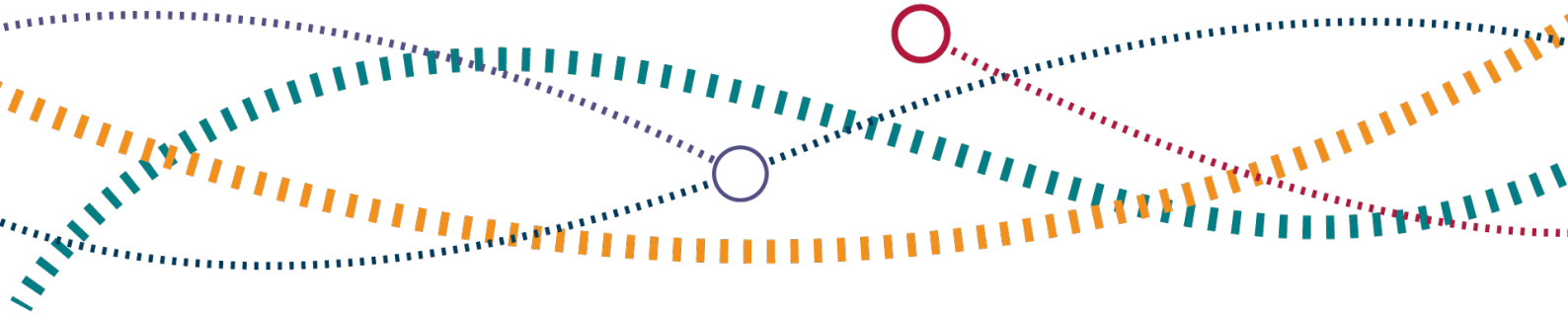
OFFICE OF RAIL AND ROAD

Annual assessment of safety performance on the strategic road network

ORR's assessment of safety performance on the strategic road network in 2023 and progress update on Transport Select Committee smart motorway recommendations

13 March 2025



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Introduction

1. The Office of Rail and Road (ORR) holds National Highways to account for delivery of the requirements set out in the second road investment strategy (RIS2), including the company's key priority of improving safety for road users. This is ORR's third annual assessment of National Highways' safety performance on the strategic road network (SRN). In this report we will:

    - assess National Highways' 2023 performance against its RIS2 key performance indicator (KPI) safety target to halve the number of people killed or seriously injured on the SRN by the end of 2025, compared to a 2005 to 2009 baseline; and

    - summarise our findings in relation to recommendations 4 and 6 from the Transport Select Committee's (TSC) inquiry into the rollout and safety of smart motorways.

Background

2. National Highways was set up as a government-owned company in 2015, tasked with managing the SRN – the motorways and major A-roads in England.

3. For RIS2, government specified a set of outcomes and investments that it requires National Highways to deliver over the second road period (RP2), from April 2020 to March 2025. This includes a target to halve the number of people killed or seriously injured (KSI) on the SRN by the end of 2025, compared to a 2005 to 2009 baseline.

4. This report uses the latest road casualty data for the SRN, published by the Department for Transport (DfT) on 26 September 2024, to inform our assessment of National Highways' progress against its target in 2023.

5. In March 2020, following publication of RIS2, DfT released its smart motorway evidence stocktake and action plan, which included a set of actions to improve the safety of, and public confidence in, smart motorways. We also hold National Highways to account for delivering these actions.

6. In February 2021, due to concerns over the safety of smart motorways, the TSC launched an inquiry into the roll-out and safety of smart motorways. It published a report in November 2021, containing nine recommendations aimed at improving the safety of smart motorways.

7. In its response, published in January 2022, DfT agreed to take forward these nine recommendations. At DfT's request, we are leading on two recommendations:

    - Assessing the effectiveness of the safety systems in place on smart motorways (recommendation 4); and
    - Evaluating the effectiveness of the action plan in reducing the frequency and duration of live lane incidents and educating drivers on what to do if they break down in a live lane (recommendation 6).

8. National Highways published its smart motorway stocktake fourth year progress report in March 2025 that includes detailed analysis of casualty rates on different road types, including smart motorways, using road casualty data up to and including 2022. The comparisons of headline casualty rates between different road types were broadly similar to those in the previous year's report.

9. In April 2023, government announced that plans for new smart motorways would be cancelled, recognising the lack of public confidence felt by drivers and cost pressures. Following this announcement, National Highways continues to operate, manage and improve existing smart motorways, and we also continue in our role to assess the effectiveness of the safety systems in place on smart motorways, as set out in this report.

10. This report builds on the findings in our two previous annual assessments of safety performance on the SRN. Three main areas of focus for this report are set out below.

Area of focus 1: National Highways' performance against the RIS2 safety key performance indicator

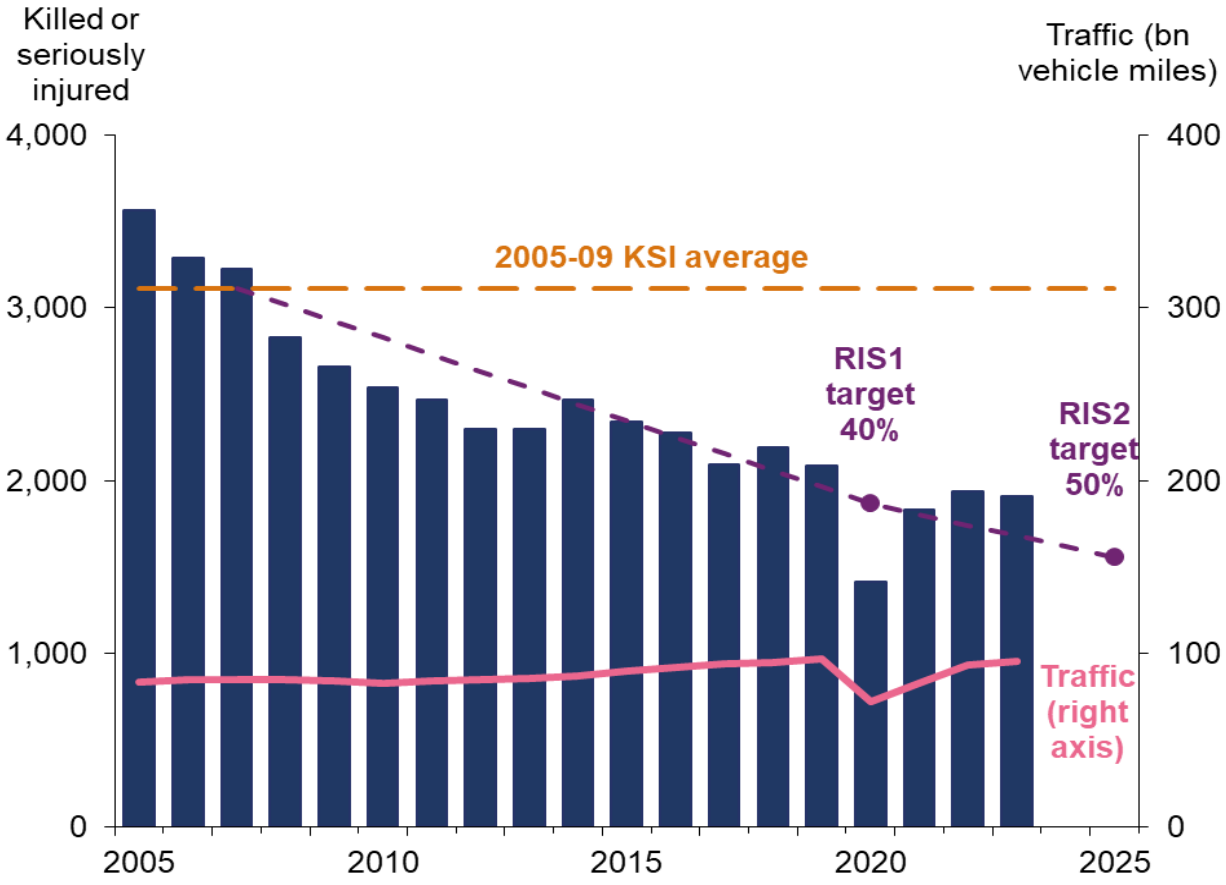
Safety on the SRN continues to improve. The latest road casualty data for 2023 show the fewest deaths and serious injuries ever recorded, excluding 2020 and 2021 when traffic volumes were significantly lower due to the pandemic, and the lowest ever casualty rate per mile travelled, excluding 2020. National Highways has now achieved a 39% reduction in the number of people killed or seriously injured on the SRN compared to a 2005 to 2009 average baseline. We believe that the company is doing everything it reasonably can in the final year of the road period, but it remains off-course to achieve the target of a 50% reduction by the end of December 2025. It is important that National Highways remains focussed on delivering the additional actions it has developed to further close this gap to the target.

11. The latest road casualty statistics for 2023 were published by DfT in September 2024. These continue the longer-term trend of decreasing deaths and serious injuries

on the SRN. It remains one of the safest road networks in the world. Casualty rates on the SRN are significantly lower than the local road network in England (20 KSI casualties per billion vehicle miles travelled compared to 130).

12. Excluding 2020 and 2021, when there was significantly less traffic using the network due to the pandemic, the latest figures show the fewest KSI casualties ever recorded. This is despite traffic on the SRN increasing by 2.2% between 2022 and 2023.

Figure 1: Killed or seriously injured (KSI) casualties (adjusted), safety targets and traffic on the SRN, 2005 to 2023



13. There were 1,913 KSI casualties on the SRN in 2023. This is 26 (1.4%) fewer than in 2022 and means that National Highways has now achieved a 39% decrease in KSI casualties compared to the 2005 to 2009 average baseline.

14. In our previous annual safety report we highlighted that the safety KPI target was at risk and required National Highways to set out a plan for how it would achieve the target.

15. As a result of our intervention and challenge, National Highways produced an enhanced safety plan that included 43 actions it proposed to deliver in the final year of RP2. The company shared its plan with us in March 2024. Despite these additional interventions we consider it is improbable that National Highways will be able to deliver the further reduction of 356 KSI casualties that is required to achieve the RIS2 target of a 50% reduction by the end of 2025.

16. At the end of February 2025, National Highways has delivered 22 of the interventions in its enhanced safety plan and expects to deliver a further 10 by the end of March 2025. 11 are planned to be delivered later in 2025. The company's ability to deliver some proposed interventions has been affected by events outside of its control. In particular, during 2024, government mandated a reduction in budgets for communication campaigns. This resulted in a halving of the company's overall communications budget that included enhanced safety plan campaigns. As a result, National Highways has scaled back some of its proposed activities, but the company still expects to deliver elements of all eight planned communication campaigns.

17. We recognise National Highways' enhanced safety plan was ambitious, and that the company is not able to deliver all the interventions it proposed to in its plan by the end of RP2. However, our assessment is that in the final year of RP2 National Highways is doing everything it reasonably can to achieve the target.

18. As we come to the end of the road period it is imperative that National Highways provides us with details of the actions that it took to improve safety at the start of RP2 and sets out the evidence it used to identify why these were the most effective interventions at the time. This is so the company can demonstrate it has done everything reasonable to try and achieve its safety target in RP2. National Highways has agreed to provide this information to support our end of RP2 assessment.

19. We recognise that not all factors that influence road safety are within the direct control of National Highways. Looking forward, it is important that the company continues to use its position in the sector to influence, and work closely with other agencies, to support its longer-term vision of zero harm on the SRN.

Area of focus 2: the effectiveness of safety systems in place on smart motorways

Extensive roadworks to build additional emergency areas on all lane running smart motorways means that it is not possible to conclusively assess technology performance, or the effect of improvements implemented by National Highways in 2024. This is because the technology at these locations has been turned off to avoid

interference from the on-going works. Despite this, 2024 data show that, at a national level, stopped vehicle detection technology continues to meet the performance requirements set by the company, and it is on track to deliver the majority of its plan to improve the reliability of other safety systems on these roads by the end of March 2025.

National Highways relies on multiple systems to operate smart motorways and has processes and contingencies in place if one or more of the technology systems are not available to minimise the effect on road users. The company needs to continue to improve its understanding of the extent of technology outages on the network and how it collects data on the number of assets that are affected. This will help it to better identify and understand trends that will further improve the timeliness and effectiveness of the solutions it implements.

20. As set out by TSC recommendation 4, this area of focus considers the effectiveness of stopped vehicle detection (SVD) on all lane running (ALR) smart motorways and National Highways' progress to increase the availability of other technologies, such as CCTV, signs and signals on these roads. These assets are part of the company's wider systems and processes for operating smart motorways that include traffic officers and control room operators. In combination, they form the contingencies that National Highways has in place to minimise the effect on road users when technology is unavailable.

21. During 2024, National Highways has progressed work on its commitment to build 151 additional emergency areas on ALR smart motorways by the end of March 2025. This work is known as the national emergency area retrofit (NEAR) programme and up to 43% of the ALR motorway network has been affected by traffic management as a result.

22. During these roadworks it has been necessary for National Highways to close lane 1 (the 'inside lane'). To avoid interference from the ongoing roadworks, the company has turned off much of the technology that is normally in place to support free flowing traffic and road user safety. Therefore it has put in mitigation measures to protect the safety of road users and workers, such as reduced speed limits and increased CCTV coverage. Due to the technology being switched off on these roads, there is less data to measure the performance and availability of safety technology on smart motorways than in previous years.

23. For SVD technology this means that National Highways has tested performance at 12 sites, compared to 21 in 2023. SVD performance continues to meet targets at a national level for key metrics set by the company:

(a) detection rates (the proportion of stopped vehicles correctly identified by SVD, target: >80%);

(b) false discovery rates (the proportion of SVD alerts that are not related to a stopped vehicle event, target: <15%); and

(c) average time to detect stopped vehicles (the elapsed time between a vehicle stopping and an SVD alert being generated, target: <20 seconds).

24. This year, we have published SVD data for individual ALR schemes. At this level of granularity, the data show a small number of targets have been missed on some schemes. Of the 36 metrics tested (12 schemes with three metrics each), seven are below target. No individual scheme has reported missing more than one metric; however, we identified two schemes that did not meet detection rates in consecutive years.

25. We have pursued further lines of enquiry with National Highways to understand details where individual metrics have not met performance requirements. In response, the company provided us with information to evidence that any issues on individual schemes do not point to underlying performance issues with the wider SVD system. The company also demonstrated that it is using results from performance testing to take timely action to optimise and improve SVD performance to ensure that the SVD system delivers the intended safety benefits for road users.

26. Last year we reported that, to improve technology performance on ALR smart motorways, National Highways was implementing a plan to improve the availability of operational technology. This is intended to increase the average availability for four key asset types to 97%: CCTV, motorway incident detection and automatic signalling (MIDAS), variable message signs (VMS) and signals. Operational technology is classed as available when it is functioning and unaffected by faults or outages.

27. With much of this technology turned off in the latter part of 2024 due to the NEAR programme, this year's report only includes technology availability data for the sub-set of smart motorways that have been unaffected by the NEAR programme. This does not provide a robust national picture and, as a result, limits our ability to make a firm conclusion about improvements to operational technology availability on ALR smart motorways.

28. Due to the lack of robust data relating to technology availability, we asked National Highways to instead report on the number of assets it has upgraded against its original plans. The latest information provided by the company shows that it is on track to deliver 90% of its plan by the end of March 2025. It expects to fully complete

its work to upgrade CCTV and MIDAS equipment by the end of the road period. Work to upgrade signs and signals, which has been delayed by challenges in integrating new technology with existing systems and coordinating works alongside major schemes such as the NEAR programme, is expected to complete before the end of 2025.

29. National Highways relies on multiple systems and procedures to operate smart motorways. If technology systems are not available, the company has processes and contingencies in place to mitigate the effect on road users. This year we have included a new topic of focus, on power and system outages for operational technology on ALR smart motorways, to examine their effect on road users. These outages represent a specific sub-set of the wider availability data that we already report for technology on smart motorways. Figures for 2024 show that average overall availability of SVD was 98%, and 94% for wider operational technology on ALR smart motorways.

30. As part of our enquiries, we asked National Highways to provide evidence on the effect of outages on ALR smart motorways, and what the implications are for road users. Data on system and power outages provided by the company are reported in chapter two. This enables us to report on the number and duration of outages on smart motorways during 2024 and whether the outages were planned or unplanned.

31. The evidence we have indicates that, for the majority of outages, relatively few technology assets are affected. For example, the longest power outage in the data we reviewed lasted for 28 days and only affected eight assets at a single junction. The mitigation measures that National Highways puts in place during such outages (for example reduced speed limits and increased traffic patrols) minimise the effect on road users. At our request, the company has provided case studies for individual outages to better illustrate this point. We have also visited one of National Highways' regional operations centres to understand further how the company operates smart motorways and how it responds to outages.

32. The data show that unplanned power outages account for 39% of all outages on ALR smart motorways. National Highways is taking action to address this through a project to move from unmetered to metered electricity supplies. This will ensure that the company is automatically notified of any power outages and therefore better able to manage and mitigate their effect.

