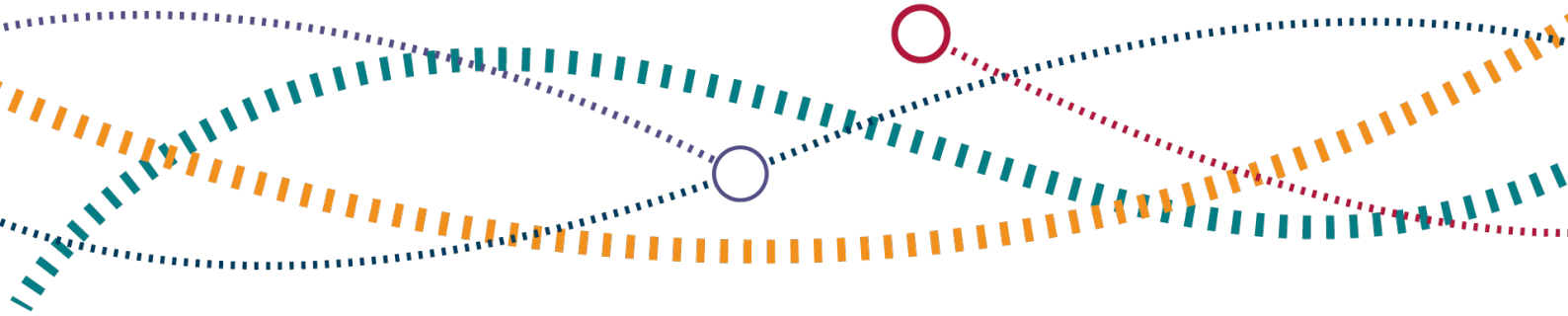
OFFICE OF RAIL AND ROAD

Second annual assessment of safety performance on the strategic road network

ORR's assessment of safety performance on the strategic road network in 2022 and progress update on Transport Select Committee smart motorways recommendations

18 December 2023



Contents

Executive summary

Introduction

1. The Office of Rail and Road (ORR) holds National Highways to account for the delivery of 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 second annual assessment of National Highways' safety performance on the strategic road network (SRN). In this report we will:

    - assess National Highways' 2022 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. In RIS2, the 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. We hold National Highways to account for delivering improvements for road users, including improving safety. This report uses the latest road casualty data for the SRN, published by the Department for Transport (DfT) on 28 September 2023, to inform our assessment of National Highways' progress against this safety target in 2022.

5. In March 2020, following publication of RIS2, DfT released its smart motorway evidence stocktake and action plan (the action plan), which included a set of actions to improve the safety of, and public confidence in, smart motorways. We also monitor National Highways' delivery of 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 October 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 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 (recommendation 6).

8. In December 2022 we reported our initial findings in relation to these recommendations and this report includes an update on progress.

9. National Highways has reported annually on safety statistics for smart motorways and delivery of the action plan, where it continues to make good progress. However, it is still too early to draw definitive conclusions about the plan's effectiveness in reducing the frequency and duration of live lane stops and we anticipate being able to say more on this in our next safety report as more data become available.

10. National Highways published its third-year progress report in December 2023 that includes detailed analysis of casualty rates on different road types, including smart motorways, using road casualty data from 2021. The comparisons of headline casualty rates between different road types were broadly similar to those in the previous year's report.

11. In April 2023, the Government announced that plans for new smart motorways would be cancelled, recognising the lack of public confidence felt by drivers and cost pressures. This announcement does not affect our role in relation to smart motorways. 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.

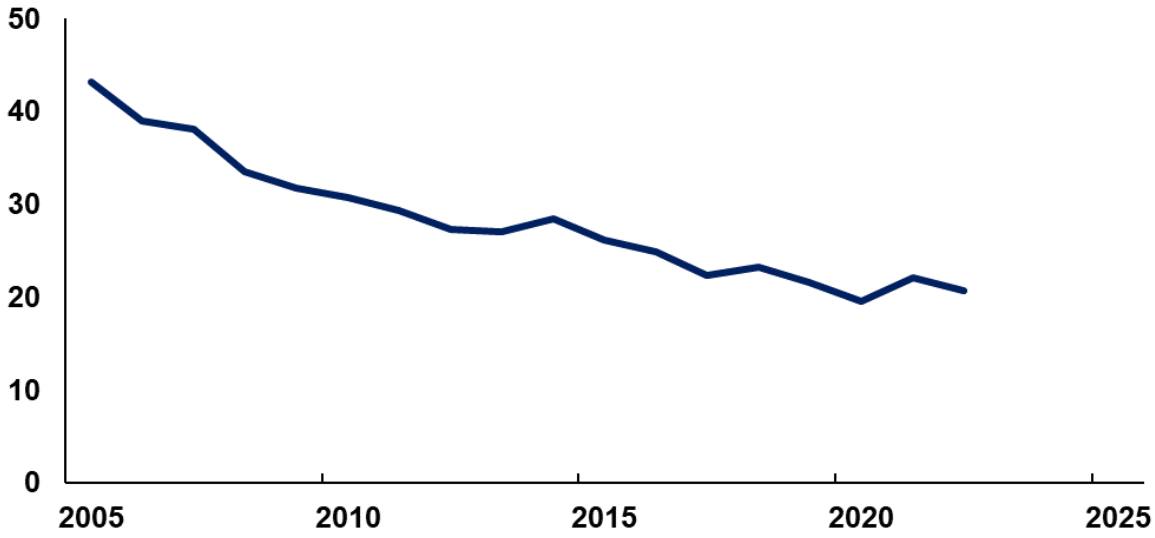
12. There are three areas of focus in this year's report, set out below.

Area of focus 1: Performance against the RIS2 safety key performance indicator for the strategic road network

National Highways has achieved a 38% reduction in the number of people killed or seriously injured (KSI) on the strategic road network in 2022 compared to a 2005 to 2009 average baseline. However, the company is not on course to achieve its safety target of a 50% reduction in KSIs across the whole of the strategic road network by the end of December 2025, with increasing traffic levels making it harder to achieve. The company needs to produce a robust plan by the end of March 2024 setting out how it aims to meet its target, which we will hold it to account for delivering.

13. The latest road casualty statistics for 2022 continue the longer-term trend of decreasing deaths and serious injuries on the strategic road network (SRN). Figure 1 below shows KSI rates per billion vehicle miles travelled on the SRN since 2005. The KSI rate for 2022 is the second lowest on record, only 2020, which is the year with the lowest traffic levels during the pandemic, has been lower.

Figure 1 Killed or seriously injured (adjusted) per billion vehicle miles driven on the SRN, 2005 to 2022



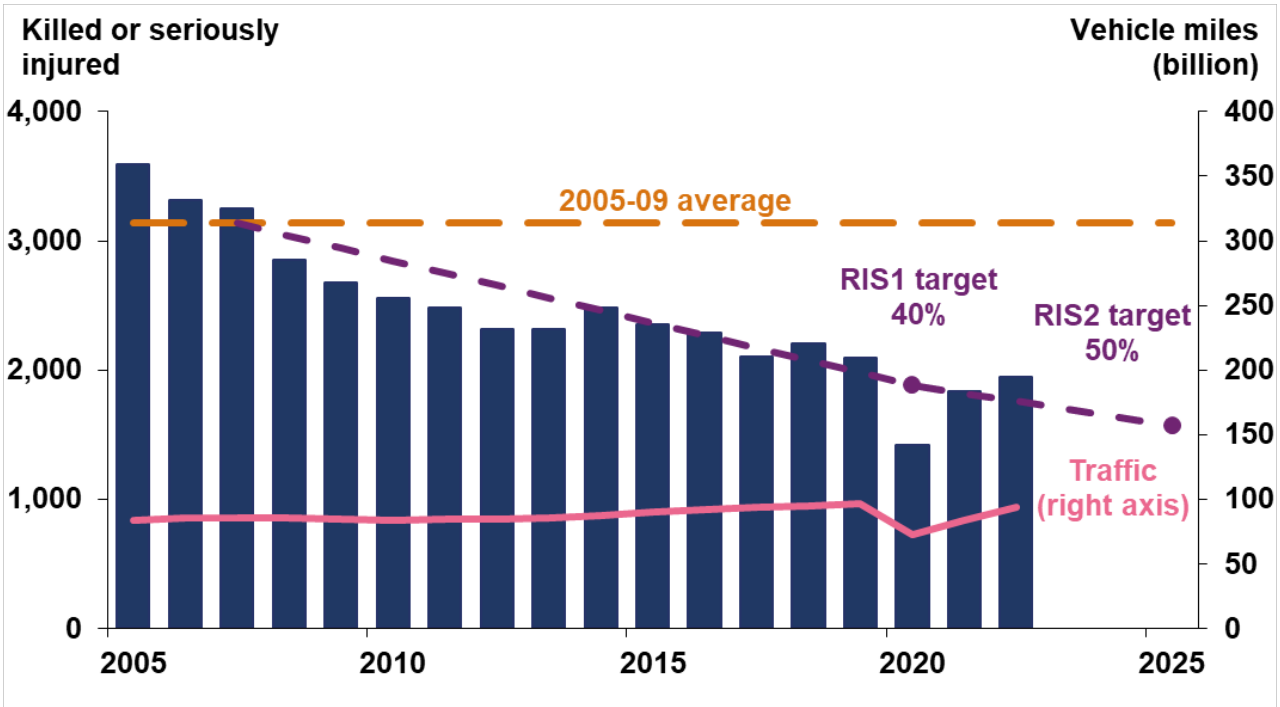
14. There were 1,944 KSIs on the SRN in 2022 which means that National Highways has now achieved a 38% decrease in KSIs compared to the 2005 to 2009 average baseline. Therefore, a further reduction of 12 percentage points (376 KSIs) is required to achieve the RIS2 target of a 50% reduction by the end of 2025.

15. Despite the longer-term downward trend in KSIs, the latest figures put National Highways 10.7% above (worse than) the trajectory required to achieve the target,

and above the 5% variance to target agreed by DfT when setting RIS2. While traffic on the SRN in 2022 was 3% below pre-pandemic levels of 2019, the potential for further traffic growth by the end of 2025 makes achieving a 50% reduction in KSIs more challenging for National Highways and puts the target at risk.

16. Figure 2, below, shows KSI totals on the SRN between 2005 and 2022 and highlights the correlation between lower traffic levels and KSIs during the pandemic.

Figure 2 Killed or seriously injured (adjusted) and traffic on the SRN, 2005 to 2022



17. National Highways has undertaken a number of actions to improve safety in the past year. This includes progress against the actions set out in its 2023 to 2024 Delivery Plan update. Examples include developing a tool to better understand unsafe speeds on the network to inform interventions; working with police forces to develop initiatives that aim to improve safety in relation to motorcycles, light commercial vehicles and network disruption; and continuing its Driving for Better Business programme which works with employers to reduce work-related road risk.

18. However, National Highways recognises that its Delivery Plan actions alone might not be sufficient to deliver the RIS2 safety KPI target. Therefore, the company is developing an additional programme of targeted interventions that it can implement in time to support delivery of the KPI.

19. As time is running out, National Highways urgently needs to make decisions regarding additional interventions. The company must set out how these will deliver its target by the end of December 2025 and transparently include them in a robust plan by the end of March 2024 that we can monitor and hold it to account for delivering.

Area of focus 2: Stopped vehicle detection performance; TSC recommendation 4 to assess the effectiveness of safety systems in place on smart motorways.

National Highways responded positively to the concerns we raised in our 2022 safety report, that stopped vehicle detection on all lane running motorways was not meeting performance requirements. The latest data show that targets for detection rates are now being met. The company now needs to focus on expanding its analysis to understand how it can further optimise stopped vehicle detection performance.

20. A key finding in our last safety report was that stopped vehicle detection (SVD) performance on all lane running (ALR) sections of smart motorway fell short of the level the company set itself and rapid improvements were required against the three key metrics of detection rates, false detection rates, and the time to detect stopped vehicles.

21. National Highways subsequently tested and implemented a series of software fixes to its SVD system by June 2023 that were designed to improve performance against these metrics by optimising the effectiveness of the radar equipment and filtering out multiple alerts created by cars stopped in queuing traffic. The latest data show that performance targets for the three metrics we reported on last year are now being met:

    (b) Detection rates (i.e., the proportion of stopped vehicles correctly identified by SVD): 89% (target >80%)

    (c) False detection rates (i.e., the proportion of SVD alerts that are reported incorrectly because the alert does not relate to a true stopped vehicle): 6% (target <15%)

    (d) Average time to detect stopped vehicles (i.e., the elapsed time between a vehicle stopping and an SVD alert being generated): 12.2 seconds (target <20 seconds)

22. This year, we have reported performance against an additional metric: the percentage of vehicles detected within 20 seconds. This more closely aligns with the SVD technical requirement that 'the time to detect shall not exceed 20 seconds'. This shows that 92% of vehicles are detected within 20 seconds.

