or enter the lane beyond a Red X.

Our campaign evaluation shows that there was

87%

awareness of Red X



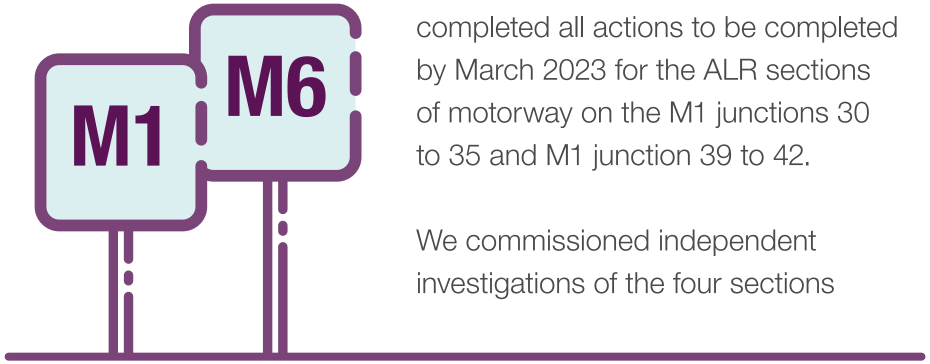
M62 junction 27 dynamic hard shoulder motorway

In conjunction with the technology upgrades, we have worked with police forces to raise awareness of Red X signals and enforcement measures so drivers know they must not drive in lanes closed by a Red X.

We have run multiple Red X awareness campaigns since 2016. We started our latest Red X campaign to raise awareness in February 2023. Our evaluation of the campaign that finished in January 2022 shows that there was 87% awareness of Red X.

It is illegal to ignore Red X signals. We will continue to work with police forces with the aim of further increasing compliance.

We have reviewed incident clusters on M1 and M6 sections



Investigating safety performance

We committed to look further at clusters of incidents on sections of the M6 and M1 smart motorways, specifically:

- *M6 junctions 5 to 6 (Bromford viaduct)*
- *M1 junctions 10 to 13*
- *M1 junctions 30 to 35*
- *M1 junctions 39 to 42*

We completed the commitment to look further at the clusters of incidents and develop action plans for all four sections of smart motorway. We have completed all actions to be completed by March 2023 for the ALR sections of motorway on the M1 junctions 30 to 35 and M1 junction 39 to 42.

We commissioned independent investigations of the four sections of smart motorway. In September 2021 we published[33] a copy of the independent investigation reports and our response to the independent review, which included our delivery programme of extra measures.

Amongst other measures, we have:

- installed signs at the M1 junction 40 bridge
- introduced new signage at junctions 11 and 12 of the M1 to assist traffic movement at these junctions
- completed the removal of additional vegetation on the M1 junctions 30 to 35
- constructed an additional emergency area near M1 Woodall services
- installed, on the M6, additional emergency area signage and introduced enhanced CCTV monitoring of traffic on Bromford Viaduct.

A stopped vehicle detection radar pole

The actions we set out for the M6 junctions 5 to 6 and M1 junctions 10 to 13 were due to be taken forward as part of the work to convert DHS motorways to ALR. The government's response to the 2021 TSC report paused this conversion work, and it has subsequently been cancelled as a result of the 2023 announcement. We updated our actions in summer 2022 and are on track to complete them by end of March 2025.

We have provided updates on our progress of the *M1 and M6 safety review actions*[34].

eCall button

Communicating the benefits of eCall and bCall

We committed to work with the Society of Motor Manufacturers and Traders (SMMT) to jointly understand the range of eCall and bCall functions in newer cars, and to communicate the benefits to drivers. **We have completed this commitment.**

We recognise the number of drivers who own a vehicle with this in-built safety feature will increase steadily over the next few years. This has been a standard feature on all new cars sold in the EU since 2018 with many manufacturers including this feature on their vehicles before that point.

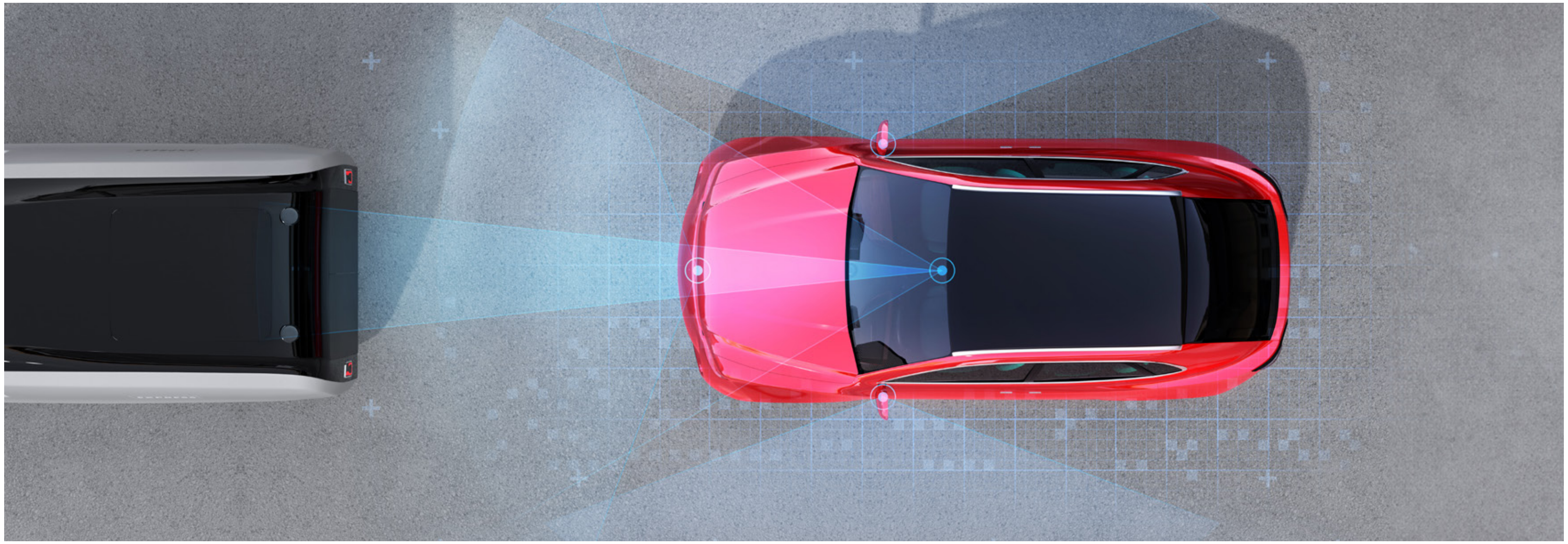
We worked with stakeholders to agree the key messages for a public information campaign, launching England's first major eCall awareness campaign in September 2021. This was on digital channels, including a dedicated campaign page on our website[35].

In November 2022 we updated our eCall campaign, highlighting that the function can be used to help both the driver and passengers of a vehicle which has eCall, and to help other road users in difficulty. We also raised awareness of our campaign via the *Driving for Better Business*[20] programme. In April 2023 we delivered further eCall campaign activity.

The Highway Code[13] also now advises the use of eCall to contact police and communicate a location directly to a 999 operator.

For drivers whose cars do not have this feature, we have also made guidance available on our website on what to do if your vehicle has a problem or you get into trouble on a motorway.

We will continue to work with stakeholders to raise road users' knowledge of using eCall, so they can confidently use the safety feature if they are unable to leave their vehicle safely or if they see someone else needing help.



Advanced Emergency Breaking

Communicated benefits of eCall and bCall functions, and Advanced Driver Assistance Systems

Working with fleet operators

We committed to use the Driving for Better Business[20] *programme to raise awareness of the benefits of using Advanced Driver Assistance Systems (ADAS), with a particular focus on Advanced Emergency Braking (AEB) systems*. **We have completed this commitment.**

We worked with fleet operators and drivers to understand the full scope of AEB system issues. We used this knowledge to develop an awareness package, released in February 2022 using the *Driving for Better Business*[20] programme, to help improve compliance with current legislation and guidance.

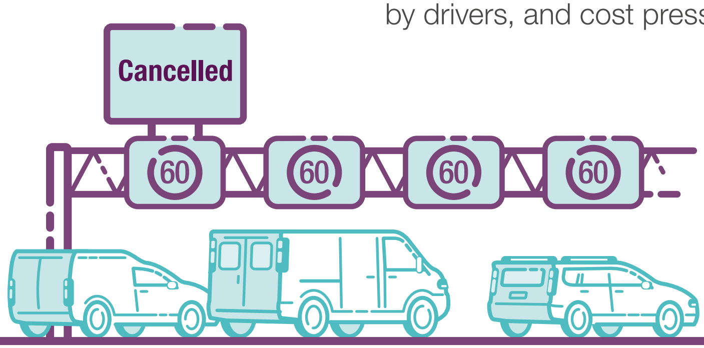
The package equips drivers and operators with all they need to know for safe use of AEB systems. It includes short animations for both drivers and transport managers, a fact sheet for transport managers and a poster for staff noticeboards.

We also committed to working with DfT to explore whether to make it illegal to switch off AEB without good reason. Outside of the 2020 Stocktake, the DfT is continuing to explore options for changes in policy or regulation.

Going further – 2021 Transport Select Committee report update

The Department for Transport (DfT) and National Highways remain grateful to the Transport Select Committee (TSC) for its continued challenge and scrutiny. We have worked closely with the DfT, Office of Rail and Road (ORR) and Transport Focus to progress the government's commitments[36] in response to the 2021 TSC's report into the rollout and safety of smart motorways[37].

In April 2023, the government announced that plans for new smart motorways would be cancelled



The TSC made nine recommendations in its report in November 2021. The government agreed to take all nine recommendations forward. In its response to the 2021 TSC report, the government paused the roll out of new all lane running (ALR) motorways. On 15 April 2023 the government announced that plans for new smart motorways would be cancelled in recognition of the lack of public confidence felt by drivers, and cost pressures.

As the government also set out in its announcement, while no new stretches of road will be converted into smart motorways, the M56 junctions 6 to 8 and M6 junctions 21a to 26, which were both in construction at the time, would be completed given they were already more than three quarters constructed.

We are fully committed to playing our part in delivering all of the TSC recommendations. Since the government published its response to the TSC report, in January 2022, we have made good progress delivering on the commitments. We have:

- continued to invest in additional safety measures at some of the locations, which, ahead of the 2022 pause and 2023 announcement, had been due to be upgraded to ALR
- published, in December 2022 and further updated in Autumn 2023, *the emergency area retrofit programme*[22]. This progresses the government's commitment to roll out more emergency areas on ALR motorways, in operation and construction

In December 2022, we published details of the emergency area retrofit programme

- completed an initial desktop options study, which is the first phase of work to consider whether alternative dynamic hard shoulder (DHS) operating regimes would reduce the potential for driver confusion. This work identified three options to be progressed to the next phase of works which will review these options against further road user insight, detailed assessments and off-road trials

- completed a full impact assessment, safety risk assessment and stakeholder consultation on the emergency corridor concept. We have further engaged with stakeholders on the findings of this work and to help shape the next steps.

During this period DfT has also:

- convened an expert panel to help the department consider the benefits of additional health and safety assessments being undertaken prior to changes to the design or operation of the strategic road network (SRN)

- commissioned ORR to independently evaluate the effectiveness of stopped vehicle detection technology and other systems in place, along with evaluating how successful the actions in the 2020 Action Plan have been. ORR published its *First annual assessment of safety on the strategic road network*[14] in December 2022, to which National Highways responded[38]

- continued to consider alternative options for enhancing capacity on the SRN as part of the preparation for the third road investment strategy. We will continue to support DfT with this work

- published its *smart motorway comparison report*[39] in December 2022. We will support DfT in progressing this recommendation as it continues to collect further data

- commissioned Transport Focus to undertake further research to provide greater road user insight on safety perception. This work has been completed by Transport Focus and has been published in their *Safety perceptions on smart motorways: the driver view report*[40]. The insight from this research has been used to inform this report.

We will continue to play our part in progressing the outcomes and next steps of the TSC commitments.

Updated safety evidence

No one type of motorway, smart or conventional, is ranked best against every safety metric

Broader and deeper safety evidence

Road type comparison (strategic road network level statistics) and beyond

At National Highways, safety is our highest priority. We take road safety very seriously and have a strategic ambition that nobody should be harmed using or working on our network. This is reflected in our stretching target to at least halve the number of people killed and seriously injured on our roads by the end of 2025[41]. We recognise there is always more that can be done.

As outlined in the government's response to the 2021 Transport Select Committee's (TSC) report, it is important to continue monitoring safety performance across smart motorways. Through monitoring and evaluation activities, we will continue to assess the safety of our roads and identify opportunities to make existing smart motorways even safer, in line with the 2023 announcement.

This section of our report builds on the high-level statistics presented in the 2020 Stocktake, and subsequent annual progress reports, using the latest available road safety statistics.

As with previous annual progress reports, strategic road network (SRN)-wide data provides a broad view on how different road types compare based on the latest national safety statistics (STATS19). These statistics are valuable in understanding whether safety across the SRN improves over time. They also help us identify areas for improvement across road types, for example for all conventional motorways or different types of smart motorways.

Based on these statistics, no one type of motorway, smart or conventional, is ranked best against every safety metric.

The latest safety data continues to show that overall, all three types of smart motorway are safer than conventional motorways for those safety metrics which consider the most significant impacts, such as deaths or serious injuries. Most incidents (96.1%) across the SRN are single vehicle collisions or incidents involving two or more moving vehicles. The rest of the collisions, which form a small proportion of all incidents (3.9%), involve moving vehicles colliding with stopped vehicles. These types of collision happen on all roads.

The risk of a collision and the risk of a serious injury or death due to a stopped vehicle collision is lowest on conventional and controlled motorways. As reported in the second year progress report, the risk of a collision between a moving and a stopped vehicle is greater on ALR and DHS motorways than on other motorway types, but the risk of a collision involving only moving vehicles is lower. This continues to be the case based on the latest safety data.

The majority of the stocktake actions such as introducing stopped vehicle detection (SVD), and enabling increased enforcement of Red X signals, are designed to reduce collisions between moving and stopped vehicles.

Due to the time lag between the actions being delivered and the data being available, it will be later in 2023 before we can start assessing and understanding the impact of the actions.

To further assess what drives safety across the SRN, understand how drivers feel and to increase transparency, this year we've also undertaken deeper safety analysis supported by broader safety evidence. This includes scheme safety comparisons, road user insights and references to the wider monitoring and evaluation activities we undertake.

In developing this report, we have engaged with external independent organisations to challenge and improve the analysis. We have also engaged with the wider public across England to understand how to better communicate safety statistics. While these have influenced our approach for this report, they have not changed the technical aspects of our analysis agreed with the Department for Transport (DfT) and the Office of Rail and Road (ORR).

Scheme safety comparison (before versus after assessment)

In addition to the high-level statistics, this year we have included scheme-level safety data to better understand how safety compares on smart motorway sections before and after they were converted to their current form of smart motorway.

This data also uses STATS19 and compares safety before a scheme was constructed to that afterwards. Where possible, we have also calculated the counterfactual, meaning a hypothetical after-period estimating what could have happened if the specific locations had not been converted to smart motorways.

These comparisons reflect the five years before a scheme was constructed and up to five years after. This scheme-level safety analysis goes to a deeper level than the high-level statistics per road type. This type of evidence assesses safety at a local level and enables us to understand which locations may be comparatively safer and for which areas there may be scope for further improvement.

This complements the high-level statistics, therefore the two are considered together. The *Smart motorways scheme* *safety - 'before' versus 'after' assessment*[42] is published separately, with the key findings summarised in this report.

Road user insights

It is important that drivers feel safe and confident on all our roads, including smart motorways, and we recognise we need to do more in this area.

We want road users to feel safe and confident using all our roads, including smart motorways

We have already done more to understand the views of road users who use smart motorways. These insights focus on what makes them feel safe. In addition to safety data, such insights help us better understand what we and our partners can do to improve how road users feel and how they behave on our roads.

Wider evidence

As the 2020 Action Plan aimed to improve safety and feelings of safety, the 'wider monitoring and evaluation' section of this report explains what we are doing to understand the impact of the interventions we have delivered in the 2020 Action Plan.

This evidence helps us understand the safety of our network, the impact we have on drivers' safety, feelings of safety and on communities across England. We do all this because safety is our top priority, and we want road users to feel safe and confident using all our roads, including smart motorways.

We will continue to work with DfT to track public confidence in smart motorways, and collect and monitor safety, economic, environment and capacity data.

Increased transparency

The safety analysis presented in this report is developed by National Highways using STATS19 data (unless stated otherwise). STATS19 data is collected by police forces and then validated and published annually by DfT. National Highways analyses the data to assess safety across road types and different parts of the network. As with the second year progress report, this analysis has been subject to five levels of assurance.

While a fifth level of assurance is not standard practice, this builds on the approach we followed for the previous annual progress reports. ORR undertook its independent assurance for the supporting analysis in March 2023. ORR found that the analysis is clear and transparent, and the conclusions are appropriate.

In more detail, the ORR review found that:

- our presentation of data and analysis in this report is largely consistent with our second year progress report, which ORR previously found to be clear and transparent. Where additional analysis is included, this is relevant to the wider report and the conclusions drawn are appropriate
- where we have made changes to how data is presented, the reasons for this are sound and clearly communicated
- we continue to follow appropriate analytical assurance processes to help ensure the reliability of the underlying data and evidence.

It will be later in 2023 before we can start assessing the data and understanding the impact of the stocktake actions

To provide greater transparency, this year we have produced an extensive file with our detailed analysis, see Annex C – Detailed tables. This presents all the detailed analysis in tables which can be readily used by other organisations or interested parties.

Alongside this report, to also allow other organisations or interested parties to undertake their own analysis, we have published detailed collision data, see Annex D – Detailed collision data.

We will be interested to hear your thoughts on how to improve this data. If you want to contact us, please email us at roadsafetydivision@nationalhighways.co.uk.

Important considerations

Before considering the updated safety evidence, it is important to outline some key considerations that have an impact on safety data, both for 2021 and historically:

- The coronavirus pandemic (Covid-19) and associated travel restrictions affected road safety data in 2020 and 2021. For example, due to varying restrictions across regions and therefore varying traffic across roads, certain safety comparisons between road types may not be like-for-like. While this report considers year-on-year safety data, to reflect trends over time it considers rolling five-year averages. This means that safety data between 2016 and 2020 is compared with the safety data between 2017 and 2021 and so on. This reduces to some extent the impact from external events, such as Covid-19
- Since 2012, many police forces have changed the way they collect safety data. Using the new method an incident is categorised automatically based on the worst injury, rather than (using the previous method) the judgement of a police officer. Police forces using the new systems report more serious injuries than those which don't. DfT and the Office for National Statistics (ONS) have developed an approach to adjust the data collected from those police forces which are not currently using the automated system. This enables better comparisons across police forces and further increases the confidence in safety data captured by police officers. This adjusted data is published annually by DfT and is the basis for the safety analysis in this report[43]
- Although we have delivered the majority of the measures in the 2020 Action Plan, such as introducing SVD technology and enabling increased enforcement of Red X signals, the impact of these measures is not yet apparent from the safety data. Due to the time lag between the actions being delivered and the data becoming available, it will be later in 2023 before we can start assessing the data and understanding the impact of the actions.

M62 junction 30 dynamic hard shoulder motorway

These considerations are important as they have resulted in data and methodology updates, enabling better alignment with police reporting and DfT guidance. As such any comparison with previous publications should consider those updates.