33. National Highways has planned procedures in place to deal with outages and to support road user safety. However, we have found the company is unable to systematically collect data that would help it to better understand the effect of

outages on road users, such as the number of technology assets that are affected. Instead, its focus has been on the location, duration and type of assets affected. Although case study evidence shows that the effect of outages is often limited, National Highways is only able to understand this by investigating each incident on a case-by-case basis. The company should continue to improve its understanding of the extent of technology outages on the SRN and how it collects data on the number of assets that are affected. This will help it to better identify and understand trends that will further improve the timeliness and effectiveness of the solutions it implements.

Area of focus 3: the effectiveness of the smart motorway evidence stocktake and action plan in reducing the frequency and duration of live lane stops

National Highways has delivered all the measures set out in the smart motorway evidence stocktake and action plan and it is progressing its evaluation work. In 2024 the company's evaluation of its smart motorway education campaigns has demonstrated an improvement in road users' understanding and awareness of smart motorways. Following completion of the stocktake actions, at least three years of stable data are required to fully assess what effect it has had in educating drivers, and reducing the number and duration of live lane stops on smart motorways. Due to the time lag in publishing national road casualty data it is unlikely that National Highways will be able to draw robust conclusions before 2027. The company will continue to provide us with information on its evaluation work and we will continue to monitor the company to ensure that progress is being made.

34. In 2024-25 National Highways completed the final two measures in the smart motorway evidence stocktake and action plan (the stocktake actions). In December 2024, the M6 J21a - 26 ALR smart motorway scheme opened fully to traffic with SVD in place. This is the last smart motorway to be completed following government's decision to cancel any new smart motorways.

35. The publication of the smart motorway stocktake fourth year progress report in March 2025 completes the other stocktake action.

36. This year, to understand their impact, National Highways has undertaken an evaluation of the education campaigns it ran as part of the stocktake actions. This has found that the campaigns achieved strong reach and recall. The evaluation provided some evidence that the campaigns contributed towards increasing road

user awareness of ‘going left’ in the event of breaking down, and road user understanding of emergency areas.

37. The more substantial and challenging evaluation work that National Highways needs to progress is an assessment of how the stocktake actions have affected the number and duration of live lane stops on smart motorways.

38. As we have previously reported, it is too early to draw conclusions about the success of the stocktake actions in reducing the number and duration of live lane stops as at least three years of stable data is required. Due to the time lag in publishing national road casualty data it is unlikely that National Highways will be able to draw robust conclusions before 2027. The company is progressing work to build the evidence base that will enable it to do this and will continue to report to us on its progress.

39. National Highways’ ability to draw robust conclusions is further complicated by the staggered delivery of the stocktake actions since 2020, other ongoing programmes and roadworks (including the impact of NEAR in 2024 and 2025), and changes in travel patterns since the pandemic. The company must continue to take these challenges into account as it progresses this evaluation work to ensure that it has a clear understanding and can draw robust conclusions on the effectiveness of the actions taken.

40. Interim analysis shows that the number of recorded stops in live lanes increased between 2022 and 2023 before beginning to decline during 2024. National Highways reports that the increase was in-part due to an improved ability and focus on recording stopped vehicles, as well as improvements to detection technology on the network. It is unclear how much of the recent decline is attributable to the NEAR roadworks that are currently in place on ALR motorways. The company’s ongoing evaluation of how the stocktake actions have affected live lane stops aims to build a better understanding of this trend.

41. Following on from work in our first safety report, we have reviewed National Highways’ progress and its plans for developing the next stages of its evaluation of the stocktake actions. We have found the company’s evaluation approach continues to align with best practice and uses an appropriate range of data sources and analytical methods that account for the challenging context in which the actions have been delivered. We are encouraged to see that it is working to improve the robustness of the evaluation by integrating additional data sources as they become available in the future. It is important that National Highways continues to develop this work to ensure it delivers a full and transparent evaluation of the stocktake

actions. We will continue to monitor the company to ensure that progress is being made in this area.

1. Safety performance on the strategic road network in 2023

1.1 As part of the second road investment strategy (RIS2) and wider duties under its licence, National Highways is required to focus on improving safety for all users of the strategic road network (SRN). This outcome is measured by the company's key performance indicator (KPI) target to reduce the number of people killed or seriously injured (KSIs) on the SRN by 50% by the end of 2025, compared to a baseline of the 2005 to 2009 average.

1.2 On 26 September 2024, the Department for Transport (DfT) published its road casualty statistics for 2023. We use these figures to report on National Highways' progress against its safety KPI target.

Severity adjustment

The KSI casualty figures referred to in this report are based on adjusted data reported by DfT. It adjusts figures reported by the police to take account of changes in the reporting of injury severity by some police forces in recent years. This adjustment is applied to the historic time series each year and enables a more reliable comparison of trends over time. Therefore, all KSI data in this report are subject to revision in future years. More details can be found in DfT's severity adjustments guidance.

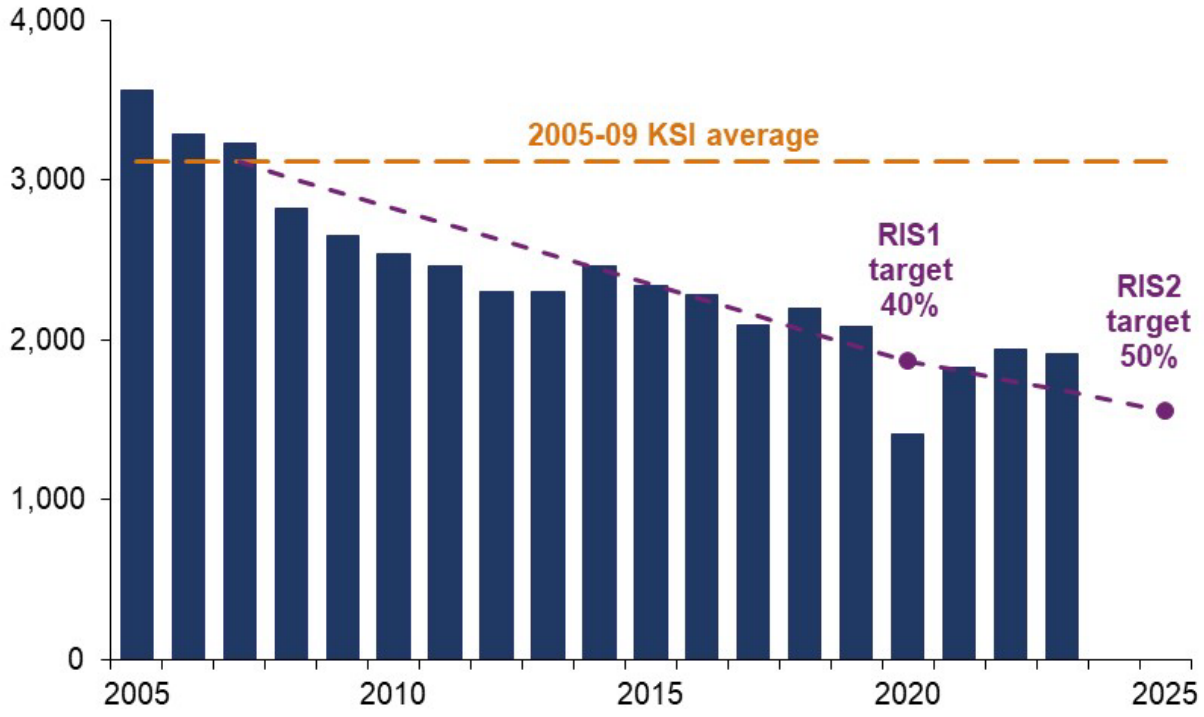
KPI: number of people killed or seriously injured on the SRN

1.3 The latest road casualty statistics for 2023 continue the longer-term trend of decreasing deaths and serious injuries on the SRN.

1.4 Excluding 2020 and 2021, when there was significantly less traffic using the network due to the pandemic, the latest figures show the fewest deaths and serious injuries ever recorded. This is despite traffic on the SRN increasing by 2.2% between 2022 and 2023.

1.5 A total of 1,913 people were killed or seriously injured on the SRN in 2023. This is 26 (1%) fewer than in 2022 and means that National Highways has now achieved a 39% decrease in KSI casualties compared to the 2005 to 2009 average baseline. Therefore, the company must deliver a further improvement of 11 percentage points (356 KSI casualties) to achieve its target of a 50% reduction by the end of 2025.

Figure 1.1 Killed or seriously injured casualties (adjusted), strategic road network, 2005 to 2023



1.6 The latest road casualty statistics confirm that, despite the latest reduction in KSI casualties on the SRN, National Highways remains off course to achieve its safety KPI target.

1.7 In our previous annual safety report, we highlighted that National Highways' safety KPI was at risk and required the company to set out a plan for how it would achieve the target.

1.8 As a result of our intervention and challenge, National Highways produced an enhanced safety plan that included 43 actions that are intended to further reduce KSI casualties in the final year of RP2. The company shared its plan with us in March 2024. Details of its progress in delivering the plan are set out below. National Highways has published details of the activities already underway and will provide further details in due course.

Enhanced safety plan

1.9 National Highways' enhanced safety plan set out 43 actions that the company would take to improve safety in the final year of RP2. These actions are in addition to its existing commitments to improve safety that are set out as part of RIS2, and within annual delivery plans.

1.10 The 43 actions were grouped into three categories:

(a) 24 road safety schemes;

(b) 8 communications campaigns; and

(c) 11 'working with others' actions to develop safety interventions in partnership with other stakeholders as part of the long-term programme to achieve zero harm on the SRN

1.11 At the end of January 2025 National Highways has delivered:

(a) five road safety schemes: A1 at Haggerston; A19 at Limekiln; A40 Huntley to Boxbush; A550 at Two Mills; and the A417 at Birdlip.

(b) eight communication campaigns that are expected to support a reduction in KSIs on the SRN are underway. This includes the Top-up, Rest, Inspect, Prepare (TRIP) Summer, Winter and Spring campaigns, Bikertek, a campaign that aims to raise awareness and educate motorcyclists about safety, and radio campaigns focussed on HGV, middle lane hogging and litter are all designed to contribute to improved safety.

(c) nine 'working with others' actions including establishing the Road Safety Panel to engage with external road safety experts as part of National Highways' Road to Zero Harm programme. The company has also progressed work through this panel to target communication campaigns at localised issues. And, following on from the stocktake action item to review permitting red flashing lights for breakdown vehicles, the company has worked with DfT to implement this.

1.12 National Highways expects to deliver a further 10 actions by the end of March 2025 and plans to deliver 11 of the actions that it set out in the enhanced safety plan later in 2025. Some of these actions, for example those requiring changes to speed limits, are subject to public consultation. Therefore, the details and locations are not included here.

1.13 National Highways' ability to deliver some planned interventions, particularly communication campaigns, has been affected by events outside of the company's control. The General Election in July 2024 meant that it had to pause some communication campaigns. Following the election, in November 2024 government mandated a reduction in budgets for communication campaigns. As a result, National Highways' overall communications budget was reduced by 50%. The company has scaled back some of its planned activities but still expects to deliver elements of all eight planned communication campaigns.

1.14 In its latest Delivery Plan Update (DPU), National Highways has set out a wider range of actions it is taking to improve safety in the final year of RP2, between April 2024 and March 2025. This includes establishing an improved process for investigating more serious incidents to support the company's longer-term aim of achieving zero harm on the SRN. Examples of actions taken as a result of this work include updating operational procedures related to recovery of broken-down vehicles and attending stopped vehicles on hard shoulders. The company's investigation work has also resulted in SatNav companies agreeing to amend their software to provide clearer guidance to drivers that is intended to reduce instances of wrong-way driving.

1.15 Despite these additional interventions we consider it is improbable that National Highways will be able to deliver the improvement that is required to achieve the RIS2 target of a 50% reduction in KSI casualties by the end of 2025. However, our assessment is that the company is doing everything it reasonably can in the final year of RP2 to achieve the target.

1.16 As we come to the end of the road period it is imperative that National Highways provides us with details of the actions that it took to improve safety at the start of RP2 and sets out the evidence it used to identify why these were the most effective interventions at the time. The company has agreed to provide this information to support our end of RP2 assessment.

Comparison with previous years

1.17 Excluding 2020 and 2021, when traffic levels on the SRN were significantly lower due to the pandemic, the latest figures show the fewest deaths and serious injuries ever recorded.

1.18 The 1,913 KSI casualties recorded on the SRN in 2023 is 26 fewer than in the previous year, a decrease of 1%. This decrease in casualties is despite traffic on the SRN increasing by 2% over the same period.

1.19 There were 198 fatalities on the SRN in 2023. This is 21 (10%) fewer than in 2022, and a reduction of 45% compared to the 2005-09 average baseline.

Table 1.1 Killed or seriously injured casualties (adjusted), strategic road network, 2022 to 2023 and baseline

Severity	2023	2022	2005-09 baseline	Percentage change from 2022	Percentage change from baseline
Killed	198	219	357	-10%	-45%
Seriously injured	1,715	1,720	2,757	0%	-38%
Killed or seriously injured (RIS2 KPI)	1,913	1,939	3,114	-1%	-39%

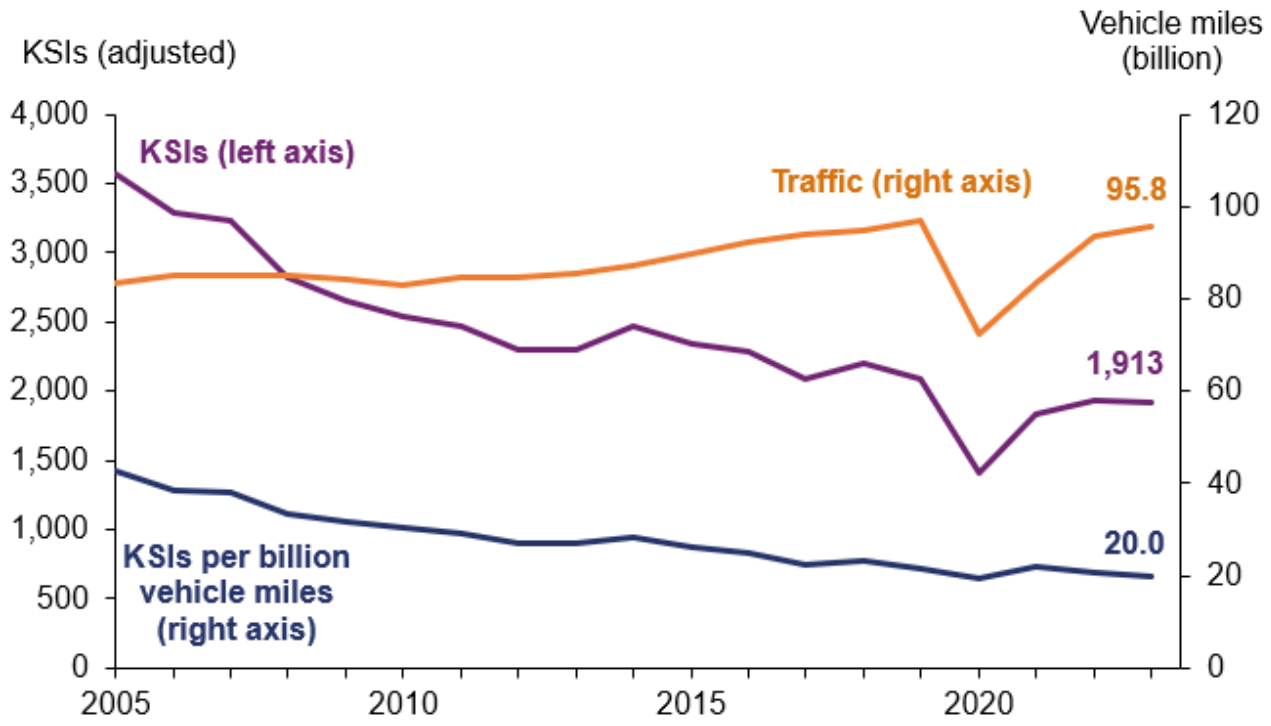
Casualty rates

1.20 A total of 95.8 billion vehicle miles were driven on the SRN in 2023, an increase of 2% compared to 2022, and around 99% of pre-pandemic levels.

1.21 The number of casualties is strongly influenced by the amount of traffic using the roads. Therefore, the sharp decline in traffic during the pandemic, and its subsequent increase, makes it difficult to compare safety performance on the SRN year-on-year since 2020. However, casualty rates (the number of casualties per mile travelled) allows us to compare annual data on a more consistent basis.

1.22 In 2023 there were 20.0 KSI casualties per billion vehicle miles travelled on the SRN. This is lower than in 2022 (20.7 KSI casualties per billion vehicle miles) and the second lowest KSI casualty rate on record. Only 2020, which is the year most affected by the pandemic, has a lower KSI casualty rate (19.5 KSI casualties per billion vehicle miles travelled). KSI casualties, traffic and casualty rates on the SRN are shown in figure 1.2.