23. National Highways has changed the methodology used to calculate SVD performance since our last safety report. The new methodology is designed to provide a more accurate measurement of performance by focussing on better quality data.

24. The process for testing SVD performance uses recorded CCTV footage of stopped vehicles that is reviewed at a later date. Because this is a post-event verification exercise, it does not affect the company's operational response to alerts, and we are satisfied that road user safety is unaffected. However, the change in methodology means the latest testing data are not directly comparable to the figures reported in December 2022.

25. National Highways must proactively set out a clearly documented methodology for measuring and better understanding SVD performance for its next round of testing in Spring 2024. As part of this, the company should focus on how it can make better use of the wider data it collects during the testing process. The methodology changes are discussed in more detail in chapter 2 of this report.

26. In addition to the improvements it has made to SVD technology, National Highways continues to support road user safety by meeting other targets, and delivering further improvements, in relation to smart motorways:

    a) The company has consistently achieved its target of an average attendance time of under 10 minutes for traffic officers responding to live lane stops on ALR motorways where emergency areas are further than one mile apart since September 2022.

    b) Availability of the SVD system – the percentage of time that it is available for use – remained above the company's 98% target over the past year.

    c) The company is continuing work to deliver an additional 150 emergency areas by the end of the road period.

Area of focus 3: Operational technology performance; TSC recommendation 4 to assess the effectiveness of safety systems in place on smart motorways.

In our 2022 annual safety report, we required National Highways to urgently produce an action plan, demonstrating how it will improve the performance of operational technology on all lane running smart motorways. The company is now implementing this plan to upgrade key equipment on these roads. We will continue to monitor delivery of the plan to ensure performance improves and it achieves its aim of 97% availability for operational technology by the end of the road period.

27. In last year's safety report, we found that National Highways was not achieving its targets for availability of essential systems that complement SVD performance on ALR motorways. These systems are known as operational technology (OpTech) and include CCTV, motorways incident detection and automatic signalling system (MIDAS), variable message signs and signals. As a result, we concluded that National Highways must urgently produce an action plan for how it will achieve performance improvements to OpTech on ALR motorways.

28. Following our December 2022 safety report, National Highways committed £105 million to improve OpTech and has set out a plan for how it will achieve its aim of 97% average availability for CCTV, MIDAS, variable message signs and signals by the end of the road period. It is important that the company maintains, and increases, the availability of OpTech to ensure that the supporting systems on ALR motorways deliver the expected improvements to road user safety.

29. This report includes the latest data on key performance metrics for smart motorway safety systems that were reported last year, including availability of CCTV and variable message signs and signals. This year, we have also included data for MIDAS and enforcement cameras, which were not available last year.

30. This shows that availability is broadly similar to last year, between 91% and 97% across the different categories of: CCTV cameras, enforcement cameras, MIDAS, signals and variable message signs. Of these, variable message signs are the asset with the lowest availability, with an average of 91% over the past year.

31. National Highways is currently completing preparatory work, including procurement, which is required prior to installing upgraded technology on the network. This work is progressing to plan, and we expect to see improved availability scores across all categories from the first quarter of 2024-25.

1. Safety performance on the strategic road network in 2022

1.1 In Road Period 2 (RP2), National Highways has a safety key performance indicator (KPI) target to reduce the number of people killed or seriously injured (KSIs) on the strategic road network (SRN) by 50% by the end of 2025, compared to a baseline of the 2005 to 2009 average.

1.2 On 28 September 2023, DfT published its road casualty statistics for 2022. This enables us to report on National Highways' progress against its safety KPI target.

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

1.3 The latest road casualty statistics continue the longer-term trend of decreasing deaths and serious injuries on the SRN. Following two years (2020 and 2021) when road traffic and casualty numbers were impacted by the Coronavirus (COVID-19) pandemic, 2022 broadly shows a return to pre-pandemic trends. The KSI rate for 2022 is the second lowest on record (only 2020, which is the year with the lowest traffic levels during the pandemic, has been lower).

1.4 The statistics show that 1,944 people were killed or seriously injured on the SRN in 2022, which is less than in any year prior to 2020. This means that National Highways has now achieved a 38% decrease in KSIs compared to the 2005 to 2009 average baseline. Therefore, the company must deliver a further improvement of 12 percentage points (376 KSIs) to achieve its target of a 50% reduction by the end of 2025.

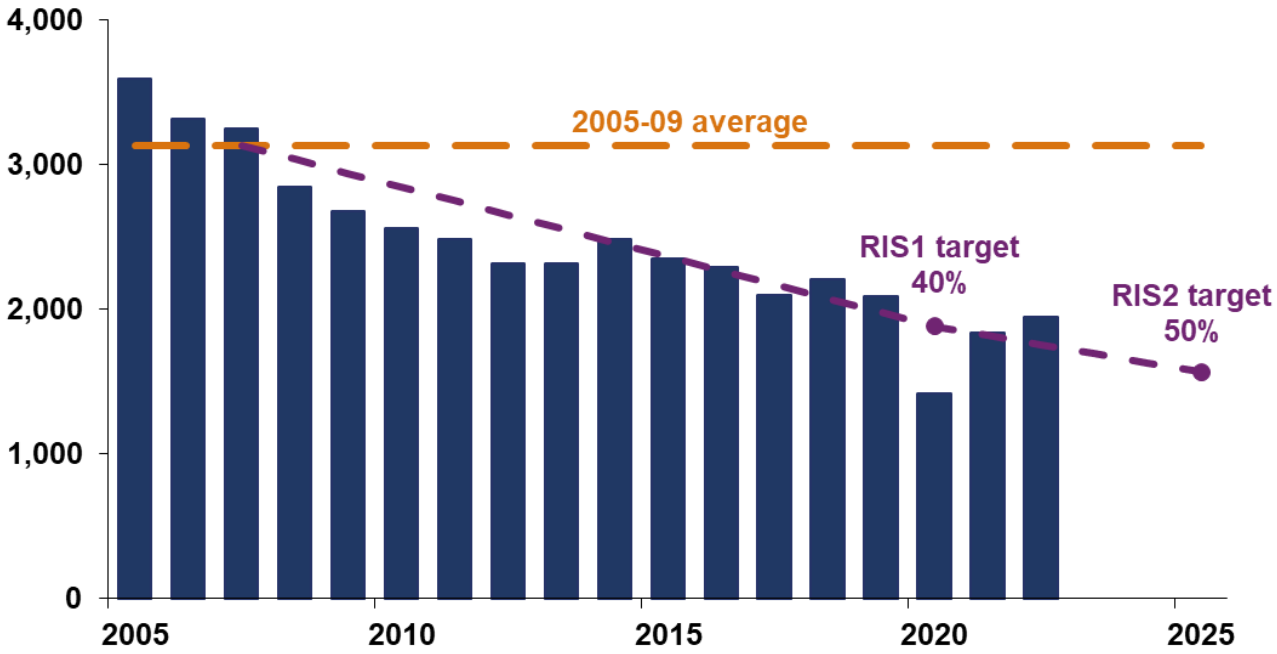
1.5 Despite the longer-term downward trend in KSIs, the latest figures put National Highways 10.7% above (worse than) the trajectory required to achieve the target, and above the 5% variance to target agreed by DfT when setting RIS2. To be on track in 2022, National Highways needed to reduce the number of people killed or seriously injured to no more than 1,756.

1.6 There were 93.7 billion vehicle miles driven on the SRN in 2022, which is 3.2% below the pre-pandemic levels of 2019. The potential for further traffic growth by the end of 2025 makes achieving a 50% reduction in KSIs more challenging for National Highways and puts the target at risk.

1.7 Figure 1.1, below, shows the straight-line trajectory for National Highways to reach a 50% reduction in people killed or seriously injured by the end of 2025. The

trajectory is based on the company reducing casualties by an equal amount each year, first from the baseline period to the RIS1 target level in 2020, and then from that point to the RIS2 target by the end of 2025.

Figure 1.1 Killed and seriously injured (adjusted), strategic road network, 2005 to 2022



Source: DfT road casualty statistics (RAS0303)

1.8 Table 1.1 sets out the 2020 to 2024 adjusted annual KSI figures compared to the 2005 to 2009 average baseline.

Table 1.1 Trajectory for National Highways to meet its end of 2025 target, killed or seriously injured (adjusted) on the strategic road network

Year	Actual KSIs	KSI trajectory	Committed target
2005 to 2009 (baseline)	3,136	-	-
2020	1,419	1,882	1,882 (40% of 3,136) by 2020
2021	1,837	1,819	-
2022	1,944	1,756	-
2023	Autumn 2024	1,693	-
2024	Autumn 2025	1,631	-
2025	Autumn 2026	1,568	1,568 (50% of 3,136) by 2025

1.9 In its Delivery Plan Update, National Highways set out the actions it is taking to improve safety on the SRN between April 2023 and March 2024. The company is making good progress in delivering the actions set out in its plan. In the financial year to date, key areas of progress include:

(a) Developing a tool to better understand unsafe speeds on the SRN that can be used to inform decision making when delivering safety improvements.

(b) Continuing to develop the Driving for Better Business programme to raise awareness of work-related road risk.

(c) Working with police and other partners, as part of the roads policing review, to develop initiatives that aim to improve safety in three main focus areas of: motorcycles; light commercial vehicles; and network disruption.

1.10 The company is also progressing additional actions to those set out in the delivery plan for the latest year. This includes working with government to support its plan for drivers by developing new communication campaigns that aim to encourage considerate motorway driving by educating road users on how to use all areas of the network, including smart motorways. These campaigns will be run in phases throughout 2024. This is in addition to existing campaigns tackling tailgating and drivers loitering in HGV blind spots.

1.11 However, National Highways recognises that these actions alone might not be sufficient to deliver the RIS2 safety KPI target. Therefore, the company is developing a programme of targeted interventions that it can implement in time to support delivery of the KPI.

1.12 As time is running out, National Highways urgently needs to make decisions regarding additional interventions. The company must set out how these will deliver its target by the end of December 2025 and transparently include them in a robust plan by the end of March 2024 that we can monitor and hold it to account for delivering.

Comparisons with previous years

1.13 There were 107 more KSIs on the SRN in 2022 compared to 2021, an increase of 5.9%. However, over the same period, traffic on the SRN increased by 12.7% as it returned close to pre-pandemic levels.

1.14 Compared to 2019 (the last year when traffic was unaffected by the pandemic) there were 149 fewer KSIs in 2022, a decrease of 7.1%. Traffic on the SRN was also lower in 2022 than in 2019, by 3.2%.

1.15 There were 219 fatalities on the SRN in 2022. This is three (1.4%) fewer than in 2021, but an increase of nine (4.3%) since 2019.

1.16 Table 1.2 shows the split between killed or seriously injured (adjusted) figures and a comparison of the 2022 figures with 2019, the last pre-pandemic year, and the 2005 to 2009 average baseline.

Table 1.2 Killed or seriously injured (adjusted), strategic road network, 2022, 2019 and 2005 to 2009 baseline

Severity	2022	2019	2005-09 baseline	Percentage change from 2019	Percentage change from Baseline
Killed	219	210	357	+4.3%	-38.7%
Seriously Injured (adjusted)	1,725	1,883	2,779	-8.4%	-37.9%
Killed or seriously injured	1,944	2,093	3,136	-7.1%	-38.0%

Severity adjustment

1.17 The KSI figures referred to in this report are based on adjusted data reported by the Department for Transport (DfT). DfT 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.

Casualty rates

1.18 In 2022, traffic levels continued to recover from the dip seen during the pandemic. A total of 93.7 billion vehicle miles were driven on the SRN. This is an increase of 12.7% compared to 2021 but remains 3.2% lower when compared to 2019 pre-pandemic levels.