As in the second year progress report and in line with our response to the *ORR independent review*[44] undertaken in 2021, the safety analysis considers the five-year average (2017-2021) for three key metrics:

- Personal injury collisions (PIC) reflects collisions where at least one person was injured but does not include any consideration of whether more than one person has sustained an injury or the severity of the injuries
- Fatal and weighted injuries (FWI) places greater emphasis on deaths and serious injuries by giving a death 10 times the weighting of a serious injury and a serious injury 10 times the weighting of a slight injury
- Killed and seriously injured (KSI), places equal emphasis on deaths and serious injuries by giving no weighting between the two.

In this report we are presenting both the absolute values and rates accounting for traffic flows. This means that while every injury is counted independently (absolute values), metrics account for differences in traffic across the SRN (rates). Rates may be more meaningful for safety comparisons compared to absolute values as they avoid certain issues, such as the fact that the least used roads may appear to be the safest roads. However, for transparency it is appropriate to present both absolute values and rates. For more information, please see Annex B – Methodology.

Safety on the strategic road network

As with our previous reports and before comparing the safety performance of different road types, it is useful to first understand the latest data in relation to the overall safety of England's roads. This information is reported for the most recent calendar year for which data is available, in this case 2021. Across all road classifications, England has some of the safest roads in the world. According to the latest international safety data consolidated by DfT, Norway, Malta, Sweden, Denmark and Switzerland perform better than England[45].

While England's road network is among the best performing road networks internationally, there is always scope for improvement. Road deaths in England increased from 1,246 in 2020 to 1,329 in 2021 as traffic increased following Covid-19.

Out of the 1,329 road deaths in England in 2021, 1,107 deaths (83%) took place on the local road network managed by local authorities. From all road deaths in England, 222 deaths (17%) took place on the SRN. On SRN A-roads, the number of deaths increased from 74 in 2020 to 142 in 2021 (11% of total road deaths in England). SRN A-roads are the longest parts of the SRN but carry the second largest traffic flows after conventional motorways.

Figure 1

Road deaths per million population in 2021

Description:

England is in the top performing countries internationally in terms of road safety

Source:

Visualisation from National Highways.
Data based on IRTAD (OECD), ETSC, EUROSTAT and CARE (EU road accidents database)[46]

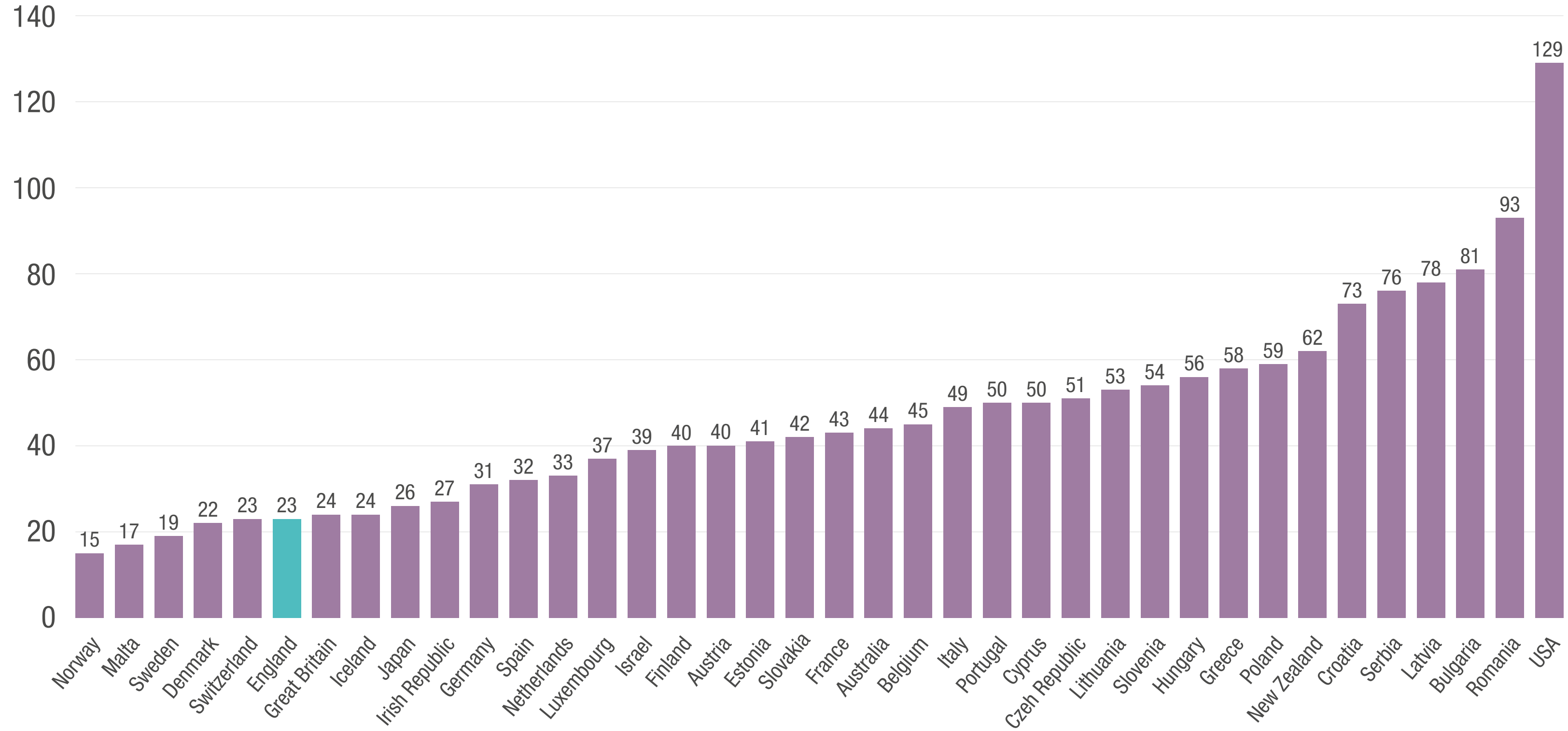


Figure 2

SRN miles and traffic flows per road type in 2021

Description:

In 2021 A-roads made up the majority of the SRN in miles, while the majority of traffic flows on the SRN were on conventional motorways

Source:

Visualisation from National Highways. DfT road length and road traffic statistics

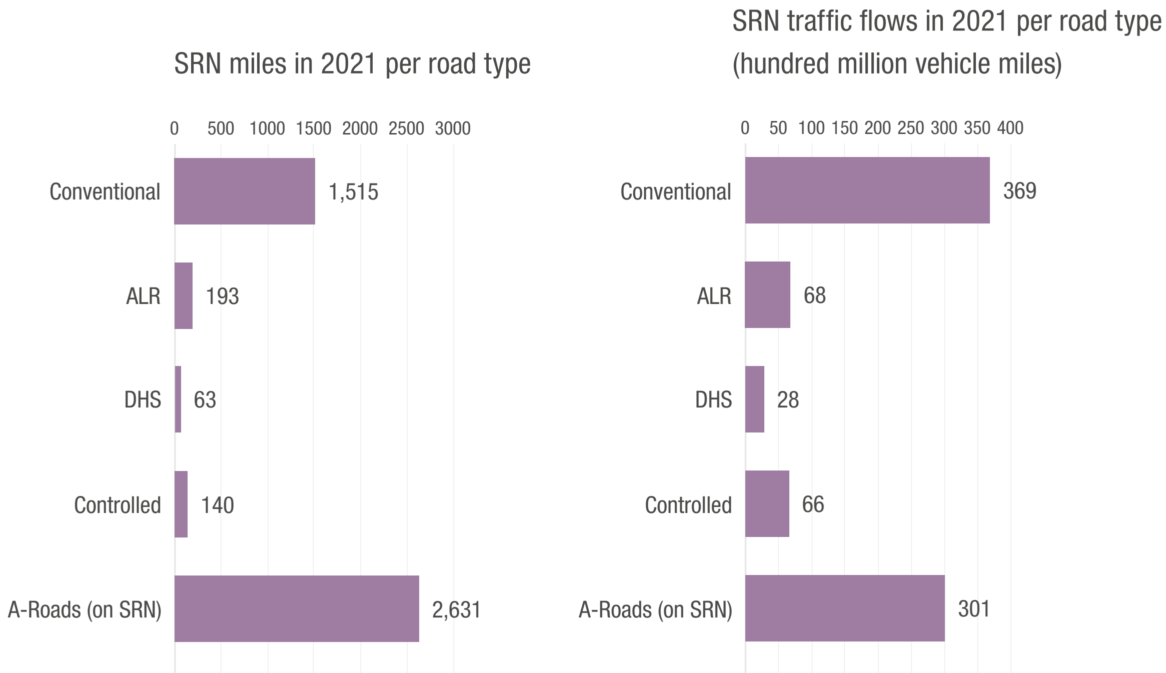


Figure 3

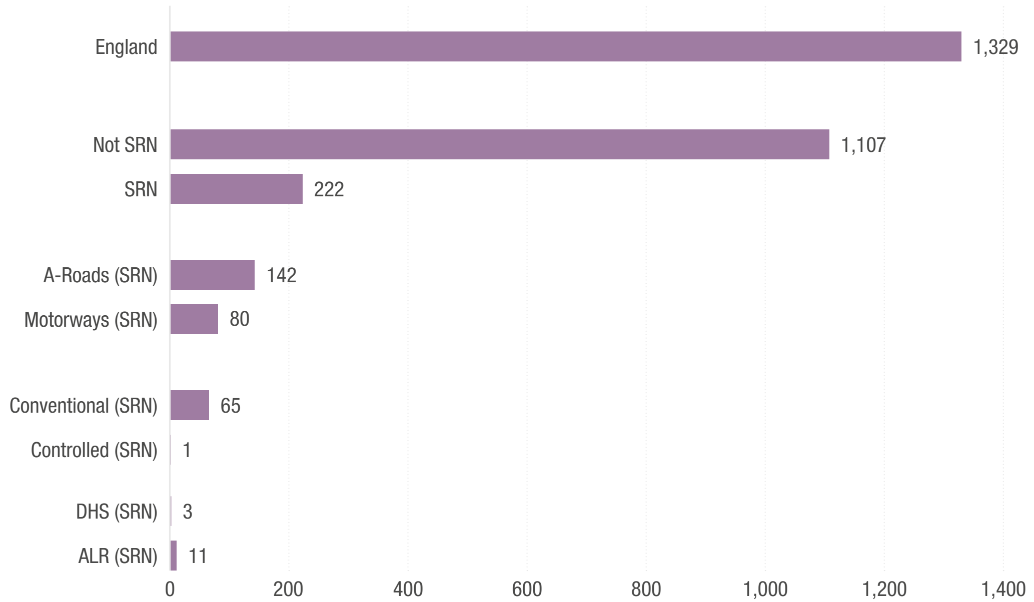
Road deaths by road type in England in 2021

Description:

1% of road deaths in England took place on ALR and DHS motorways in 2021

Source:

Visualisation from National Highways. Data based on STATS19[47]



All lane running motorway

Out of all road deaths in England, 80 deaths (6%) took place on motorways, of which 14 (1%) took place on ALR and DHS motorways. Motorways carried 21% of all England's road traffic in 2021, of which 4% was on ALR and DHS motorways.

Motorways are the safest type of road to travel on. The most recent Road Safety Foundation assessment also rated the majority of our motorways as Low Risk[48]. This is based on the *International Road Assessment Programme*[49] (iRAP), a charity which measures how safe roads are across the world. iRAP independently gathers road inspection data and provides an objective measure of the level of safety on a road.

Every five years, through iRAP, our road network is surveyed and independently assessed to calculate star ratings. In terms of safety, the highest risk roads are rated as 1-star and the lowest risk roads are rated as 5-star. We are proud that we exceeded our target in that at least 90% of travel on our network was on roads which were rated 3-star or better in 2020.

While the star ratings and supporting data can provide some information about smart motorways, more work is needed to develop the iRAP model to better reflect all the features of smart motorways in combination and to make sure that the model scores these accurately. We are supporting the Road Safety Foundation in their independent assessments of our network.

Any move towards increasing capacity on our safest roads can provide safer overall capacity for drivers on the road. That is because drivers can move away from less safe roads where there tend to be more deaths and injuries.

Safety update on smart motorways

Safety headlines

No one type of motorway, smart or conventional, is ranked best against every safety metric.

The latest safety data continues to show that overall, all three types of smart motorway are better than conventional motorways for those safety metrics which consider the most significant impacts, such as deaths or serious injuries[50].

As per the second year progress report, a collision on a conventional motorway is more likely to involve a death or serious injury than a collision on any of the three types of smart motorway. This is due to PIC rates being lower on conventional motorways, but their FWI and KSI rates being higher compared to smart motorways.

We have also undertaken statistical significance testing, which helps us understand whether a difference in numbers is likely to be due to random variation. Simply put, as the numbers are low and similar to each other statistical significance testing helps explain whether the numbers are statistically different to

Table 1

Headline five-year average (2017-2021) injury-adjusted metrics per road type[51]

Description: Across all collisions, all three types of smart motorway continue to be better than conventional motorways for those metrics which consider the most significant impacts, such as deaths or serious injuries

Source: Analysis from National Highways Data based on STATS19 with minor amendment[52]

		PIC	PIC per hmvm	FWI	FWI per hmvm	KSI	KSI per hmvm
Types of motorway	Conventional	2,423	5.67	155	0.36	615	1.45
	ALR	335	5.99	20	0.35	82	1.43
	DHS	219	7.32	9	0.31	34	1.14
	Controlled	534	7.76	21	0.31	90	1.31
A-roads (on SRN)		4,045	12.59	286	0.89	1,172	3.65


A view of the M1 in West Yorkshire from fields

each other. This helps make some of the comparisons between different road types more meaningful.

Statistical significance testing is only viable where the measure being tested is an observed whole number data point, for example an event such as a collision or a specific outcome such as an injury from a collision. The FWI and KSI rates do not meet the criteria and cannot be tested at this time. We understand that all police forces will eventually move to injury-based reporting systems and when that change has occurred severity adjustments will no longer be necessary. This will allow us to undertake statistical testing of KSI rates from that point onwards, starting with one year of data.

The PIC rate for conventional motorways is 5.67 and for ALR motorways is 5.99. Based on the statistical significance testing, these two figures are considered very close, ie they are not statistically different to each other. This means that it is not possible to state that the PIC rate for conventional motorways is statistically lower than the PIC rate of ALR motorways. However, the PIC rates for both conventional and ALR motorways are statistically lower than the PIC rates for DHS motorways (7.32) and controlled motorways (7.76).

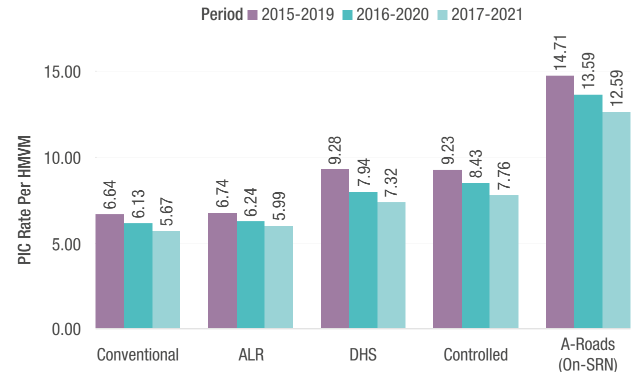
Reducing the number of collisions is an integral part of further improving safety on our roads. This makes it a concern for all road types. We continue to monitor safety across our network to help identify appropriate and targeted actions towards halving the number of people killed and seriously injured on our roads by the end of 2025[41]. For more information, please see Annex B – Methodology.

Safety trends

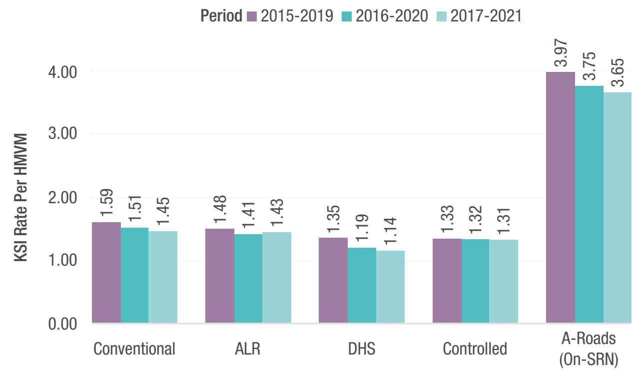
Data can be affected by external events. For example, data for the years 2020 and 2021 was affected by travel restrictions and lower traffic flows as a result of Covid-19 measures. This means year-on-year comparisons of safety trends become challenging as we may not be able to compare like-for-like.

In this report we report trends based on five-year rolling averages. Five-year rolling averages smooth some of the peaks and troughs caused when safety across all roads in individual years is very different to its usual levels. This means that safety data between 2015 and 2019 is compared with the safety data between 2016 and 2020, which is then compared with the safety data between 2017 and 2021 and so on. This was also highlighted in the second year progress report, which indicated that from this report onwards we would move to assessing safety data based on a five-year rolling average method.

Rolling PIC Rate by Type of Road



Rolling KSI Rate by Type of Road



Rolling FWI Rate by Type of Road

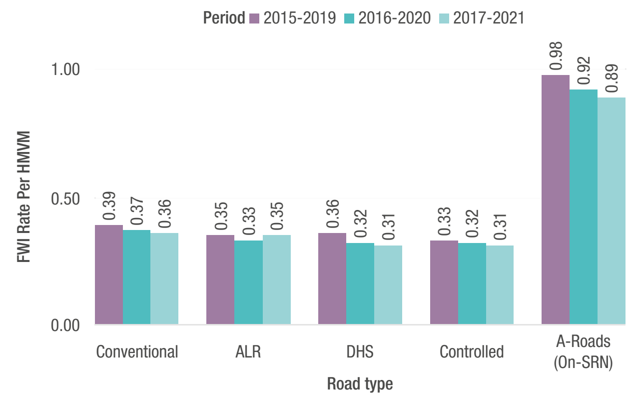


Figure 4

Injury-adjusted five-year rolling average rates per hmvm by road type

Description:

Across all safety metrics, all road types have relatively stable or improving trends

Source:

Visualisation from National Highways. Data based on STATS19 with minor amendment. Road traffic statistics from DfT on the SRN

All lane running motorway

Across all safety metrics, all roads have relatively stable or improving trends

Across all safety metrics, all roads have relatively stable or improving trends. ALR motorways saw a slight worsening in the latest five-year period (2017 to 2021) for the FWI rate and KSI rate metrics compared to the previous five-year period (2016 to 2020). However when compared to the first five-year period (2015 to 2019) there has been an improvement for ALR overall with the PIC rate and KSI rate being lower in the latest period (2017 to 2021) than the first period (2015 to 2019). The FWI rate has been the same for both the latest and first periods. The reduction in the KSI rate alongside the FWI rate being the same in both periods indicates that there has been an improvement over time in respect of serious injuries on ALR motorways. For each metric's detailed year-on-year rates, please see Annex C – Detailed tables.

Stopped and moving vehicle safety

The vast majority of incidents across the SRN are single vehicle collisions or incidents involving two or more moving vehicles. The rest of the collisions, which form a small proportion of all incidents, involve moving vehicles colliding with stopped vehicles.

In terms of the five-year average between 2017 and 2021, moving vehicle FWI and KSI rates are the lowest on DHS motorways, followed by ALR and controlled motorways.

To understand the reason for the improved safety between moving vehicles on smart motorways, we undertook detailed analysis to better understand the different types of collisions across road types. The most common type of collision on conventional motorways and A-roads were those where the front of a vehicle crashes into the back of another vehicle. For this type of collision, smart motorways were not different to other road types.

However, the second most common type of collision across the SRN is a single moving vehicle collision. This is where a single vehicle has a collision without involving any other vehicle or a pedestrian. The nature of these collisions typically involves the vehicle running off the road or striking a safety barrier. On conventional motorways 20% of all collisions are single vehicle collisions compared to 13% on ALR, 10% on controlled motorways and 5% on DHS.