Figure 1.2 Killed or seriously injured (KSIs, adjusted), traffic and KSI rate per billion vehicle miles travelled, strategic road network, 2005 to 2023



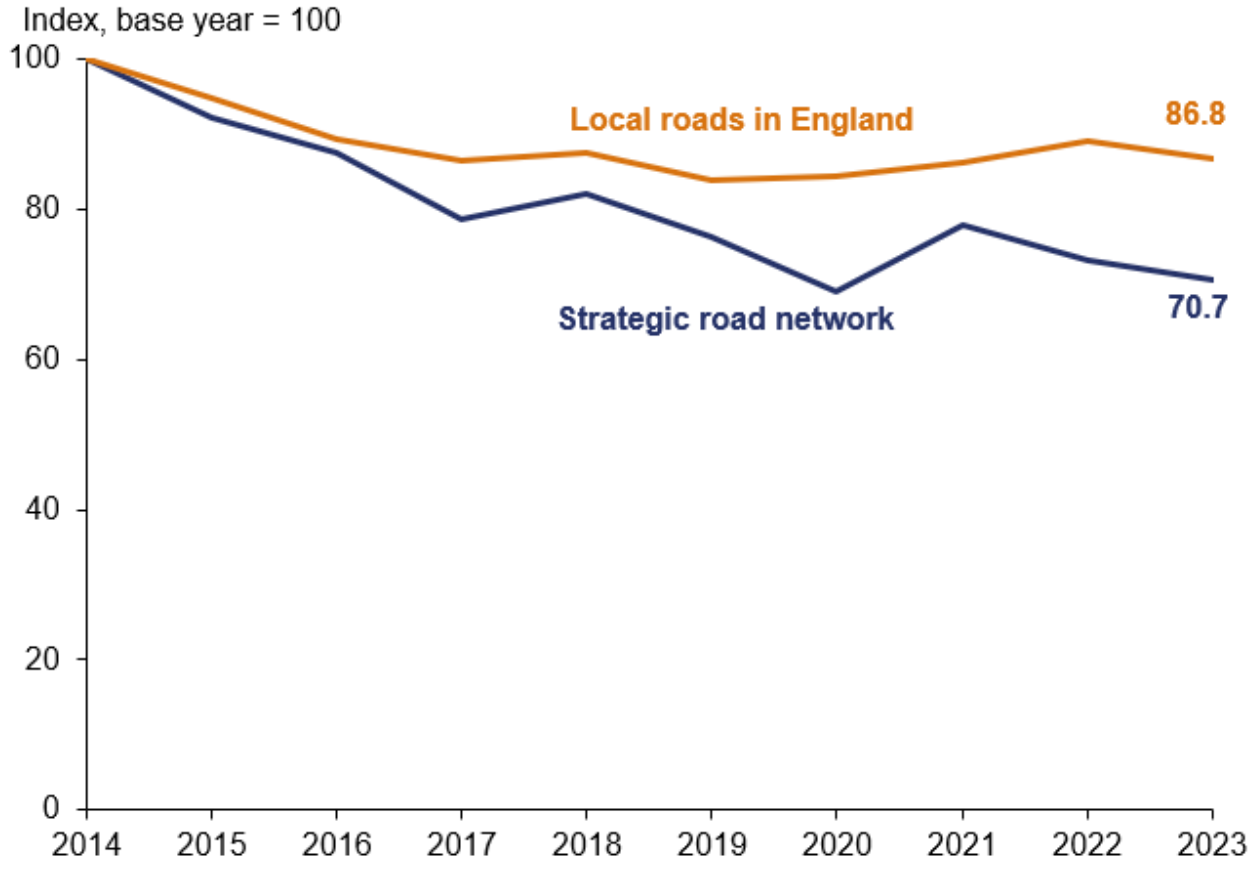
1.23 Casualty rates can be used to compare relative safety on the SRN to other road networks. In 2023, the KSI rate on the SRN (20.0 KSI casualties per billion vehicle miles travelled) was significantly lower than on local roads in England (130.3 KSI casualties per billion vehicle miles travelled).

1.24 The large difference in these rates reflects the different road types that make up each road network. The SRN has a much higher proportion of motorways and dual carriageways. Through separation of traffic, these offer an additional level of safety compared to the single carriageway roads that form much of the local road network. This limits our ability to use comparisons of casualty rates between the SRN and local roads to draw conclusions about National Highways' performance in improving safety on the SRN.

1.25 However, analysing trend data allows us to compare the rate of improvement on different networks over time. Figure 1.3, below, shows that KSI casualty rates have improved by more on the SRN than on local roads in England over the past ten years. While it is difficult to determine how much of this improvement is due to National Highways' actions, and how much is a result of external factors, this does provide some evidence on the effectiveness of the company's approach to improving safety on the SRN. An important factor that is likely to have contributed

to better safety outcomes on the SRN over the last 10 years is National Highways' higher level of funding compared to local highways authorities.

Figure 1.3 Killed or seriously injured (adjusted) casualty rates, strategic road network and local roads in England, indexed, 2014 to 2023



1.26 The latest data show that the SRN remains amongst the safest road networks in the world. Differences in how road types are classified, and in how road casualty data are collected, means it is difficult to directly compare safety on the SRN to road networks in other countries. However, analysis published by DfT highlights that, in 2023, based on a comparison of the number of road fatalities per million population, Great Britain is ranked third out of 33 countries.

Comparisons by road category and road user type

1.27 Casualty data for the SRN can be split by motorways and A-roads.

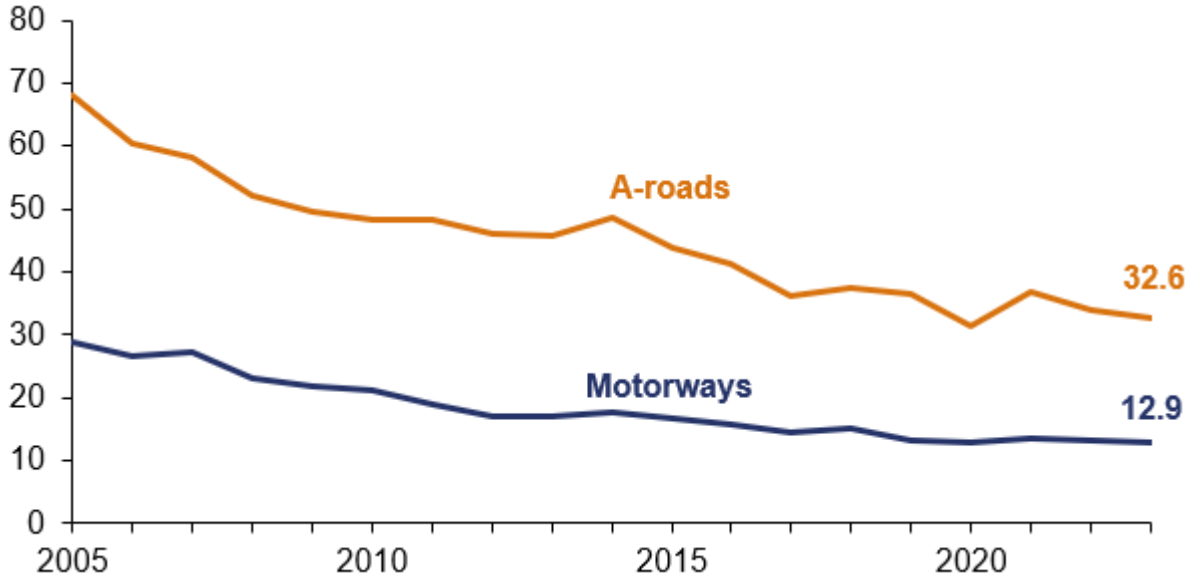
1.28 There were 793 deaths or serious injuries on National Highways' motorway network in 2023. This is a decrease of ten (1%) compared to 2022 and the lowest

total on record, excluding 2020 and 2021 when figures were affected by lower traffic levels during the pandemic.

1.29 On National Highways' A-roads, 1,120 people were killed or seriously injured in 2023. This is 16 (1%) fewer than in 2022 and the lowest total on record, excluding 2020 and 2021.

1.30 Figure 1.4 shows that the KSI casualty rate on SRN motorways in 2023 (12.9 KSI casualties per billion vehicle miles travelled) is lower than on SRN A-roads (32.6 KSI casualties per billion vehicle miles travelled).

Figure 1.4 Killed or seriously injured (adjusted) per billion vehicle miles travelled, strategic road network, by road type, 2005 to 2023



1.31 National Highways has undertaken more detailed analysis into the latest casualty data. Headlines findings from this work show a 14% increase in KSI casualties on single carriageway A-roads, and a 25% increase amongst elderly drivers (aged over 70).

1.32 National Highways' smart motorway stocktake fourth year progress report, published in March 2025, reports road casualty data up to 2022 for a more disaggregated set of road types, including distinguishing between conventional motorways and different types of smart motorway.

1.33 National Highways used this detailed analysis to support its development of the enhanced safety plan, which includes a focus on higher risk single-carriageway A-roads, and we expect the company's future plans to include actions relating to

older drivers. It is important that National Highways continues its detailed analysis of road casualty data so that the company can better understand trends on the SRN and use this intelligence to ensure that its actions are targeted in areas where they will have the greatest effect.

Performance indicators: improving safety for all

1.34 In the RIS2 performance specification, government specified a number of untargeted performance indicators (PIs). The safety PIs provide additional context to the main KPI and enable us to scrutinise more aspects of National Highways' performance as part of our monitoring.

PI: Total number of people killed or injured on the SRN

1.35 This PI reports the number of casualties of all severities, including 'slight injuries' that are excluded from the KPI.

1.36 In 2023, a total of 10,089 people were killed or injured on the SRN. This is a decrease of 317 (3%) compared to 2022. In line with the KSI casualty data reported for the KPI, this is the lowest on record, excluding 2020 and 2021 when figures were affected by lower traffic levels during the pandemic.

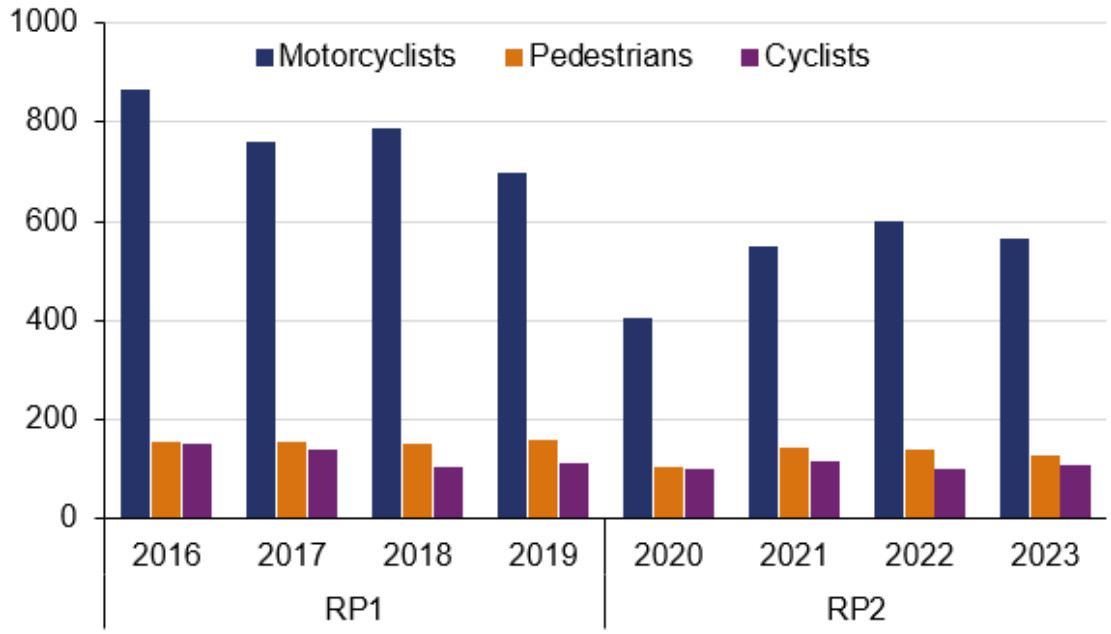
PI: Non-motorised and motorcyclist users killed or injured

1.37 In 2023, a total of 795 non-motorised and motorcyclist users were killed or injured on the SRN. This is a decrease of 39 (5%) compared to 2022. This is the lowest total for non-motorised and motorcyclist users on record, except for 2020, which was the year most affected by the pandemic.

1.38 The 795 non-motorised and motorcyclist casualties in 2023 were made up of:

- 565 motorcyclist casualties, which is 33 (6%) fewer than in 2022;
- 125 pedestrian casualties, which is 11 (8%) fewer than in 2022; and
- 105 cyclist casualties, which is five (5%) more than in 2022.

Figure 1.5 Non-motorised and motorcyclist users killed or injured, strategic road network, 2016 to 2023



1.39 National Highways' plans to improve overall road safety include actions specifically aimed at non-motorised and motorcyclist road users. In 2024, the company published a review of existing interventions and guidance on motorcycle safety which concludes that interventions tailored to different categories of motorcyclists are essential in approaching motorcycle safety. National Highways is looking to build on these findings with its Motorcycle training and Intervention Refinement and Evaluation report. The outcome of this project will evaluate and suggest refinements to the Bikertek campaign and other post-licensing motorcycle interventions.

1.40 As part of its longer-term plans to achieve zero harm, National Highways has a workstream looking at its approach to barrier upgrades, including additional protection for motorcyclists. This will review the deployment and replacement of vehicle restraint systems (barriers) to enhance the company's ability to protect vehicle occupants and motorcycle riders from the worst consequences of collisions, with a focus on single carriageway roads and older dual carriageways with higher risk junctions and gaps in central reservations.

PI: Number of injury collisions on the SRN

1.41 In 2023 a total of 6,577 collisions were recorded on the SRN that resulted in at least one injury of any severity. This is 194 (3%) fewer than in 2022 and the lowest total on record, excluding 2020 and 2021.

PI: Percentage of traffic using iRAP 3-star or above roads

1.42 The International Road Assessment Programme (iRAP) is a charity that works in partnership with National Highways and other roads authorities around the world to develop tools to measure all elements of a road's life cycle. This includes star ratings that provide an objective measure of the level of safety 'built-in' to the road for road users.

1.43 We have previously reported that the latest version of the iRAP model shows that 89% of journeys on the SRN are undertaken on roads that are rated 3-stars or above. This is unchanged from last year because a full iRAP survey of the SRN is carried out every five years. The latest survey started on 2 January 2025 and is expected to continue until March 2026, with data becoming available to National Highways from June 2026.

1.44 National Highways uses evidence from iRAP to inform safety interventions on the SRN. Progress that the company has made in how it uses iRAP in 2024 includes:

(a) developing a speed management module that works within its iRAP route review tool to consolidate speed related data to support operational decision making on safety interventions on the network. The company is delivering training in-house and will spend the first six months of 2025 embedding the use of the route review tool in its scheme development processes and governance.

(b) developing a future iRAP model, from which it will assess the relationship between star ratings and KSI casualties.

PI: Accident frequency rate for National Highways' staff and supply chain

1.45 National Highways has two PIs that measure the safety of workers. The company reports the accident frequency rate for its own employees, and for those working in its supply chain. We reported National Highways' performance in the year from April 2023 to March 2024 in our most recent annual assessment of the company's performance, published in July 2024.

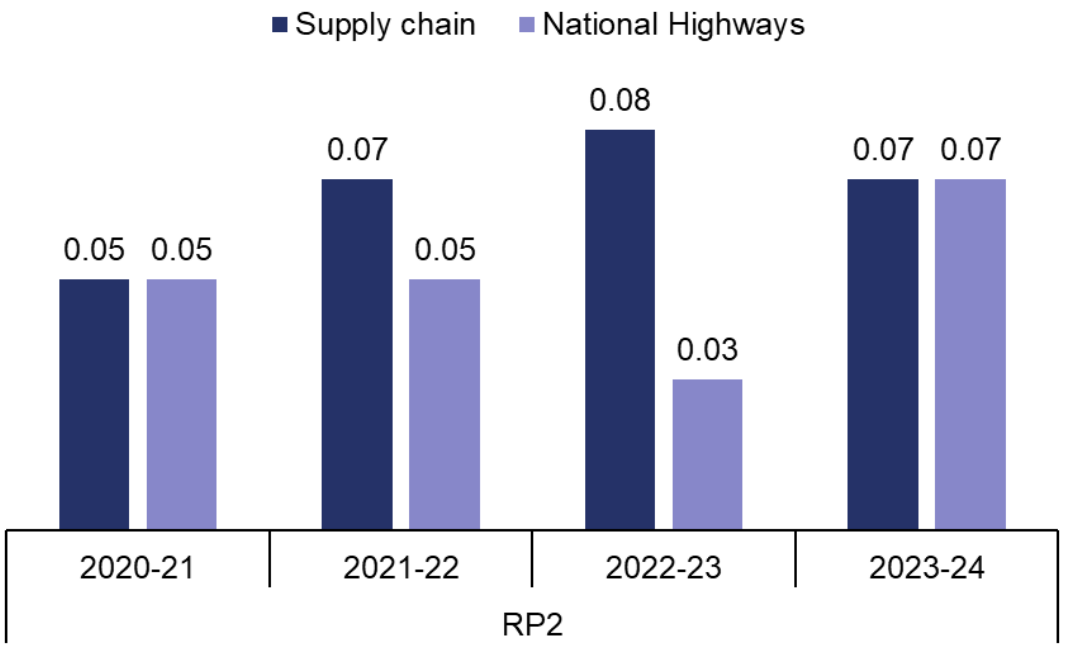
1.46 The data showed that, for National Highways' employees, there were 11 RIDDOR (Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 2013)

reportable incidents on the SRN in 2023-24. This is an accident frequency rate of 0.07 reportable incidents per 100,000 hours work, which is higher than in the previous year when the rate was 0.03 reportable incidents per 100,000 hours worked.