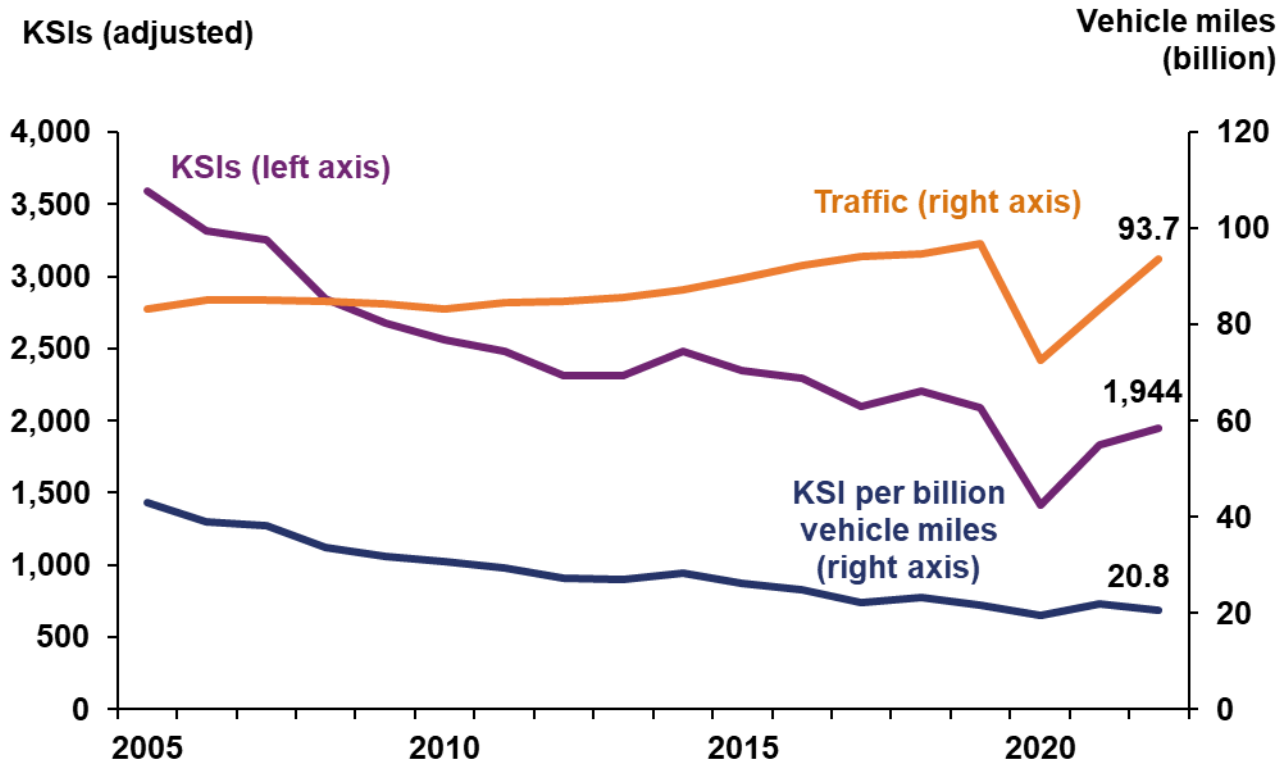
1.19 The number of casualties is strongly influenced by the amount of traffic using the roads, which makes it difficult to compare National Highways' performance against its safety target on a consistent basis in recent years. One way to address this is to look at casualty rates, the number of casualties per mile travelled.

1.20 In 2022 there were 20.8 KSIs per billion vehicle miles travelled on the SRN. This is the second lowest rate on record. Only 2020, which is the year most affected by the pandemic, has been lower.

1.21 In comparison, DfT reported that KSI rates on all roads in Great Britain increased by 2% compared to 2019, to 90.8 KSIs per billion vehicle miles travelled.

1.22 Figure 1.2 summarises the trends in traffic, KSIs and KSI rates on the SRN since 2005.

Figure 1.2 Killed or seriously injured (adjusted), traffic and KSI rates per billion vehicle miles, strategic road network, 2005 to 2022



Source: DfT road casualty statistics (RAS0303) and DfT traffic statistics (TRA41010)

Road type

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

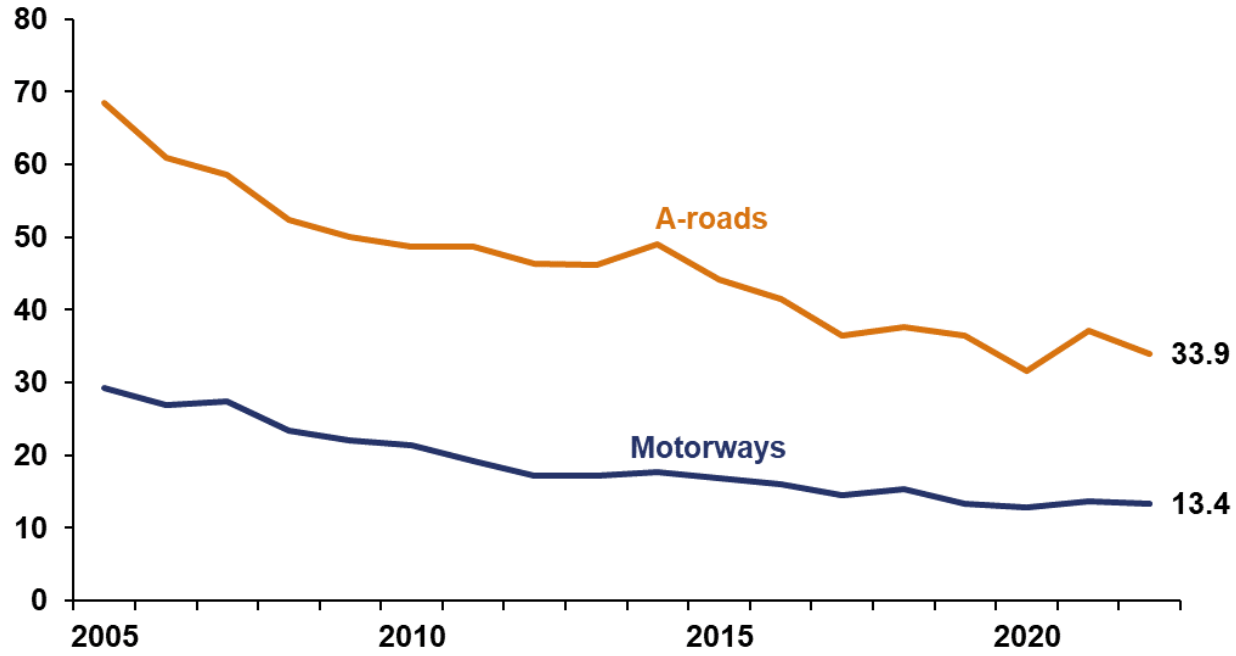
1.24 On National Highways' motorway network, 804 people were killed or seriously injured in 2022. This is an increase of 83 (11.5%) compared to 2021, but 22 (2.6%) fewer than in 2019.

1.25 On National Highways' A-roads 1,140 people were killed or seriously injured in 2022. This is an increase of 25 (2.2%) compared to 2021, but 127 (10%) fewer than in 2019.

1.26 Figure 1.3 shows the rate of people killed or seriously injured on motorways in 2022 (13.4 KSIs per billion vehicle miles) is lower than on A-roads (33.9 KSIs per billion vehicle miles). National Highways' third-year smart motorway progress report, published in December 2023, uses road casualty data up to 2021 to provide a more disaggregated set of road types, including distinguishing between conventional motorways and different types of smart motorway.

1.27 We expect the company's fourth-year report, which is due to be published in 2024, to include analysis for road casualty data up to 2022.

Figure 1.3 Killed or seriously injured (adjusted) per billion vehicle miles, strategic road network, by road type, 2005 to 2022



Source: DfT road casualty statistics (RAS0303) and DfT traffic statistics (TRA41010)

Performance indicators: improving safety for all

1.28 Performance indicators (PIs) are untargeted metrics that are specified by government as part of the road investment strategy (RIS). They enable us to scrutinise more aspects of National Highways' network performance beyond the headline key performance indicators (KPIs).

Total number of people killed or injured on the SRN

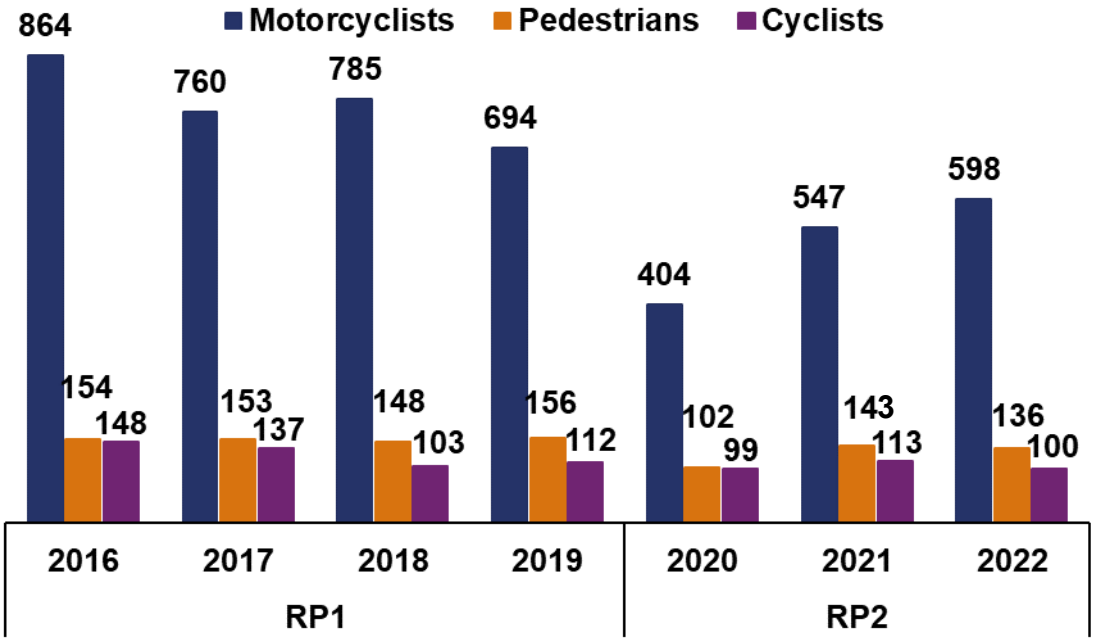
1.29 This PI reports the number of casualties of all severities, including 'slight injuries' that are excluded from the KPI.

1.30 In 2022, a total of 10,406 people were killed or injured on the SRN. This is an increase of 587 (6%) compared to 2021 but 1,941 (15.7%) fewer than pre-pandemic levels in 2019.

Number of non-motorised and motorcyclist users killed or injured on the SRN

1.31 In 2022, a total of 834 non-motorised and motorcyclist users were killed or injured on the SRN. This is an increase of 31 (3.9%) compared to 2021 but 128 (13.3%) fewer than pre-pandemic levels in 2019.

Figure 1.4 Non-motorised and motorcyclist users killed or injured, strategic road network, 2016 to 2022



Number of injury collisions on the SRN

1.32 In 2022 a total of 6,771 collisions were recorded on the SRN that resulted in at least one injury of any severity. This is an increase of 232 (3.6%) compared to 2021 but 1,134 (14.3%) fewer than pre-pandemic levels in 2019.

Accident frequency rate for National Highways' staff and supply chain

1.33 As reported in our Annual Assessment of National Highways' performance (April 2022 to March 2023), published in July 2023, the accident frequency rate for National Highways' staff was 0.03 incidents per 100,000 hours worked. This is lower than the previous year when the rate was 0.05. The rate for National Highways' supply chain staff was 0.08 incidents per 100,000 hours worked, which is higher than the previous year when the rate was 0.07.

Percentage of traffic using iRAP 3-star or above roads

1.34 As reported in our most recent Annual Assessment of National Highways' performance, 89% of travel on the SRN was on roads rated three stars or better against the latest version of the iRAP model (v3.02).

1.35 In 2023-24 National Highways is supporting the further development of the iRAP model for improved suitability to assess the SRN. National Highways is working with relevant stakeholders to progress this work through the global iRAP validation processes and expects to continue this for the remainder of the road period.

Conclusions

1.36 The latest road casualty statistics for 2022 continue the longer-term trend of decreasing deaths and serious injuries on the SRN. These show that National Highways has now achieved a 38% decrease in KSIs compared to the 2005 to 2009 average baseline.

1.37 Despite this, the company is above (worse than) the trajectory required to achieve its RP2 target to reduce the number of people killed or seriously injured on the SRN by 50% by the end of December 2025.

1.38 National Highways is making good progress in delivering the actions set out in its delivery plan to improve safety on the SRN. It is also progressing additional actions, including developing new communication campaigns aimed at influencing road user behaviour.

1.39 However, National Highways recognises that these actions alone might not be sufficient to deliver the RIS2 safety KPI target. Therefore, the company is developing a programme of targeted interventions that it can implement in time to support delivery of the KPI. As time is running out, it urgently needs to make decisions regarding additional interventions and transparently include these in a robust plan by the end of March 2024 that we can monitor and hold it to account for delivering, setting out how it will achieve its target for the end of December 2025.

1.40 It is also important that National Highways continues to focus on its longer-term ambition of achieving zero harm on the SRN by 2040. The company has commissioned independent research to assess and prioritise the actions it can take to achieve this vision and, in October 2023, began a programme of engagement with its stakeholders to take forward the recommendations from this work.

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

2.1 Smart motorways on the strategic road network (SRN) use technologies and features not present on conventional motorways. There are three different types of smart motorway, which are described in Table 2.1.

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.
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.
Dynamic hard shoulder running (DHS) motorways	DHS motorways also apply the controlled motorway technology. The hard shoulder is used as a live running lane some of the time, with electronic signs to guide drivers when it is safe to use for live running. Emergency areas are installed as on ALR motorways.