As reported in the second year progress report, the risk of a live lane collision between a moving and a stopped vehicle is greater on ALR and DHS motorways than on other motorway types, but the risk of a collision involving only moving vehicles is lower. This continues to be the case based on the latest safety data. ALR and DHS motorways have variable mandatory speed limits to smooth traffic flow, and electronic signs and signals to warn drivers of incidents ahead.

In a similar way to the headline PIC rates, we have undertaken statistical testing for moving and stopped vehicle

Figure 5

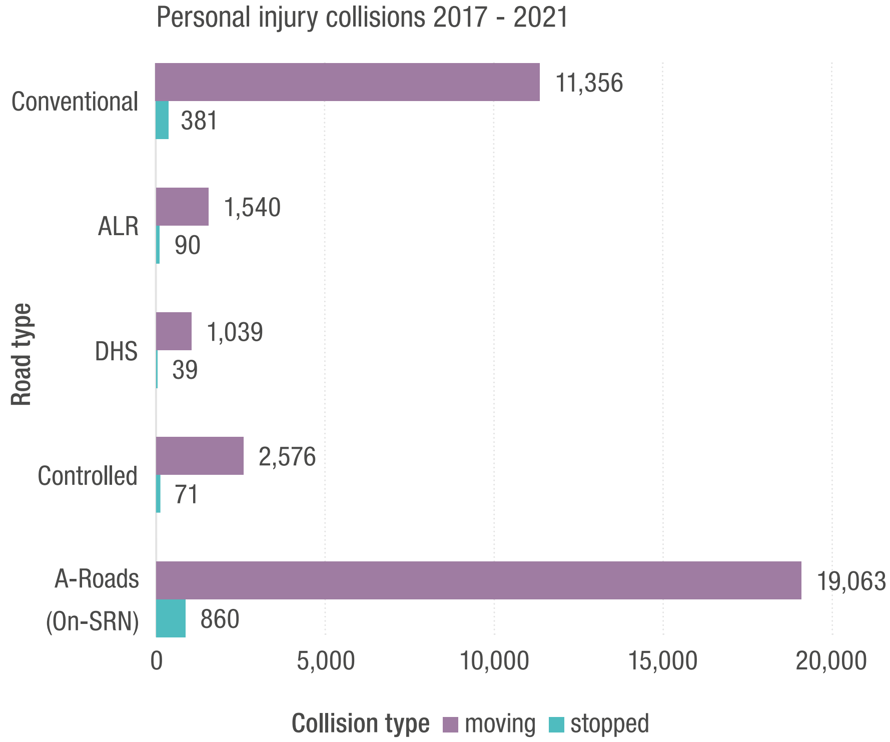
Total moving versus stopped vehicle collisions per road type between 2017-2021

Description:

Across the SRN most collisions occur between moving vehicles

Source:

Analysis from National Highways. Data based on STATS19 with minor amendment



collisions. This helps make some of the comparisons between different road types more meaningful.

The moving vehicle PIC rate for conventional motorways is 5.48 and for ALR motorways is 5.66. As with the headline PIC rates, these two figures are considered very close as they are not statistically different to each other. This means that it is not possible to state that the PIC rate for conventional motorways is statistically lower than the PIC rate for ALR motorways. However, the PIC rates for both conventional and ALR motorways are statistically lower than the PIC rates for DHS motorways (7.06) and controlled motorways (7.55). For more information, please see Annex B – Methodology.

Stopped vehicle collisions take place on all roads and they are a small proportion of the overall number of collisions. When considering collisions across the SRN, most collisions occur between moving vehicles rather than involving a stopped vehicle.

On average across all road types, moving collisions are 96.1% and stopped vehicle collisions are 3.9%[54]. Moving collisions range between 94.5% on ALR motorways, 96.4% for DHS motorways and 97.3% on controlled motorways. Stopped vehicle collisions

Table 2

Moving vehicle five-year average (2017-2021) injury-adjusted metrics per road type

Description:
Moving vehicle FWI and KSI rates are the lowest on DHS motorways[53]. Moving vehicle collisions are 96.1% of all collisions across the SRN

Source:
Analysis from National Highways. Data based on STATS19

		PIC	PIC per hmvm	FWI	FWI per hmvm	KSI	KSI per hmvm
Types of motorway	Conventional	2,346	5.48	141	0.33	574	1.35
	ALR	317	5.66	17	0.29	70	1.23
	DHS	211	7.06	8	0.26	29	0.97
	Controlled	519	7.55	20	0.29	85	1.24
A-roads (on SRN)		3,871	12.05	259	0.80	1,092	3.40

M1 junction 40 all lane running motorway

Stopped collisions are a small proportion of all collisions across all roads

range between 2.7% on controlled motorways, 3.6% on DHS motorways and 5.5% on ALR motorways. Stopped vehicle FWI and KSI rates are the lowest on controlled motorways.

This continues to reflect the assessment in the second year progress report, that the risk of a live lane collision between a moving and a stopped vehicle is greater on ALR and DHS motorways than on other motorway types, but that the risk of a collision between moving vehicles is lower.

Small datasets can be very sensitive to small changes. As stopped collisions are a small proportion of all collisions across all roads, these should always be considered within a broader context.

Stopped vehicle PIC rates are lowest for conventional motorways, while FWI and KSI rates are lowest for controlled motorways. This continues to reflect the summary we included in the second year progress report.

As previously noted, the safety data does not yet show the impact of actions delivered as part of the 2020 Action Plan, such as SVD technology on ALR motorways. Many of these actions are designed to reduce the risk of live lane stops. Due to the time lag between the actions being delivered and the data being available, it will be later in 2023 before we can start assessing and understanding the impact of the actions. We will continue to assess the data in line with our monitoring and evaluation processes.

Similar to the headline and moving vehicle metrics, we have also undertaken statistical significance testing for stopped vehicle metrics. Stopped vehicle collisions are a much smaller dataset than moving vehicle collisions and this means that there is a higher level of uncertainty in the stopped vehicle PIC rates than moving vehicle PIC rates.

The statistical testing suggests that we can be confident that the stopped vehicle PIC rates for conventional motorways (0.18) and controlled motorways (0.21), are lower than that of ALR (0.33), however the evidence for statistical differences between other motorway types is not as strong. For more information, please see Annex B – Methodology.

Contributory factors

Following the second year progress report, using STATS19 data, we have undertaken contributory factor analysis to help us further understand which factors are involved in collisions on the SRN.

It should be noted that for every collision the investigating police officer

Table 3

Stopped vehicle five-year average (2017-2021) injury-adjusted metrics per road type

Description: Stopped vehicle FWI and KSI rates are the lowest on controlled motorways. Stopped vehicle collisions are 3.9% of all collisions across the SRN

Source: Analysis from National Highways. Data based on STATS19 with minor amendment

		PIC	PIC per hmvm	FWI	FWI per hmvm	KSI	KSI per hmvm
Types of motorway	Conventional	78	0.18	13	0.03	41	0.10
	ALR	18	0.33	3	0.05	12	0.21
	DHS	8	0.26	2	0.05	5	0.16
	Controlled	14	0.21	1	0.02	5	0.07
A-roads (on SRN)		175	0.54	28	0.09	81	0.25

can assign between zero and six contributory factors from a list of 78 factors (STATS19) which they believe influenced the collision occurring. These are based on the subjective view of the officer at the time and are identified as either “very likely” or “possible” factors.

For this analysis, these collisions have been grouped into three overarching categories: collisions involving at least one driver factor, collisions involving at least one environment factor and collisions involving at least one vehicle factor. Driver factors include issues such as following too close or failing to look properly. Environment factors include issues such as a slippery road due to weather. Vehicle factors include issues such as defective brakes, steering or suspension. Some collisions belong to more than one group. This means that contributory factors in most cases overlap[55].

Driver factors are most prominent across all road types, while environment or vehicle factors vary depending on road type. Collisions on all smart motorways have a higher percentage of vehicle factors than collisions on conventional motorways, but a lower percentage of environment and driver factors compared to conventional motorways. For more information, please see Annex C – Detailed tables.

Table 4

Total personal injury collisions by contributory factor group by road type between 2017-2021

Description:
Across all roads, the most prominent collision factors are driver-related

Source:
Data based on STATS19[57]

		Driver factors	Vehicle factors	Environment factors	N/A[56]
Types of motorway	Conventional	71.59%	4.12%	12.98%	23.41%
	ALR	70.61%	6.01%	10.92%	24.23%
	DHS	53.48%	5.57%	4.27%	43.45%
	Controlled	69.63%	5.21%	7.71%	27.69%
A-roads (on SRN)		71.33%	3.30%	14.01%	24.68%

We will work with stakeholders and partners to target key audiences and driving behaviours

We will continue to make enhancements to the smart motorway network and build on our advice to drivers, so they have more information on how to use smart motorways, know what to do in an emergency, helping ensure everyone feels confident when using existing smart motorways. We will work with stakeholders and partners to target key audiences and driving behaviours.

As part of this analysis, we continue to see that contributory factors for DHS roads are not captured by some police forces as extensively as they are captured for other roads. This means that currently it is not possible to make like-for-like comparisons between DHS motorways and other types of road.

While this issue will be at least partially resolved through the DfT's *STATS19 review*[58], following on from the second year progress report, we will continue to engage with DfT and where possible with the relevant police forces to address local reporting issues and understand differences in contributory factors between roads.

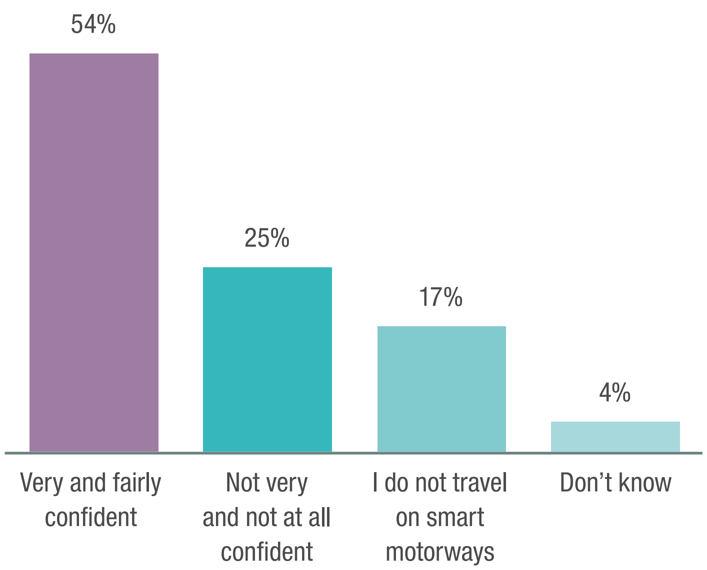
M5 junctions 16 to 17 dynamic hard shoulder motorway

Figure 6

Confidence travelling on smart motorways by English drivers and riders (at the time of being surveyed). This includes drivers and riders who do not drive in parts of the country where smart motorways are located

Description: 54% of drivers and riders on English roads say they are very or fairly confident on smart motorways

Source: Data from Ipsos for National Highways Customer Experience Tracker based on answers to the question "How confident, if at all, would you say you are when travelling on Smart Motorways?" asked between May – December 2022 (cumulative sample of 20,001 drivers / riders in England). Visualisation from National Highways



Feelings of safety

It is important that drivers feel safe and confident on all our roads, including smart motorways, and we recognise we need to do more in this area.

We have already started working with other organisations including Transport Focus to improve our understanding of what influences these feelings. We have also conducted our own research.

While Transport Focus' Strategic Road User Satisfaction Survey continues to report that more than 80%[59] of those driving on our network felt safe on their last journey, we know some may not feel as confident when using smart motorways.

Within National Highways, we have a Customer Experience Tracker which has considered responses from more than 20,000 adults in England between May and December 2022, including drivers and riders who do not travel on the SRN or in parts of the country

Emergency area sign

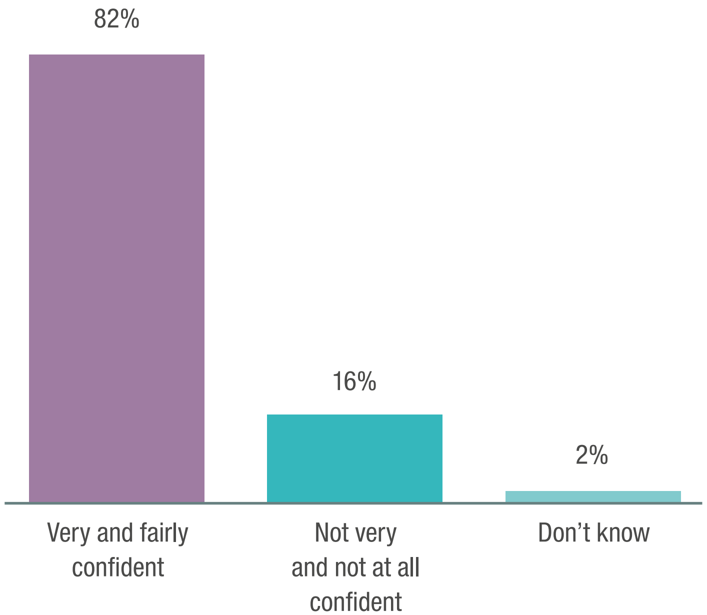
Figure 7

Confidence travelling on smart motorways by drivers and riders who drove on smart motorways in the last four weeks (at the time of being surveyed)

Description: 82% of drivers and riders who drove on smart motorways recently say they are very or fairly confident on smart motorways

Source: Data from Ipsos for National Highways Customer Experience Tracker based on answers to the question "How confident, if at all, would you say you are when travelling on Smart Motorways?" asked between May – December 2022 (cumulative sample of 3,313 drivers / riders who drove on smart motorways in the last four weeks)

Visualisation from National Highways



where smart motorways are located. Just over half (54%) of these drivers and riders on English roads said they are very or fairly confident in smart motorways, while 25% reported that they were not very or not at all confident.

Among those who had recently[17] driven or ridden on a smart motorway, 82% reported that they were very or fairly confident when travelling on smart motorways and 16% reported that they were not very or not at all confident.

To better understand what factors people say influence their feelings of safety when driving on SRN roads, we previously also commissioned a qualitative study[60]. This study highlighted that drivers' feelings of safety are impacted by:

- other drivers' actions, both actual and anticipated
- their surrounding environment, including the type of road, familiarity of the road, physical space, available information, visibility and weather conditions
- their own confidence in their driving skills, experience and exposure to a range of different road environments
- their own vehicle, including the size of vehicle, the age of the vehicle and its features, and the mix of vehicle types around them, particularly HGVs.

Based on these discussions with drivers, we also identified which road environment factors are important to drivers across all roads, including smart motorways:

- space – a road which gives drivers a sense of space around them may help to reduce extreme emotional responses, while also increasing their ability to manage risk
- visibility – being able to see ahead may reduce the sense of unknown risk. 'Virtual' ways of seeing ahead such as via signage, may offer a similar benefit

The most common safety concern is other drivers on the road and especially behaviours such as looking at phones, speeding and sharp braking

- clarity – knowing where drivers are meant to be and what drivers are meant to do, and believing that other drivers know the same, may play a vital role in making risks known and manageable
- familiarity – trying to maintain consistency in the road environment, either between different roads, or within the same road can help reduce the sense of unknown risks and make the overall sense of risk more manageable.

Building on this, and in response to a TSC commitment, we also worked with DfT and Transport Focus to gain greater insight into what makes drivers feel safe or unsafe. In late 2022, Transport Focus commissioned a focused qualitative study using a selected mix of drivers, which highlighted that[61]:

- convenience is more prominent on drivers' minds, however safety is paramount
- the most common safety concern is other drivers on the road and especially behaviours such as looking at phones, speeding and sharp braking
- specific concerns about driving on motorways includes being alongside lorries because space feels constrained, or that competence to drive on a motorway is not tested before a driving licence is issued
- weather conditions, such as rain and fog, or time of day may increase drivers' safety concerns.

While most of these considerations apply to all roads on the SRN, some may be more prominent on smart motorways. Witnessing, reading and talking about incidents on smart motorways has a bigger effect on feelings of safety than direct experience of something unsafe on one[62].

While hard shoulders are not entirely safe, and deaths occur on them, the study shows some drivers think hard shoulders have a role to play in helping people feel safe on a motorway, irrespective of whether they are actually safer. Those who have previously used a hard shoulder suggest that driving on a road without a hard shoulder increases their 'what if' worries, i.e. what would happen if their vehicle stopped. Additionally, some drivers may not perceive emergency areas as an adequate substitute. These drivers are unsure how far apart the emergency areas are, and they suggest it is not clear what would happen if the one they need is already occupied.

This study also suggests that some drivers are impacted more by changes in their feelings of safety. For example, lower confidence drivers feel concerns more intensely than higher confidence drivers, and this can make these groups less keen to drive on these roads.

When drivers were asked what they felt could improve their safety perceptions in relation to smart motorways, their

Traffic officer vehicle in an emergency area

We recognise the importance of being able to stop in a place of relative safety at the time of an emergency. The hard shoulder is perceived to be a place of safety but, in reality, it does not provide a completely safe place to stop

views fell into three broad categories (i) awareness of smart motorways and how they work, (ii) trust in these roads, including that they are safe and (iii) education so they know how to drive safely on them.

This information is valuable to us because it is important that drivers have confidence in smart motorways. We are committed to enhancing drivers' experience of our network overall.

We have provided more clarity for drivers on smart motorways. We have delivered several national awareness campaigns, including our *'Go Left' breakdown campaign*[11]. We also launched a *Driving on motorways*[12] hub on our website and worked with DfT and the Driver and Vehicle Standards Agency to update *The Highway Code*[13]

We will redouble our efforts to raise awareness among drivers of smart motorways and about how they work, so that they feel safe and confident using smart motorways. We will also review the ways we communicate to better reach those drivers that need this advice most and will continue to work with our partners to better understand driver concerns across the network.

Specific safety considerations

Hard shoulder and emergency areas

We recognise the importance of being able to stop in a place of relative safety at the time of an emergency. The hard shoulder is perceived to be a place of safety but, in reality, it does not provide a completely safe place to stop.

Between 2017 and 2021 there were 20 deaths (out of a total of 406 deaths on motorways) resulting from a vehicle entering, leaving or being on a hard shoulder, which is one out of every 20. Of these deaths, 19 occurred on conventional motorways, one on a controlled motorway and none on a DHS motorway. There were two additional deaths on DHS motorways which occurred when the hard shoulder was operating as a live lane and as per DfT guidance these collisions are categorised as live lane and included in the DHS live lane data instead. For more information, please see Annex C – Detailed tables.

Between 2017 and 2021 there were no deaths in emergency areas on ALR and DHS motorways.

Live lane and non-live lane stops

Millions of drivers use our network daily and a very small proportion of total journeys on any road result in live lane stops. We understand this is the main concern drivers have, especially for smart motorways.

While most of these breakdowns do not lead to any injuries, we recognise it can affect how drivers feel. Through the 2020 Action Plan measures, we have taken steps to address this. And we will continue to build on our advice, so that drivers have more information on how to use smart motorways, feel confident using them and know what to do in an emergency.

Between 2017 and 2021, there were more than 347,000 stops[63] recorded on live lanes across all road types. Almost half of these took place on conventional motorways, whereas more than a quarter took place on ALR and DHS motorways.

During the same period, more than 715,000 vehicles are recorded to have stopped on a non-live lane location, such as a hard shoulder or an emergency area. This is more than double the number of recorded live lane stops.

The majority of the stocktake actions, such as introducing SVD, and enabling increased enforcement of Red X signals, are designed to reduce the risk of live lane stops and to address remaining concerns about smart motorways without a permanent hard shoulder. As we found in the second year progress report, it is still the case that live lane stops which occur on ALR and DHS motorways are identified more extensively compared to other road types. There are many reasons that may influence our knowledge of live lane stops on different roads. For example, ALR motorways include increased use of technology some of which helps to detect stopped vehicles and helps our operators manage traffic flows and incidents when they are notified.