1.47 For National Highways' supply chain, there were 23 RIDDOR reportable incidents on the SRN in 2023-24. This is an accident frequency rate of 0.07 reportable incidents per 100,000 hours work, which is lower than in the previous year when the rate was 0.08 reportable incidents per 100,000 hours worked.

1.48 National Highways continues to work with other infrastructure operators to benchmark health and safety performance and share best practice to identify opportunities for improvement. We continue to monitor the company's progress in this area.

Figure 1.6 RIDDOR accident frequency rate per 100,000 hours worked, National Highways and supply chain staff, April 2020 to March 2024



1.49 We will report accident frequency rates for the final year of RP2 (April 2024 to March 2025) in our next annual assessment of National Highways' performance that is due to be published in July 2025.

Home Safe and Well

1.50 National Highways' approach to managing the health, safety and wellbeing of its employees and supply chain is set out in the company's Home Safe and Well strategy. Alongside work to improve capability and effective leadership the company has undertaken work to address physical and verbal abuse from road users suffered by its employees while performing their duties. National Highways has set out the actions it is taking to address such incidents, which are focussed across three main areas:

(a) **Operational practice**: as well as increasing the use of body worn and vehicle cameras, the company has undertaken work to monitor and improve driver behaviour with the aim of reducing risks from speeding and collisions. It has also utilised technology solutions (such as radars and incursion alarms) to further mitigate this risk.

(b) **Risk management:** this includes the company updating risk assessments and work instructions, incident reporting on near miss and actual incidents, with systems in place for post incident assessment and support for staff.

(c) **Worker development:** the company has rolled out training for working with customers and conflict resolution.

Conclusions and recommendations

1.51 The SRN remains one of the safest road networks in the world. In 2023, deaths and serious injuries continued to decrease. Casualties, and casualty rates, on the SRN are at their lowest ever level, excluding 2020 and 2021 when there was significantly less traffic using the network due to the pandemic.

1.52 National Highways has now achieved a 39% reduction in the number of KSI casualties compared to the 2005 to 2009 average baseline. At our request, the company developed, and is now delivering, an enhanced safety plan that aims to close the gap to its target of achieving a 50% reduction by the end of 2025.

1.53 We consider that in the final year of RP2 National Highways is doing everything that it reasonably can to reduce casualties on the SRN. However, it is improbable that the company will be able to achieve its target by the end of 2025.

1.54 We continue to hold National Highways to account for delivering its plans for improving safety on the SRN. This includes the actions set out in the company's 2024-25 delivery plan and its enhanced safety plan that, together, aim to support delivery of the safety KPI by reducing the number of KSI casualties on the SRN.

1.55 As we approach the end of RP2 it is important that National Highways continues to use its position in the sector to influence, and work closely with, other agencies to support its longer-term vision of zero harm on the SRN. The company has commissioned independent research and engaged stakeholders to assess and prioritise actions it could take to achieve this, including the achievability of zero harm by 2040. We expect the company to present its findings from this work in due course.

1.56 As we come to the end of the road period it is imperative that National Highways provides us with details of the actions that it took to improve safety at the start of RP2 and sets out the evidence it used to identify that these were the most effective interventions at the time. The company has agreed to provide this information to support our end of RP2 assessment.

2. Effectiveness and operation of the end-to-end safety systems on smart motorways

2.1 England's strategic road network (SRN) is made up of 4,555 miles of motorways and A-roads, of which 446 miles (9.8%) are smart motorways. Smart motorways use technologies and features not present on conventional motorways to control traffic and support road user safety. The three different types of smart motorway are described in Table 2.1.

2.2 In 2021, the Transport Select Committee's (TSC's) inquiry into the roll-out and safety of smart motorways made nine recommendations aimed at improving safety for road users. At the Department for Transport's (DfT's) request, ORR is leading on two of these recommendations.

2.3 This chapter sets out our latest findings in relation to recommendation 4, to assess the effectiveness of the safety systems in place on smart motorways. It specifically focuses on smart motorways that permanently operate with no hard shoulder, also known as all lane running (ALR) smart motorways. The main areas of focus are:

- the effect of the national emergency area retrofit (NEAR) programme in 2024;
- performance of stopped vehicle detection (SVD) technology; and
- availability of other operational technology.

Table 2.1 Types of smart motorway

Motorway type	Features
Controlled motorways	Controlled motorways add variable and mandatory speed limits to a conventional motorway to control the speed of traffic, while retaining a permanent hard shoulder. Overhead electronic signs display messages to drivers, such as warning of an incident ahead, slowing traffic approaching an incident, or closing lanes using a red X.
All lane running (ALR) motorways	ALR motorways apply the controlled motorway technology, permanently convert the hard shoulder as a running lane, and feature emergency areas to stop in an emergency. ALR motorways also have stopped vehicle detection technology.

Motorway type	Features
Dynamic hard shoulder (DHS) motorways	DHS motorways also apply the controlled motorway technology. The hard shoulder is selectively opened as a running lane during periods when there is a lower speed limit in force and electronic signs to guide drivers when it is safe to use. Emergency areas are installed as on ALR motorways.

2.4 Smart motorways use multiple interconnected systems and sensors to support free-flowing traffic and road user safety, as illustrated in figure 2.1. These include:

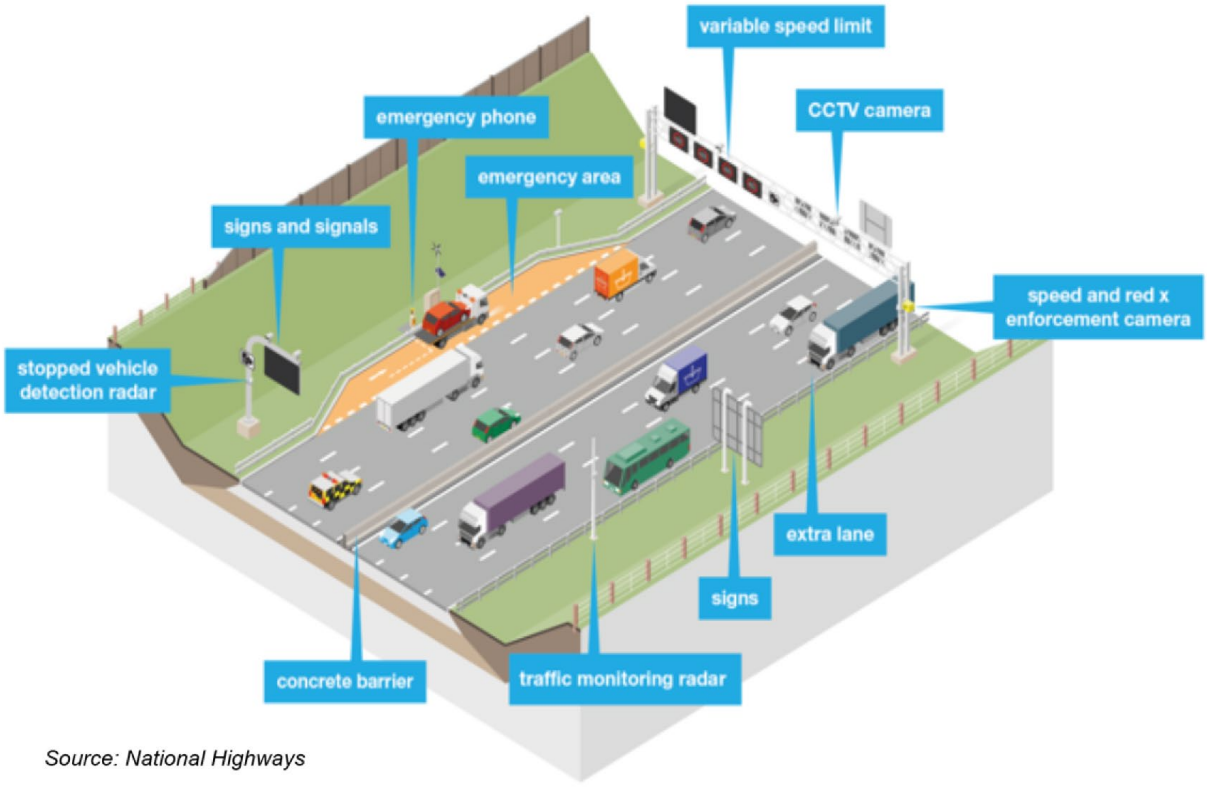
(a) emergency areas (on ALR and DHS motorways);

(b) technology to detect traffic and incidents, including CCTV, SVD and motorway incident detection automatic signalling (MIDAS);

(c) regional operations centres (ROCs) and outstations to support National Highways' response to incidents, and the traffic management systems to connect them to the network; and

(d) signs and signals to provide information to road users, including variable speed limits and lane closures ('Red X').

Figure 2.1 Infrastructure and technology on ALR smart motorways



Source: National Highways

2.5 Each component sits within the wider system, which is designed to ensure there is no over-reliance on a single feature. A more detailed description of these systems can be found in Annex B of our 2023 safety report.

2.6 It should be noted that extensive roadworks on the ALR smart motorway network during 2024 mean that there is less data to measure the performance and availability of safety technology on smart motorways than in previous years. The effect of this is discussed in more detail below.

The national emergency area retrofit (NEAR) programme

2.7 During 2024 and 2025, National Highways has progressed work to build an additional 151 emergency areas on ALR sections of smart motorway. This was in response to the TSC's recommendation to add emergency areas to existing ALR motorways to make them a maximum of 1,500 metres apart, decreasing to every 1,000 metres where physically possible.

2.8 This work is known as the national emergency area retrofit (NEAR) programme, which is planned to be completed by the end of March 2025. At the end of December 2024, National Highways had completed 56 new emergency areas, and we will report on delivery of the programme in our next annual assessment of National Highways' performance, to be published in July 2025. A full list of the NEAR schemes can be found in Annex A.

2.9 The NEAR programme has resulted in extensive roadworks on ALR motorways across the SRN. Since April 2024, up to 43% (117 miles) of the ALR smart motorway network has been affected by traffic management. During the roadworks, National Highways closes lane 1 (the 'inside lane') to protect the workforce and provide access to the work area.

2.10 At the same time, it is also necessary for National Highways to switch off much of the technology that is normally in place to support free-flowing traffic and road user safety, including SVD. This is because the barriers, construction vehicles and other equipment present during the work interferes with the technology. As a result, these roads do not operate as smart motorways while the roadworks are taking place.

2.11 National Highways has put mitigations in place to protect the safety of road users and workers during this installation of emergency areas. These include:

(a) reducing speed limits from 70 to 50 miles per hour;

(b) using wider cone spacing to enable road users to more easily access the closed lane in an emergency;

(c) dedicated 24/7 CCTV; and

(d) free vehicle recovery.

2.12 When the technology is turned off this has the effect of reducing the amount of data we can use to assess the performance and availability of safety systems on smart motorways.

Stopped vehicle detection (SVD) performance

2.13 National Highways' SVD system uses radar technology to detect stopped vehicles on ALR smart motorways. The company tests performance of SVD when the equipment is first commissioned, and then annually.

2.14 The testing process uses CCTV footage from each scheme to measure performance over a 24-hour period. When a vehicle is observed to have stopped on the CCTV footage, this is known as a stopped vehicle event. The response of the SVD system to each stopped vehicle event is then checked to determine whether the stopped vehicle event was correctly identified by the system. This information is used to calculate a 'detection rate' for each scheme.

2.15 Alerts generated by the SVD system are then checked to determine whether they relate to an observed stopped vehicle event on the CCTV footage. This information is used to calculate 'false discovery rates'.

2.16 The SVD testing process takes place retrospectively and does not affect the company's response to alerts in real time. The process for testing SVD performance in the most recent year is unchanged from 2023.

2.17 National Highways measures SVD performance at a national level against three key metrics:

(a) detection rates (the proportion of stopped vehicles correctly identified by SVD, target: >80%);

(b) false discovery rates (the proportion of SVD alerts that are not related to a stopped vehicle event, target: <15%); and

(c) average time to detect stopped vehicles (the elapsed time between a vehicle stopping and an SVD alert being generated, target: <20 seconds).

2.18 To ensure consistency with our previous reporting of SVD performance, our reporting also includes the percentage of vehicles detected within 20 seconds.

2.19 In 2024 National Highways provided SVD performance data for 12 schemes. This is less than the 21 schemes that we reported on in 2023 because the technology was switched off due to the NEAR programme.

2.20 National results are presented in table 2.2. This shows that, at a national level, SVD achieved its performance requirements in 2024. Overall performance levels are similar to those in 2023, although comparisons between years should be treated with caution due to fewer schemes being tested in 2024.

Table 2.2 SVD performance results, ALR smart motorways, 2024

Metric	Target	2023 results (21 schemes)	2024 results (12 schemes)
Detection rate	>80%	89%	86%
False discovery rate	<15%	6%	6%
Alert time average	<20 seconds	12.2 seconds	12.9 seconds

2.21 We also required National Highways to report on the percentage of stopped vehicles that were correctly detected within 20 seconds on the 12 schemes that were tested. This shows that, of all stopped vehicles detected, 91% were detected within 20 seconds, compared to 92% in 2023.

2.22 Previously we have reported SVD testing results at a regional level. However, the smaller number of schemes tested in 2024 has resulted in much smaller sample sizes for some regions. As a result, comparisons between regions, and with previous years, are less robust. Therefore, we have not included regional level results in this year's report.

2.23 Despite testing fewer schemes, the overall sample size of stopped vehicle events in 2024 (476 events) was only 16% less than in the previous year (564 events). This provides some confidence that, at a national level, SVD performance figures are comparable between the two years.

2.24 SVD performance data for each individual scheme that was tested in 2024 are set out in Annex B. These figures are published to provide transparency of National Highways' SVD testing results. However, performance data for individual schemes

should be treated with caution. These data represent a snapshot of performance over a 24-hour testing period, and the small sample sizes involved may not provide a reliable indication of longer-term SVD performance for an individual scheme. Where a performance metric has not been achieved for an individual scheme, National Highways has provided us with details of why this was the case and what actions it is taking to resolve any issues.

2.25 The results show that:

- four schemes did not meet the target for detection rates;
- the target for false discovery rates was not achieved by one scheme; and
- two schemes did not meet the target for average detection times.

2.26 Our analysis of the latest results identified two schemes where the same performance metric was not met in the two most recent rounds of annual testing, in 2023 and 2024. These schemes are: the M6 (J13-J15), where the detection rate was 74% in 2024 and 78% in 2023; and the M1 (J13-J16), where the detection rate was 69% in 2024 and 76% in 2023.

2.27 We asked National Highways to provide more information about performance at these locations. The company reported that both schemes were affected by individual asset faults when testing was undertaken in 2024, and this was also the case in 2023. It told us that the faults in 2023 and 2024 were addressed through established processes to identify and respond to issues relating to SVD technology and that these issues did not point to any wider underlying issue with the SVD system.

Progress against ORR's recommendations

2.28 Our previous annual safety assessment made several recommendations to National Highways relating to how the company measures SVD performance, and how it can use the data collected during testing to further optimise SVD performance.

2.29 These recommendations followed on from software fixes that National Highways implemented in 2023 to improve SVD performance after our safety report of 2022 identified that it was not meeting performance requirements. The recommendations can be categorised in three main areas:

(1) review and development of SVD performance methodology;

(2) expanding analysis of data from stopped vehicle events, including unverified events; and

(3) use of data to optimise detection performance.