2.2 Smart motorways use multiple interconnected systems to support free-flowing traffic and road users' safety. The system is designed to ensure there is no over-reliance on a single feature and include the following features. A more detailed description of these systems can be found in Annex B:

- Variable speed limits
- Signs and signals (including 'Red-X' signals to close lanes)
- CCTV
- Motorway Incident Detection and Automatic Signalling (MIDAS) system
- Enforcement cameras
- Emergency areas (on ALR and DHS)
- Stopped Vehicle Detection (SVD) as an enhancement on ALR motorways

2.3 In April 2023, the Government announced that plans for new smart motorways would be cancelled, recognising the lack of public confidence felt by drivers and cost pressures at the time. National Highways' work to operate, manage and improve existing smart motorways continues in line with this announcement.

2.4 ORR also continues our role to assess the effectiveness of the safety systems in place on smart motorways. We are leading this work at the request of DfT, following the recommendations set out in the Transport Select Committee's (TSC's) 2021 inquiry into the roll-out and safety of smart motorways.

2.5 This section of the report considers TSC recommendation 4, to assess the effectiveness of safety systems in place on smart motorways. In particular, it focuses on National Highways' progress in the areas that we raised as key concerns in our 2022 annual safety report. These are: the performance of stopped vehicle detection on ALR sections of smart motorway; and the availability of other technology, such as CCTV cameras and variable message signs, that support road user safety on these roads.

2.6 In December 2023 National Highways published its most recent smart motorway progress report. In this, the company concluded that no one type of motorway, smart or conventional, performs better than the others against all of the safety metrics considered. However, it concluded that there was a higher risk of a collision in a live lane involving a stopped vehicle on ALR and DHS smart motorways than on motorways with a permanent hard shoulder.

2.7 ALR motorways are a relatively new feature on the SRN and, as a result, there is a limited amount of safety data available compared to other road types. Therefore, it is important that National Highways continues to update these analyses as more data become available.

Stopped Vehicle Detection (SVD) performance

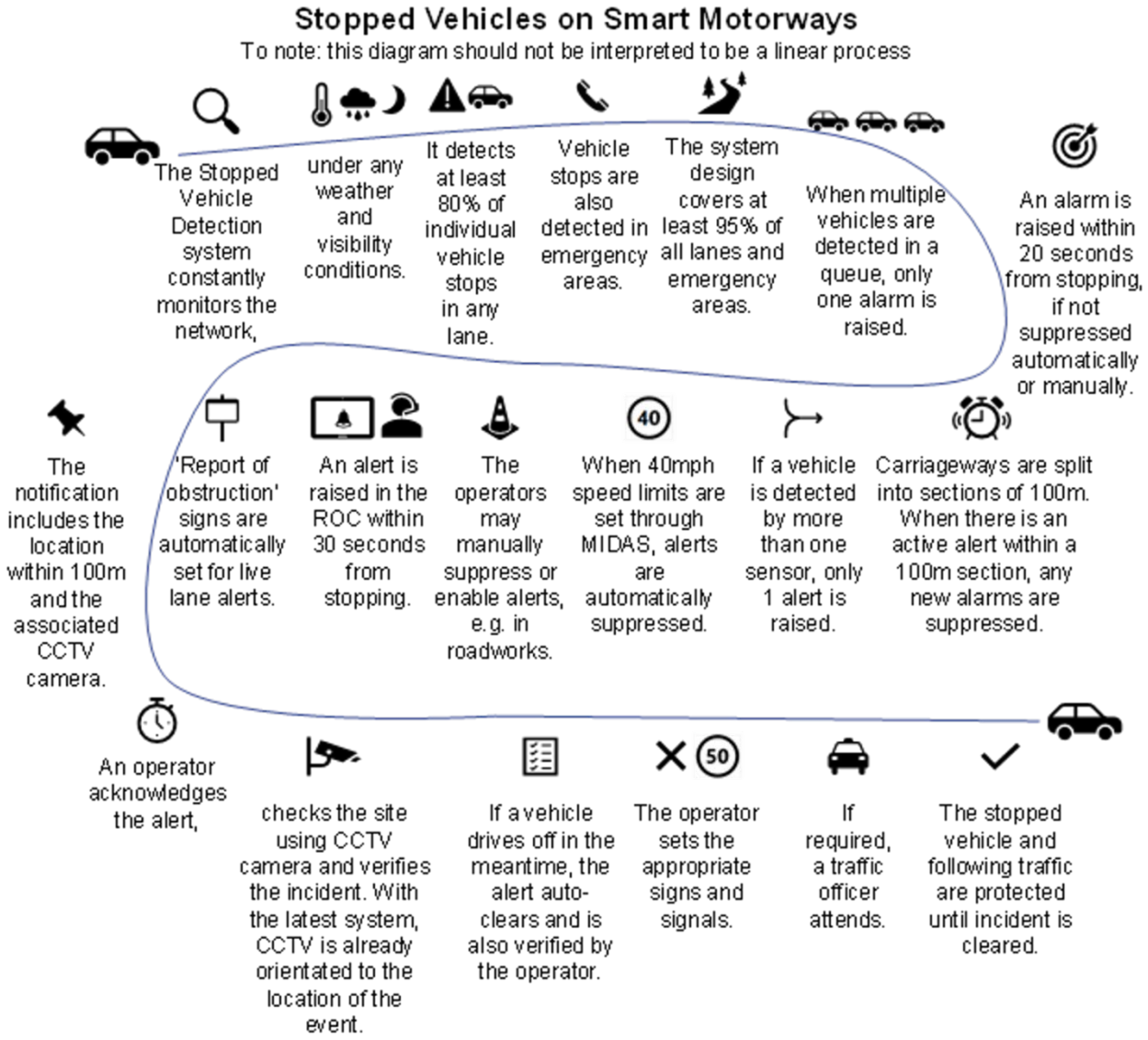
2.8 SVD is a radar-based enhancement that works with other systems to reduce the risks associated with live lane stops on ALR smart motorways. After a stopped vehicle is detected, the SVD system sends alerts of stopped vehicles to the traffic management systems in place at National Highways' Regional Operations Centres (ROCs). Once received, the system presents an alert to the operator for action, and automatically sets 'report of obstruction' on message signs on roads.

2.9 The end-to-end process for SVD is illustrated in the diagram below, based on the performance requirements set by National Highways. There are two key parts of this process where National Highways can measure performance of the system.

One is the effectiveness of the radar system in detecting stopped vehicles, which is discussed in detail below.

2.10 Another key part is the final step in the process, where National Highways' traffic officers attend and assist a stopped vehicle until the incident is cleared. The company has consistently achieved an average attendance time of under 10 minutes for traffic officers responding to live lane stops on ALR motorways where emergency areas are greater than one mile apart since September 2022.

Figure 2.1 The concept for the end-to-end systems for stopped vehicle detection



Source: National Highways

2.11 In our 2022 safety report we detailed how National Highways tests SVD in a post-event verification exercise to assure itself that the system is meeting its operational requirements for detection rates, detection time and false alerts. This process is called 'ground truthing' and is undertaken at the opening of each ALR scheme, and subsequently on an annual basis.

2.12 Ground truthing uses a 24-hour period of recorded CCTV footage from the ROC. This footage is manually reviewed at a later date to determine the proportion of stopped vehicles where an alert was correctly raised by the SVD system, and the time taken for an alert to be generated. The footage is also used to calculate the proportion of SVD alerts that were incorrectly raised ('false detections'). Ground truthing does not measure National Highways' wider operational response to a stopped vehicle; traffic officer attendance, for instance, is reported separately.

2.13 The results from ground truthing are a snapshot of the system at the time of testing, and do not provide a continuous assessment of performance. As it is not carried out in real time, it has no impact on the automatic setting of warning signs, or on the operator's subsequent actions. As such, the ground truthing process has no direct effect on National Highways' operational response to stopped vehicles on the network or on road user safety.

2.14 A key finding from our safety report in December 2022 was that SVD technology in place on ALR smart motorways was not meeting the performance requirements set by National Highways. We said that rapid improvements were urgently required against three key metrics of detection rate, false detection rate, and time to detect stopped vehicles. National Highways committed to achieving this by the end of June 2023.

2.15 Since then, we have worked closely with National Highways to monitor its work to improve SVD performance. The company identified a series of potential software fixes that included improvements to the performance of radar equipment and filtering out multiple alerts created by vehicles stopped in queuing traffic.

2.16 National Highways subsequently implemented these on three initial pilot sites, also known as the 'spearhead' schemes. The three ALR motorway sites where the fixes were first tested were: M20, junction 3-5; M1 junction 16-19; and M6 junction 2-4.

2.17 National Highways analysed the testing data from these schemes to confirm that the fixes resulted in improved performance of SVD before they were rolled out to the remaining ALR motorways by 14 June 2023. The company shared this

analysis with us as part of our review. On 28 June 2023, National Highways wrote to us to provide a formal update on its progress, including initial performance results from the spearhead schemes.

2.18 We have now received data for a total of 21 schemes, following ground truthing testing of all ALR motorways where the software fixes were rolled out. A detailed list of these can be found at Annex A.

Key SVD requirements

2.19 The key requirements for the SVD service as set out by National Highways in its technical requirements are:

(a) Detection rate 80% minimum

The detection rate for detecting a stopped vehicle that triggers an SVD alert shall be at least 80%. This is the proportion of stopped vehicles that are correctly identified by SVD.

(b) False detection rate 15% maximum

The false detection rate shall be lower than 15% of all SVD alerts raised. The false detection rate is defined as the proportion of all SVD alerts reported incorrectly, because a SVD alert does not relate to a true stopped vehicle event.

(c) Time to detect shall not exceed 20 seconds

The time to detect shall not exceed 20 seconds. The time to detect is the elapsed time between a vehicle stopping and a SVD alert message with the status ‘alert’ being generated.

Ground truthing results

2.20 Table 2.2 summarises aggregated results for all ALR schemes following the most recent round of ground truthing testing in 2023.

Table 2.2 SVD performance on ALR motorways, based on ground truthing testing undertaken between June and October 2023

Key: Above target Below target

Metric	Target	East	North West	Midlands	South East	Yorkshire and North East	National
Detection rate (%)	**>80%**	93%	87%	88%	91%	76%	89%
False detection (%)	**<15%**	3%	4%	8%	4%	13%	6%
Alert time (secs)	**<20 secs**	10.8	15.3	13.9	8.5	9.7	12.2

2.21 This shows that:

- The 80% target for detection rates was met in all regions, except for Yorkshire and North East, where performance was 76%. Annex C shows that there were significantly fewer SVD alerts in Yorkshire and North East, compared to the other regions.
- The requirement for false detection rates to be below 15% was met in all regions. The region with the highest proportion of false detections was Yorkshire and North East, where the rate was 13%.
- The average alert time target to detect stopped vehicles in less than 20 seconds is being met in all regions. The region with the highest average time to detect was the North West (15.3 seconds).

2.22 This year, we also required National Highways to report on the 'proportion of stopped vehicles that were correctly detected within 20 seconds'. We consider this is a better measurement of the technical requirement for SVD that the time to detect shall not exceed 20 seconds. This showed that 92% of stopped vehicles were detected within 20 seconds.

2.23 National Highways changed the methodology used to calculate SVD performance for the ground truthing that was undertaken following the software fixes that were

rolled out in the first half of 2023. The latest testing data are therefore not directly comparable to the figures reported in December 2022. These methodology changes are discussed next.

Stopped Vehicle Detection: Methodology changes

2.24 In 2023 National Highways made changes to the ground truthing methodology it uses for measuring SVD performance.

2.25 The methodological changes were to:

(a) Exclude any alerts beyond defined SVD coverage areas. This means any alerts outside defined coverage areas, for example, short segments of the hard shoulder, were excluded from the testing.

(b) Exclude 'unverified' alerts: Any alerts categorised as 'unverified' were excluded from the analysis. An alert is classified as unverified when, during the ground truthing testing process, it has not been possible to use the recorded CCTV footage to verify all the performance metrics which are measured in a 'stopped vehicle event'. For example, if recorded CCTV footage does not capture the start of the event because it was pointed in a different direction, this would be excluded from the calculation as it is not possible to measure the time taken to detect the stopped vehicle.

Validation of performance improvements

2.26 We challenged National Highways to demonstrate that the improved performance of SVD was due to the fixes it had applied to the system, rather than being a result of the methodology changes.

2.27 The company did this by sharing details from testing it had undertaken on the three spearhead schemes to assess the effectiveness of the software fixes. Here, it applied a consistent methodology to ground truthing data from before the software upgrade (in 2022) and after the upgrade (in 2023). It repeated this for both the old and new methodologies. In both cases, the data showed improved performance across all three metrics of detection rate, time to detect and false detection rates in 2023 (after the software fixes).