The bias in this data means that comparisons of the number of stopped vehicles recorded on different road types are inappropriate and are not a reliable indicator of actual safety. For more information, please see Annex B – Methodology.

In the second year progress report, we also identified the need to address these reporting differences by working

M62 junction 27 dynamic hard shoulder motorway

More than
715,000
vehicles are recorded to have stopped on a non-live lane location such as a hard shoulder or an emergency area

Close-up view of a National Highways traffic officer vehicle

with our partners, such as recovery organisations, to access the relevant data allowing for more representative data across the SRN. Having engaged with recovery organisations, it has been identified that there is further data available, however this is not ready to access or use. We continue to explore opportunities to improve our understanding of live lane stops across all roads, including smart motorways.

We will also continue to collect data and analyse the safety performance of smart motorways as part of our ongoing assessment of risks to help inform our thinking.

Scheme safety - 'Before' versus 'after' assessment

In early 2020 we published the *Smart Motorway All Lane Running Overarching Safety Report 2019*[64], which compared the safety of nine ALR motorway schemes before their construction and after their opening.

The ORR 2021 *Quality assurance of all lane running motorway data*[16] report recommended updating the 2019 report and to also include DHS motorway schemes. In the *ORR Quality Assurance of All Lane Running Motorway Data - Highways England Response to ORR Key Findings & Recommendations*[44], we committed to undertake this analysis.

This report goes beyond the commitment in response to the ORR's report and assesses a total of 37 smart motorway schemes[65]. This report includes schemes which have at least one year's worth of 'after' data, and covers 15 ALR, seven DHS and 15 controlled motorways. This report compares five years' worth of safety data before the schemes' construction started and up to five years after opening and helps understand how each scheme's safety compares between before each scheme was constructed and after. Two-thirds of all smart motorway schemes and only one-third of ALR motorways have five-years' worth of after data. Due to differences in the amount of data available per scheme, any direct comparisons between scheme safety should be made with significant caution.

Where appropriate, we have also calculated the counterfactual, meaning a hypothetical after-period estimating what could have happened if the specific locations had not been converted to smart motorways. This gives an indication whether changes in safety data may be due to a scheme or to other external factors. In this report we have undertaken this counterfactual only in relation to PIC rates.

As highlighted in the ORR 2021 *Quality assurance of all lane running motorway data*[16] report, when schemes are constructed over different time periods, the counterfactual is specific to each scheme. Because collisions fluctuate from year-to-year, the counterfactual can be very sensitive to the precise years chosen. This is particularly the case for FWI rates, which place greater emphasis on deaths and serious injuries, and KSI rates, which place equal emphasis on deaths and serious injuries. Both of these metrics are influenced by the STATS19 adjustments factors which are explained later in this report, whereas PICs are not. For this reason, we have chosen not to calculate the counterfactual for FWI and KSI rates. We will now work closely with specialist statisticians and the ORR to assess the most appropriate way to apply the counterfactual to FWI and KSI rates.

Based on available data so far, most ALR, DHS and controlled motorway schemes (25 out of 37) have seen a reduction in PIC rates after they were constructed both against the before and the counterfactual[66]. Most schemes (32 out of 37) have also seen a reduction in FWI rates. This has also been the case for most schemes (29 out of 37) for the KSI rates.

In this report we have taken a conservative approach to conducting and presenting the analysis. We will work closely with specialist statisticians and the ORR to assess opportunities to continuously improve, where possible, our analysis over the coming years. Such opportunities may include research on statistical significance testing, the counterfactual method, expanding the safety data over longer periods and aggregating the scheme-level data.

As part of our response to the 2020 Action Plan, we have already completed safety reviews and committed to interventions on the M1 junctions 32 to 35a, M1 junctions 39 to 42 (ALR motorways), M1 junctions 10 to 13 and M6 junctions 5 to 8 (DHS motorways)[67].

Using the results of this report, in addition to other evidence sources, we want to better understand why other locations in the after period show increased rates compared to the before period. We have defined these as locations where at least one metric is higher either compared to before (FWI/ KSI) or to counterfactual (PIC).

As part of our business-as-usual (BAU) activities we are already undertaking safety reviews of the ALR and DHS motorways which have not already been subject to safety reviews following the 2020 Action Plan. We are doing the same for the M60 junctions 8 to 18 (controlled motorway) scheme.

For the remaining schemes we are undertaking desktop safety assessments to understand the latest safety data (if available) and to better understand why these locations in their after period show increased rates compared to the before period. These are the locations included in Table 5 on page 61.

Table 5

Locations across all smart motorways where we will undertake safety reviews and desktop safety assessments

Scheme	Type	Assessment/ Review
M1 J16-19	ALR	Safety review in progress through BAU activities
M5 J4a-6	ALR	Safety review in progress through BAU activities
M23 J8-10	ALR	Desktop safety assessment
M25 J5-7	ALR	Safety review in progress through BAU activities
M6 J11a-13	ALR	Safety review in progress through BAU activities
M1 J23a-J24	Controlled	Desktop safety assessment
M25 J15-J16	Controlled	Desktop safety assessment
M42 J7-J9	Controlled	Desktop safety assessment
M20 J5-J7	Controlled	Desktop safety assessment
M25 J2-J3	Controlled	Desktop safety assessment
M25 J7-J10	Controlled	Desktop safety assessment
M25 J10-J15	Controlled	Desktop safety assessment
M60 J8-J18	Controlled	Safety review in progress through BAU activities
M6 J8-J10a	DHS	Safety review in progress through BAU activities

We plan to complete both the safety reviews and desktop safety assessments in autumn 2023, at which point we will review the results and determine the next steps, if any, we need to take. We will continue to monitor the safety of sections where the after period has improved compared to the before period. We will also continue to monitor and evaluate the safety of our network over the coming years as more data becomes available, including for recently opened ALR schemes[68].

There are some key considerations in using or referring to the results of this report:

- Due to differences in the amount of data available per scheme, significant caution should be taken in making comparisons either between schemes or between before and after periods for schemes that have less than five-year after data
- Many controlled motorway schemes opened some time ago, with the earliest opening as far back as 1995. Therefore, the after period rates may not reflect recent safety data. At the moment, it is not appropriate to extrapolate the findings from this analysis to make judgements for the respective road types, especially as they cover different time periods over the last three decades. The desktop safety assessments will also consider recent data for these schemes. In the future, we will assess appropriate ways to aggregate before versus after data over long periods. For comparisons between road types across the SRN, please see the safety data in this annual progress report, which considers fixed time periods for all road types
- While the analysis goes some way to comparing safety data after a scheme was put in place with safety before, it does not explain what has caused the safety changes, such as the smart motorway itself or external factors. Methods such as the counterfactual and statistical significance testing help increase our understanding of any safety changes. With future applications of these methods, additional safety assessments and reviews, we will have even greater understanding of the reasons behind the scheme-level safety changes.

To gain further confidence in the analysis, ORR undertook additional independent assurance for the supporting analysis in March 2023

To gain further confidence in the analysis, ORR undertook additional independent assurance for the supporting analysis in March 2023. ORR noted that we have gone beyond its recommendation from its earlier work to update and extend the analysis, we have continued to follow appropriate analytical assurance processes, and our conclusions are appropriate for this stage of the analysis. In more detail the ORR review found that:

- we have updated the before versus after analysis of ALR motorways published in the *Smart Motorway All Lane Running Overarching Safety report 2019*[64] and also expanded it to cover DHS and controlled motorways, going beyond the recommendation from ORR's 2021 *Quality assurance of all lane running motorway data*[16]
- we have developed our approach to the counterfactual and statistical testing of differences in PIC rates, applying methods used in our other analysis, and we have described these clearly in our report

Close-up view up of a National Highways traffic officer vehicle

- in updating, expanding and developing our analysis, we have continued to follow appropriate analytical assurance processes to ensure the reliability of our analysis
- we have been cautious in drawing firm conclusions from our analysis. This is appropriate at this stage – for example because the methodological developments applied to PIC rates have not yet been extended to the FWI and KSI rates. This results in more focus on simpler before versus after comparisons, rather than using more complex statistical methods, which could support firmer conclusions.

Over the coming years we will undertake various evaluation activities as part of our 2020 Stocktake monitoring and evaluation plan

Wider monitoring and evaluation

Over the coming years we will undertake various evaluation activities as part of our 2020 Stocktake monitoring and evaluation plan. This plan will assess whether the 2020 Stocktake actions have been effective in (i) reducing incidences of live lane breakdowns, (ii) reducing the time for which people who break down or stop in a live lane are at risk and (iii) educating drivers on what to do if they breakdown in a live lane.

This plan was reviewed independently by ORR in late 2022. ORR endorsed the way in which we will monitor and evaluate the success of the action plan as being well aligned to best practice guidance across government. Delivering this will enable us to understand the effects of the overarching programme on safety.

Our next steps

Safety has always been our top priority. In 2015, we adopted the Safe System approach, the latest road safety good practice. The Safe System is an approach to road safety management based on the principle that our life and health should not be compromised by our need to travel. The Safe System considers how roads, vehicles, people, speeds and emergency service response come together to improve safety. We will assess in future safety reporting the best way to reflect these considerations.

Over the next years we will continue to:

- monitor SRN-level statistics across all roads. These provide a broad view on how different road types compare to each other based on the latest STATS19 safety data
- update the scheme-level safety data. This analysis enables us to understand within each road type, which locations may be comparatively safer and for which areas there is scope for further improvement
- work with DfT to track public confidence in smart motorways. In addition to safety data, road user insights help us better understand what we and our partners can do to improve how road users feel about smart motorways and behave on our roads
- evaluate smart motorway schemes through post opening project evaluation (POPE) reports. POPEs enable us to understand whether a scheme's objectives have been met and consider the impacts of individual schemes across traffic, safety, the economy and the environment.

We will also start to evaluate the impact of the 2020 Stocktake actions. This evaluation will enable us to understand how effective actions have been in delivering their intended outcomes, such as those targeted at educating drivers.

We will continue to work with the ORR to conduct appropriate independent checks.

Conclusion

At National Highways, safety is our highest priority. England continues to have some of the safest roads in the world and compared to other roads, motorways remain the safest roads to travel on. But there is always more that can be done and that is reflected in our strategic ambition that nobody should be harmed using or working on our network.

No one type of motorway, smart or conventional, is ranked best against every safety metric

No one type of motorway, smart or conventional, is ranked best against every safety metric.

The latest safety data continues to show that overall, all three types of smart motorway are safer than conventional motorways for those safety metrics which consider the most significant impacts, such as deaths or serious injuries. Most incidents (96.1%) across the SRN are single vehicle collisions or incidents involving two or more moving vehicles. The rest of the collisions, which form a small proportion of all incidents (3.9%), involve moving vehicles colliding with stopped vehicles. These types of collision happen on all roads.

The risk of a collision and the risk of a serious injury or death due to a stopped vehicle collision is lowest on conventional and controlled motorways. The risk of a collision between a moving and a stopped vehicle is greater on ALR and DHS motorways than on other motorway types, but the risk of a collision involving only moving vehicles is lower. This continues to be the case based on the latest safety data.

The majority of the stocktake actions, such as introducing SVD, and enabling increased enforcement of Red X signals, are designed to reduce the risk of a collision between a moving and a stopped vehicle, and to address remaining concerns about smart motorways without a permanent hard shoulder.

Due to the time lag between the actions being delivered and the data being available, it will be later in 2023 before we can start assessing and understanding the impact of the actions. We will continue to assess the data in line with our monitoring and evaluation processes.

It is important that besides being safe, drivers feel confident on all our roads, including smart motorways, and we recognise we need to do more in this area. That is why we have already started working with other organisations including Transport Focus to improve our understanding of what influences these feelings. Our progress since 2020 has included improving our advice to drivers and enhancing our infrastructure and technology, but we know there is more we can do. We will continue to invest to improve understanding of how to drive safely.

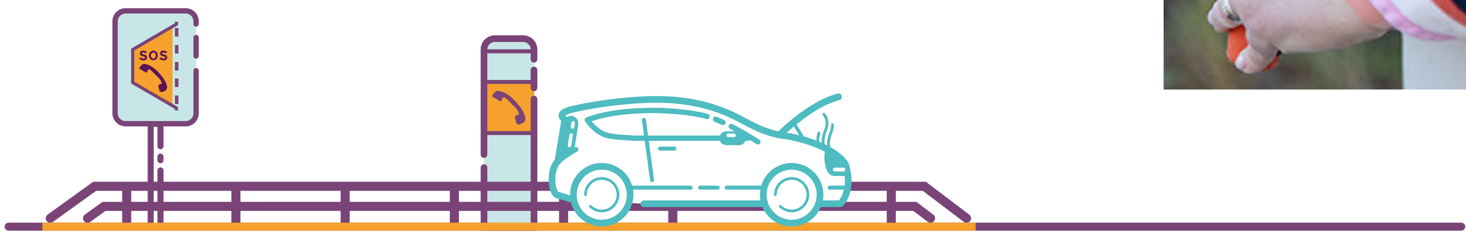
Safety remains our highest priority and in line with the 2023 announcement we will continue to deliver further safety improvements on existing smart motorways. With support from our supply chain, partners and government departments, and by working with a range of road user groups, we will continue striving to deliver the safe road network road users expect.

Having delivered the majority of the actions from the 2020 Stocktake, we will keep working hard to deliver the commitments made to the TSC, and to improve the reliability of our operational technology systems on ALR motorways.

It remains too early to see the impact of the actions we have delivered so far, and we will continue to build an evidence base of safety, economic, environment and capacity data. We will also work with the Department for Transport to track public confidence in smart motorways.

As we continue our work to further improve the safety of all our roads, including smart motorways, we will continue to listen to the public and stakeholders, and take any necessary actions as a result.

Emergency roadside telephone in use



Annex A – Smart motorways map

(correct as of June 2023)

ALR motorway

- 3 M1 Junction 13 - 16
- 4 M1 Junction 16 - 19
- 6 M1 Junction 24 - 25
- 8 M1 Junction 28 - 31
- 10 M1 Junction 32 - 35a
- 11 M1 Junction 39 - 42
- 12 M3 Junction 2 - 4a
- 14 M4 Junction 3 - 12
- 16 M5 Junction 4a - 6
- 17 M6 Junction 2 - 4 (i)
- 22 M6 Junction 11a - 13
- 23 M6 Junction 13 - 15
- 24 M6 Junction 16 - 19
- 26 M20 Junction 3 - 5
- 28 M23 Junction 8 - 10
- 30 M25 Junction 5 - 6
- 35 M25 Junction 23 - 27
- 37 M27 Junction 4 - 11
- 41 M56 Junction 6 - 8
- 43 M62 Junction 10 - 12
- 44 M62 Junction 18 - 20

i) M6 Junction 3a to 4 **Controlled motorway**

ALR scheme in construction

- 25 M6 Junction 21a - 26

ALR schemes cancelled

- 13 M3 Junction 9 - 14
- 33 M25 Junction 10 - 16
- 38 M40 - M42 interchange
- 45 M62 Junction 20 - 25

DHS motorway conversion to ALR cancelled

- 2 M1 Junction 10 - 13 (ii)
- 15 M4 - M5 interchange (iii)
- 18 M6 Junction 4 - 5 (iv)
- 19 M6 Junction 5 - 8 (v)
- 20 M6 Junction 8 - 10a
- 39 M42 Junction 3a - 7
- 46 M62 Junction 25 - 30 (vi)

ii) M1 Junction 11a to 12 **DHS infrastructure**, short link with motorway service area slip roads and no hard shoulder for part of link

iii) M4 Junction 19 to 20 M5 Junction 16 - 17

M5 Junction 15 to 16 **Controlled motorway**

iv) M6 Junction 4 to 4a southbound **Controlled motorway**

v) M6 Junction 7 to 8 **DHS infrastructure**, short link with no hard shoulder

vi) M62 Junction 25 to 26 **DHS infrastructure**, short link with motorway service area slip roads and no hard shoulder

M62 Junction 28 to 29 **Controlled motorway**

M62 Junction 29 to 30 **DHS infrastructure**, short link with no hard shoulder (westbound only)

Controlled motorway

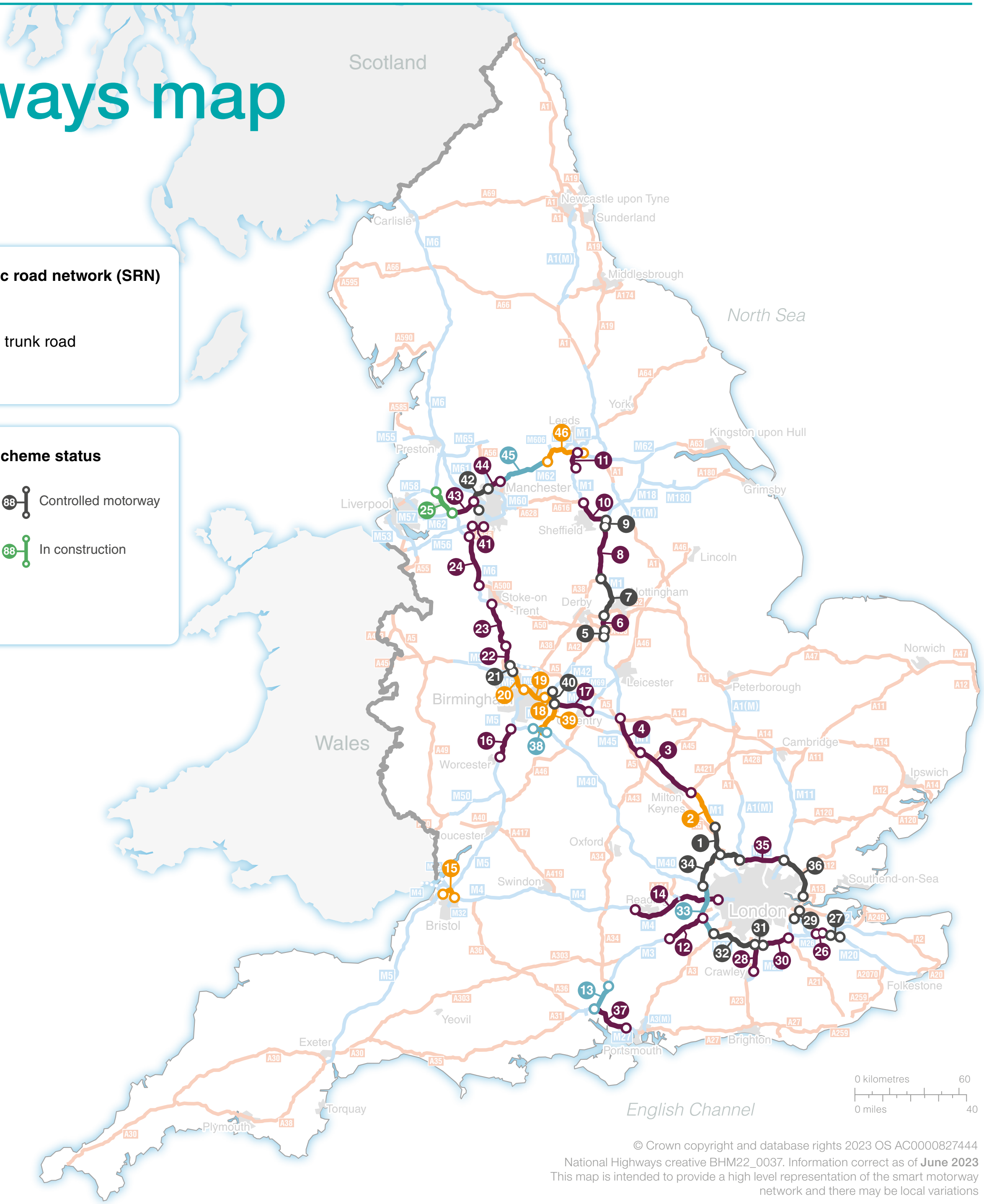
- 1 M1 Junction 6a - 10
- 5 M1 Junction 23a - 24
- 7 M1 Junction 25 - 28
- 9 M1 Junction 31 - 32
- 21 M6 Junction 10a - 11a
- 27 M20 Junction 5 - 7
- 29 M25 Junction 2 - 3
- 31 M25 Junction 6 - 7
- 32 M25 Junction 7 - 10
- 33 M25 Junction 10 - 16
- 34 M25 Junction 16 - 23
- 36 M25 Junction 27 - 30
- 40 M42 Junction 7 - 9
- 42 M60 Junction 8 - 18

England's strategic road network (SRN)

- Motorway
- All purpose trunk road
- Toll roads

Smart motorway scheme status

- 88 ALR motorway
- 88 Controlled motorway
- 88 DHS motorway
- 88 In construction
- 88 Cancelled



Annex B – Methodology

Assurance

As with the second-year progress report, this analysis has been subject to five levels of assurance:

- the first level is undertaken by the suppliers delivering the analysis to identify and address any material issues with the inputs, calculations, outputs and supporting methodology
- the second level is undertaken by the team commissioning the analysis within National Highways and includes, but is not limited to, replicating inputs and calculations using the same methodology as the supplier to reach the same results, so called 'dual running' of the analysis
- the third level is then undertaken by a team within National Highways who have not been part of the analysis and can provide a degree of independence. This step highlights potential issues or concerns on the overall approach, specific analysis or supporting methods
- the fourth level is undertaken by DfT who review the analysis, its supporting methods and presentation to gain confidence in the results
- the fifth level is undertaken by the ORR to gain further confidence in the safety conclusions of this report.