Review and development of SVD performance methodology

2.30 When National Highways implemented software fixes to improve SVD performance in 2023, the company also made changes to the methodology it uses for performance testing. These changes were discussed in detail in our previous safety report, where we recommended that National Highways should review and clarify the methodology and targets that it uses for measuring SVD performance. We also recommended that, following this review, the company should set out a clearly defined methodology for testing SVD performance that allows for consistent year on year comparisons. The methodology for testing SVD performance in 2024 is the same as in 2023, which is in-line with our recommendation.

2.31 In response to our recommendations, National Highways has undertaken two key projects relating to the SVD performance testing methodology. In the first of these projects, the company commissioned an independent review of how SVD system performance is measured and verified. This work was split into three key phases:

(1) Creating an idealised methodology for measuring performance that was unaffected by real world constraints.

(2) Applying real world restrictions to this methodology (e.g. recognising that it is not possible to close motorways to undertake SVD testing and that this can only be done in a live environment).

(3) Comparing National Highways' current methodology to the independent methodologies from the earlier phases of the work.

2.32 The review identified opportunities for National Highways to improve how it measures SVD performance. This included reviewing the frequency of testing, the use of automation in testing, and to consider optimising sample sizes by increasing the duration of testing on schemes with historically lower volume of stopped vehicles.

2.33 The independent review concluded that National Highways' methodology for measuring SVD performance is appropriate, stating that: 'The methodology used by National Highways has been found to be capable and statistically meaningful for the monitoring of the key performance metrics of the SVD System.'

2.34 The second project that National Highways progressed in 2024 is a multi-year project to develop and test SVD performance on ALR motorways. The proposed improvements focus on the collection and categorisation of unverified data.

2.35 This work also identified other actions the company could take to improve confidence in the current SVD system. It found that the naming conventions and language used in relation to SVD performance assessments was inconsistent. In response, National Highways has adopted industry standard best practice language to inform its assessment of SVD detection performance in 2024. Key changes are:

(a) *Ground truthing*, which had previously been used to describe the process of testing SVD performance, has been renamed *performance monitoring and reporting (PMR)*;

(b) *False detection rate* is now referred to as the *false discovery rate*. This is an industry standard measure to describe stopped vehicle alerts that are not related to a stopped vehicle event; and

(c) The definition of *alerts* and *alarms* has been updated to reflect industry best practice. An *alert* refers to a stopped vehicle identified by the SVD radar and notified to National Highways. Once in National Highways' system, an *alarm* is the notification of a stopped vehicle presented to an operator.

Expand analysis of data from stopped vehicle events including unverified events

2.36 In our last annual safety report we highlighted that that a high proportion of stopped vehicle events were classed as 'unverified' during SVD performance testing. An unverified event is when, during SVD testing, it is not possible to use the recorded CCTV footage to verify all the metrics that are measured in a stopped vehicle event (e.g. the start time may not be captured because the camera was pointing in the wrong direction).This does not affect National Highways' response to incidents, where operators are able to use technology, such as CCTV, to actively monitor the network in real time.

2.37 The high proportion of unverified events means that there is a lot of data collected by National Highways during testing that is not being used to better understand SVD performance. Therefore, we recommended that the company should review how it collects and analyses information about unverified events and use this to inform further performance improvements.

2.38 This year, National Highways used CCTV footage of unverified events from five schemes from 2023 performance testing, and all 12 schemes tested in 2024, to

expand its analysis of these events. The company's analysis found similar detection rates for unverified events and verified events. This provides further confidence that the SVD testing results, which show that the system is meeting performance requirements at a national level, are representative of all stopped vehicle events – not just those that are classed as verified. A summary of the data that supports this analysis can be found at Annex C.

2.39 Despite National Highways' progress in this area, a large number of stopped vehicle events remain unverified. The company continues to work to identify solutions to this issue and in 2024 it ran an innovation competition that aimed to provide solutions to issues such as visibility and CCTV coverage that limit the amount of usable information collected during testing. It is important that the company continues to identify opportunities to increase the amount of data it can use to better understand SVD performance.

Use of data to optimise detection performance

2.40 In our previous safety report, we recommended that National Highways should improve its understanding of the circumstances and locations where stopped vehicle events occur to inform the company's ongoing work to optimise and enhance SVD performance.

2.41 In May 2024, National Highways completed a project to evaluate the duration of stopped vehicle events. This project used data from 1,089 stopped vehicle events that were gathered during 2023 SVD performance testing.

2.42 This showed that:

(a) The majority (77%) of stopped vehicle events were in an emergency area (EA).

(b) More stops were for non-emergency reasons (41%) than emergencies (35%). The reason for the remaining 24% was unknown.

(c) The proportion of emergency stops was higher on live lanes (64%) than in EAs (42%).

(d) 76% of all stopped vehicle events lasted five minutes or less, with an average duration of 2 minutes. Of these, 84% were for non-emergencies.

(e) 25% of stopped vehicle events in places of relative safety involved "injudicious manoeuvres" (defined as an entrance or exit to EA that

negatively affects the safety of other road users, such as a vehicle swerving into an EA from lane 2).

2.43 By better understanding the circumstances of stopped vehicle events on ALR smart motorways, we expect National Highways to develop interventions that are as effective as possible in addressing the causes of these events.

Wider SVD performance

Alternatives SVD technologies

2.44 We previously recommended that, in the longer term, National Highways should consider potential enhancements to SVD technology to ensure the systems for detecting stopped vehicles are as efficient and accurate as possible.

2.45 In our last safety assessment, we reported that National Highways had seen positive initial results from its CCTV analytics project, which aims to develop the capability to automatically detect stopped vehicles from CCTV footage during performance testing. Since then, the company has conducted successful trials on footage from the M6. It is currently undertaking further analysis of the results to fully understand the accuracy and reliability of the technology before it can consider its potential for wider use alongside existing technology.

2.46 National Highways has told us it will use insights from the video analytics testing, alongside solutions identified through its hazard protection innovation competition, to inform future decisions on how the company can use new technology to maximise the effectiveness of SVD in supporting road user safety on ALR motorways. We will continue to work with the company to track progress in this area in 2025.

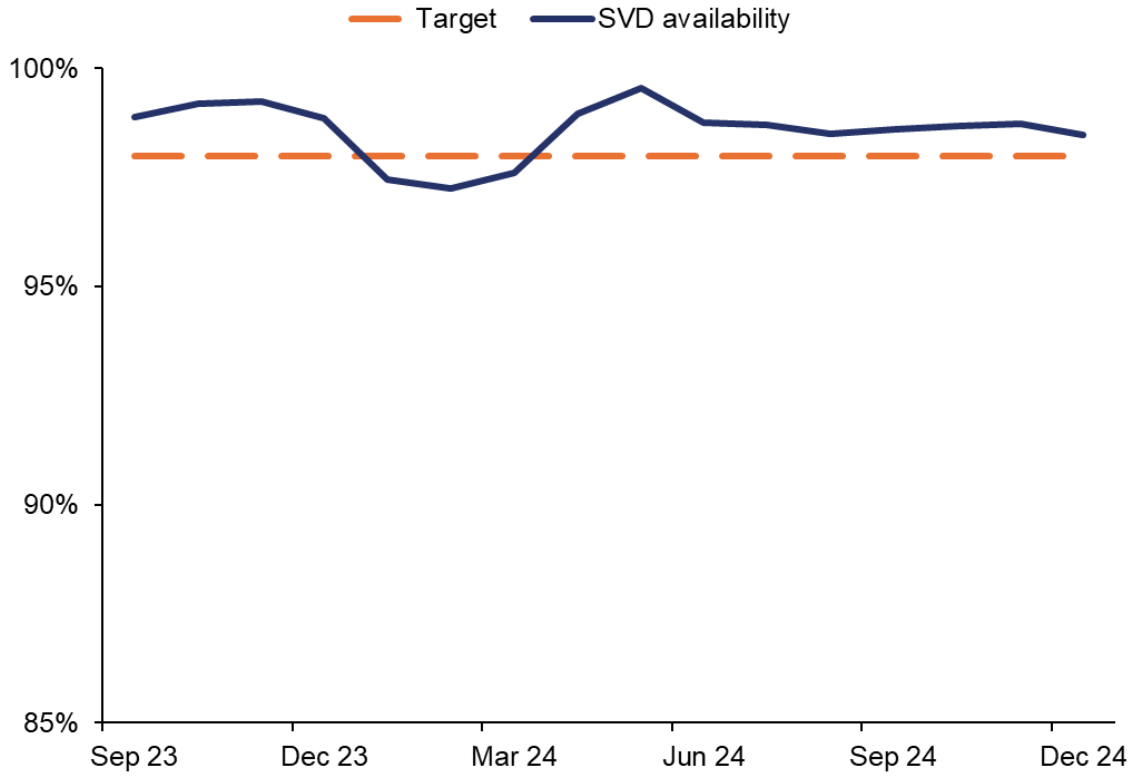
Stopped vehicle detection (SVD) availability

2.47 National Highways has an internal target for SVD to be available for use 98% of the time. ‘Available for use’ means that the system is functioning and unaffected by faults or power or technology outages. This is separate to the company’s aim that technology assets across the entire SRN are available 95% of the time. We report against this performance indicator in our annual assessment of National Highways’ performance.

2.48 In 2024, the average availability score for SVD was 98%. This compares to 99% in 2023. As detailed above, the number of SVD assets included within this figure during 2024 was affected by the NEAR programme and therefore comparisons between years should be treated with caution.

2.49 Figure 2.2, below, shows SVD availability during 2024. The rolling annual average remained at National Highways' target of 98% throughout the year. The company has explained that the dip in performance in the early part of 2024 is likely to be a result of preparations for construction beginning on the NEAR programme, which affected asset availability.

Figure 2.2 SVD availability on ALR smart motorways, September 2023 to December 2024



2.50 We continue to closely monitor SVD performance as schemes that were affected by NEAR come back online and National Highways is able to reinstate testing and reporting on these schemes.

SVD Coverage

2.51 In our previous annual safety assessment, we reported that National Highways was meeting the requirement that at least 95% of the ALR motorway network is covered by SVD. The company should provide an update on this requirement following the NEAR programme, where additional technology, including SVD radars is being added.

2.52 We previously highlighted that National Highways had no robust system for measuring changes in SVD coverage over time (for instance to identify where it is

affected by vegetation growth). We therefore recommended that the company should review its process for monitoring SVD coverage to ensure that the required 95% coverage level is maintained.

2.53 During 2024 National Highways started work to identify how it can better assess changes in SVD coverage. This includes when SVD is installed or relocated, or where other changes to the roadside have occurred, such as other technology installations or temporary roadworks. The company is currently trialling the use of existing tools that can report data on its requirement to achieve 95% coverage, and we will monitor its progress in 2025.

Assessment of risk reduction

2.54 National Highways' SVD safety risk assessment, undertaken in 2022, concluded that the overall risk associated with a vehicle stopped in a live lane on an ALR motorway is reduced by 51.8% compared to the risk without SVD. Following the software fixes that the company implemented to SVD technology in 2023, we recommended that it should use data from 2023 SVD testing to understand what effect the improvements had on the overall risk assessment.

2.55 National Highways undertook this work in 2024. This showed that, following the improvements that were made to SVD in 2023, nationally, the overall risk associated with a vehicle stopped in a live lane reduces by 60.5% compared to the risks without SVD. The company repeated this exercise using data from the 12 schemes that it tested in 2024. This showed that the risk associated with stopping in a live lane was reduced by 57.8%. The latest figure should be treated with caution due to the smaller number of schemes that were included in testing.

Operational Technology performance

2.56 Operational Technology (OpTech) describes the technology that enables National Highways to operate and monitor the SRN. It can be found at the roadside and in the company's ROCs.

2.57 OpTech includes the CCTV cameras, radars, signs and signals that form an important part of the end-to-end safety system on ALR smart motorways. The technology enables National Highways to detect and respond to incidents, which contributes to better safety outcomes for road users.

2.58 In 2022 we reported that OpTech assets on ALR motorways were not meeting the wider technology availability target of 95% that National Highways had set itself.

As a result, the company committed £105 million to improve OpTech on ALR motorways through its modernisation and refresh programme.

2.59 National Highways' modernisation and refresh programme aims to achieve average availability of 97% by the end of RP2 for four key asset types on ALR motorways:

(a) motorway Incident Detection and Automatic Signalling (MIDAS);

(b) variable message signs (VMS, also known as signs);

(c) signals (speed and lane control signals); and

(d) CCTV cameras.

2.60 Extensive roadworks on ALR motorways as part of the NEAR programme means that National Highways turned off many of its OpTech assets on these roads during 2024, and the early part of 2025. The resulting lack of robust data means that we are unable to report on the availability of OpTech for the full ALR motorway network.

2.61 However, this report does include information on how many OpTech assets National Highways has upgraded, and how this compares to the company's original plans. It also includes data for OpTech availability on the sub-set of ALR motorways that were unaffected by the NEAR programme.

Delivery of modernisation and refresh programme

2.62 Figure 2.3, below, shows the number of OpTech assets that National Highways has upgraded on ALR motorways as part of its modernisation and refresh programme.

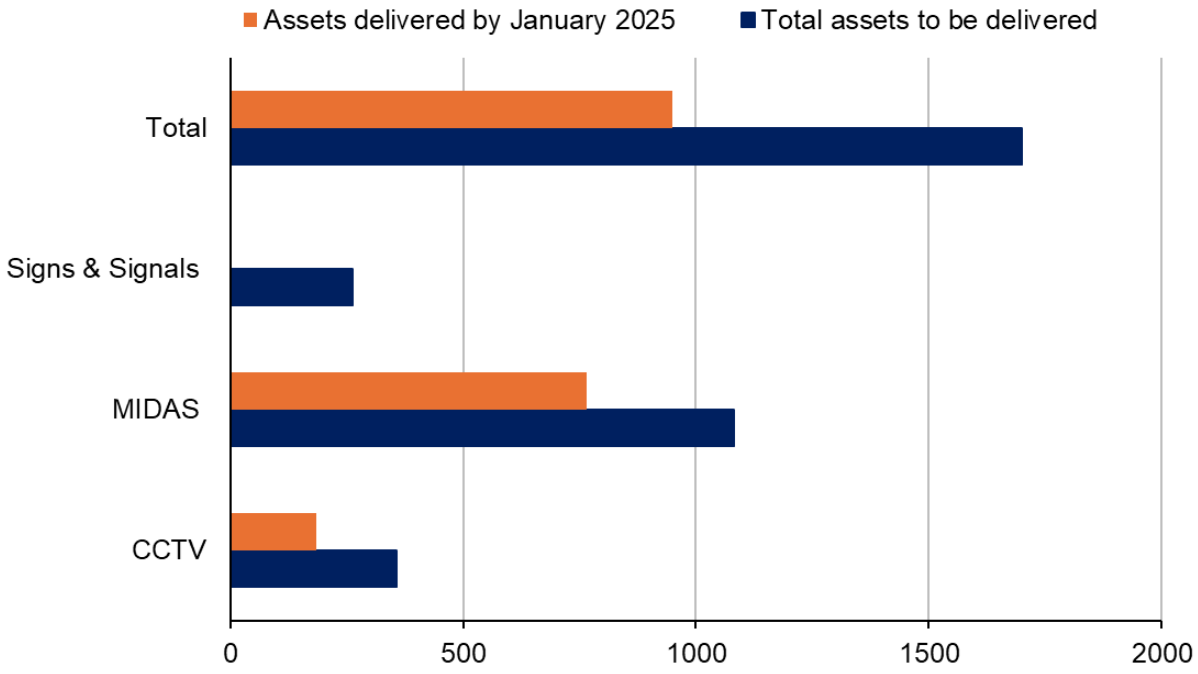
2.63 At the end of January 2025, National Highways had upgraded 949 OpTech assets. This is 56% of the assets that the company planned to deliver as part of this programme, with a further 580 expected by the end of March 2025.

2.64 The latest information provided by National Highways shows that it is on track to upgrade 90% of the assets in its plan by the end of March 2025. The company expects to fully complete its work to upgrade CCTV and MIDAS equipment by the end of March 2025. Work to upgrade the remaining signs and signals assets in the plan is now due to complete in the second half of 2025. We will continue to hold the company to account for completing this work during 2025.

2.65 We challenged National Highways on the reasons why its work to upgrade all signs and signals assets will not be complete by the end of March 2025. The company set out a number of reasons for this, including challenges in ensuring the new technology worked well with existing systems, and difficulties in carrying out the work at the same location as other major roadworks, such as the NEAR programme.

2.66 We asked National Highways to demonstrate what lessons it had learnt from this programme and how these would help ensure more efficient delivery of technology in the future. The company told us it is using learning from the programme to develop a more standardised approach to design and installation across the network, and improve the data it holds on assets. It is also working with the supply chain to increase installation capacity. We will monitor progress of this work in 2025.