2.28 National Highways used this evidence of the efficacy of the software upgrade to support its roll out to the remaining ALR sites. Due to the time and resources required to replicate old and new methodologies as part of the ground truthing testing, this process was not applied to all ALR sites.

2.29 As part of our work to assess SVD performance we visited one of National Highways' ROCs, which enabled us to observe performance first-hand. This is important because there are some parts of the operation of smart motorways that it is difficult to measure and seeing it first-hand allowed us a better understanding. This provided us with further assurance that National Highways had delivered performance improvements to the SVD system. In particular, it was clear that the volume of false alerts – which was a key concern when we reported on performance last year – was significantly lower than we observed on a similar visit in 2022.

Unverified alerts

2.30 One impact of the methodological changes is that a large number of stopped vehicle alerts are classified as 'unverified'. Our analysis shows that 85% of all stopped vehicle alerts were classed as unverified and therefore excluded from the performance calculation.

2.31 An alert is only classified as unverified as part of the ground truthing process – not in real time at the ROC. Therefore, the process of automatically setting warning signs, and subsequent actions of control room staff, is the same for all alerts irrespective of whether they are unverified or not.

2.32 Across the 21 schemes, there were 3,850 alerts. Of these, 3,286 were classified as unverified, this left a total sample size of 564 used for testing SVD detection rate and time to detect. This is set out in more detail in Annex C. Our analysis of the results shows that 80% of the tested events occurred in an emergency area. The remaining 20% were live lane stops.

2.33 A more detailed explanation of unverified alerts is provided below:

- Whether an event is 'verified' or 'unverified' is determined as part of the ground truthing testing process. As the testing takes place at a later date, and away from the control centre, it therefore has no impact on National Highways' operational response to a stopped vehicle, or on road user safety.
- Ground truthing is based on the manual review of recorded CCTV footage from a 24hr period to test whether alerts are true or false, and to measure the time taken to detect a stopped vehicle.

- If a vehicle stops in a live lane or an emergency area, but the CCTV camera is not pointing in the correct direction (and subsequently pans to view the vehicle), the testing process would class this as unverified.

- Part of the reason for this is that the start time of the incident cannot be accurately determined, so it is not possible to measure how long SVD took to detect the stopped vehicle. Where a camera pans round and detects a stopped vehicle, National Highways can have a high level of confidence that it has worked correctly, and it could be argued that this should result in a verified positive detection that would count positively towards SVD performance. However, to be consistent, and minimise bias in the calculation, it would be necessary to apply the same rule to when a camera pans round to see nothing there, and count that as a false alert. However, it is not always appropriate to do that (see next points).

- A camera may pan round and see a vehicle moving off. This is not unusual because testing data from ground truthing on the M20 has shown that over half of all verified stops are under 135 seconds (this does not include vehicles stopped in already queuing traffic). Here, National Highways cannot be certain if the alert was caused by a stopped vehicle (i.e. it would be required to make an assumption about how close to the radar location a moving car should be before it is classed as a verified alert). In these circumstances, the alert was likely to have been caused by the vehicle, but there is less certainty. And, again, the start time of the stop is not known.

- Alternatively, if a camera pans round and sees nothing there, there is uncertainty about whether this should be classed as a verified false detection. It is not clear if there was never anything there, or if a vehicle slowed down, or stopped, and then moved off again before the camera panned round.

- There are different levels of certainty associated with the various scenarios but, under the new methodology, National Highways only uses data where it has 100% certainty about how well the system has performed in detecting a stopped vehicle.

2.34 A further reason for a stopped vehicle alert being classed as unverified is because of camera faults. Data provided by National Highways show that average CCTV camera availability in 2023 is 96%, which is above the company's target of 95%. This suggests that most unverified alerts are due to cameras needing to be adjusted by operators, rather than cameras that were not working.

2.35 Where the closest camera to an SVD alert is not working, operators will use alternative cameras that are upstream or downstream of the alert to inform the operational response. When we visited the ROC we observed National Highways staff adjusting cameras to view vehicles once the system had alerted them to a stopped vehicle; this typically took only a few seconds.

2.36 As set out above, SVD detection rates, and times to detect, were calculated from 564 SVD alerts that were verified during ground truthing. Of these, 20% (112) related to vehicles stopping in live lanes, with the remainder relating to stops in emergency areas.

2.37 We recognise that vehicles stopped in a live lane represent a higher risk to road user safety than those stopped in emergency areas. With relatively few data points relating to live lane stops, we challenged National Highways on whether SVD is achieving the required standards in both emergency areas and live lanes.

2.38 In response to these concerns, National Highways provided additional evidence on SVD performance in live lanes, which is summarised below:

(a) The proportion of live lane stops compared to emergency area stops in the ground truthing data is broadly similar to that observed from other data sources. National Highways' operational data sampling in April and July 2023 shows that live lane stops account for 13% to 14% of all stops on ALR motorways. In comparison, the ground truthing results showed that live lane stops accounted for 20% of observations.

(b) The company highlighted that stopped vehicle detection rates identified in ground truthing were identical, at 89%, in both live lanes and in emergency areas. The 20 second average time to detect stopped vehicles was also met in both areas.

(c) National Highways also explained that it did not consider there to be any inherent bias in the ability of SVD radars to detect stopped vehicles in either live lanes or emergency areas. This conclusion is supported by the previous two points.

2.39 This provided us with assurance that SVD performance in live lanes is properly reflected in the wider data. However, it is important that National Highways continues to understand any difference between stops in live lanes and emergency areas as part of its ongoing work to optimise and enhance SVD performance.

Recommendations

2.40 The methodology and targets currently used by National Highways for measuring SVD performance are derived from two separate sources that are not fully aligned: the SVD user requirements and SVD technical requirements. The company should review and clarify both sets of requirements.

2.41 Following this review, National Highways must set out a clearly defined methodology for testing SVD performance to ensure comparable data is reported in future years. The company should ensure that the new methodology reflects the user and technical requirements and considers sample size and frequency of testing. This should be in place for the next round of testing that will take place in 2024 and allow a meaningful comparison with the data reported in 2023.

2.42 The large number of unverified results mean that there is a lot of data that National Highways is not utilising to better understand SVD performance. We consider that more detailed analysis of unverified alerts will help the company better understand SVD system performance and improve confidence in the SVD system in general. For example:

(a) Building a larger sample size of observations, particularly for live lane stops, will help the company better understand where and why these stops occur and inform the actions it can take to address the issue.

(b) Identifying localised issues relating to CCTV positioning or functionality will enable the company to identify actions it can take to optimise performance of the wider SVD system.

(c) Building its understanding of circumstances and locations where stopped vehicle detection rates are lower will help the company identify physical interventions and software fixes to improve performance.

2.43 Therefore, we recommend that, over the next year, National Highways reviews how it collects and analyses information about unverified alerts and uses this to inform further performance improvements. It is important that the company considers any differences in performance between live lanes and emergency areas as part of this.

Wider SVD performance

2.44 In addition to performance against the targets for detection rates and times, other metrics provide insight into the performance and availability of the wider SVD system. These are discussed below.

Alternative SVD technologies

2.45 In our 2022 annual safety report we recommended that, in the longer term, National Highways should consider alternative SVD technologies and suppliers to ensure it gets the most efficient and accurate systems for detecting stopped vehicles.

2.46 National Highways has updated us on the status of its CCTV analytics project, which aims to use artificial intelligence (AI) to work alongside, rather than replace, the existing SVD solution. The company has tested this to identify stopped vehicles from CCTV footage as part of its ground truthing process.

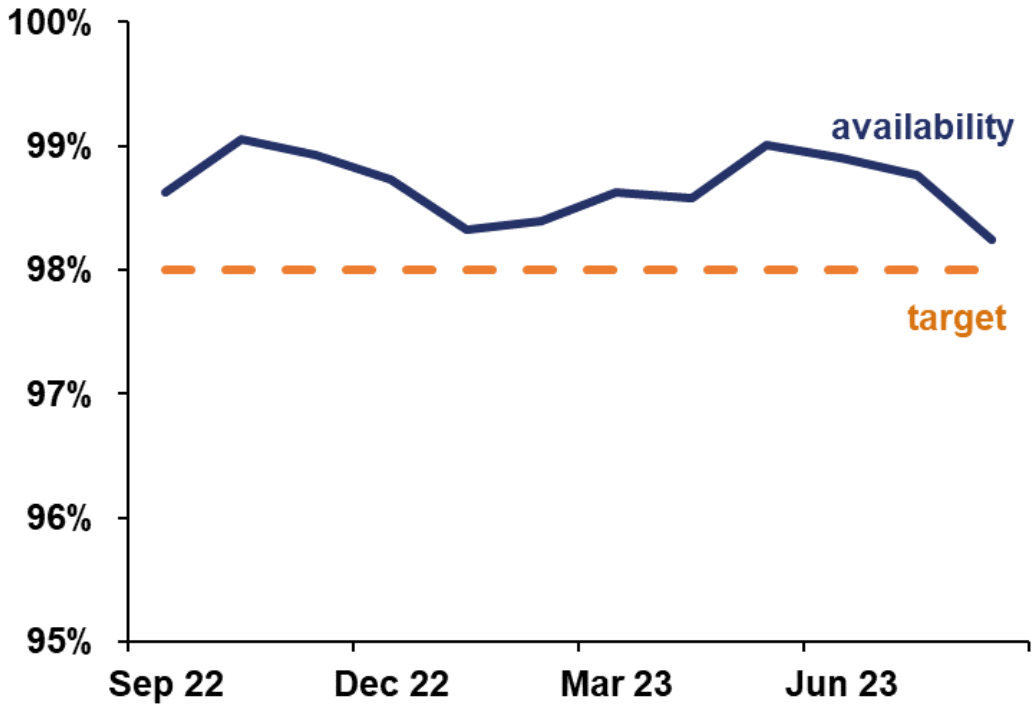
2.47 National Highways has reported that initial results are positive, and performance is comparable with the current (manual) solution. The company expects to have completed testing and, if successful, be able to use the solution in ground truthing by June 2024. Beyond this, and assuming successful deployment, the company intends to investigate the potential to bring the solutions into the live operational environment to supplement radar based SVD detection.

2.48 In addition, National Highways has launched an Innovation Competition to promote innovative solutions for hazard identification, management and response on the network, and human based challenges in the ROCs. We will work with the company to understand progress in this area, and how it can contribute to improvements in the performance of the SVD system, in 2024.

SVD system availability

2.49 System availability is a performance metric that reports the proportion of time that a system is available for use. Figure 2.2 shows that availability of the SVD system remained above National Highways' target of 98% in the 12 months from September 2022 to August 2023. The average score for the year was 99%, with all regions achieving availability above 98%.

Figure 2.2 SVD system availability, September 2022 to August 2023



SVD Coverage

2.50 During the detailed design stage of an ALR scheme's development, National Highways goes through a process to ensure the SVD radars are positioned to meet the detection coverage area requirement of 95%. This involves desktop verification with 2D and 3D modelling and site surveys by the contractor and SVD supplier.

2.51 This year we reviewed a sample of ALR scheme drawings which demonstrated that the system design exceeded the target at the time of installation. However, National Highways does not currently have a robust system for ensuring this coverage is maintained. For example, if vegetation growth blocked the radar's coverage area, there is no proactive measure to alert operational teams to this.

2.52 We recommend that National Highways reviews the processes it has in place for monitoring SVD coverage to ensure that its 95% target is maintained.

SVD risk assessment update

2.53 In our 2022 safety report we reviewed the safety risk assessment that National Highways carried out in February 2022 to establish the risk profile of ALR with SVD in operation compared to ALR without SVD. The February 2022 safety risk

assessment concluded that the overall risk associated with a vehicle stopped in a live lane would reduce by 51.8% compared to the risk without SVD.

2.54 We queried whether enhanced SVD performance (i.e. increasing the detection rate) would result in a greater risk reduction and whether the company intended to revisit the safety risk assessment using up-to-date operational data.

2.55 In 2023 we revisited the company's SVD safety risk assessment in more detail. We found that the safety risk assessment was carried out in a logical way, using a timeline model and reasonable assumptions. This is in accordance with the company's requirements for safety risk assessment (GG 104) and is based on risk assessment methodologies that are recognised as good industry practice across sectors.

2.56 The risk assessment includes additional analysis, which used operational data from early SVD deployments on the M3 and M20 motorways and assumed enhanced SVD performance of 85% detection rates. This identified that the overall risk associated with a vehicle stopped in a live lane would reduce by 53.1% compared to the risks without SVD (a 1.3 percentage point improvement on the baseline risk reduction percentage identified by the company).

2.57 It remains unclear whether National Highways intends to revisit the SVD risk assessment using the latest operational performance data from the SVD system. It is also unclear how the company intends to validate the assumptions in the SVD risk assessment and how it will incorporate the findings from the SVD risk assessment in design and operational safety practices.