Data sources

Road injury data in Great Britain is collected via the STATS19 process. These statistics are collected by police forces, either through officers attending the scene of incidents, from members of the public reporting the incident in police stations after the incident, or more recently online and then validated and published annually by DfT. The safety analysis presented here is developed by National Highways using STATS19 data (unless stated otherwise).

STATS19 data is published annually by DfT in the autumn and provides details of the previous calendar year (for example, DfT published the 2021 calendar year dataset at the end of September 2022).

Injury data can change considerably from year to year, depending on circumstances in any given year, and injury rates can be sensitive to small changes in the absolute number of injuries. Such changes can be more prominent for specific schemes or parts of the SRN, and less so for wider geographical areas (for example the full SRN or Great Britain). Volatility is an issue as it can obscure more meaningful conclusions that can be drawn from the data. When considering injury statistics, looking at the average over a recent set of years reduces the impact of volatility and helps identify trends. This report uses the last seven years of available data (2015-2021).

STATS19 data as provided by DfT reflects the situation at the time the annual statistics are produced. Subsequently, further information may become available which may suggest that some incidents should have been either in or out of scope.

Every injury is important. STATS19 database is a collection of all collisions that resulted in a personal injury and were reported to the police within 30 days of the incident. The analysis supporting this report reflects the same threshold of 30 days. One smart motorway death has historically been omitted from STATS19. This was manually added in the 2020 Stocktake, and first and second year progress reports and will continue to be added in subsequent overall smart motorways reporting. This means that while this is added in summary tables, detailed analysis (such as contributory factor analysis) excludes this incident as the supporting information is not available on STATS19. To reflect this, relevant table clarifications and footnotes have been added throughout this report.

Live lane stop data (unless stated otherwise) reflects stops recorded on National Highways' Incident Management system (ControlWorks). This system records stops that National Highways has been informed of and its primary purpose is to enable operational teams to manage these incidents. National Highways adopted ControlWorks in September 2016, replacing the previous incident management system. Previous reports such as the first and second year progress reports also referred to live lane breakdowns. Live lane stops can include stops over and above live lane breakdowns, such as medical episodes. The safety analysis in this report has been updated to reflect all reasons for live lane stops.

Over time we have observed that live lane stops which occur on ALR and DHS motorways are identified more extensively compared to other road types. There are many reasons that may influence our knowledge of live

M20 all lane running motorway

lane stops on different roads. For example, ALR motorways include increased use of technology which help our operators manage traffic flows and incidents and detect stopped vehicles faster. This means that ALR motorways are likely to have more and/or better information captured for stops compared to other road types. This means that comparisons on vehicle stop data per road type should be made with caution, as ALR and DHS motorways are likely to have considerably better reporting.

Vehicle stops can take place both on live lanes and non-live lane locations, such as a hard shoulder or emergency area. Live lane stops are all stops recorded on ControlWorks where the location has been categorised as being in a live lane. Vehicle stops where location is not specified or recorded as not being in a live lane, are excluded. The methodology used to provide the data in this report and its subsequent outputs may differ to methodologies used in different analyses at different points in time. This is due to continuous improvements of data mapping, capture and quality, as well as changes in reporting, for example updating the data extraction method to reflect live lane stops rather than live lane breakdowns. As these factors evolve over time any comparison with earlier data or data from other sources, should be interpreted with caution.

Mapping process

STATS19 collision data is matched to pre-selected extents, identifying STATS19 collision data that overlap extents using a geographic information system approach.

This two-step process allows us to validate data and potentially identify exceptions/differences. The data and the extents have some limitations such as:

- the definition of where a smart motorway starts and where it finishes might vary depending on the type of the smart motorway and any assumptions used
- any variation in the definition of the date smart motorways were opened could have an impact on the numbers reported
- the coordinates provided under STATS19 might not always be accurate which could have an impact on the numbers reported
- a mismatch of road name and co-ordinates can increase the uncertainty in collision mapping
- detailed data analysis according to smart motorway type (eg DHS versus ALR) may need caution particularly where road types change from one to another or where multiple road types overlap.

Due to continuous improvements in mapping and data quality, for example when new information may be available about specific schemes, methods are likely to evolve over time. For this reason, any comparison with earlier data or data from other sources should be interpreted with caution.

Later in 2023, we expect to start adopting a new network model developed with our partners, which is likely to supersede the above mapping method.

Control room monitor

Headline safety metrics

The ORR suggested in its 2021 *Quality assurance of all lane running motorway data*[16] report that ‘a smaller number of ‘headline’ metrics should be used to communicate safety’. In discussions with the ORR review team, it was acknowledged that selecting a single safety metric may be subject to challenge as each metric will have its own limitations. For this reason, this report uses a set of headline metrics.

Personal injury collisions (PIC) – These are the number of collisions which have resulted in a person sustaining an injury. PICs do not reflect the number of people injured in each collision (casualties). This metric has certain benefits, such as not including uncertainty from (i) random effects, for example a coach accident leading to multiple injuries (casualties) and (ii) non-random effects on vehicle type and vehicle occupancy, such as socio-demographic effects. On the other hand, collisions do not reflect the number of injured people involved.

PIC rates accounting for traffic flow – A rate calculated using the number of PICs and the total miles travelled on a road section or type. This metric allows roads with heavy traffic or span a long distance to be compared against roads which carry less traffic or which span a shorter distance. The rate is presented as the number of collisions per hundred million vehicle miles (hmvm), which is an established way of assessing rates across the road sector.

Fatal and weighted injuries (FWI) – A metric which weights and aggregates the number of people that have been injured in collisions. It gives a fatality 10 times the weighting of a serious injury, and a serious injury 10 times the weighting of a slight injury. This is calculated as follows: Fatal and Weighted Injuries = Fatal + Serious injuries * 0.1 + Slight injuries * 0.01. In its 2021 *Quality assurance of all lane running motorway data*[16] report, the ORR highlighted that ‘the methodology was derived from that used by the *Rail Safety and Standards Board*[69] (RSSB). RSSB has since adopted new weightings for calculating FWI, but we consider that the weightings used by Highways England were appropriate’. These weightings continue to be largely aligned with the ‘average value of prevention per casualty’ set out by DfT’s *Transport Analysis Guidance data book*[70]. While FWI recognises all injuries, it acknowledges that not all injuries are equal.

FWI rates accounting for traffic flow – A rate calculated using the aggregate FWI and the total miles travelled on a road section or type. This metric allows roads with heavy traffic or span a long distance to be compared against roads which carry less traffic or which span a shorter distance. The rate is presented as the aggregate FWI per hundred million vehicle miles, which is an established way of assessing rates across the road sector.

Killed and Seriously Injured (KSI) – The severity-adjusted number of people killed and seriously injured in collisions. KSIs are a simple aggregation of fatal and serious injuries, ie no weighting applied to either. While this means that the metric's methodology is simple, KSIs do not account for slight injuries. Therefore reporting only this metric may undermine the importance of slight injuries.

KSI rates accounting for traffic flow – A rate calculated using the number of people who are killed and seriously injured, and the total miles travelled on a road section or type. This metric allows roads with heavy traffic or span a long distance to be compared against roads which carry less traffic or span a shorter distance. The rate is presented as the severity-adjusted number of KSIs per hundred million vehicle miles, which is an established way of assessing rates across the road sector.

Adopting all the above metrics means that safety can be assessed both in absolute and relative terms (considering both number of collisions and injuries and rates normalised per traffic flows). Rates may be more meaningful for safety comparisons compared to absolute values as they avoid certain issues, such as suggesting that the least used roads are the safest roads.

Emergency roadside telephone

Averages

Millions of drivers use our network, and fortunately collisions which result in injuries are rare. As a result the number of collisions, and the number of deaths or injuries resulting from those collisions, are subject to a degree of fluctuation, particularly when being reviewed at a localised level, such as on specific schemes. To be more certain that the differences, if any, we see are due to a change in safety rather than within what could be seen as the normal range of fluctuation, it is preferable to capture as many data points as possible. A minimum of three years of data is required to be considered sufficiently robust to assess the safety on different parts of the network.

Data for a single year or averages over shorter periods, such as three-year averages, are likely to be impacted more by external rare systemic events, such as Covid-19. Such events can skew the data and increase analytical uncertainty. For example, if a three-year average was selected, then the three-year average between 2019 and 2021 would be even more impacted due to traffic flows being lower in 2020 and 2021. This would make comparison between this three-year period with other three-year periods even more difficult.

Instead, using a wider data range such as the five-year average selected in this report, helps reduce the impact of rare systemic events, such as Covid-19, and make some comparisons more meaningful.

The average used in this and previous reports, such as the 2020 Stocktake, the first and second year progress reports, takes into account the relative importance of traffic flows (weighted average). This is calculated as the: sum ([PIC/FWI/KSI] for calendar year * HMVM traffic for that year)/ sum (HMVM traffic for five-year period).

A weighted average is sometimes more accurate than a simple average, as it accounts for changes in traffic flows over a period of time.

Considering a five-year average, rather than an average for all available years, means that in the future this analysis will evolve to reflect the five-year rolling average metrics which is in line with good reporting practices.

All lane running motorway

Covid-19 effect

The STATS19 dataset for both 2020 and 2021 collisions is heavily influenced by the rare event of the Covid-19 pandemic, which caused three national lockdowns and various regional restrictions throughout the year.

By June 2021, overall road traffic levels had returned to levels close to those seen before the pandemic

The peak impact of the pandemic saw a significant reduction in traffic in April 2020 compared to the same period the year before (see the *Vehicle speed compliance statistics for Great Britain: July to September 2021* published by DfT). Over more than a year, traffic across the SRN fluctuated as there were three major lockdowns. By June 2021, overall road traffic levels had returned to levels close to those seen before the pandemic.

This is likely to have impacted collisions and casualties in two ways: (i) rates per hmvm are likely to have been influenced by changes in traffic flows and (ii) less congestion on various roads may have impacted driver behaviour. The former is reflected in this report and mitigated through the use of five-year average metrics, ie two out of five years are impacted by Covid-19. The latter is not considered within the scope of this report.

Road length and traffic statistics

This analysis uses DfT road length and traffic statistics with inputs provided by National Highways. This report reflects minor changes in road lengths over time due to detailed information added at a scheme level.

Traffic statistics are usually published by DfT as an annual average. In line with the 2020 Stocktake, first and second year progress reports, DfT has apportioned the road lengths and traffic flows depending on the month and year that each scheme opened. Additionally, the traffic statistics produced for this report reflect the SRN at the end of each calendar year. This year DfT has made some minor changes both for 2021 and historical road length and traffic statistics as more detailed information has become available. For more information, please see Annex C – Detailed tables.

Injury-based reporting in STATS19 data

Since 2012, many police forces have changed the way they collect *STATS19 data*[71]. These changes mean casualty severity is now categorised automatically based on the most severe injury, rather than the judgement of an attending police officer. Police forces using the new systems, called injury-based severity reporting systems (also known as CRaSH and COPA), report more serious injuries than those which do not.

These changes make it particularly difficult to monitor trends in the number of people killed and seriously injured over time, or between areas overseen by different police forces.

In response to these challenges, DfT and the ONS have developed an approach to adjust the data collected from those police forces not currently using injury-based reporting systems. These adjustments are estimates for how the severity of an injury may have been recorded had the new injury-based reporting system been used. These adjusted estimates apply retrospectively from 2004 and adjust historical data to show casualty severity ‘as if’ this was recorded under the new injury-based system. This enables better comparisons across police forces and further increases the confidence in safety data captured by police officers.

Until all police forces have started using the new systems, these historical adjustments will continue to be updated every year. Using these adjusted totals allows for more consistent and comparable reporting when tracking severity over time, across a region, or nationally. While there is no impact on collisions, total injuries and deaths, these adjustments do impact serious and slight injuries.

DfT analytical guidance was updated in October 2021 to further strengthen advice on including injury-based adjusted figures where possible. Following the same approach as in the second year progress report, this means that the injury figures reported in the main part of the report are adjusted, ie KSI and FWI, but not PIC as the latter is not influenced by these adjustments. For more information, please see the *Guide to severity adjustments for reported road casualties Great Britain*[72] published by DfT.

This map shows the smart motorway network as of 31 December 2021. It highlights non-injury-based reporting police forces, CRaSH (Collision Reporting and Sharing) reporting forces and the Metropolitan Police area which has adopted COPA (Case Overview Preparation Application). The map below outlines the variances in the collection and reporting of data across individual police forces and highlights the need for a consistent comparison, supporting the application of injury-based reporting adjustments.

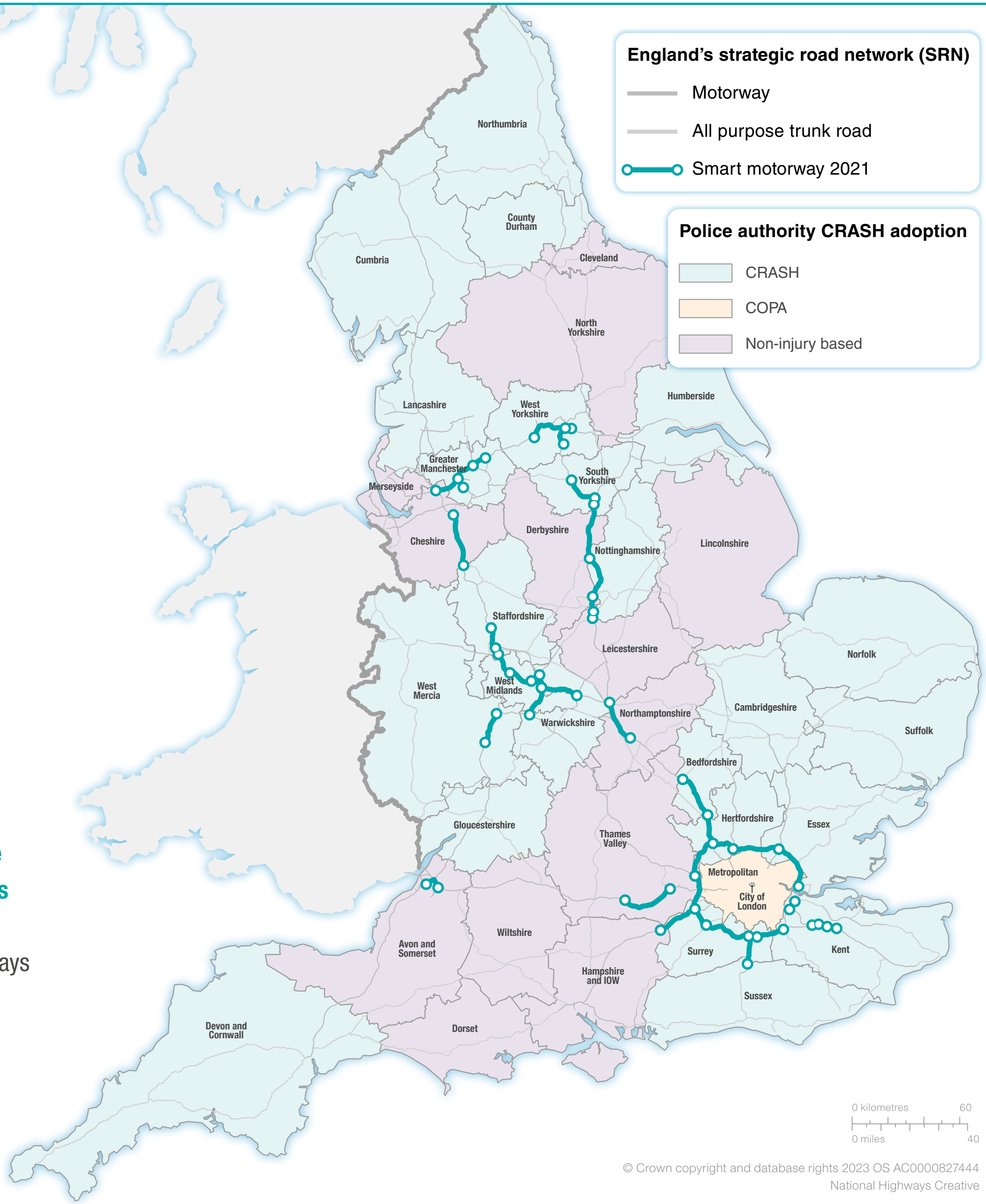


Figure 8

Smart motorway network across police forces per injury-based reporting status as of 31 December 2021

Source: Visualisation from National Highways

Statistical significance testing

The ORR 2021 *Quality assurance of all lane running motorway data*[16] report noted that: (i) 'undertaking significance testing on the headline figures in future would help explain the levels of uncertainty around the results. We recommend that this is developed' and (ii) 'including information about the level of uncertainty associated with the high-level statistics, through statistical significance testing, would add important context to any conclusions.'

For the second year progress report, we developed methods to compare road traffic collision and casualty rates using confidence intervals and hypothesis tests. We invited feedback on the methods and their use from the wider statistical community and have now finalised them.

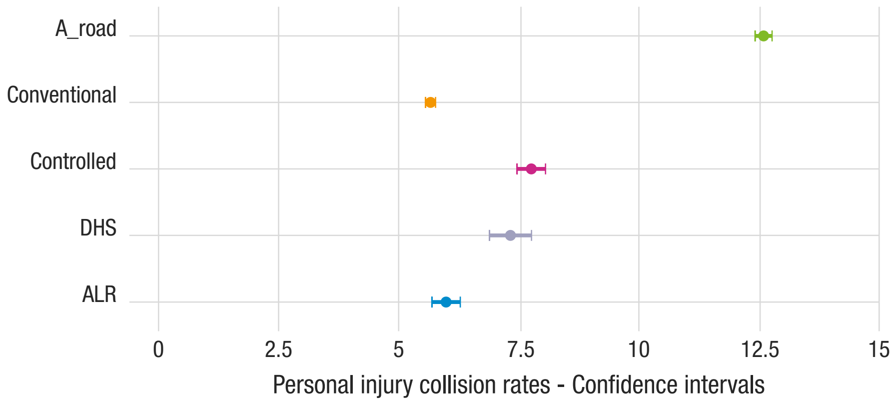
We are still limited in the high-level statistics with which these methods can be used. Therefore this report, we provide the conclusions of applying these methods to the headline five-year average personal injury collision (PIC) rates and five-year average all casualty rates (using data from 2017 to 2021). We have also applied these methods further to moving and stopped five-year average PIC rates and five-year average all casualty rates.