Figure 2.3 Number of OpTech assets delivered against plan, position at end of January 2025

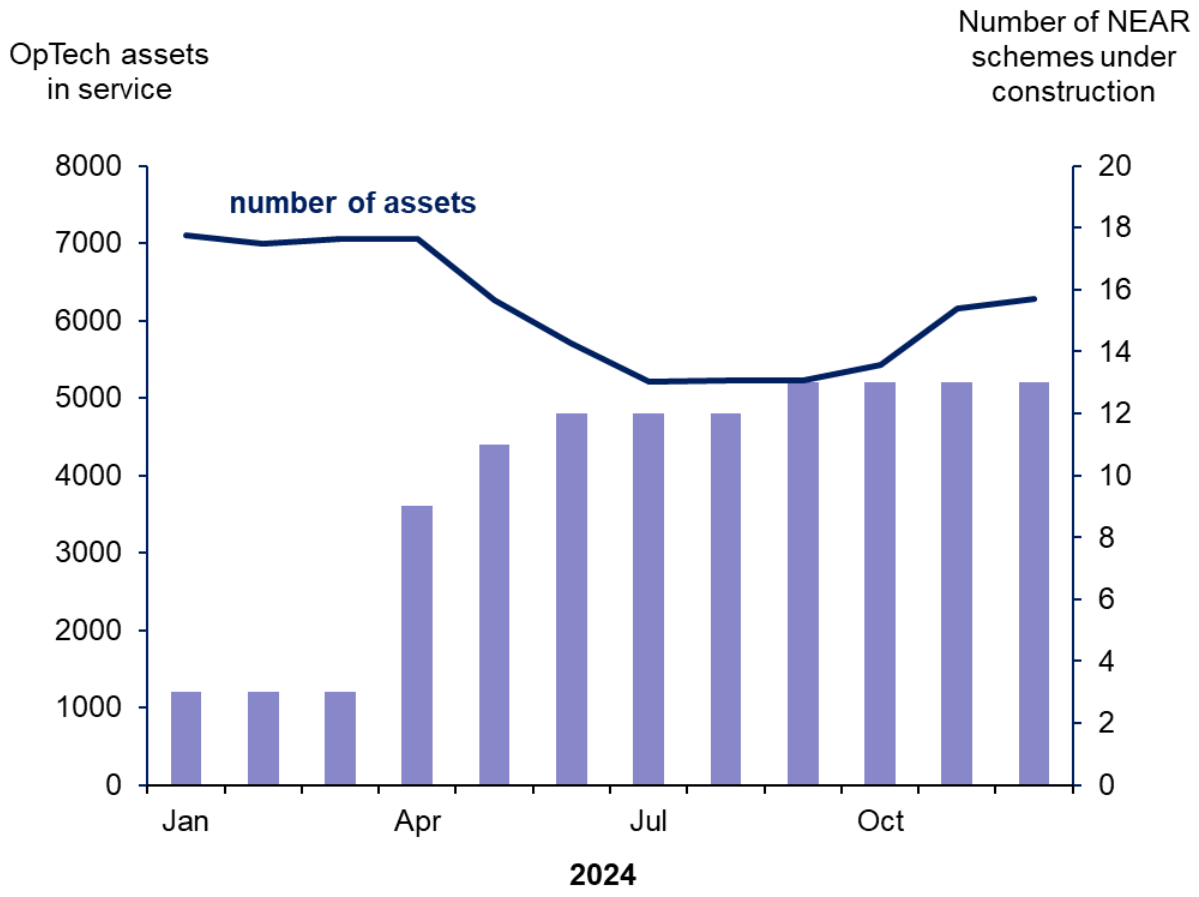


OpTech availability

2.67 The modernisation and refresh programme is underway on 21 ALR smart motorways. Across 13 schemes, this work has taken place in parallel with the NEAR programme. Up to 27% of assets have been switched off during NEAR roadworks, which means we are unable to present availability data for all ALR

motorways. Figure 2.4 below illustrates how the NEAR programme has affected the number of OpTech assets in operation on ALR motorways.

Figure 2.4 OpTech assets in service (including CCTV, Signs, Signals and MIDAS) and NEAR schemes under construction, ALR smart motorways, 2024

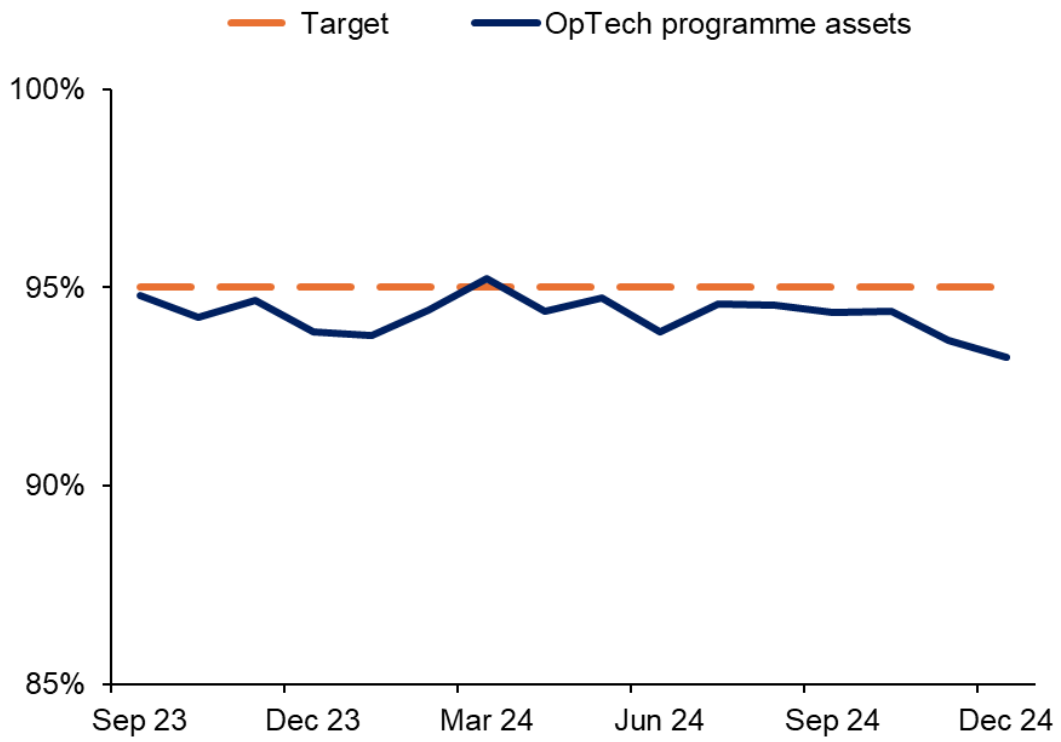


2.68 OpTech availability is measured by the percentage of time that assets (such as CCTV and SVD) are online and available for use, and not subject to any faults or outages.

2.69 Figure 2.5, below, shows the overall availability of the four asset types that are being upgraded as part of the modernisation and refresh programme. It does not include data for assets that have been switched off during NEAR. It shows that average availability is below National Highways' internal target that, at a national level, technology should be available 95% of the time. However, as discussed above, latest performance figures against the national level target should be treated with caution due to large number of OpTech assets that have been switched off during the NEAR programme. It will not be possible to fully assess whether National Highways has been successful in delivering its ambition of 97%

availability until the first half of 2025-26, when it is due to complete the modernisation and refresh programme. We will provide an update in our next annual safety report.

Figure 2.5 OpTech availability on ALR smart motorways, September 2023 to December 2024



2.70 National Highways also reports data on the performance and availability of other OpTech assets on ALR motorways that are not part of the modernisation and refresh programme. This includes enforcement cameras, for which we have previously reported availability data.

2.71 These cameras (which are used to enforce variable speed limits and 'Red-X' compliance on smart motorways) are also affected by the NEAR programme, which again means it is not possible to report availability data for them on all ALR motorways during 2024. Data from sections of ALR motorways that are unaffected by the NEAR programme show that availability of enforcement cameras was 98% in 2024.

Outages

2.72 OpTech can be classed as unavailable for various reasons, including damaged equipment and power or system outages. Unlike faults with individual pieces of equipment, power or system outages can affect multiple assets at the same time.

This section of the report considers these outages in more detail, including their duration and frequency on the SRN.

2.73 Power outages are normally the result of actions taken by the electricity distribution network operator (DNO). System outages are when technology is unavailable due to National Highways' own systems undergoing maintenance or experiencing a fault that affects more than one asset. Both types of outage may be categorised as planned or unplanned.

Table 2.3: Description of outages

	Type	
Category	**Power**	**System**
Planned	Scheduled power supply outages that can affect systems and assets. While recorded as planned outages, the DNO is not required to notify customers on an unmetered supply.	Planned upgrades or necessary maintenance of key National Highways' operational technology systems. These activities can affect a range of systems and asset types.
Unplanned	Unexpected power supply outages that can affect systems and assets.	Unplanned outages affecting National Highways' operational technology system or affecting multiple assets.

2.74 All types and categories of outage are included in National Highways' overall OpTech availability figures. For example, where we reported 98% SVD availability in 2024, the reasons for the remaining 2% will include a combination of outages and other reasons for unavailability, such as equipment faults.

2.75 Power and system outages can affect multiple assets on the same part of the network, at the same time. This could affect road user safety more significantly than isolated faults to individual pieces of equipment. Therefore, we asked National Highways to provide us with more information about outages on ALR motorways so we could understand the scale and frequency of these outages, and what the company is doing to address them. A key finding from the evidence provided is that there is a wide range in the scale and significance of outages, with many affecting very small numbers of technology assets with little or no effect on

road users. Other outages are more widespread, requiring National Highways to take mitigation measures to protect road user safety.

2.76 Data provided by the company shows that in 2024 there were 304 outages on smart motorways, including 266 on ALR smart motorways. The data show the type, category and duration of the outage and the types of assets affected but does not include information about how many assets were affected. Of the 266 outages:

(a) 67% were unplanned (33% planned);

(b) 55% were power outages (45% system outages);

(c) The average (mean) duration was 12 hours 41 minutes (the median duration was 4 hours 6 minutes). The large difference between the average and median outage duration reflects a small number of very long outages;

(d) 25 outages lasted longer than 24 hours (9.4% of all outages) and 76 outages lasted 2 hours or less (28.6% of all outages);

2.77 To better demonstrate the number and duration of outages, we examined one month of outages in greater detail. April 2024 had the highest number of outages, with 37 recorded in total. Figure 2.6, below, shows the distribution of outages by duration. The median outage duration in April was 2.5 hours, with 17 out of the 37 outages (or 46%) lasting less than two hours.

2.78 In addition, we looked at the types and categories of outages in combination. Figure 2.7, also below, sets out the number of outages in each of the four areas. It shows that unplanned power outages make up 104 (39%) out of the 266 outages on ALR smart motorways in 2024, followed by 73 (27%) unplanned system outages.

Figure 2.6 Number of outages on ALR smart motorways by duration, April 2024

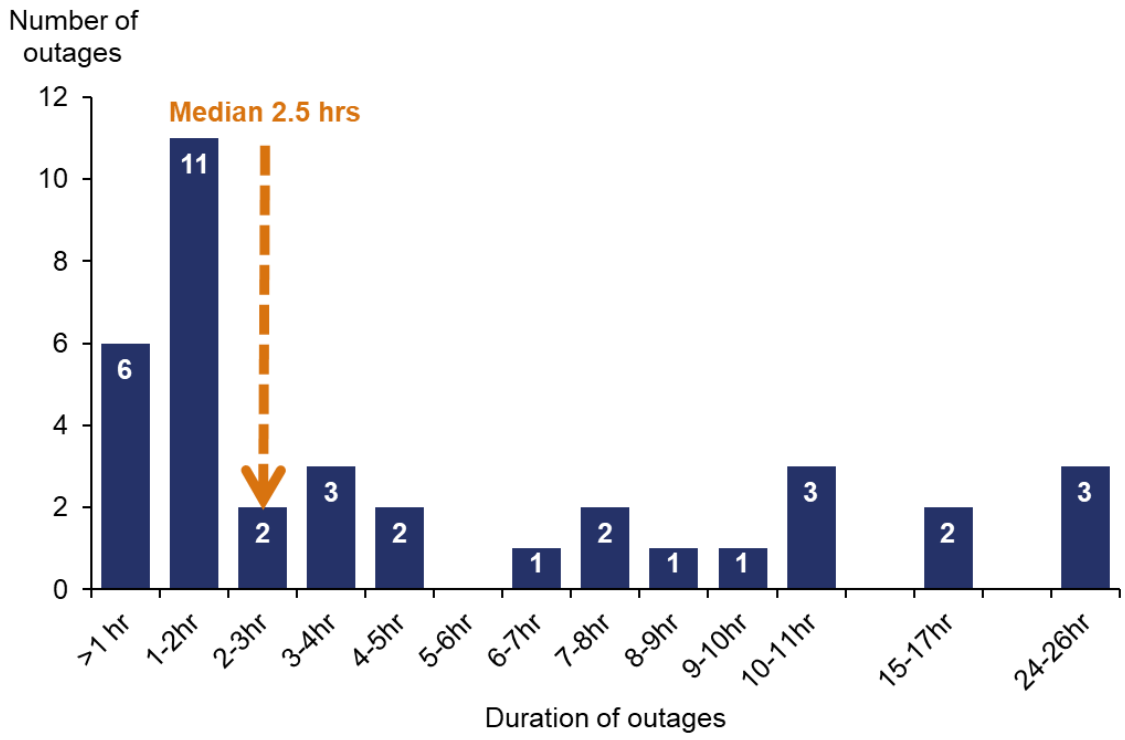
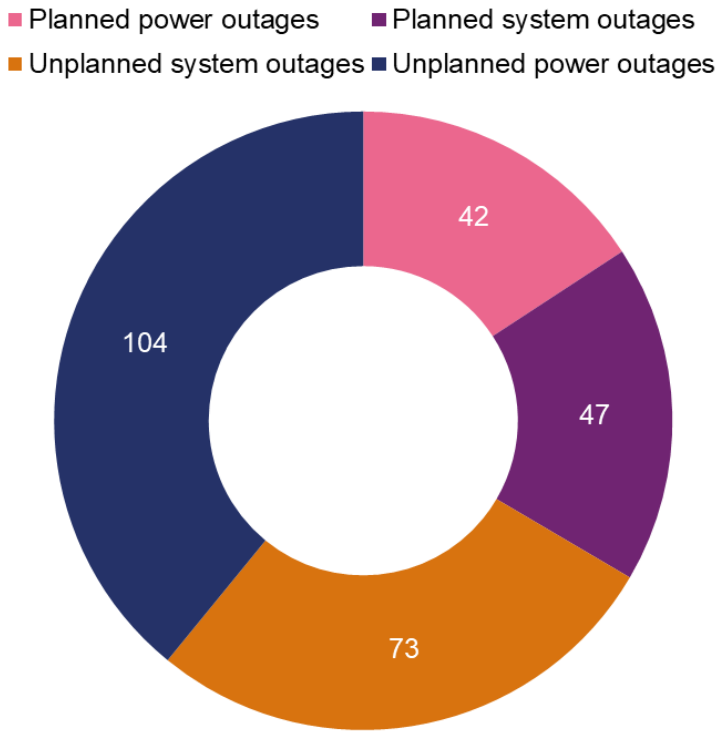


Figure 2.7 Number of outages (by type and category combined) affecting ALR smart motorways, 2024



Outage case studies from National Highways

2.79 To understand more about the effect of outages on road users, we asked National Highways to provide more detail in a sample of case studies. The sample we selected covered each type and category of outage (power and system, planned and unplanned). It also included different regions and the longest duration outage. The outages we selected are summarised in the table below:

Table 2.4 Outage case studies overview table

Date	Location	Duration	Category	Type
3 October 2023	M6 J18-J19	6 days	Planned	Power
2 December 2023	M5 J6	3 days, 11 hours 43 minutes	Unplanned	Power
13 January 2024	National	7 hours 5 minutes	Planned	System
13 January 2024	East Region	7 hours 58 minutes	Unplanned	System
13 January 2024	M1 J13-J16	1 hour 42 minutes	Unplanned	System
13 January 2024	M1 J16-J17	1 day, 2 hours 51 minutes	Unplanned	Power
7 August 2024	M62 J10-J11	28 days, 8 hours 4 minutes	Unplanned	System

2.80 The information provided by National Highways showed that the circumstances of each outage were unique, and each required a different response. The company has a well-documented set of mitigation measures in place for responding to outages. These are deployed on a case-by-case basis, depending on the nature of the outage, and consider factors like time of day, location, severity and traffic conditions. Communication of outages is also dependent on these factors, and the company can include traffic updates on its website and, in the case of planned outages, update road users via social media.

2.81 A description of each case study is included in Annex E. Some key findings are summarised below:

(a) The 6-day outage on the M6 J18-J19 in October 2023 was a planned power outage affecting the local area that National Highways was notified about in advance. Although this outage was included in the company's outage log, it did not affect any assets on the SRN and therefore had no effect on road users. It is appropriate that National Highways collects information about outages such as this so it can plan mitigations. However, to build a better understanding of the effect that outages have on road users it is important that the company improves its ability to distinguish between this type of outage and those that do affect road users in the data it collects.