2.58 We recommend that the company reviews the safety risk assessment using up-to-date operational data from the SVD system to establish a clear view of the safety benefits of the system and clarifies how it intends to incorporate the findings from the safety risk assessment in design and operational safety practices.

SVD Maintenance

2.59 In December 2022 we reported that, in line with National Highways' maintenance requirements (GM701), all roadside technology defects that limit the capability of the SVD service must be resolved within 48 hours unless an alternative intelligence-led approach is identified and justified by network characteristics, asset intelligence and customer, safety, and delivery needs.

2.60 This year, National Highways has provided detailed data on ALR road asset maintenance. This shows that:

(a) 2,331 unique faults were raised against SVD radars

(b) 65.4% of faults were resolved in 48 hours

(c) The average fault duration is 5.3 days

2.61 National Highways is not meeting its requirement to resolve faults within 48 hours. The company recognises this and provided us with details of its fault prioritisation process, including how it tracks recurring faults. This process prioritises certain types of faults, for example those that are safety related, which can result in delays to resolving lower priority faults. We will continue to work with the company and monitor its progress in delivering improvements related to roadside technology defects, and report on this in our next safety assessment.

Interrelated systems and operational technology

Operational technology availability

2.62 Operational Technology (OpTech) describes the technology used by National Highways to operate and enable maintenance of the SRN. It can be found at the roadside and in the company's ROCs.

2.63 OpTech contributes to better safety outcomes for road users by providing the CCTV cameras, radars, signs and signals on smart motorways. These are essential systems that support SVD performance and form an important part of the end-to-end safety system that is described earlier in this chapter.

2.64 In our 2022 safety report we found that key OpTech assets on ALR motorways were not meeting the wider technology availability target of 95% that National Highways set itself (availability refers to the proportion of time that that the system is available for use). As a result, we concluded that the company must urgently produce an action plan for how it will achieve performance improvements.

2.65 Following this, National Highways committed £105 million to improve OpTech on ALR motorways and has set out a plan for how it will improve performance to achieve the aim the company set itself of 97% average availability for four asset types by the end of the road period. The availability score in September 2023 across these four assets was 95.6%.

2.66 National Highways' Modernisation and Refresh program for OpTech focuses on four key asset types on ALR motorways:

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

(b) Variable message signs (also known as warning signs);

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

(d) CCTV Cameras

2.67 The first phase of National Highways' plan involved analysis of data relating to the different OpTech asset types to identify those that were obsolete, not performing, or at the end of their life. This information was then used to inform the subsequent planning and procurement phases of this work.

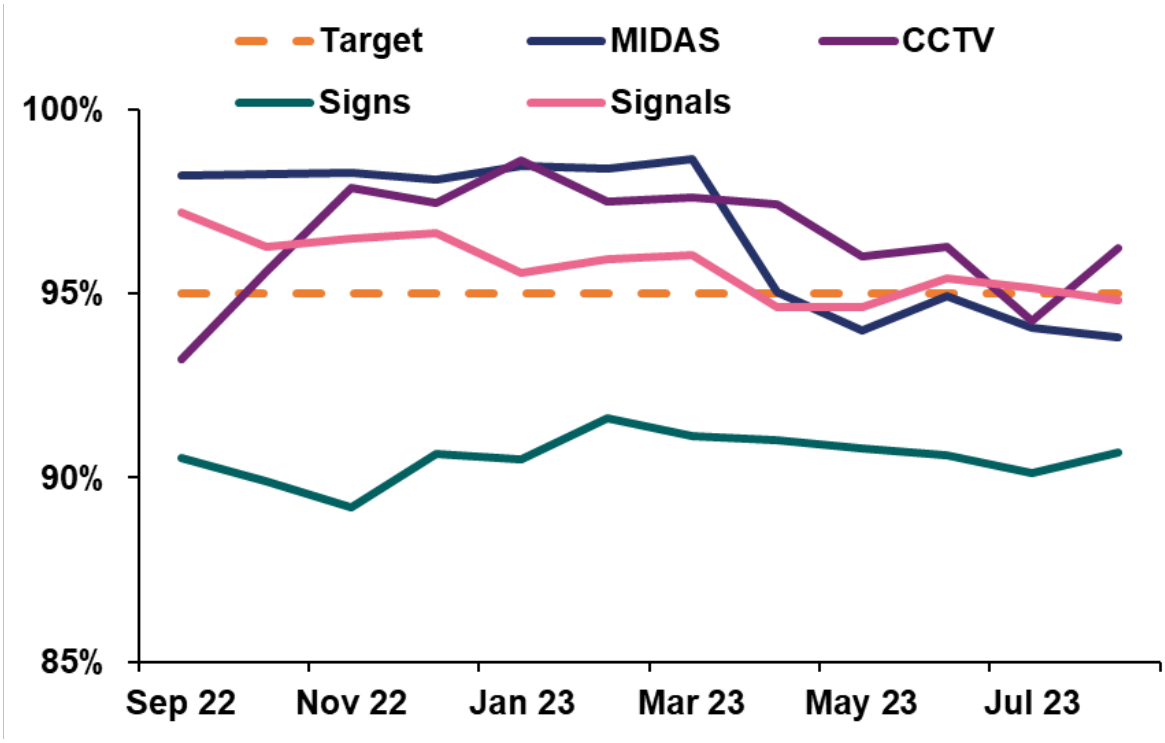
2.68 As part of this, National Highways is currently progressing surveys of CCTV and MIDAS, with further surveys of signs and signals planned from the end of January 2024. Delivery of upgrades to MIDAS and CCTV is planned from April 2024.

2.69 Figure 2.3 shows availability for the four key OpTech asset types for the year from September 2022 to August 2023 against the company's wider target of 95%. Performance is broadly similar to that reported in the previous year.

2.70 We expect to see improvements from April 2024 as upgrades are delivered and will hold National Highways to account for achieving a minimum of 97% average availability by the end of the road period.

2.71 In 2023 National Highways changed how it classifies faults relating to the availability of some technology assets. This change was intended to better identify those faults that affect service of the asset and improve how fault resolution is prioritised. This has resulted in changes to the availability scores reported for some asset types from April 2023.

Figure 2.3 MIDAS, CCTV, signs and signals availability on ALR smart motorways, September 2022 to August 2023



MIDAS and alert suppression

2.72 MIDAS detectors monitor traffic by collecting data on vehicle speeds, volumes, classification, and occupancy, aiding the identification of traffic queues and congestion. As part of the SVD system, MIDAS automatically suppresses alerts when traffic slows to 40mph or below. This reduces the number of alerts raised to operators from stationary or slow-moving traffic that can overwhelm control room staff.

2.73 For the year from September 2022 to August 2023, average availability for MIDAS was 97%. Figure 2.3 shows a drop in availability from April 2023, which corresponds to a change in how National Highways classifies faults, discussed in more detail in paragraph 2.71.

2.74 Last year we reported that vehicles stopped in already queuing traffic had contributed to the high number of reported false alerts and that this part of the system was not operating as effectively as it could. The software fixes rolled out by National Highways to improve SVD performance have addressed this issue, which has resulted in improved false detection rates. We also reviewed additional data from National Highways that demonstrated the system is working as intended (i.e.,

that alert suppression correctly functioned when 40mph variable speed limits were in place).

Signs (variable message signs)

2.75 Variable message signs (VMS) are used to convey safety information to road users on ALR motorways. These can be set by SVD alerts, which automatically trigger 'report of obstruction' messages (relating to live lanes), ahead of alert locations. The system triggers two variable message signs 'upstream' from the alert location, which is intended to give road users sufficient warning and also to provide additional resilience should a sign be faulty or displaying a higher priority message.

2.76 The average annual availability for warning signs in the latest year was 91%. This is slightly higher than the figure reported in the previous year (90%) but below National Highways' target of 95%. We expect to see improved availability of this asset from April 2024 as part of National Highways' OpTech improvement plan.

2.77 In 2022 we reported that further analysis was needed to provide confidence that system is operating as required. To assess performance in 2023, we analysed data from variable message sign logs and reviewed this against SVD alarms. This enabled us to check if the variable message signs were correctly displaying following an SVD alarm. We used data from two ROCs and two 24-hour periods, which showed that 97.1% of SVD alarms triggered a change to the variable message sign (Table 2.3, below).

Table 2.3 SVD alarms and variable message sign (VMS) setting across two 24-hour periods

Total SVD alarms	Change to VMS	Percentage of alarms changing VMS	Fail to change VMS	Percentage of alarms failing to change VMS
1,719	1,670	97.1%	49	2.9%

Signals (speed and lane control signals)

2.78 Signs and signals provide information that alerts drivers to hazards ahead and display 'Red-X' signals to close lanes to other traffic when a stopped vehicle is identified. This follows on directly from the warning sign function above; where a 'report of obstruction' sign is set, the operator will verify the incident and manually set the signals to close lanes as required.

2.79 Annual average availability for signals in the year from September 2022 to August 2023 was 96%. This is slightly below the figure of 97% we reported for the previous year. We will continue to monitor signal availability in 2024 as National Highways delivers its OpTech improvement plan.

CCTV

2.80 CCTV plays an important role in the SVD system. Once an alert is displayed to the ROC operators, the operators use the cameras to verify and classify the alert and then set the signals as appropriate.

2.81 Annual average availability for CCTV in the year from September 2022 to August 2023 was 96%. This is slightly better than the figure of 95% we reported for the previous year. We will continue to monitor CCTV availability in 2024 as National Highways delivers its OpTech improvement plan.

Enforcement cameras

2.82 Enforcement cameras are used to enforce variable mandatory speed limits and 'Red-X' compliance on smart motorways. They are designed to improve compliance with speed limits and 'Red-X' signals which should reduce the risk of a collision when a stopped vehicle has been identified.

2.83 Average availability for the year from September 2022 to August 2023 was 97%. National Highways is not the enforcing authority for traffic offences; therefore, this metric represents the technical availability of the cameras.

Issues affecting availability

2.84 In December 2022 we recommended that National Highways should establish the root causes of, and solutions to, issues affecting availability of CCTV and variable message signs. The company has begun a programme of work that will continue into 2024 to address this issue. We will assess progress as part of our wider work to monitor improved OpTech availability in 2024.

Conclusions

2.85 National Highways responded positively to the concerns we raised in our 2022 safety report that stopped vehicle detection on all lane running motorways was not meeting performance requirements. Targets for detection rate, false detection rate, and time to detect are now being met but the company now needs to focus on expanding its analysis to understand how it can fully optimise stopped vehicle detection performance.

2.86 In line with the recommendations made in this chapter, National Highways must set out a clearly defined methodology for testing SVD performance to ensure comparable data is reported in future years. This should be in place for the next round of testing that will take place in 2024 and allow a meaningful comparison with the data reported in 2023. In doing this, the company should review and clarify the SVD technical requirements, ensuring that the new methodology is fully aligned with these requirements, and considers sample size and frequency of testing.

2.87 The large number of unverified results mean that there is a lot of data that National Highways is not utilising to better understand SVD performance. We consider that more detailed analysis of unverified alerts will help the company better understand SVD system performance and improve confidence in the SVD system in general. Therefore, we recommend that over the next year National Highways reviews how it collects and analyses information about unverified alerts and uses this to inform further performance improvements. It is important that the company considers any differences in performance between live lanes and emergency areas as part of this.

2.88 In our 2022 annual safety report, we required National Highways to urgently produce an action plan, demonstrating how it will improve the performance of operational technology on all lane running smart motorways. The company is now implementing this plan to upgrade key equipment on these roads. We will continue to monitor delivery of the plan to ensure performance improves and it achieves its aim of 97% availability for key operational technology assets by the end of the road period.

3. Smart Motorway Stocktake and Action Plan

3.1 In March 2020, DfT published the smart motorway evidence stocktake and action plan (referred to in this section as 'the action plan'). The action plan set out 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 October 2021, the Transport Select Committee (TSC) published the outcome from its inquiry into the roll-out and safety of smart motorways. DfT responded to this review and, in line with the TSC's recommendation 6, commissioned ORR to report on the delivery of the action plan and evaluate its success in relation to:

(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 National Highways has now delivered the majority of the measures in the action plan, including all those that were due to be complete by this point. Many of these were completed during 2022, and into 2023, so there is currently limited data that can be used to make an overall assessment of the effectiveness of the action plan.

3.4 In late 2023, initial data to support this work has become available and we expect to see this reflected in the company's fourth-year smart motorway progress report, to be published in 2024. However, a full and robust assessment will require more data over several years. National Highways' Monitoring and Evaluation Plan sets out that three years of safety data, covering 2022 to 2025, will be required for this assessment.

3.5 This chapter focuses on National Highways' progress in delivering the action plan, and on the recommendations we made in our 2022 safety report in relation to the company's approach to evaluating the success of the action plan.