As in the second year progress report, we report p-values[73] as they are calculated and interpret them on a continuous scale from zero to one, rather than only in comparison to a threshold. This reflects current best practice guidelines.

Statistical hypothesis testing can only identify statistical differences. With large volumes of data, very small differences can result in small p-values. Therefore, statistical differences should not be misinterpreted as important or meaningful differences. Confidence intervals and hypothesis testing are statistical methods that do not take into account the subject matter, nor

National Highways traffic officer vehicle in an emergency area

what is an important difference in collision and casualty rates. That consideration requires subject matter expertise instead of statistics.



Personal injury collision (PIC) rates

We have compared the PIC rates for all road types using a maximum likelihood test. In brief, we have anticipated that road traffic collisions occur according to a non-homogeneous Poisson process with underlying rate dependent on the measured road traffic. From this assumption, we use maximum likelihood techniques to calculate confidence intervals and to formally compare the underlying collision rates through a p-value calculated using a Monte-Carlo approach[74].

The location and size of the 95% confidence intervals of the underlying PIC rates are visually different. This suggests that there is variation in the underlying PIC rates of the different road types. We formally test this hypothesis in subsequent sections. The confidence interval for conventional motorways is narrower than other road types. This is due to the higher traffic volumes on conventional motorways.

PIC rates for all road types

We formally consider whether there is sufficient evidence to suggest that the PIC rates among all roads are different by testing the following hypothesis:

H_0: Underlying PIC rates are the same for all road types

H_1: Underlying PIC rates are not the same for all road types

The computed p-value is 0.000, shown to three decimal places: very close to zero. Therefore, we confidently reject the null hypothesis (H0) and conclude that the underlying PIC rates are not the same for all road types. Comparing all road types in this way is not particularly informative; given the spread of the locations of the confidence intervals it is not surprising that the formal hypothesis test suggests some differences.

The largest difference in PIC rates is due to the relatively high PIC rate for A-roads. The smallest differences in PIC rates are observed between ALR and conventional motorways, followed by controlled and DHS motorways. We conduct those two formal hypothesis tests to understand how the observed differences in these specific pairs of PIC rates contribute to the small overall p-value.

The confidence intervals give us confidence that the underlying ALR PIC rates are lower than the DHS and controlled motorway PIC rates, and that the underlying conventional motorway PIC rates are lower than the DHS and controlled motorway PIC rates. For this reason, we considered there was no need to formally test these comparisons.

PIC rates for ALR and conventional motorways

We test whether there is a difference in the underlying PIC rate for ALR and conventional motorways with the following hypothesis:

H_0: Underlying PIC rates are the same for ALR and conventional motorways

H_1: Underlying PIC rates are not the same for ALR and conventional motorways

The computed p-value is 0.018, shown to three decimal places. The p-value is close to zero. Therefore, we confidently reject the null hypothesis and conclude there is evidence suggesting that the underlying PIC rates for ALR and conventional motorways are not the same. In particular as the observed PIC rate for conventional motorways is smaller than the observed PIC rate for ALR motorways, there is some evidence to suggest the underlying PIC rate for conventional motorways is smaller than that of ALR motorways.

PIC rates for controlled and DHS motorways

Here, we formally test whether there is a difference in the underlying PIC rate for controlled and DHS motorways with the following hypothesis:

H_0: Underlying PIC rates are the same for controlled and DHS motorways

H_1: Underlying PIC rates are not the same for controlled and DHS motorways

The computed p-value is 0.054, shown to three decimal places. The p-value is somewhat close to zero, but we can't outright reject the null hypothesis. Therefore, we conclude there is some evidence suggesting that the underlying PIC rates for controlled and DHS motorways are not the same. In particular, there is some evidence to suggest the underlying PIC rate for DHS motorways is smaller than that of controlled motorways.

Casualty rates

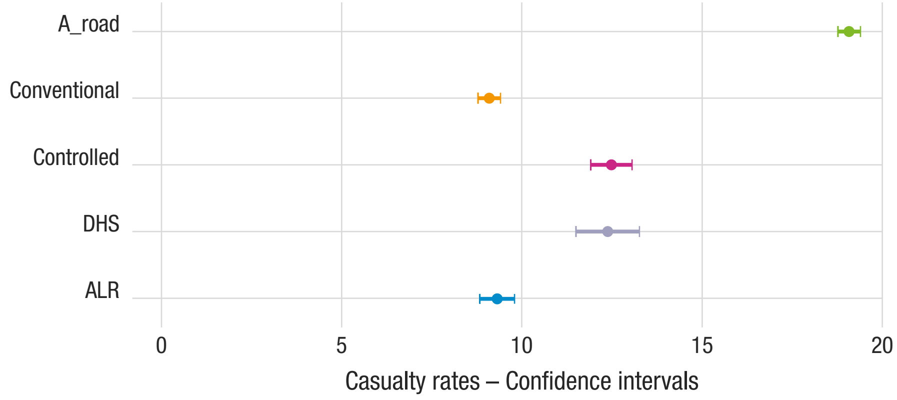
The number of casualties is dependent on both the total number of personal injury collisions and the number of casualties that result from each collision.

Casualty rate confidence intervals

We compare the underlying casualty rates for all road types by calculating confidence intervals. We use a two-step process to reflect the dependence on the number of collisions and the casualties resulting from those collisions. The number of casualties is simulated by first simulating the number of personal injury collisions from a Poisson distribution and then the number of casualties per collision by sampling from the observed distribution.

The confidence intervals on the underlying casualty rates are larger than the confidence intervals for the PIC rates due to the additional variability arising from the two-step process.

The variation in the location of the confidence intervals suggests that the underlying casualty rates vary between road types. The confidence interval for the underlying casualty rate for ALR motorways contains that of conventional



motorways, and the DHS confidence interval contains that of controlled motorways. We consider differences in these underlying casualty rates in the next sections. The confidence intervals for the other road types are so visually different we do not formally test any other comparisons.

There are similar shaped histograms for the number of casualties that result from each PIC, truncated at 10. The mean number of casualties per collision observed on each road type is shown by the solid black vertical line in the charts on the following page, and the mean across all road types is shown by the dashed orange vertical line. Collisions resulting in more than 10 casualties are rare (13 events in 5 years).

In the following sections, we formally test for a difference in the first moment (mean) of the number of casualties per collision amongst the road types. We then combine the results with those obtained previously to determine whether there is sufficient evidence to suggest that the underlying casualty rates vary between the road types.

A car in an emergency area

Casualty rates for all road types

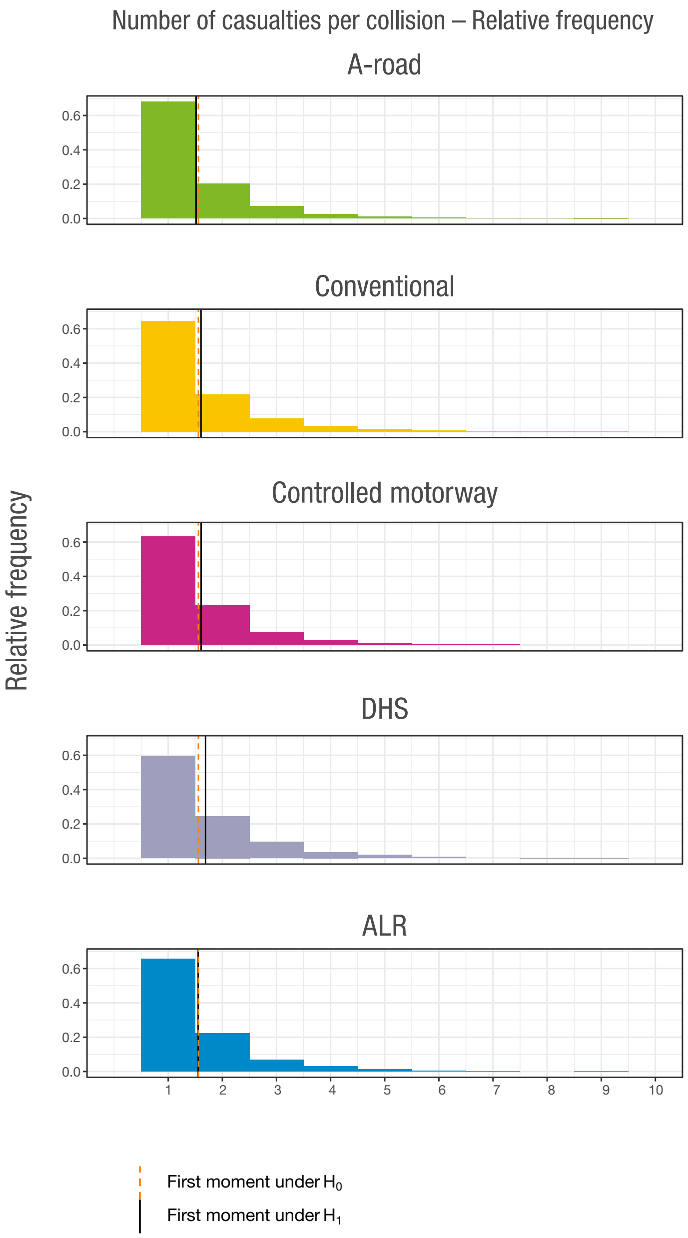
To determine whether there is sufficient evidence to suggest that the underlying casualty rates are different, we combine the analysis of PIC rates with additional analysis of the following hypothesis:

H_0: First moments of the distribution for the number of casualties per collision are the same for all road types

H_1: First moments of the distribution for the number of casualties per collision are not the same for all road types

The computed p-value is 0.000, shown to three decimal places. The p-value is very close to zero. Therefore, we confidently reject the null hypothesis and conclude that the first moment of the number of casualties per collision is not the same for all road types.

Combining the conclusions from the PIC rate analysis and first moment of the distribution for the casualties per collision we confidently conclude the underlying casualty rates are not the same for all road types.



Road type	Number of casualties per collision	Number of times observed
A-road	11	1
A-road	13	1
A-road	14	1
A-road	20	1
A-road	23	1
ALR	13	1
Controlled	13	1
Conventional	11	1
Conventional	12	1
Conventional	13	1
Conventional	14	1
Conventional	33	1
DHS	11	1

Casualty rates for ALR and conventional motorways

To determine whether there is sufficient evidence to suggest that the underlying casualty rates for ALR and conventional motorways are different, we combine the analysis of PIC rates with additional analysis of the following hypothesis:

H_0: First moments of the distribution for the number of casualties per collision are the same for ALR and conventional motorways

H_1: First moments of the distribution for the number of casualties per collision are not the same for ALR and conventional motorways

The computed p-value is 0.073, shown to three decimal places. The p-value is somewhat close to zero, but we cannot outright reject the null hypothesis. Instead, we conclude there may be some evidence that the underlying first moment (the average) of the distribution for the number of casualties per collision are not the same. In particular, there may be some evidence that suggests the underlying first moment of the distribution for the number of casualties per collision for conventional motorways is smaller than that of ALR motorways.

Recall that the computed p-value from the PIC rate analysis is 0.018 and we concluded that there is some evidence to conclude that the underlying PIC rates for ALR and conventional motorways are not the same. Taking these two conclusions into account, we conclude there is also some evidence of a small difference in the underlying casualty rates.

Casualty rates for controlled and DHS motorways

To determine whether there is sufficient evidence to suggest that the underlying casualty rates for controlled and DHS motorways are different, we combine the analysis of PIC rates with additional analysis of the following hypothesis:

H_0: First moments of the distribution for the number of casualties per collision are the same for controlled and DHS motorways

H_1: First moments of the distribution for the number of casualties per collision are not the same for controlled and DHS motorways

The computed p-value is 0.038 shown to three decimal places. The p-value is close to zero. Therefore, we reject the null hypothesis and conclude there is some evidence suggesting that the underlying first moment of the distribution for the number of casualties per collision are not the same. In particular, there is some evidence that the underlying first moment of the distribution for the number of casualties per collision for controlled motorways is smaller than that of DHS motorways.

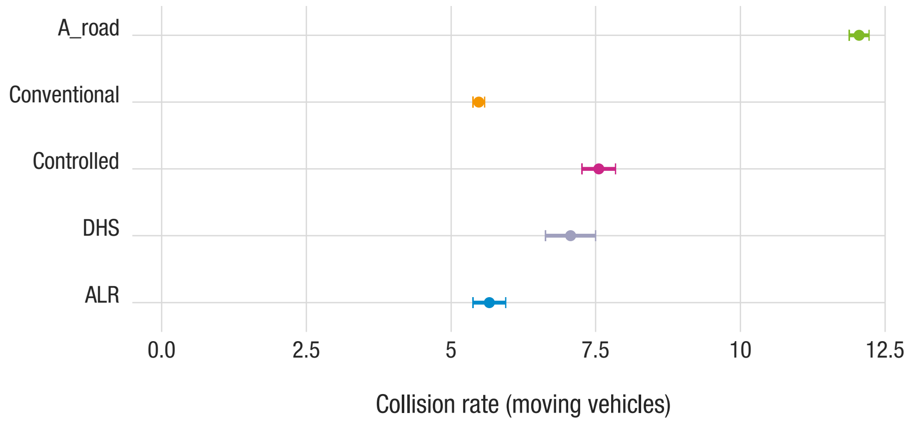
Recall that the computed p-value from the PIC rate analysis was 0.054 and that we concluded there is some evidence suggesting that the underlying PIC rate for DHS motorways is smaller than that of controlled motorways.

Whilst the observed PIC rate for DHS is lower than that of controlled motorways, the observed first moment of the distribution for the casualties per collisions is lower for controlled than DHS motorways. Therefore, these combine to give estimates of the casualty rates that are similar. Therefore, whilst there is some evidence to suggest that both the underlying PIC rate and the first moment for the distribution of the casualties per collision are different, there is insufficient evidence to suggest that the casualty rates are different.

Summary

Between all road types, we confidently conclude that there are differences in PIC rates, mean numbers of casualties per collision and casualty rates. There are some differences between particular road types, with varying strengths of evidence.

	Comparison between	p-value	Conclusion
Underlying PIC rates	All road types	0.000	Confidently conclude the rates are not the same between all road types
	ALR and conventional motorways	0.018	Evidence suggesting the rates are not the same, suggesting underlying PIC rate for conventional motorways is smaller than that of ALR motorways
	DHS and controlled motorways	0.054	May be some evidence suggesting the rates are not the same, suggesting the underlying PIC rate for DHS motorways is smaller than that of controlled motorways
Mean number of casualties per collision	All road types	0.000	Confidently conclude the means are not the same between all road types
	ALR and conventional motorways	0.073	May be some evidence suggesting the means are not the same, suggesting that the underlying mean for conventional motorways is smaller than that of ALR motorways
	DHS and controlled motorways	0.038	Evidence suggesting the means are not the same, in particular suggesting that the underlying first moment for controlled motorways is smaller than that of DHS motorways
Underlying casualty rates	All road types	-	Confidently conclude there are differences between all road types
	ALR and conventional motorways	-	Some evidence of a small difference
	DHS and controlled motorways	-	Insufficient evidence to suggest a difference



Personal injury collision (PIC) rates - Moving

We calculate confidence intervals and to formally compare the underlying collision rates through a p-value calculated using a Monte-Carlo approach.

The location and size of the 95% confidence intervals of the underlying PIC rates are visually different. This suggests that there is variation in the underlying PIC rates of the different road types. We formally assess this hypothesis in subsequent sections. The confidence interval for conventional motorways is narrower than other road types. This is due to the higher traffic volumes on conventional motorways.

PIC rates (moving vehicles) for all road types

We formally consider whether there is sufficient evidence to suggest that the PIC rates (moving vehicles) among all roads are different by testing the following hypothesis:

H_0: Underlying PIC rates (moving vehicles) are the same for all road types

H_1: Underlying PIC rates (moving vehicles) are not the same for all road types

The computed p-value is 0.000, shown to three decimal places: very close to zero. Therefore, we confidently reject the null hypothesis (H0) and conclude that the underlying PIC rates are not the same for all road types (moving vehicles). Comparing all road types in this way is not particularly informative; given the spread of the locations of the confidence intervals, it is not surprising that the formal hypothesis test suggests some differences.

The largest difference in PIC rates is due to the relatively high PIC rate for A-roads. The smallest differences in PIC rates are observed between ALR and conventional motorways and controlled and DHS motorways. We conduct those two formal hypothesis tests to understand how the observed differences in these specific pairs of PIC rates contribute to the small overall p-value.

The confidence intervals demonstrate that the underlying ALR PIC rates are lower than the DHS and controlled motorway PIC rates, and that the underlying conventional motorway PIC rates are lower than the DHS and controlled motorway PIC rates. For this reason, we considered there was no need to formally assess these comparisons.

All lane running motorway on the M1

PIC rates (moving vehicles) for ALR and conventional motorways

We test whether there is a difference in the underlying PIC rate (moving vehicles) for ALR and conventional motorways with the following hypothesis:

H_0: Underlying PIC rates (moving vehicles) are the same for ALR and conventional motorways

H_1: Underlying PIC rates (moving vehicles) are not the same for ALR and conventional motorways

The computed p-value is 0.119, shown to three decimal places. The p-value is not close to zero, and we cannot reject the null hypothesis and conclude there is insufficient evidence to suggest that the underlying PIC rates (moving vehicles) for ALR and conventional motorways are different.

PIC rates (moving vehicles) for controlled and DHS motorways

Here, we formally test whether there is a difference in the underlying PIC rate for controlled and DHS motorways with the following hypothesis:

H_0: Underlying PIC rates (moving vehicles) are the same for controlled and DHS motorways

H_1: Underlying PIC rates (moving vehicles) are not the same for controlled and DHS motorways

The computed p-value is 0.032, shown to three decimal places. The p-value is close to zero. Therefore, we reject the null hypothesis and conclude there is some evidence suggesting that the underlying PIC rate (moving vehicles) for DHS motorways is smaller than that of controlled motorways.

Casualty rates (moving vehicles)

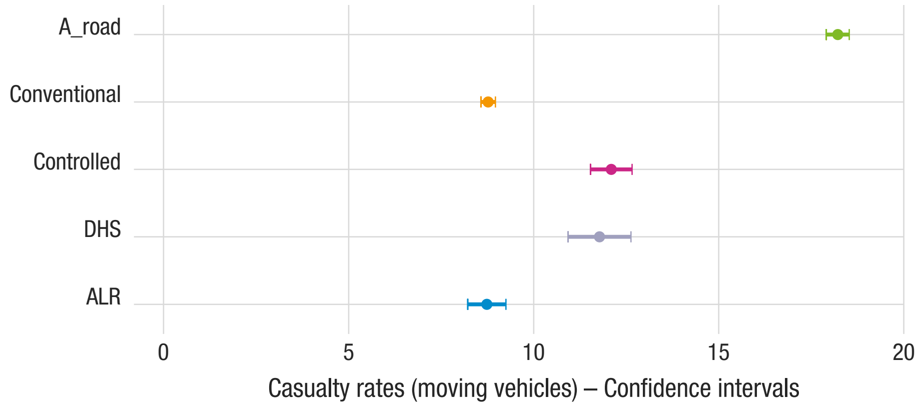
The number of casualties is dependent on both the total number of personal injury collisions and the number of casualties that result from each collision.

We compare the underlying casualty rates for all road types by calculating confidence intervals. We use a two-step process to reflect the dependence on the number of collisions and the casualties resulting from those collisions. The confidence intervals on the underlying casualty rates are larger than the confidence intervals for the PIC rates due to the additional variability arising from the two-step process.