(b) Several of the case studies showed that the total duration of an outage reported by National Highways did not give a clear indication of the number of assets affected, or for how long. For example, the company reported that the outage on the M5 lasted over three days. However, very few assets were affected for this length of time as power was restored to all but three individual assets in under 11 hours. Other case studies showed that small numbers of assets were affected for the full duration of an outage. In the case of the outage on the M1 on 13 January, 13 to 15 (around 4%) of the 375 assets on this section of road were affected. This makes it difficult to use the data collected about outages to draw conclusions about the effect on road users without further investigation.

2.82 The case studies show that the cause, scale, and effect of each outage is different. In each case National Highways has demonstrated that it puts in place plans to mitigate the effect of outages on road users, including reducing speed limits, additional traffic patrols and setting signs, and that it records the number and duration of these outages. However, the company is not able to systematically measure the effect of these outages on road users. Currently, it is only possible to gather this information by considering outages on a case-by-case basis, as we have done through the case studies. By improving its ability to collect this type of data, the company will be better able to identify and understand trends that will further improve the timeliness and effectiveness of the solutions it implements.

2.83 It is important that National Highways continues to develop its work to improve its ability to collect and interrogate data on outages. We will continue to work closely with the company to monitor progress during 2025.

Power outage project

2.84 As shown in Figure 2.7, unplanned power outages are the most common cause of OpTech outages, accounting for 39% of all events.

2.85 To address this issue, National Highways has increased its engagement with DNOs to develop better awareness of power outages that affect the SRN.

2.86 National Highways identified that a large proportion of its power supplies on ALR motorways were unmetered. Unmetered supplies contribute to the unpredictability of OpTech outages because DNOs are not required to inform the company when its power supply will be affected by the DNO's actions. To address this, National Highways is delivering a project to install more electricity metering supply points on smart motorways.

2.87 By moving to a metered power supply, National Highways will be better able to manage power outages by pinpointing the location of any disruption from planned and unplanned outages. This change will also require the DNO to notify the company of any planned outages. National Highways will also be able to work with the DNO to ensure it is aware of high priority sections of the network.

2.88 The first stage of this project was for National Highways to identify locations on the SRN where meter installations are required. At the end of January 2025, National Highways had completed 1,427 out of 1,445 planned surveys.

2.89 Of the 1,427 sites surveyed:

(a) 617 (43%) were already metered and details shared with relevant DNOs;

(b) 204 (14%) fall into other categories where installation is currently restricted due to access; for example vegetation clearance is required; these are issues that the company is working to resolve.

(c) 149 (10%) apply to sites that show there was either no meter present, or connection is not possible; for example duplicate meters and meters housed in cabinets that do not supply operational technology.

(d) 457 (32%) sites were identified as a location where a meter can be installed.

2.90 Of the 457 sites, National Highways had installed 341 meters by the end of January 2025. Of the remaining 116 sites, the company expects to install meters at least half of these by the end of March 2025, and complete the remainder later in 2025.

2.91 National Highways has provided additional detail on the work it is undertaking to resolve sites where installation is not currently possible. We continue to track progress of this work to improve OpTech availability by increasing the proportion

of metered power supplies on the SRN, and we will report on this in our next safety report.

Technology fault resolution

2.92 In 2023 we reported fault resolution data for SVD radars on ALR motorways. We are working with National Highways to expand this to include fault resolution data for all OpTech assets on these roads. The company has not yet been able to provide this but has told us that it is currently working to improve its ability to report more detailed data in this area. National Highways must develop a robust and clearly documented methodology for reporting fault data for OpTech on ALR smart motorways, ensuring it is capable of effectively combining relevant data sources so that it can report these data in future years. We will monitor and report on progress in 2025.

Conclusions and recommendations

2.93 In 2024, less data were available to measure the performance and availability of safety systems on smart motorways. This is due to the NEAR programme causing many OpTech assets to be switched off while National Highways worked to add an additional 151 emergency areas on ALR smart motorways.

2.94 The data that are available show that, at a national level, SVD technology continues to meet the performance levels set by National Highways. The company has also made progress on recommendations that we made in 2023 in relation to setting out a clearly defined methodology, and making better use of the data it collects, as part of SVD testing to inform future performance improvements.

2.95 National Highways has also made progress with its work to develop video analytics, which would enable the company to increase the effectiveness of its testing process by automatically detecting stopped vehicles from CCTV footage. We will continue to monitor progress with this work in 2025.

2.96 National Highways has progressed its modernisation and refresh programme, which aims to improve average availability of wider OpTech assets on ALR motorways to 97% by the end of March 2025. However, the lack of data, due to the NEAR programme, means that more time is required before we can assess how effective this programme has been. The company should report progress against its target following the conclusion of both the NEAR programme and the modernisation and refresh programme. We will continue to hold it to account for delivering the expected benefits in this area and we will report on this in our next safety report.

2.97 This year, National Highways has provided new data and information relating to technology outages on smart motorways. Case study evidence provided by the company shows that the effect of technology outages on road users is often limited. National Highways has demonstrated that it has pre-planned actions in place to mitigate the effect of outages on road users. It is positive that it is already taking action to reduce the number of power outages on ALR smart motorways by working more closely with DNOs and moving to metered electricity supplies in 2025.

2.98 National Highways is able to demonstrate the frequency and duration of technology outages, but the company needs to continue to improve the data it collects on the extent of these outages, and the number of assets that are affected. This is necessary for it to be able to better identify and understand trends that will improve the timeliness and effectiveness of the solutions it implements. We will monitor progress of this work in 2025.

3. Smart Motorway Evidence Stocktake and Action Plan

3.1 In March 2020, DfT published the smart motorway evidence stocktake and action plan (the 'stocktake actions'). This included eighteen actions to improve smart motorway safety. National Highways committed to two additional actions in its first-year progress report in April 2021 and classified the 20 actions under three themes:

(a) Giving clarity to drivers;

(b) Finding a safe place to stop; and

(c) Being safer in moving traffic.

3.2 In November 2021, the Transport Select Committee (TSC) published the outcome from its inquiry into the roll-out and safety of smart motorways. As part of DfT's response to recommendation 6, it commissioned ORR to report on the delivery of the stocktake actions and National Highways' evaluation of their success in:

(a) Reducing incidences of live lane breakdowns;

(b) Reducing the time for which people who breakdown or stop in a live lane are at risk; and

(c) Educating drivers on what to do if they breakdown in a live lane

3.3 Table 3.1, which provides an update on each stocktake action, shows that all actions are now complete. Since our last annual safety report, National Highways has progressed work to evaluate the success of the stocktake actions. In 2024, the company concluded analysis of its driver education campaigns and set out its approach to evaluating of the effectiveness of other stocktake actions in reducing live lane stops.

3.4 We subsequently appointed consultants, Agilysis, to undertake an independent review of National Highways' approach to evaluating the success of the stocktake actions in reducing the frequency and duration of live lane stops. This built on the initial assessment of the company's approach that we made in 2022.

3.5 As we have previously reported, it is too early to conclude about the success of the stocktake actions in reducing the number and duration of live lane stops as at

least three years of stable data are required. The company should review its evaluation plans and dates for reporting on the success of the stocktake actions. This should continue to take account of data challenges, including the time lag in publishing road casualty statistics, and the effect of the NEAR programme on 2024 live lane stops, to ensure it provides a robust assessment of the success of the stocktake actions.

Table 3.1 Progress with the smart motorway evidence stocktake and action plan

Action reference	Description	Status at March 2025	Completion date
1	Ending the use of dynamic hard shoulders	Cancelled (following Government announcement)	N/A
2a	Faster rollout of Stopped Vehicle Detection; all new schemes to have SVD in place.	Complete	December 2024
2b	CCTV trial for Stopped Vehicle Detection	Complete	December 2020
3	Faster traffic officer attendance times	Complete	September 2022
4	Committing to a new standard for spacing of places to stop in an emergency	Complete	November 2020
5	Delivering ten additional emergency areas on the M25	Complete	March 2022
6	Considering a national programme to install more emergency areas on existing smart motorways	Complete	March 2022
7	(a) Investigate M6 Bromford viaduct and sections of the M1	Complete	September 2021
	(b) Monitor smart motorway performance and annual issue of safety performance report	Complete	March 2025
8	Making emergency areas more visible	Complete	March 2020

Action reference	Description	Status at March 2025	Completion date
9	More traffic signs giving the distance to the next place to stop in an emergency	Complete	March 2023
10	More communication with drivers through targeted communication campaigns	Complete	March 2023
11	Displaying 'REPORT OF OBSTRUCTION' messages	Complete	December 2022
12	Places to stop in an emergency shown on your satnav	Complete	March 2021
13	eCall, promoting awareness, understanding and use of the system	Complete	November 2020
14	'Red-X' compliance through education and enforcement	Complete	July 2023
15	Updating the Highway Code with enhanced guidance relevant to smart motorways	Complete	March 2022
16	Committing to working closer with the recovery industry	Complete	September 2020
17	Committing to reviewing all existing emergency areas where the width is less than the current standard.	Complete	October 2020
18	Review of red flashing lights by recovery vehicles	Complete (led by DfT)	October 2023
19	Working with fleet operators to influence the driving behaviour of drivers	Complete	October 2020

Reducing incidences of live lane breakdowns

3.6 The stocktake actions included eight actions to reduce incidences of live lane breakdowns (actions 4 to 9, 12 and 17), all of which are now complete. Alongside its stocktake actions evaluation work, National Highways has committed to

undertake a separate evaluation of the NEAR programme. We will monitor progress of this work and provide an update in our next safety report.

Recorded live lane stops

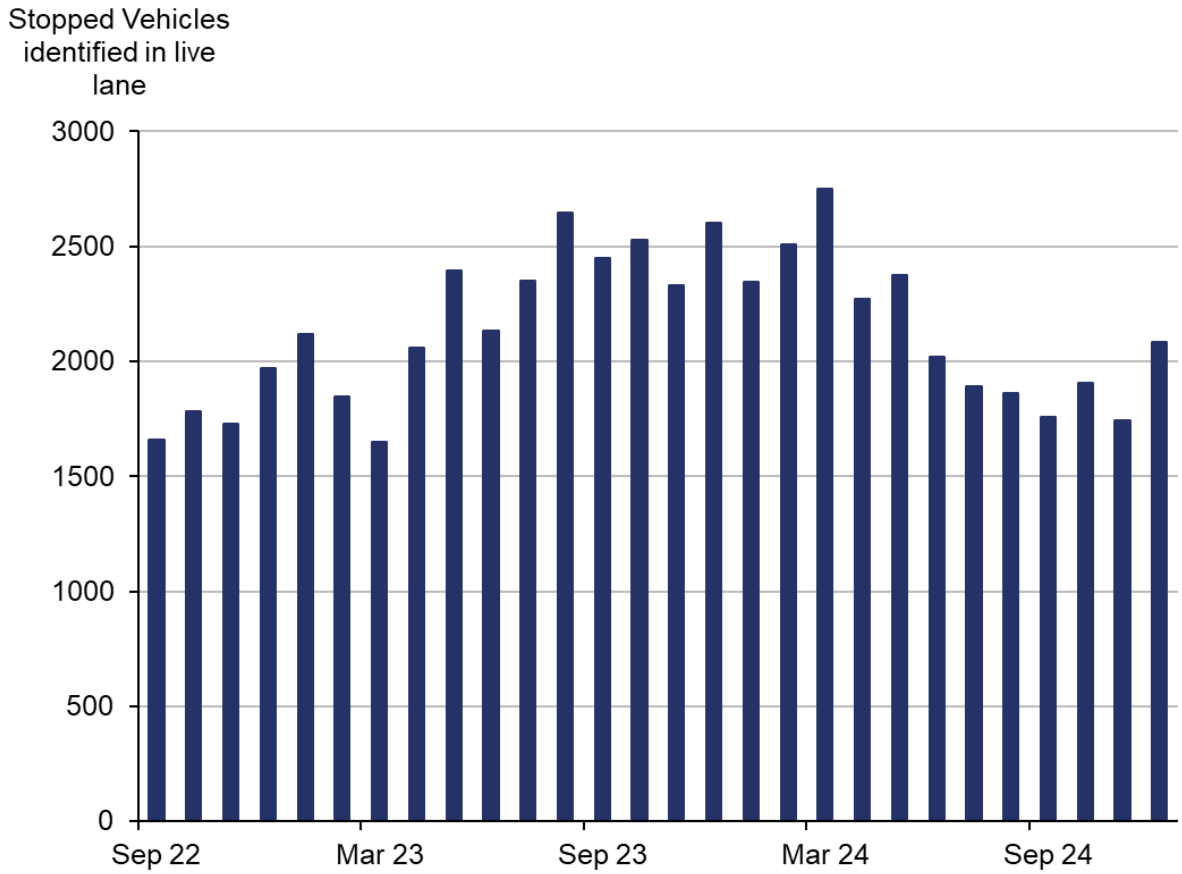
3.7 National Highways is using live lane stop data to support its initial evaluation of the stocktake action's success in reducing the frequency of live lane stops. It expects to conclude this work in the first half of 2025.

3.8 Our analysis of National Highways' data, illustrated in figure 3.1, shows a trend of increasing live lane stops from the end of 2022 through 2023. The company reports that the increasing trend in 2023 can be attributed to an increased focus on recording stopped vehicles, and enhanced detection technology being rolled out on the SRN. There were 27,112 live lane stops recorded on ALR smart motorways during 2023. This subsequently fell to 25,512 live lane stops in 2024. It is unclear how much of the reduction in live lane stops in 2024 can be attributed to the presence of the NEAR programme, when up to 43% of the ALR smart motorways network has been subject to traffic management. The company's continued evaluation of how the stocktake actions have influenced live lane stops aims to better understand this trend.

3.9 Our review of National Highways' evaluation approach concluded that it is aligned with best practice and utilises and appropriate range of data sources and analysis methods that account for the challenging context in which the stocktake actions have been delivered.

3.10 It is important that National Highways continues to develop this evaluation work so that the company can fully understand the effect of its interventions in improving safety for road users on ALR smart motorways. As part of this, it should also improve how it collects and reports data in relation to vehicles stopping in emergency areas.

Figure 3.1 Number of recorded stopped vehicles in live lanes, ALR smart motorways, September 2022 to December 2024



Reducing the time for which people who breakdown or stop in a live lane are at risk

3.11 The stocktake actions included six actions aligned with reducing the time for which people who breakdown or stop in a live lane are at risk (actions 2a, 2b, 3, 11, 16 and 18). All these actions are now complete.

Completed action 2a: All new smart motorways will open with SVD in place

3.12 This action was completed in December 2024, when the final ALR smart motorways scheme (M6 J21a-26) fully opened to traffic with SVD in place.

Traffic officer attendance times

3.13 National Highways continues to meet its target of 10-minute traffic officer attendance times on ALR smart motorways with emergency areas more than a mile apart. The company has achieved this target each month since it was first met in September 2022, following close monitoring and engagement with ORR. In December 2024 the average traffic officer attendance time where emergency

areas are further than one mile apart was 8 minutes 40 seconds. This is better than December 2023 when the average attendance time was 9 minutes 16 seconds. However, caution should be used when comparing these figures as the NEAR programme means there are fewer stretches of ALR smart motorway where emergency areas are more than a mile apart. This has resulted in fewer ALR motorways included in reporting for this metric during 2024.

Educating drivers on what to do if they breakdown in a live lane

3.14 The five remaining actions (10, 13, 14, 15 and 19) relate to educating drivers on what to do if they breakdown in a live lane. These actions have previously been reported as complete, and National Highways continues to deliver education campaigns for road users on an on-going basis. In 2024 the company provided us with its assessment of the effectiveness of earlier communication campaigns.

Evaluating the success of the smart motorways evidence stocktake and action plan

3.15 During 2024, National Highways continued the monitoring and evaluation activities it set out in its monitoring and evaluation plan (MEP) in 2022. We presented an overview of this plan in our first annual safety report.

3.16 National Highways' evaluation relies on comparing data from before and after the stocktake actions were delivered. This requires sufficient time following the implementation of stocktake actions to collect enough data that can be used to draw robust conclusions. Three full years of data (following the completion of the majority of stocktake actions) are needed to enable the company to assess the impact of the actions. Road casualty data is a key source of data, and the time lag between the data being collected and published by DfT means it is unlikely that the company will be able to form robust conclusions before 2027.

3.17 Building on our 2022 review of the company's 'Go Left' breakdown campaign, in 2024 we commissioned an independent review of the National Highways' approach to evaluating the action plan (the stocktake actions). This focussed on four key areas:

(a) initial success and response to previous recommendations;

(b) use of data;

(c) overall evaluation approach; and

(d) continual impact and improvement.