Action plan progress

3.6 National Highways continued to make progress in delivering the action plan during 2023. It has now completed the majority of actions, including all those that were due to be complete at this point. Two actions remain ongoing and are on track. These are:

(a) Action 2(a): all new smart motorways will open with SVD in place (as part of faster rollout of SVD). The M6 J21a-26 is the last remaining ALR scheme in construction, due to open with SVD in place by March 2025.

(b) Action 7(b): National Highways monitors and reports on smart motorway performance annually.

3.7 Table 3.1, below, summarises the status of each action from the action plan.

Table 3.1 Progress with the smart motorway action plan

Action reference	Description	Status (November 2023)	Completion date
1	Ending the use of dynamic hard shoulders	Cancelled (following the Government announcement)	N/A
2a	Faster rollout of Stopped Vehicle Detection	On track	On completion of M6 J21a-26 ALR scheme, expected by March 2025.
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

Action reference	Description	Status (November 2023)	Completion date
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	On track	Expected 2024
8	Making emergency areas more visible	Complete	March 2020
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

Action reference	Description	Status (November 2023)	Completion date
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

3.8 Eight of the actions above are aligned to reducing incidences of live lane breakdowns (actions 4 to 9, 12 and 17). Of these, only action 7 remains ongoing.

Investigations complete, action 7(a): A programme of safety measures to enhance safety across four locations

3.9 In September 2021 National Highways published the independent investigation reports into safety performance on specific sections of the M1 and M6 smart motorways where clusters of incidents had previously been identified. In summer 2022 the company published an update on the actions it was progressing on the M1 and M6.

3.10 A number of actions set out by National Highways for the M1 (J10-13) and M6 (J5-6) that were due to be taken forward as part of the work to convert DHS motorways to ALR were cancelled following the Government's 2023 announcement that plans for new smart motorways would be cancelled.

3.11 The company has now completed the actions it had identified for the M1 (J30-35 and J39-42), and it reports that the remaining actions on the M1 (J10-13) and M6 (J5-6) are on track to be completed by the end of March 2025.

Ongoing action 7(b): Monitor smart motorway performance and annual issue of safety performance report

3.12 National Highways published its third-year smart motorway progress report in December 2023, and we expect the fourth-year progress report to be published in 2024, which will complete action 7.

Completed action 17: Review all existing emergency areas where the width is less than the current standard

3.13 Since publication of our annual safety report in 2022, National Highways completed action 17, to review all existing emergency areas where the width is less than the current standard of 4.4 metres wide.

3.14 Last year we reported that National Highways had reviewed the width of 249 pre-existing emergency areas and identified 13 (six on ALR motorways and seven on DHS motorways) that were less than the standard.

3.15 Of the six emergency areas on ALR motorways, National Highways completed widening work at one, on the M1 between junction 32 and 33 in December 2022. In January 2023 it completed work at a second emergency area, on the M25 between junction 5 and 6. On-site measurements of three emergency areas showed that the width was greater than 4.4 metres and therefore no further work was required. No further work is planned at the remaining emergency area after National Highways concluded that widening work would have a detrimental impact on safety by worsening visibility to and from the emergency area.

3.16 Of the seven emergency areas on DHS motorways, one was situated behind a full-time hard shoulder and therefore did not require widening. National Highways' review of the remaining six (on the M5, M6 and M42) found that these emergency areas were all at least four metres wide and would require significant engineering work to extend them to 4.4 metres. It concluded that the safety benefit from widening the emergency areas would be negligible compared to the negative safety impact on the workforce and road users during construction. The work would also cause disruption to journeys and incur significant costs.

3.17 Last year we reported that National Highways had completed action six, to consider a national programme to install more emergency areas on existing smart motorways. In response to this, the company committed to install over 150 additional emergency areas on ALR smart motorways by the end of RP2. This work forms £390 million of the £900 million commitment by government to help ensure drivers feel safe by improving safety on existing all lane running motorways.

3.18 In September 2023, National Highways had completed work on 13 emergency areas, on the M1 and M6. The next phase of work is expected to deliver a further 40 emergency areas on the M1 and M25. We will continue to hold National Highways to account for its progress in delivering the full programme of 150 emergency areas by the end of the road period.

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

3.19 Six actions from the action plan are 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). Of these, only action 2a, that all new smart motorways will open with SVD in place, remains ongoing and on track.

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

3.20 All existing ALR smart motorways have SVD in place. However, there is one remaining ALR scheme (M6 J21a-26) that is currently under construction. Therefore, this action will remain open until the scheme is complete and opens with SVD in place, which is expected by March 2025.

Completed action 18: Review of red flashing lights by recovery vehicles

3.21 Since publication of our 2022 annual safety report, action 18, to review the use of flashing red lights by recovery vehicles, has been completed. This action was led by DfT and is considered complete following the Government's announcement in October 2023 that recovery vehicles will be allowed to display red flashing lights.

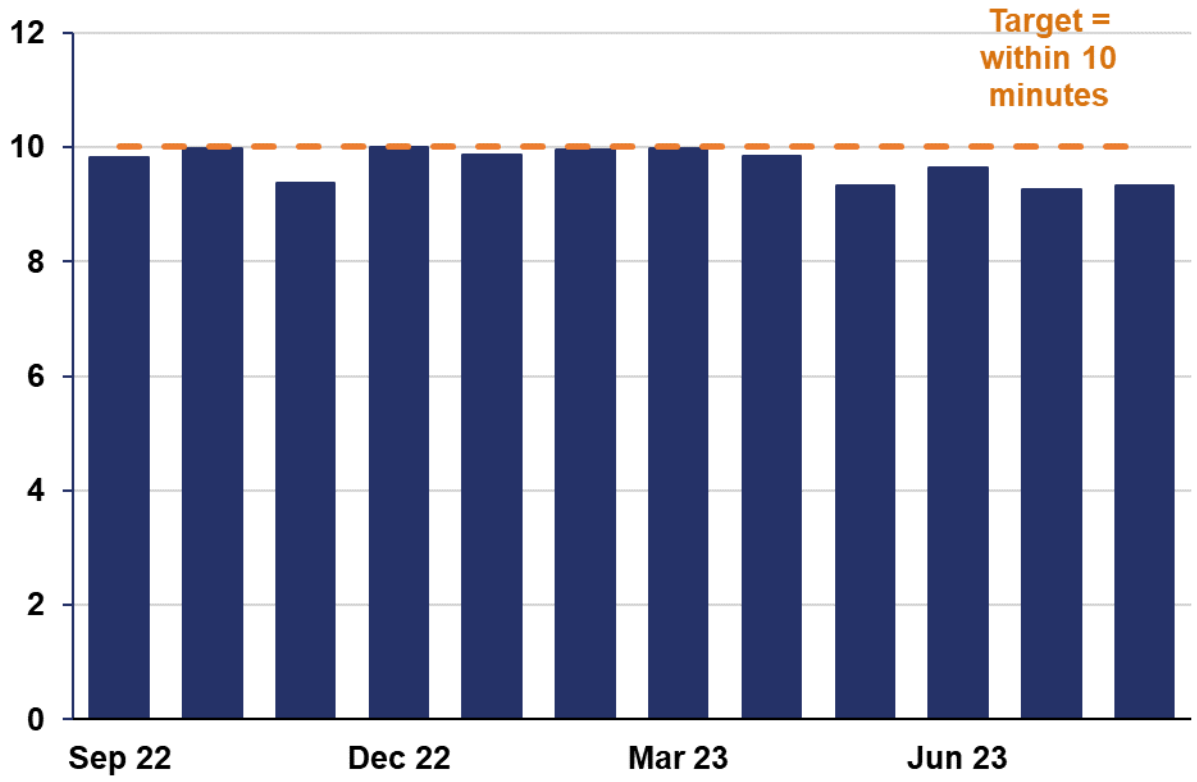
Traffic officer attendance times

3.22 Last year we reported that National Highways had achieved its target of 10-minute traffic officer attendance times on ALR smart motorways with emergency areas more than a mile apart. This relates to action 3, for 'faster attendance by National Highways traffic officers'.

3.23 The target was achieved in September 2022, following close monitoring and engagement between ORR and National Highways throughout 2022.

3.24 National Highways reports monthly data to us on its performance against this target. Figure 3.1 shows that the company has achieved the 10-minute target each month between September 2022 and August 2023.

Figure 3.1 Traffic officer attendance times on ALR motorways where emergency areas are further than one mile apart, monthly national average time in minutes, September 2022 to August 2023



3.25 Four of National Highways' six operational regions achieved annual average attendance times of under 10 minutes in the year from September 2022 to August 2023. The two regions that did not achieve annual average response times of 10 minutes were: the East region (10 minutes 22 seconds); and the South East (10 minutes 55 seconds).

3.26 National Highways reports that, between September 2022 and August 2023, live lane incident numbers on ALR smart motorways increased by 38%, from 1,308 to 1,808. This is likely to be related to increased traffic, as four new ALR schemes opened in this period, bringing the total to 21. We will continue to monitor and report performance against the company's attendance time target for the remainder of the road period.

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

3.27 Five actions relate to educating drivers on what to do if they breakdown in a live lane (actions 10, 13, 14, 15 and 19). Last year, we reported that all of these had been completed in line with the action plan.

Education campaigns

3.28 Last year we commissioned an independent review of the 'Go left' breakdown campaign, undertaken by Agilysis. The report on smart motorways education campaigns concluded that, overall, National Highways' approach aligned well with best practice. It also presented potential opportunities for the company to strengthen any future phases of education campaigns. Progress in these areas is outlined below.

(a) **Recommendation:** Extending the way in which internal behaviour change experts are involved can help to place the unwanted and desired behaviours in context, influencing the messages provided and the measurements collected.

Response: National Highways has partnered with external and internal specialists to create targeted campaigns that utilise tools including Theory of Change Models and segmentation.

(b) **Recommendation:** Quantitative data, collected on the SRN, could be used to provide a snapshot of actual driver behaviour (both in terms of the rate of breakdowns and the proportion of drivers using the left-hand lane) at specific locations and over the lifetime of the campaign. Additional qualitative testing could help to gauge the continuing relevance of the campaign content and enhance the lessons learnt.

Response: The company is collecting internal quantitative data from its incident management system (ControlWorks) and road casualty data, to support how it measures the effectiveness of its campaigns. However, it is recognised there are challenges to establishing cause and effect in this way.

(c) **Recommendation:** Other evaluation frameworks from wider transport campaigns and public health communications design best practice can be used to enhance the Government Communication Service (GCS) Framework and delve more deeply in to understanding the problem being addressed by the campaign.

Response: National Highways has drawn on guidance from other best practice frameworks in areas such as communications research and behavioural change, to enhance its application of the GCS framework in line with the recommendation.

3.29 Table 3.2 below gives an overview of campaigns run by National Highways between December 2022 and September 2023. Where initial work has been undertaken to assess the impact of the campaign, this is included in the summary.

Table 3.2 Summary of safety campaigns run by National Highways, December 2022 to September 2023

Campaign	Delivery dates	Summary and initial assessment findings
Breakdowns (Wave 5)	December 2022 to January 2023	Advice for drivers if they breakdown on a motorway without a hard shoulder. Almost six in 10 drivers recognised the campaign in some form.
'Red-X' Campaign	January 2023 to February 2023	Reminding drivers what to do when they see a 'Red-X' on a smart motorway. Over one in four drivers (26%) recognise the campaign, and 86% of drivers feel confident to move into an open lane if a 'Red-X' sign is set.
HGV Campaign	March 2023 to April 2023	Increasing awareness of HGV blind spots and areas of limited visibility. One in three car and van drivers recognised the HGV campaign with 70% of these drivers claiming to change their behaviours as a result.
T.R.I.P. Journey planning	July 2023 to September 2023	Initial campaign to raise awareness of how to prepare for long journeys: T.R.I.P. (Top-up, Rest, Inspect, Prepare).
Emergency call (eCall) awareness	Ongoing	Raising awareness of using eCall and the SOS button in an emergency.

Evaluating the success of the action plan

3.30 In our 2022 safety report, we detailed National Highways' monitoring and evaluation plan (MEP) that aims to assess how the action plan is contributing to the outcomes listed in paragraph 3.2. The MEP provides a top-down overview of the evaluation approach across the Stocktake Action Plan and sets out the implications for analysis and reporting timescales.

3.31 The company has continued to develop the plan to support monitoring and evaluation activities by setting out methodologies for:

(a) attributing impacts to stocktake actions;

(b) reviewing the impact of driver education campaigns;

(c) conducting longitudinal analysis for stocktake evaluation over a period of years; and

(d) a process evaluation (which aims to link changes in action scope to changes to action impacts).

3.32 National Highways continues to monitor the additional 10 emergency areas on the M25 and has issued 2021 and 2022 results to DfT. These results were inconclusive due to insufficient data. To fully establish whether additional emergency areas are having a safety impact, the company is undertaking further monitoring and evaluation work through the emergency retrofit programme.