The variation in the location of the confidence intervals suggests that the underlying casualty rates vary between road types. The confidence interval for the underlying casualty rate for ALR motorways contains that of conventional motorways, and the DHS confidence interval contains nearly all that of controlled motorways. We consider differences in these underlying casualty rates in the next sections. The confidence intervals for the other road types are so visually different we do not formally assess any other comparisons.

There are similar shaped histograms for the number of casualties that result from each PIC, truncated at 10. The mean number of casualties per collision observed on each road type is shown by the solid black vertical line in the charts on the following page, and the mean across all road types is shown by the dashed orange vertical line. Collisions resulting in more than 10 casualties are rare (nine events in five years).

In the following sections, we formally assess for a difference in the first moment (mean) of the number of casualties per collision amongst the road types. We combine the results to determine whether there is sufficient evidence to suggest that the underlying casualty rates vary between the road types.



All lane running motorway

Casualty rates (moving vehicles) for all road types

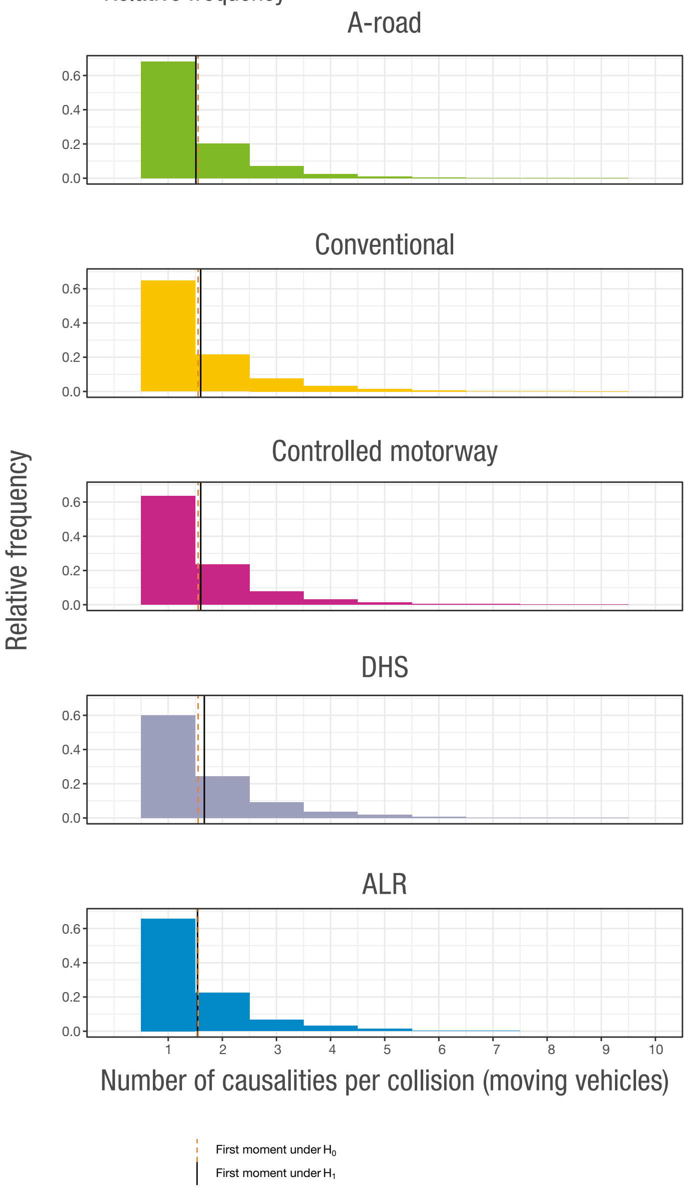
To determine whether there is sufficient evidence to suggest that the underlying casualty rates are different, we combine the analysis of PIC rates with additional analysis of the following hypothesis:

H_0: First moments of the distribution for the number of casualties per collision (moving vehicles) are the same for all road types

H_1: First moments of the distribution for the number of casualties per collision (moving vehicles) are not the same for all road types

The computed p-value is 0.000, shown to three decimal places. The p-value is very close to zero. Therefore, we confidently reject the null hypothesis and conclude that the first moment of the number of casualties per collision (moving vehicles) is not the same for all road types.

Number of casualties per collision (moving vehicles) – Relative frequency



Road type	Number of casualties per collision (moving vehicles)	Number of times observed
A-road	11	1
A-road	13	1
A-road	20	1
A-road	23	1
Controlled	13	1
Conventional	11	1
Conventional	12	1
Conventional	13	1
Conventional	33	1

Combining the conclusions from the PIC rate (moving vehicles) analysis and first moment of the distribution for the casualties per collision (moving vehicles) we confidently conclude the underlying casualty rates are not the same for all road types.

Casualty rates (moving vehicles) for ALR and conventional motorways

To determine whether there is sufficient evidence to suggest that the underlying casualty rates for ALR and conventional motorways are different, we combine the analysis of PIC rates with additional analysis of the following hypothesis:

H_0: First moments of the distribution for the number of casualties per collision (moving vehicles) are the same for ALR and conventional motorways

H_1: First moments of the distribution for the number of casualties per collision (moving vehicles) are not the same for ALR and conventional motorways

The computed p-value is 0.047, shown to three decimal places. The p-value is somewhat close to zero. Therefore, we cannot outright reject the null hypothesis and conclude there is some evidence suggesting that the underlying first moment of the distribution for the number of casualties per collision (moving vehicles) are different, with ALR casualties per collision (moving vehicles) being smaller.

Recall that the computed p-value from the PIC rate analysis is 0.119 and we concluded that there is insufficient evidence to conclude that the underlying PIC rates for ALR and conventional motorways are different. Taking these two conclusions into account, we conclude there is insufficient evidence of a small difference in the underlying casualty rates.

Casualty rates (moving vehicles) for controlled and DHS motorways

To determine whether there is sufficient evidence to suggest that the underlying casualty rates for controlled and DHS motorways are different, we combine the analysis of PIC rates with additional analysis of the following hypothesis:

H_0: First moments of the distribution for the number of casualties per collision (moving vehicles) are the same for controlled and DHS motorways

H_1: First moments of the distribution for the number of casualties per collision (moving vehicles) are not the same for controlled and DHS motorways

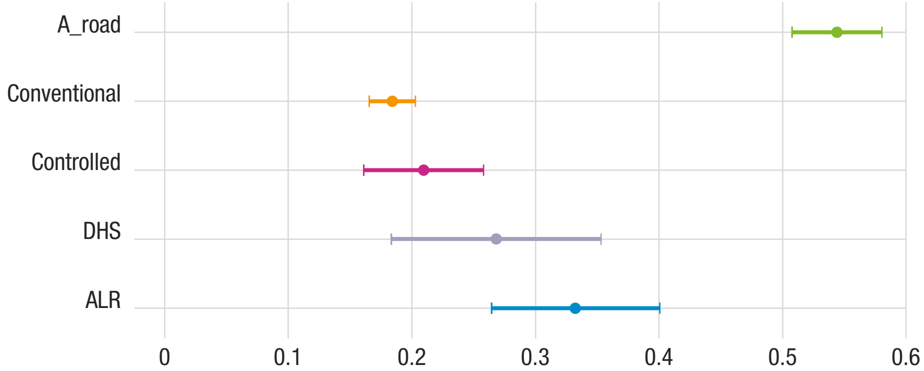
The computed p-value is 0.092, shown to three decimal places The p-value is somewhat close to zero, but we cannot outright reject the null hypothesis. We instead conclude there may be some evidence that the underlying first moment of the distribution for the number of casualties per collision (moving vehicles) are different: with DHS being smaller.

Recall that the computed p-value from the PIC rate analysis was 0.032 and that we concluded there is some evidence suggesting that the underlying PIC rate for DHS motorways is smaller than that of controlled motorways.

The observed PIC rate for DHS is lower than that of controlled motorways, and the observed first moment of the distribution for the casualties per collisions is lower for DHS than controlled motorways; together this suggests there is some evidence to conclude that the casualty rates are different, with DHS being smaller than controlled (moving vehicles).

For moving vehicles, between all road types, we confidently conclude there are differences in PIC rates, mean numbers of casualties per collision, and casualty rates. There are some differences between particular road types, with varying strengths of evidence.

Moving vehicles	Comparison between	p-value (shown to 3 decimals)	Conclusion
Underlying PIC rates	All road types	0.000	Confidently conclude the rates are not the same between all road types
	ALR and conventional motorways	0.119	Insufficient evidence to suggest a difference between ALR and conventional motorways
	DHS and controlled motorways	0.032	Some evidence suggesting the rates are not the same, suggesting the underlying PIC rate for DHS motorways is smaller than that of controlled motorways
Mean number of casualties per collision	All road types	0.000	Confidently conclude the means are not the same between all road types
	ALR and conventional motorways	0.047	Some evidence suggesting the rates are not the same, with ALR casualties per collision (moving vehicles) being smaller
	DHS and controlled motorways	0.092	May be some evidence suggesting the means are not the same suggesting that the underlying first moment DHS is smaller than that of controlled motorways
Underlying casualty rates	All road types	-	Confidently conclude there are differences between all road types
	ALR and conventional motorways	-	Insufficient evidence to suggest a difference between ALR and conventional motorways
	DHS and controlled motorways	-	Some evidence to conclude that the casualty rates are different, with DHS being smaller than controlled (moving vehicles)



Personal injury collision rates (stopped vehicles) - Confidence intervals

Personal injury collision (PIC) rates - Stopped

We calculate confidence intervals and to formally compare the underlying collision rates through a p-value calculated using a Monte-Carlo approach.

The location and size of the 95% confidence intervals of the underlying PIC rates are visually different. This suggests that there is variation in the underlying stopped vehicle PIC rates of the different road types. We formally test this hypothesis in subsequent sections. The confidence interval for conventional motorways is narrower than other road types. This is due to the higher traffic volumes on conventional motorways.

PIC rates (stopped vehicles) for all road types

We formally consider whether there is sufficient evidence to suggest that the PIC rates (stopped vehicles) among all roads are different by testing the following hypothesis:

H_0: Underlying stopped vehicle PIC rates stopped vehicle are the same for all road types

H_1: Underlying stopped vehicle PIC rates are not the same for all road types

The computed p-value is 0.000, shown to three decimal places: very close to zero. Therefore, we confidently reject the null hypothesis (H0) and conclude that the underlying stopped vehicle PIC rates are not the same for all road types. Comparing all road types in this way is not particularly informative; given the spread of the locations of the confidence intervals, we are not surprised that the formal hypothesis test suggests some differences.

There are overlapping confidence intervals for conventional and controlled motorways (CM), CM and DHS, DHS and ALR, and CM and ALR. In the subsequent sections we formally test for differences in these pairs of underlying rates.

The non-overlapping confidence intervals give us confidence that the underlying ALR PIC rates (stopped vehicles) are higher than the conventional motorway PIC rates (stopped vehicles). Additionally, A-road PIC rates (stopped vehicles) are higher than all other road types. We considered there was no need to formally test these comparisons.

PIC rates (moving vehicles) for controlled and conventional motorways

We test whether there is a difference in the underlying stopped vehicle PIC rate for controlled and conventional motorways with the following hypothesis:

H_0: Underlying PIC rates (stopped vehicles) are the same for controlled and conventional motorways

H_1: Underlying PIC rates (stopped vehicles) are not the same for controlled and conventional motorways

The computed p-value is 0.169, shown to three decimal places. The p-value is not close to zero. Therefore, we cannot reject the null hypothesis and conclude there is insufficient evidence to suggest that the underlying PIC rates for controlled and conventional motorways are different.

PIC rates (moving vehicles) for conventional and DHS motorways

Here, we formally test whether there is a difference in the underlying stopped vehicle PIC rate for conventional and DHS motorways with the following hypothesis:

H_0: Underlying PIC rates (stopped vehicles) are the same for conventional and DHS motorways

H_1: Underlying PIC rates (stopped vehicles) are not the same for conventional and DHS motorways

The computed p-value is 0.018, shown to three decimal places. The p-value is close to zero, and we reject the null hypothesis. Therefore, we conclude there is evidence suggesting that the underlying PIC rates for conventional and DHS motorways are not the same: there is some evidence to suggest the underlying PIC rate for conventional motorways is smaller than that of DHS motorways.

PIC rates (moving vehicles) for controlled and DHS motorways

Here, we formally test whether there is a difference in the underlying PIC rate (stopped vehicles) for controlled and DHS motorways with the following hypothesis:

H_0: Underlying PIC rates (stopped vehicles) are the same for controlled and DHS motorways

H_1: Underlying PIC rates (stopped vehicles) are not the same for controlled and DHS motorways

The computed p-value is 0.114, shown to three decimal places The p-value is not close to zero. Therefore, we cannot reject the null hypothesis and conclude there is insufficient evidence to suggest that the underlying PIC rates for controlled and DHS motorways are different.

National Highways traffic officer in an emergency area

PIC rates (moving vehicles) for controlled and ALR motorways

Here, we formally test whether there is a difference in the underlying PIC rate (stopped vehicles) for controlled and ALR motorways with the following hypothesis:

H_0: Underlying PIC rates (stopped vehicles) are the same for controlled and ALR motorways

H_1: Underlying PIC rates (stopped vehicles) are not the same for controlled and ALR motorways

The computed p-value is 0.002, shown to three decimal places. The p-value is close to zero, and we confidently reject the null hypothesis. Therefore, we conclude that the underlying PIC rates for controlled and ALR motorways are different: there is some evidence to suggest the underlying PIC rate (stopped vehicles) for controlled motorways is smaller than that of ALR motorways.

PIC rates (moving vehicles) for ALR and DHS motorways

Here, we formally test whether there is a difference in the underlying stopped vehicle PIC rate for ALR and DHS motorways with the following hypothesis:

H_0: Underlying PIC rates (stopped vehicles) are the same for ALR and DHS motorways

H_1: Underlying PIC rates (stopped vehicles) are not the same for ALR and DHS motorways

The computed p-value is 0.123, shown to three decimal places. The p-value is not close to zero, and we cannot reject the null hypothesis. Therefore, we conclude there is insufficient evidence to suggest that the underlying PIC rates (stopped vehicles) for ALR and DHS motorways are different.

Casualty rates (stopped vehicles)

The number of casualties is dependent on both the total number of personal injury collisions and the number of casualties that result from each collision. We do not present confidence intervals on the underlying stopped vehicle casualty rates, or formally test for any differences, as the methods used require sufficient observations of collisions for each road type being compared. This is due to the need to have sufficient information about the distribution of casualties per collision for each road type here. The number of stopped vehicle collisions is small for DHS, ALR, and CM motorways, and we do not consider there to be the required amount of information to robustly make comparisons at this stage.

For stopped vehicles, between all road types, we confidently conclude there are overall differences in stopped vehicle PIC rates. There are some differences between particular road types, with varying strengths of evidence.

Stopped vehicles	Comparison between	p-value	Conclusion
Underlying PIC rates	All road types	0.000	Confidently conclude the rates are not the same between all road types
	Controlled and conventional motorways	0.169	Insufficient evidence to suggest that the rates for controlled and conventional motorways are different
	DHS and conventional motorways	0.018	Evidence suggesting that the rates for conventional and DHS motorways are not the same, suggesting conventional is smaller
	DHS and controlled motorways	0.114	Insufficient evidence suggesting that the rates for DHS and controlled motorways are different
	ALR and controlled motorways	0.002	Confidently conclude the rates for controlled motorways are smaller than ALR motorways
	ALR and DHS motorways	0.123	Insufficient evidence to suggest that the rates for ALR and DHS motorways are different

Annex C – Detailed tables

To continue providing transparency on the analysis, alongside this report we have published a detailed safety tables spreadsheet[75].

As per Annex B – Methodology, the figures included in this spreadsheet are the statistics used in this report. These reflect DfT's latest guidance on injury-based reporting ie using adjusted STATS19 data where possible.

It should be noted that these adjustments influence (i) casualties (but not total collisions reported here) and (ii) serious and slight severities (not fatal). In addition, as these are based on a probabilistic model developed and used by ONS and DfT, adjusted figures are no longer whole numbers, but are decimal values.

Figures not including these adjustments have also been included for completeness. Such figures are categorised as 'unadjusted for injury-based reporting'.

To continue providing transparency on the analysis, alongside this report we have published the detailed safety tables spreadsheet

Car in an emergency area

Annex D – Detailed collision data

To provide greater transparency, alongside this report we have published a detailed collision data spreadsheet[76].

This document and accompanying data have been prepared by National Highways with assistance from its consultants (where employed). The document and its accompanying data remain the property of National Highways.

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The methodology used to generate the data in this document should only be considered in the context of this smart motorways third year progress report.

This methodology, and its subsequent outputs may differ from methodologies used in different analyses at different points in time. This is due to continuous improvements of data mapping, capture and quality. As these factors evolve over time, any comparison with earlier data or data from other sources, should be interpreted with caution.

This dataset will be refreshed when updated information becomes available. We will be interested to hear your thoughts on how to improve this data. If you want to contact us, please email us at roadsafetydivision@nationalhighways.co.uk.

Annex E – Relevant analyses and reports

We undertake different types of analysis to better understand safety. These include (i) road type comparisons, (ii) scheme safety comparisons, (iii) road user insights and (iv) wider evidence activities such as post opening project evaluation reports (POPEs) and monitoring and evaluation activities.

The latter activities include:

- bespoke monitoring and evaluation activities – understanding whether specific measures, such as additional emergency areas, are effective and/or achieve their outcomes
- POPE evaluations - undertaking POPEs to understand whether a scheme's objectives have been met and consider the impacts of individual schemes across traffic, safety, the economy and the environment
- other road user research – understanding what aspects beyond safety impact road user experience
- bespoke safety assessments – investigations into the safety of specific sections of road

Since the second year progress report we have also published two smart motorway-related reports. These are included below:

- *M6 and M1 smart motorways Incident and infrastructure investigations – summary report update 2022*[34]
- *Smart motorways scheme safety - 'before' versus 'after' assessment*[42]

Glossary

All lane running (ALR) motorways
All lane running motorways add variable mandatory speed limits to control the speed and smooth the flow of traffic and increase capacity by permanently converting the hard shoulder into a running lane. ALR motorways feature emergency areas, which are places to stop in an emergency. To further enhance safety, stopped vehicle detection technology is put in place on all ALR motorways.

BAU
Business as usual.

bCall
bCall is a system that allows the driver to call for breakdown assistance direct from their vehicle.

Casualty rate
The casualty rate takes the number of casualties and controls for the volume of traffic on the road, more specifically it is defined as the number of casualties per hundred million vehicle miles travelled.

CCTV
Closed-circuit television. The primary users of the traffic cameras are our regional and national traffic operations centre operators. The operators are able to move and zoom the cameras to monitor and manage congestion and incidents, when notified. The cameras give a bird's eye view of what is happening which helps the operator to decide on the support needed.

Controlled motorways
Controlled motorways apply variable mandatory speed limits to a conventional motorway to control the speed and smooth the flow of traffic and retain a permanent hard shoulder. Overhead electronic signs display messages to drivers, such as warning of an incident ahead.

DfT
Department for Transport.

Dynamic hard shoulder (DHS) motorways

Dynamic hard shoulder motorways apply variable mandatory speed limits to control the speed and smooth the flow of traffic and temporarily increase capacity by using the hard shoulder as a running lane at the busiest times. Electronic signs and signals instruct drivers when hard shoulder is available to use for live running. When the hard shoulder is operating as a live lane, the speed is set at a maximum of 60mph. DHS motorways feature emergency areas, which are places to stop in an emergency.

DVLA
Driver and Vehicle Licensing Agency is an executive agency, sponsored by DfT.