3.18 Our latest assessment showed that across these four areas, National Highways' approach continues to align with best practice and uses an appropriate range of data sources and analytical methods that account for the challenging context in which the actions have been delivered.

3.19 We found that National Highways is accounting for, and actively addressing, data challenges relating to the effect of events like the COVID-19 pandemic and, more recently, the NEAR programme. The staggered delivery of smart motorway stocktake actions since 2020 also presents an analytical challenge. The company is attempting to address these by progressing work to build the evidence base that will enable it to draw robust conclusions on the effectiveness of the stocktake actions.

Driver education campaign analysis

3.20 In 2024 National Highways completed its driver education campaign analysis. The company has continued to implement the campaigns assessed in its analysis, including the Driving on Motorways hub which serves as a central point for information and advice to drivers of how to navigate motorways safely

3.21 National Highways' monitoring and evaluation plan (MEP) aims to assess how the stocktake actions are contributing to reducing the frequency and duration of live lane stops, and educating drivers on what to do if they breakdown in a live lane.

3.22 The company's analysis of driver education campaigns focussed on stocktake action 10, which aims 'to tackle the public perception of, and public confidence in, the safety of smart motorways' through more communication with drivers.

3.23 This year National Highways concluded work to evaluate the effectiveness of driver education campaigns it delivered between March 2021 to October 2022. Key findings from this evaluation showed:

(a) The campaigns reached a wide audience, who were able to recall the key messages.

(b) In relation to the 'Go Left' campaign, there was good evidence for an increase in awareness of what to do in the event of a breakdown on a smart motorway.

(c) There was strong evidence that campaigns were contributing to an observed increase in road user awareness and understanding of emergency areas.

3.24 In its analysis, National Highways highlighted the challenges of linking actions directly to their outcomes on the ground. Several of the driver education stocktake actions were implemented across a number of years; other actions were implemented alongside other measures or improvements being made to the network. For example, during the first wave of the 'Go Left' breakdown campaign, England was emerging from coronavirus (COVID-19) pandemic restrictions, resulting in fluctuations in traffic and travel behaviours. Our independent review identified that the company has accounted for these impacts on the baseline data.

Conclusions and recommendations

3.25 Following the opening of the final ALR smart motorway scheme with SVD in place in December 2024, and publication of the smart motorway stocktake fourth year progress report in March 2025, National Highways has now delivered all its actions in response to the 2020 smart motorway evidence stocktake and action plan.

3.26 The company has conducted analysis to assess how its communication campaigns have improved drivers' awareness and understanding of safety on smart motorways. The results are generally positive, though not without challenges in attributing outcomes directly to actions.

3.27 Our assessment of National Highways' approach to evaluation in 2024 showed that, across four evaluation areas, the company's approach continues to align with best practice and uses an appropriate range of data sources and analytical methods that account for the challenging context in which the actions have been delivered.

3.28 The company has actioned previous recommendations from 2022 and shown through its annual stocktake progress reporting that stocktake actions and evaluation activity are key areas of focus for the company. It has also considered a suitable range of data sources to improve the robustness of the evaluation. The company should continue to use available data sources and integrate new ones where they become available.

3.29 It remains too early to conclude about the success of the stocktake actions in reducing the number and duration of live lane stops as at least three years of stable data is required. National Highways' ability to draw robust conclusions is further complicated by the staggered delivery of smart motorway stocktake actions since 2020, other ongoing programmes and roadworks (including the impact of NEAR in 2024 and 2025), and changes in travel patterns since the pandemic. The company must continue to take these challenges into account as it progresses this evaluation work. The time lag in publishing road casualty data means it is unlikely

that it will be able to draw robust conclusions before 2027. We will continue to monitor National Highways to ensure that progress is being made in this area and provide an update in our next annual safety report.

Annex A: ALR schemes table

Table A.1 List of ALR schemes and national emergency area retrofit (NEAR) programme schemes

Region	Scheme	Number of new emergency areas	SVD performance testing in 2024	OpTech modernisation and refresh programme
Yorkshire North East	M1 J32-35a	13	No	Yes
Yorkshire North East	M1 J30-31	10	No	Yes
Midlands	M1 J28- 30	18	No	Yes
Midlands	M6 J21a-26	12	No	No
Midlands	M5 J4a-6	9	No	Yes
Midlands	M1 J23a-25	6	No	Yes
Midlands	M1 J19-16	18	No	Yes
South East	M27 J4-11	2	No	Yes
South East	M25 J23-27	15	No	Yes
South East	M3 J2-4a	10	No	Yes
South East	M25 J5-7	9	No	Yes
South East	M20 J3-5	4	No	Yes
South East	M4 J8/9-12 East	12	No	Yes
South East	M4 J3-8/9 East	NA	Yes	Yes
Midlands	M6 J2-4	NA	Yes	Yes
Yorkshire North East	M1 J39-42	NA	Yes	Yes
Midlands	M6 J13-15	5	Yes	Yes

Region	Scheme	Number of new emergency areas	SVD performance testing in 2024	OpTech modernisation and refresh programme
Midlands	M6 J10a-13	NA	Yes	Yes
North West	M56 J6-8	NA	Yes	No
North West	M62 J10-12	NA	Yes	Yes
North West	M62 J18-20	NA	Yes	Yes
North West	M6 J16-19	NA	Yes	Yes
South East	M23 J8-10	NA	Yes	Yes
East	M1 J13-16 (L1a&b, 2a)	8 across this scheme and M1 J13-16 (L2b&3)	Yes	No
Midlands	M1 J13-16 (L2b&3)	As above	Yes	No

Annex B: SVD performance monitoring and reporting results by scheme

Table B.1 SVD detailed performance monitoring and reporting results by scheme

Scheme	Number of events (a)	Number of events detected (b)	False discovery rate: Total number of alerts (c)	False discovery rate: Alerts not related to an event (d)	Detection rate. Target: >80% ** (e)	False discovery rate. Target: <15% *** (f)	Average time to detect (seconds) (g)	Alert time within 20 seconds % **** (h)	Total number of alerts * (i)	Unverified alerts (j)
M6 J2-4	45	38	70	1	84%	1%	22.7	82%	358	288
M1 J39-42	19	19	31	0	100%	0%	7.7	95%	126	95
M6 J13-15	31	23	56	3	74%	5%	10.0	96%	112	56
M6 J10a-13	23	23	44	2	100%	5%	15.8	91%	121	77
M56 J6-8	23	18	31	0	78%	0%	11.4	94%	70	39
M62 J10-12	38	31	137	26	82%	19%	7.0	97%	236	99
M62 J18-20	31	22	32	1	71%	3%	9.6	91%	201	169
M6 J16-19	37	32	47	0	86%	0%	9.3	97%	128	81

Scheme	Number of events (a)	Number of events detected (b)	False discovery rate: Total number of alerts (c)	False discovery rate: Alerts not related to an event (d)	Detection rate. Target: >80% ** (e)	False discovery rate. Target: <15% *** (f)	Average time to detect (seconds) (g)	Alert time within 20 seconds % **** (h)	Total number of alerts * (i)	Unverified alerts (j)
M23 J8-10	104	98	154	7	94%	5%	10.1	92%	355	201
M1 J13-16 (L1a&b, 2a)	59	51	131	8	86%	6%	21.2	80%	283	152
M1 J13-16 (L2b&3)	26	18	35	0	69%	0%	15.7	89%	91	56
M4 J3-8/9 East	40	35	59	1	88%	2%	10.2	94%	99	39

**An event can trigger multiple alerts*

***Detection rate (e) is number of events detected (b) as a proportion of events (a)*

****False discovery rate (f) is the total number of alerts related to an event (d) as a proportion of the total number of alerts (c)*

*****Alert time within 20 seconds (h) is the percentage of detected vehicles listed in (b) that were detected within 20 seconds*

Annex C: SVD analysis – Unverified alerts

Table C.1 SVD detail of unverified alert analysis, 2023 and 2024

Year	Total number of alerts (a)	Total number of unverified alerts (b)	% of all alerts (c)	Unverified alerts related to an event (d)	Number of Unverified events able to be assessed for detection rate (e)	Unverified events detected (f)	Unverified detection rate* (g)	Verified detection rate (h)
2023 (5 schemes)	1,277	850	67%	230	84	78	93%	86%
2024 (12 schemes)	2,180	1,352	62%	378	73	69	95%	86%

** Unverified detection rate (g) is the number of unverified events detected (f) as a proportion of unverified events able to be assessed for detection rate (e)*

Annex D: Operational technology availability data

Table D.1 National operational technology availability figures

Operational technology availability: SVD availability target 98%

CCTV, VMS, MIDAS, Signs and Signals, Enforcement cameras: availability target 95%

	Sep 2023	Oct 2023	Nov 2023	Dec 2023	Jan 2024	Feb 2024	Mar 2024	Apr 2024	May 2024	Jun 2024	Jul 2024	Aug 2024	Sep 2024	Oct 2024	Nov 2024	Dec 2024
SVD	98.9	99.2	99.2	98.9	97.4	97.3	97.6	99.0	99.6	98.8	98.7	98.5	98.6	98.7	98.7	98.5
CCTV	97.1	96.9	96.7	93.9	94.4	96.2	97.2	95.6	95.9	96.2	95.8	95.9	95.6	97.2	95.7	95.7
Variable message signs (VMS)	89.8	88.4	89.9	89.9	90.0	90.6	92.2	92.4	92.0	91.2	92.2	91.9	91.7	90.5	90.1	89.7
MIDAS	97.6	97.4	97.6	97.5	97.3	97.3	97.1	97.3	96.8	94.4	95.3	95.3	95.2	95.2	95.1	95.2
Signals	94.7	94.4	94.5	94.3	93.5	93.7	94.4	92.3	94.3	93.7	95.1	95.2	95.0	94.7	93.8	92.4
Enforcement cameras	97.0	97.0	96.6	96.9	97.3	96.6	97.8	97.1	97.5	97.5	97.5	97.1	98.0	97.8	98.0	98.6

Annex E: Outage case studies

Table E.1 Outage case studies and affected assets

Date	Location	Duration	Category	Type	Assets affected
3 October 2023	M6 J18-J19	6 days	Planned	Power	No assets affected.
2 December 2023	M5 J6	3 days, 11 hours 43 minutes	Unplanned	Power	SVD, MIDAS, CCTV, Signs and Signals affected. Initial outage resolved in 11 hours; 3 individual assets remained affected for duration.
13 January 2024	National	7 hours 5 minutes	Planned	System	CCTV and SVD affected. Outage scheduled for overnight to reduce effect on road users.
13 January 2024	East Region	7 hours 58 minutes	Unplanned	System	Signs and Signals affected. In this region this accounts for 187 assets.
13 January 2024	M1 J13-J16	1 hour 42 minutes	Unplanned	System	3 individual SVD radars affected out of 107 radars.
13 January 2024	M1 J16-J17	1 day, 2 hours 51 minutes	Unplanned	Power	SVD, MIDAS, CCTV, Signs and Signals affected, 13-15 individual assets out of 375 affected during outage.
7 August 2024	M62 J10-J11	28 days, 8 hours 4 minutes	Unplanned	System	MIDAS affected. 8 individual assets affected during outage.

Annex F: Glossary

Terminology	Description
All lane running (ALR) motorways	A type of motorway design where the hard shoulder is permanently converted to a running lane, with refuge areas available for drivers to use in an emergency. It also deploys technology, such as overhead electronic signs, which can be used to set variable speed limits and display messages to drivers.
Closed-circuit television (CCTV)	CCTV plays a vital role in the SVD service. When an alarm is presented to the ROC operators, they utilise cameras to verify and classify it before adjusting signals accordingly. The inclusion of CCTV enables ROC operators to visually inspect sections of the highway network, providing a comprehensive view of 100% of the carriageway on All Lane Running (ALR) smart motorways.
Coverage area	The area that SVD radar covers on ALR. This includes all the primary running lanes of the mainline carriageway (outside of carriageway markings) and every emergency area (formerly referred to as emergency refuge areas). If any portion of a vehicle is situated within this space, it is deemed to be within the coverage area.
Detection rate	The proportion of stopped vehicles correctly identified by SVD.
Detection time (time to detect)	The time to detect is the elapsed time between a stopped vehicle event occurring and being detected.
Delivery plan	National Highways' plan, which sets out in detail how it will deliver its strategic outcomes and measure success for the road investment strategy (RIS)
eCall	eCall is a system that phones the emergency services automatically if the vehicle it is fitted to is involved in an incident.
Emergency areas	A purpose-built place of relative safety that is located adjacent to the nearside of a mainline carriageway or diverge connector road.
False discovery rate	The proportion of SVD alerts that are not related to a stopped vehicle event
Incident	Unplanned traffic incidents including road traffic collisions (RTCs) and ad hoc road closures.
iRAP	The International Road Assessment Programme is a registered charity dedicated to saving lives by eliminating high risk roads throughout the world. iRAP develops the star rating method of measuring the safety of a particular stretch of road.

Terminology	Description
Key performance indicator (KPI)	In the RIS2 performance specification, DfT sets out the key performance indicators that are used to measure National Highways' performance in the road period.
Killed or seriously injured (KSI)	A person killed or seriously injured in a road traffic collision.
Message signs and signals	Signals display illuminated speed information and lane closure symbols, while message signs present illuminated text. This information encompasses signal settings, journey time details, incidents, weather conditions, planned works, or road layout changes. In the context of the SVD service, signs and signals play a crucial role in alerting drivers to potential hazards ahead. They also employ 'Red-X' signals to indicate lane closures to other traffic when a stopped vehicle is identified. *Message signs can be referred to as variable message signs (VMS) or warning signs* *Signals can be referred to as speed control and lane signals*
MIDAS	Motorway Incident Detection and Automatic Signalling. MIDAS detectors monitor traffic by collecting data on vehicle speeds, volumes, classification, and occupancy. *MIDAS can be referred to as traffic monitoring radar*.
Missed detection	A stopped vehicle event that is not detected by the SVD system (in direct proportion to the detection rate, e.g. detection rate 85% = missed detection rate 15%)
Performance monitoring and reporting (PMR) formerly known as ground truthing	The process used by National Highways to assess and validate the performance of the Stopped Vehicle Detection (SVD) system. It involves testing the system against predefined requirements of detection rate, detection time, and false discoveries. In the PMR process, recorded CCTV footage is employed, and this footage is later reviewed to monitor, verify and time the stopped vehicle events throughout a 24-hour period.
Road investment strategy (RIS)	This document sets out a long-term vision for England's strategic road network, including a multi-year investment plan for improving the network and high-level objectives. RIS1 refers to the first road period (2015-20), and RIS2 to the second road period (2020-25).
Road period (RP)	The period that the road investment strategy covers. RP1 covered April 2015 to March 2020. RP2 covers April 2020 to March 2025.
Regional operations centres (ROC)	Control rooms based in each region that manage the safety and flow of traffic using signs, signals and cameras. Used for the management of incidents and despatch of on-road Traffic Officers

Terminology	Description
Stopped vehicle event (as it relates to SVD performance measurement)	One or more vehicles that have come to a complete stop within the coverage area as part of a single event. The time the vehicle/s stopped and then set off, and the time taken to detect the vehicle are captured in SVD performance measurement. Stopped vehicle events do not include queuing vehicles that have stopped due to congestion or an incident.
Stopped vehicle detection alarm	This refers to the notification of a stopped vehicle generated by National Highways' SVD system that is presented to National Highways' operators via the traffic management system. In the ROC the terms alarm and alert are interchangeable as they serve an equivalent function. Multiple alarms for the same location can be raised but only one is presented to an operator.
Stopped vehicle detection alert	The notification of a stopped vehicle that is generated by the SVD radar and passed to National Highways' SVD system before being presented to an operator via the traffic management system. There can be multiple alerts related to a single stopped vehicle event.
Stopped vehicle detection system	The Stopped Vehicle Detection (SVD) system is defined as the roadside system responsible for sending alerts regarding stopped vehicles to National Highways. Presently, the technology employed for the SVD system is radar-based, with National Highways having a single supplier nationwide. The scanning SVD radar is a technology that monitors the movement of vehicles within its radar field of view and triggers an alarm to a Regional Operations Centre (ROC) operator if a vehicle comes to a stop in the carriageway or emergency area (EA).
Strategic road network (SRN)	The road network that National Highways is responsible for managing, comprising 4,555 miles of motorways and main 'A' roads in England.
System availability	System availability is a performance metric that reports the proportion of time that a system is available for use. It is defined as the percentage of time available. It is measured through obtaining the percentage of uptime / (uptime + downtime).
Unverified event	A stopped vehicle event for which the CCTV footage was insufficient to record attributes necessary to determine if an event definitely was, or definitely wasn't detected (these events, unlike unverified, would be captured by the detection rate, or the false discovery rate). These attributes include the event start time and event end time; for example, an unverified event would include where footage has not captured these attributes.

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