DVSA
Driver and Vehicle Standards Agency is an executive agency, sponsored by DfT.

eCall
eCall is a system that phones the emergency services automatically if the vehicle it's fitted to is involved in an incident.

Emergency areas
Smart motorways feature emergency areas. They are orange, set back from live traffic lanes and have an emergency phone which connects directly to our control room so help can be arranged. These are spaced regularly on a motorway with no hard shoulder and are marked with blue signs featuring an orange SOS telephone symbol.

Emergency areas are for when a driver has no alternative but to stop and it has not been possible to leave the motorway or reach a motorway service area. Other places to stop in an emergency include sections of remaining hard shoulder, such as on slip roads at junctions.

Emergency corridor
This term is used to describe a temporary corridor, used in some European countries but not the UK. It is formed by drivers providing space between the off-side lane and the adjacent lane in slow (ie walking speed) traffic. This enables emergency vehicles to pass slow moving or stationary traffic to reach the scene of an incident (or equivalent emergency) using the gap formed by traffic between two marked lanes.

Fatal and Weighted Injuries (FWI) metric
This gives a fatality 10 times the weighting of a serious casualty, and a serious casualty 10 times the weighting of a slight casualty. Specifically, it is calculated as:
Fatal and Weighted Injuries = Fatal casualties + Serious Casualties * 0.1 + Slight Casualties * 0.01.

Fatal and Weighted Injuries (FWI) rate
The FWI rate takes the FWI metric and controls for the volume of traffic on the road and is more specifically defined as the number of FWI casualties per hundred million vehicle miles travelled.

Fatal casualty
A person who has died from their injuries up to 30 days after the incident.

Journey time
Journey time is how long it takes to make a journey

Journey time reliability
Journey time reliability is being able to expect that the same journey, on the same stretch of road, at the same time of day, will take a similar amount of time each time it is made.

Killed and seriously injured (KSI) metric
The number of people killed and seriously injured in a road traffic collision.

Killed and seriously injured (KSI) rate
The KSI rate takes the KSI metric and controls for the volume of traffic on the road and is more specifically defined as the number of KSI casualties per hundred million vehicle miles travelled.

Live lane stop
Vehicles that are stationary or parked in any of the live lanes. Previous reports have primarily considered live lane breakdowns, whereas this report considers a larger number of factors as live lane stops – for example breakdown, collisions or medical episodes.

Monitoring

Regional control room incident management and monitoring

Once we are notified of an incident, we can use CCTV and other technology to verify details and determine appropriate actions during the course of the incident. Notification can arise from various sources including the police, public, stopped vehicle detection technology where in place, recovery industry and our traffic officers. Actions in response may include setting signs and signals and deploying resources, such as traffic officers.

When resources allow, we carry out virtual patrolling. This is the proactive use of technology to provide an overview of smart motorway sections, including emergency areas. Virtual patrolling is not a routine activity conducted in our regional control rooms.

Roadworks monitoring

For major scheme upgrades where we have roadworks in place, we typically implement a reduced speed limit and CCTV monitoring within the roadworks. An on-site, 24/7 team use the CCTV to proactively monitor the roadworks section and can arrange to deploy free recovery service to vehicles which stop in the roadworks.

Further monitoring

We also use equipment to monitor areas such as data, air quality and wind speed. The information is gathered periodically.

Motorway Incident Detection and Automatic Signalling (MIDAS)

MIDAS is a system set up to identify queuing traffic or congestion by monitoring traffic speed and flow. Once queuing traffic or congestion is detected, the system automatically sets appropriate messages on variable message signs to warn drivers of conditions of the road ahead. It also automatically sets speed limits displayed on the signs and signals at the roadside and overhead on gantries.

MIDAS can also reduce the risk of secondary incidents in queuing traffic, ie the risk of vehicles colliding with the rear of a queue of traffic. It does this by identifying a queue and then automatically reducing speeds and setting accompanying warning messages.

In addition, on smart motorway sections only, it also includes a congestion management function designed to smooth traffic flow and throughput by reducing traffic speed, allowing more space between vehicles, to try and stop traffic queues forming. This is done by setting signals and message signs upstream of where congestion is detected.

ONS

Office for National Statistics.

Operational data

This is data we have extracted from operational systems (such as, but not limited to, our incident management system, ControlWorks) and analysed to meet the needs of the reporting requirements as agreed with DfT and/or ORR. Due to the reporting not being equivalent to a key performance indicator, this data may not require similar level of assurance.

ORR

Office of Rail and Road.

Personal Injury Collisions (PIC) metric

The number of collisions which have resulted in a person sustaining an injury. PICs do not reflect the number of people injured in each collision (casualties).

Personal Injury Collisions (PIC) rate

The PIC rate takes the PIC metric and controls for the volume of traffic on the road and is more specifically defined as the number of PICs per hundred million vehicle miles travelled.

Places to stop in an emergency

Places to stop in an emergency include motorway services, emergency areas and remaining sections of hard shoulder, such as on slip roads.

POPE

National Highways produces post opening project evaluation (POPE) reports ‘one year after’ and ‘five years after’ following the opening of a road scheme for all scheme impacts, including but not limited to safety.

Road investment strategy

The government’s five-year strategy for investment in and management of the strategic road network.

Road investment period

Five-year period aligned to the government’s five-year strategy for investment in and management of the strategic road network.

Serious casualties

People sustaining injuries requiring hospitalisation, or any of the following injuries whether or not the individual went to hospital: fractures, concussion, internal injuries, crushings, burns (excluding friction burns), severe cuts, severe general shock requiring medical treatment and injuries causing death 30 or more days after the incident.

Slight casualties

People sustaining a minor injury such as a sprain (including neck whiplash), bruise or cut which is not judged to be severe, or slight shock requiring roadside attention. This definition includes injuries not requiring medical treatment.

Smart motorway

Smart motorway is a generic term for a section of motorway that uses traffic management methods to increase capacity and reduce congestion in particularly busy areas. These methods include using the hard shoulder as a running lane and using variable speed limits to control the flow of traffic. There are three types of smart motorway – as defined in this glossary – all lane running, dynamic hard shoulder and controlled.

STATS19

The STATS19 database is a collection of all road traffic accidents (collisions) that resulted in a personal injury (casualty) and were reported to the police within 30 days of the accident. More information can be found on the *DfT’s Road Safety data webpage*[77].

One collision may give rise to several casualties, which are categorised according to their severity (slight, serious or fatal). In this report we predominantly use the terms ‘collisions’ and ‘casualties’. The term ‘injuries’ is used particularly in line with widely adopted definitions and metrics or in order to reduce the technical language of the report.

Stopped vehicle

Vehicles that are stationary or parked. This may be due to various reasons, including a vehicle breakdown, collision with another vehicle or medical episode of the driver or passenger.

Stopped vehicle detection (SVD)

Stopped vehicle detection enables the detection of vehicles which have stopped on the carriageway or in an emergency area. Currently a radar-based system, it is in place on ALR sections of smart motorway. When SVD identifies a stopped vehicle, it provides an alert to our regional control room and at the same time automatically sets a message sign on the road to warn of a report of obstruction whilst the alert is verified by an operator. Our operators can then respond quickly to close lanes with a Red X signal, display speed limits and deploy traffic officers.

The 'being safer in moving traffic' section of this report sets out the four main requirements that SVD performance is measured against.

Strategic road network (SRN)

In England, the strategic road network is made up of motorways and trunk roads (the most significant A-roads). They are administered by National Highways, a government-owned company.

Transport Focus

Independent watchdog for transport users.

Transport Select Committee

Nominated by the House of Commons to scrutinise the Department for Transport. Its formal remit is to hold ministers and departments to account, and to investigate matters of public concern where there is a need for accountability to the public through Parliament. It is currently chaired by Iain Stewart MP.

Vehicle miles

Traffic statistics are presented in units of vehicle miles (billion or hundred million vehicle miles – bvm or hmvm respectively), which combines the number of vehicles on the road and how far they drive. This is a standard way of presenting traffic volumes.

VRO

Vehicle Recovery Operator.

Endnotes

National Highway is not responsible for third party reports, links or their location.

1 Average calculated using operational data for number of stopped vehicles in live lanes across all regions for the period November 2022 to April 2023

2 Road Traffic Estimates: Great Britain 2021, p19: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1107056/road-traffic-estimates-in-great-britain-2021.pdf

3 The 'just over 500 miles' figure includes both carriageways

4 First year smart motorway progress report: https://nationalhighways.co.uk/media/bb4lpkcp/smart-motorways-stocktake-first-year-progress-report-2021.pdf Referred to as the first year progress report or annual progress reports

5 Second year smart motorway progress report: https://nationalhighways.co.uk/media/uivj2zem/smart-motorways-stocktake-second-year-2022.pdf Referred to as the second year progress report or annual progress reports

6 Smart motorway safety evidence stocktake and action plan: https://www.gov.uk/government/publications/smart-motorway-evidence-stocktake-and-action-plan

7 The role out and safety of smart motorways: https://publications.parliament.uk/pa/cm5802/cmselect/cmtrans/1020/report.html

8 Referred to in this report as the 2022 pause

9 Referred to in this report as the 2023 announcement

10 This is the point in time post construction and following initial calibration where SVD alerts begin activating and are responded to within our regional control rooms. During this period we continue to calibrate the SVD system

11 'Go Left' breakdown campaign: https://nationalhighways.co.uk/road-safety/breakdowns/

12 Driving on motorways: https://nationalhighways.co.uk/road-safety/driving-on-motorways/

13 The Highway Code: https://www.gov.uk/guidance/the-highway-code

14 First Annual Assessment of safety performance on the strategic road network: https://www.orr.gov.uk/sites/default/files/2022-12/first-annual-assessment-of-safety-performance-on-the-srn.pdf

15 MIDAS is a system set up to identify queuing traffic or congestion by monitoring traffic speed and flow. See glossary for a full definition

16 ORR quality assurance of all lane running motorway data report: https://www.gov.uk/government/publications/orr-quality-assurance-of-all-lane-running-motorway-data-report

17 In the previous four weeks before they were asked

18 How to check your vehicle: https://nationalhighways.co.uk/road-safety/how-to-check-your-vehicle/

19 Stay safe - stay back: https://nationalhighways.co.uk/road-safety/stay-safe-stay-back/

20 Driving for better business: https://www.drivingforbetterbusiness.com/

21 The Highway Code says you should "allow at least a two second gap between you and the vehicle in front on roads carrying faster moving traffic". The two seconds are made up of the time needed for thinking and stopping. And when it's raining you need to at least double that gap

22 National emergency area retrofit: https://nationalhighways.co.uk/our-work/smart-motorways-evidence-stocktake/national-emergency-area-retrofit/

23 This scheme was already over three quarters constructed when the 2023 announcement was made

24 Emergency area width review: https://nationalhighways.co.uk/our-work/smart-motorways-evidence-stocktake/emergency-area-width-review/

25 National Highways Open Data: https://opendata.nationalhighways.co.uk/

26 CCTV availability is defined as the percentage of time CCTV cameras are working on ALR motorways, for the calendar month

27 Speed control signal availability is defined as the percentage of time an electronic signal that shows information about speed limits and lane availability is working on ALR motorways, for the calendar month

28 Warning sign availability is the percentage of time an electronic sign that shows general driver information in text or pictorial format is working on ALR motorways, for a calendar month

29 The remaining scheme in construction (as of June 2023) is the M6 junctions 21a to 26. This scheme was already over three quarters constructed when the 2023 announcement was made

30 Average calculated using operational data for number of stopped vehicles in live lanes across all regions for the period November 2022 to April 2023

31 National Highways letter to the ORR, SVD performance update: https://nationalhighways.co.uk/svd-performance-update

32 Based on operational data: This is data we have extracted from operational systems (such as, but not limited to, our incident management system, ControlWorks) and analysed to meet the needs of the reporting requirements as agreed with DfT and/or ORR. Due to the reporting not being equivalent to a key performance indicator, this data may not require similar level of assurance

33 M6 and M1 safety reviews: https://nationalhighways.co.uk/our-work/smart-motorways-evidence-stocktake/m6-and-m1-safety-reviews/

34 M6 and M1 smart motorways Incident and infrastructure investigations – summary report Update 2022: https://nationalhighways.co.uk/media/lcwf3gyw/brs22_0041_m6_and_m1_summary-report_2022_final.pdf

35 eCall SOS: https://nationalhighways.co.uk/road-safety/ecall/#:~:text=eCall%20should%20only%20be%20used,means%20help%20arrives%20more%20quickly

36 Rollout and safety of smart motorways: Government Response to the Committee's Third Report: https://publications.parliament.uk/pa/cm5802/cmselect/cmtrans/1020/report.html

37 House of Commons Transport Committee, Rollout and safety of smart motorways. Third Report of Session 2021–22: https://committees.parliament.uk/publications/7703/documents/80447/default/

38 National Highways response to ORR's First Annual Assessment of safety performance on the strategic road network: https://nationalhighways.co.uk/media/zn4pj5ay/orr-2022-annual-report-nh-response-221212.pdf

39 Smart motorways comparison report: https://www.gov.uk/government/publications/smart-motorway-comparison-report-december-2022/smart-motorway-comparison-report-december-2022

40 Transport Focus' Safety perceptions on smart motorways: the driver view report: https://www.transportfocus.org.uk/publication/safety-perceptions-on-smart-motorways-the-driver-view/

41 Compared to an agreed 2005 to 2009 baseline

42 Smart motorways scheme safety - 'before' versus 'after' assessment: https://nationalhighways.co.uk/smart-motorways-scheme-safety-before-versus-after-assessment

43 While the safety analysis for this report is based on STATS19 adjusted data, this report publishes both adjusted and unadjusted data in Annex C – Detailed tables for completeness and transparency. More information on injury based reporting and severity adjustments can be found in DfT's 'Guide to severity adjustments for reported road casualties Great Britain'

44 ORR Quality Assurance of All Lane Running Motorway Data, Highways England Response to ORR Key Findings & Recommendations August 2021: https://nationalhighways.co.uk/media/nk4jdiwh/ccs0821127562-001_orr_safety_data_review_report_v4.pdf

45 England (23.40) and Switzerland (22.98) appear the same in this graph due to rounding

46 Data summarised and released by DfT on their webpage titled 'Reported road collisions, vehicles and casualties tables for Great Britain': https://www.gov.uk/government/statistical-data-sets/reported-road-accidents-vehicles-and-casualties-tables-for-great-britain

47 STATS19 data released by DfT on their webpage titled 'Reported road collisions, vehicles and casualties tables for Great Britain': https://www.gov.uk/government/statistical-data-sets/reported-road-accidents-vehicles-and-casualties-tables-for-great-britain

48 This assessment reflects the period between 2018 and 2020 at the RSF EuroRAP 2022 Results Data Portal: http://rsfmaps.agilysis.co.uk/

49 International Road Assessment Programme (iRAP): https://irap.org/

50 See table 1 FWI per hmvm and KSI per hmvm

51 It should be noted that average metrics are not total. For example, a five-year average PIC between 2017-2021 reflects the equivalent to a year, not the total number of PICs between 2017-2021. Rates are presented per hundred million vehicle miles (hmvm)

52 One smart motorway death has historically been omitted from STATS19. This was manually added in the 2020 Stocktake, annual progress reports and will continue to be added in subsequent overall smart motorways reporting, including this report. Where this is considered, the relevant graphs/ figures will include the statement 'Data based on STATS19 with minor amendment'

53 Absolute figures are rounded to the nearest whole numbers. As a result, the sum of these absolute figures for moving and stopped collisions may differ from total collisions

54 During the 2017-2021 period

55 A collision can have multiple factors attributed to it and from more than one grouping. The result is that when driver, vehicle, environment and N/A factor percentages are added together the total percentages exceed 100%. See Annex B – Methodology for more information on contributory factor analysis. For a detailed view of the STATS19 contributory factors, please see DfT's 'STATS19 Accident Statistics form': https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/995422/stats19.pdf

56 N/A includes collisions where there are no specified contributory factors and collisions where the only specified factors are special factors and pedestrian factors

57 One smart motorway fatality has historically been omitted from STATS19. This was manually added in the 2020 Stocktake, first and second year progress reports and will continue to be added in subsequent overall smart motorways reporting. However, as the fatality is omitted in STATS19, there is no further official information available on the detailed conditions of the collision. For this reason, the detailed analysis in this report (such as contributory factor analysis) does not reflect this incident

58 STATS19 review: Final recommendations: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1001195/stats-19-review-final-report.pdf

59 For the period between December 2021 and December 2022, based on a sample of 8,142 at the Transport Focus data hub: https://transportfocusdatahub.org.uk/manager/login.aspx?ReturnUrl=%2fmanager%2f

60 Please see TRL's report 'Perceptions of safety: findings from focus groups': https://trl.co.uk/publications/perceptions-of-safety--findings-from-focus-groups

61 The statements are extracts from the research undertaken by Transport Focus

62 This is expected to be due to availability bias. This is a mental shortcut that relies on immediate examples that come to a given person's mind when assessing a specific issue. Simply put, the easier it is to recall the consequences of something, the greater those consequences are often perceived to be

63 Previous reports have primarily considered live lane breakdowns, whereas this report considers a larger number of factors as live lane stops – for example breakdown, collisions or medical episodes

64 Smart Motorway All Lane Running Overarching Safety Report 2019: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/872153/SMALR_Overarching_Safety_Report_2019_v1.0.pdf

65 In our response to the ORR 2021 Quality assurance of all lane running motorway data report, we suggested the name of this report would be 'ALR & DHS Overarching Safety Report'. As we increased the scope subsequently to include controlled motorways, we have updated the name of this report to 'Smart motorways scheme safety - 'Before' versus 'after' assessment'

66 For one scheme (M1 J24-25) it was not possible to calculate the counterfactual due to limited background data. This scheme saw lower collision rates in the after period compared to before

67 The safety review already undertaken combined sections of the M1 J28-31 and J32-35a into a single review of the section M1 J30-35. For schemes M1 J28-J31, M1 J32-J35a and M6 J5-J8 we undertook safety reviews particularly for sections M1 J30-35 and M6 J5-6 as part of the 2020 Action Plan. As this report does not suggest an increase in rates, we consider that it is not required to undertake another safety assessment or safety review

68 The government's response to the TSC's inquiry led to the pause of the rollout of new ALR motorways. The reference to recently opened schemes refers to ALR schemes which were more than 50% complete when the pause into the rollout of new ALR schemes was announced

69 Evaluating Safety through Fatalities Weighted Injuries: https://www.rssb.co.uk/safety-and-health/risk-and-safety-intelligence/annual-health-and-safety-report/evaluating-safety-through-fatalities-weighted-injuries

70 Transport Analysis Guidance data book: https://www.gov.uk/government/publications/tag-data-book

71 Guide to severity adjustments for reported road casualties Great Britain: https://www.gov.uk/government/publications/guide-to-severity-adjustments-for-reported-road-casualty-statistics/guide-to-severity-adjustments-for-reported-road-casualties-great-britain

72 Guide to severity adjustments for reported road casualty statistics: https://www.gov.uk/government/publications/guide-to-severity-adjustments-for-reported-road-casualty-statistics

73 The p-value is defined as the probability under the assumption of no effect or no difference (null hypothesis), of obtaining a result equal to or more extreme than what was actually observed

74 A Monte Carlo approach is a model used to predict the probability of a variety of outcomes when the potential for random variables is present

75 Detailed safety tables: https://nationalhighways.co.uk/smart-motorways-stocktake-third-year-progress-report-annex-c

76 Detailed collision data: https://nationalhighways.co.uk/smart-motorways-stocktake-third-year-progress-report-annex-d

77 Road Safety Data: https://www.data.gov.uk/dataset/cb7ae6f0-4be6-4935-9277-47e5ce24a11f/road-safety-data

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