3.33 The company is progressing its safety analysis, recognising the time lag between the stocktake actions being delivered and the data being available, and has told us it aims to share initial data with us early in 2024, as part of the delivery of the fourth-year smart motorway progress report, with associated analysis continuing year-on-year until 2027.

Coronavirus (COVID-19) pandemic impact

3.34 National Highways previously identified that impacts from the pandemic would complicate its methodology for evaluating the action plan. Fluctuations in traffic, particularly during 2020 and 2021, have heavily influenced safety data in these years, with casualty rates and driver behaviour both likely to have been affected.

3.35 The company has attempted to mitigate this in its analysis by using multi-year averages to smooth out short term fluctuations and has adopted these into wider monitoring and evaluation activities.

Recommendations on risk modelling

3.36 In 2021, we published our first quality assurance report of all lane running motorway data. This report included recommendations in relation to National Highways' approach to risk modelling on smart motorways, which we revisited in 2023.

3.37 Our 2021 recommendations focussed on National Highways' Generic Hazard Log for smart motorways. At the time we found that, overall, the process employed for constructing the Generic Hazard Log followed established practices that are commonly used in other sectors.

3.38 In the 2021 review, we found that some elements of the log were incomplete. While this did not lead to any material issues, this was addressed by the company at the time of the review. We also advised that National Highways should consider complementary tools in validating the Generic Hazard Log (such as extending its use of fishbone analysis, which is a visual representation of a process to understand contributing factors).

3.39 In 2023, we assessed the company's response to these recommendations. We appointed independent risk modelling experts (the Rail Safety and Standards Board, RSSB) to lead this work.

3.40 In 2021 we made three recommendations in relation to risk modelling:

(a) We recommended that the ALR Generic Hazard Log is completed with the relevant information inputted into the missing fields.

(b) In any regular review of the log, National Highways should specifically consider whether hazards are becoming inaptly fractionalised (i.e., dividing hazards into a number of sub-hazards that are principally the same).

(c) National Highways should use further risk analysis tools (such as fishbone analysis), to verify the expert views which have been used to populate the log. The outcome of this analysis could also inform whether there are other metrics that act as precursor indicators. This should be verified independently of National Highways, to provide stakeholders with greater confidence in the conclusions.

3.41 National Highways completed recommendation (a) at the time of the 2021 review.

3.42 For the remaining two recommendations, our 2023 assessment of the company's progress concluded that:

- National Highways' ALR hazard log represents a robust and comprehensive list of hazardous scenarios, providing a good framework for risk analysis of the hazards identified.

- Further rationalisation of the hazard categorisations is considered an ongoing feature of the company's continual review of the hazard log, and National Highways has a suitable continual improvement process to monitor, review and improve the hazard log, and this process is aligned with the good practice framework applied by RSSB.

3.43 This addresses the key recommendations on risk modelling from our 2021 quality assurance of ALR motorway data. In line with the findings from our review, noting that National Highways has appropriate processes in place to do so, it is important that the company ensures its ongoing review of the ALR hazard log continues to be aligned with good practice.

Conclusions

3.44 National Highways continues to make good progress in delivering the smart motorway action plan. The majority of actions are now complete, including all those that were due to be complete by this point, and the remainder are on track. However, it remains too early to make an overall assessment of the effectiveness of the action plan in:

(a) reducing the frequency of live lane stops;

(b) reducing the duration of live lane stops; or

(c) improving drivers' perception of safety.

3.45 In our 2022 safety report we concluded that National Highways' evaluation approach was in line with best practice guidance. In the latest year we have seen evidence that the company continues to develop and strengthen its approach.

3.46 In late 2023, data that will inform initial assessments has become available. In 2024 we will continue to work with National Highways to understand how it is using these data to support its evaluation of the action plan and we will report on this as the outputs of its analysis become available.

3.47 In December 2022 we highlighted that it was important that National Highways maintained its focus on achieving faster attendance times by traffic officers. It has demonstrated this by consistently achieving its 10-minute attendance time since then.

Annex A: ALR smart motorway scheme by region

Table A.1 ALR smart motorway SVD schemes for performance review 2023

Region	Scheme
East	M1 J13-16*
East	M4 J3-8/9
East	M4 J8/9-12
Midlands	M1 J13-16*
Midlands	M1 J16-19
Midlands	M1 J23a-25
Midlands	M1 J28-30
Midlands	M5 J4a-6
Midlands	M6 J2-4
Midlands	M6 J10a-13
Midlands	M6 J13-15
Yorkshire and North East	M1 J30-31
Yorkshire and North East	M1 J39-42
Yorkshire and North East	M1 J32-35a
North West	M6 J16-19
North West	M56 J6-8
North West	M62 J10-12
North West	M62 J18-20
South East	M20 J3-5
South East	M23 J8-10
South East	M27 J4-11

**M1 J13-16 crosses two regions and is treated as two separate schemes*

Annex B: Stopped Vehicle Detection

SVD system components from detection to alert

System	Description
SVD system (ALR only)	The SVD system is defined as the system on the roadside that sends alerts of stopped vehicles to the traffic management system. The SVD system raises two categories of alert – SVD (Live) – stopped vehicle detected in a live lane and SVD(EA) – stopped vehicle in an emergency area (EA). Currently, the technology used for the SVD system is radar based, for which National Highways has a sole supplier nationally. Scanning SVD radar is a technology that tracks moving vehicles through the field of view of the radar and raises the alarm to a Regional Operations Centre (ROC) operator if a vehicle stops in the carriageway or EA. The system is configured locally to understand which zones within its range are live lanes or EAs, and which zones are not relevant for SVD.
Traffic management system	Two traffic management systems are currently implemented in National Highways' Regional Operations Centres (ROCs) and receive stopped vehicle alerts from the roadside SVD systems. These traffic management systems are Control Office Base Station (COBS) & DYNAC. COBS is the National Highways legacy system, while DYNAC is the upgraded advanced traffic management system. DYNAC roll-out across the regions began in 2021. DYNAC has been installed in five ROCs. Two remaining ROCs are utilising the COBS system but are being maintained ahead of a future programmed upgrade. The traffic management system receives the alerts from the SVD servers, displays them to the operators for action and automatically sets 'report of obstruction' on upstream motorway signs, whilst operators are taking action.
National Road Tele-communications Service (NRTS)	NRTS operates and maintains the telecommunications services that link over 30,000 roadside assets including SVD, message signs, CCTV cameras and MIDAS to seven ROCs and the National Traffic Operation Centre enabling National Highways to manage and operate the network. NRTS provides the communication link between the roadside SVD radar, the SVD servers, and the traffic management system (DYNAC or COBS) in the ROC.

SVD service components from alert to resolution

System	Description
Closed-circuit television (CCTV)	CCTV plays an important role in the SVD service. Once an alert is displayed to the ROC operators, the operators use the cameras to verify and classify the alert and then set the signals as appropriate. CCTV allows

System	Description
	operators in the ROC to view parts of the highway network with the ability to see 100% of the carriageway on ALR smart motorways.
Message signs and signals	Signals display illuminated speed information and lane closure symbols. Message signs display illuminated text. This information can relate to signal setting, journey time information, incidents, weather, planned works, or road layout changes. For the SVD service, signs and signals provide information that alerts drivers to hazards ahead and display 'Red-X' signals to close lanes to other traffic when a stopped vehicle is identified. When an SVD alert is raised, the SVD system will automatically set message signs within the area to display 'report of obstruction'. Once the operator has verified the incident and its location, they can manually close lanes accordingly on the motorway using the signals.
National Highways' ROC operator actions	The operators play a critical role in providing the SVD service. Their role includes acknowledging the SVD alert, using CCTV to verify the situation, classifying the alert, setting signs and signals, and deploying resources, such as traffic officers.
Traffic officer attendance times	Traffic officers play a significant role in achieving National Highways' three imperatives of safety, customer service and delivery, by helping to keep the roads moving and road users safe. Traffic officers are deployed by the operators in the ROC when a stopped vehicle is detected and they take the lead role in managing the situation, except where there is an incident involving loss of life, life-changing injuries, or potential criminal activity which are managed by emergency services. There is an average 10minute attendance time target set for traffic officers on parts of the ALR network where places to stop in an emergency are greater than one mile apart.

Wider detection systems influencing SVD outcomes

System	Description
Motorway Incident Detection and Automatic Signalling (MIDAS)	MIDAS detectors monitor traffic by collecting data on vehicle speeds, volumes, classification, and occupancy. They identify queuing traffic or congestion by monitoring traffic speed and flow. Detectors can be inductive loops (sensors installed in the road surface) or 'side-fire radar' (radars installed on a pole beside the motorway). In the SVD service, MIDAS enables auto suppression of SVD alerts when the traffic flow is at 40mph or below. Auto suppression prevents multiple alerts from being sent to the ROC operators when cars are moving at low speeds and the risk of a collision (or non-identification of a stoppage) is low. MIDAS is not designed to automatically detect stopped vehicles, but due to its ability to detect slowing traffic and queues in the event of a stopped

System	Description
	vehicle in a live lane, it will provide a level of resilience to the SVD system for the operator to identify if there has been an incident. The ROC operators will see the automatic setting of reduced speed signs which will alert them to an incident that can be evaluated using the CCTV cameras to inform their response.
Enforcement cameras (HADECS)	Highways Agency Digital Enforcement Camera System (HADECS) v3 is a multi-lane speed enforcement system used to enforce Variable Mandatory Speed Limits (VMSL) and 'Red-X' compliance on smart motorway schemes. This should improve compliance with the speed limit and 'Red-X' signals set by the operators for various reasons including when a stopped vehicle has been identified, which should, in turn, reduce the risk of a collision.

Annex C: SVD ground truthing data

Table C.1 SVD detailed ground truthing results, regional totals, ground truthing testing between June 2023 and October 2023

	Total number of alerts (a)	Unverified alerts (b)	Number of events (c)	Number of events detected (d)	Detection rate (e)**	Average time to detect in seconds (f)	Number detected within 20 seconds (g)	Percent detected within 20 seconds (h)***	Number of alarms (i)	Number of Alarms related to an event* (j)	False detection total (k)	False detection rate (l)****
East	517	396	121	113	93%	10.8	107	95%	286	276	10	3%
North West	860	777	83	72	87%	15.3	60	83%	237	227	10	4%
Midlands	1,691	1,465	226	200	88%	13.9	184	92%	545	502	43	8%
South East	611	511	100	91	91%	8.5	87	96%	168	161	7	4%
Yorkshire and North East	171	137	34	26	76%	9.7	25	96%	63	55	8	13%
Total	**3,850**	**3,286**	**564**	**502**	**89%**	**12.2**	**463**	**92%**	**1,299**	**1,221**	**78**	**6%**

** An event can trigger multiple alarms*

*** Detection rate (e) is the number of stopped vehicle events detected (d) as a proportion of all stopped vehicle events (c).*

*** Percent detected within 20 seconds (h) is the number of stopped vehicle events detected within 20 seconds (g) as a proportion of all stopped vehicle events detected (d).

**** False detection rate (l) is the number of false detections (k) as a proportion of all alarms (i).

Annex D: Operational availability data

Table D.1 SVD availability, national total, monthly data, September 2022 to August 2023

	Sep 2022	Oct 2022	Nov 2022	Dec 2022	Jan 2023	Feb 2023	Mar 2023	Apr 2023	May 2023	Jun 2023	Jul 2023	Aug 2023
Availability %	98.6	99.1	98.9	98.7	98.3	98.4	98.6	98.6	99.0	98.9	98.8	98.2
Target %	**98**	**98**	**98**	**98**	**98**	**98**	**98**	**98**	**98**	**98**	**98**	**98**

Table D.2 CCTV availability, national total, monthly data, September 2022 to August 2023

	Sep 2022	Oct 2022	Nov 2022	Dec 2022	Jan 2023	Feb 2023	Mar 2023	Apr 2023	May 2023	Jun 2023	Jul 2023	Aug 2023
Availability %	93.2	95.6	97.9	97.4	98.6	97.5	97.6	97.4	96.0	96.3	94.3	96.2
Target %	**95**	**95**	**95**	**95**	**95**	**95**	**95**	**95**	**95**	**95**	**95**	**95**

Table D.3 Variable message signs availability, national total, monthly data, September 2022 to August 2023

	Sep 2022	Oct 2022	Nov 2022	Dec 2022	Jan 2023	Feb 2023	Mar 2023	Apr 2023	May 2023	Jun 2023	Jul 2023	Aug 2023
Availability %	90.5	89.9	89.2	90.7	90.5	91.6	91.1	91.0	90.8	90.6	90.1	90.7
Target %	**95**	**95**	**95**	**95**	**95**	**95**	**95**	**95**	**95**	**95**	**95**	**95**

Table D.4 VMS 2 x 24-hour snapshot data, supporting data to Table 2.3, VMS data from North West and West Midlands ROCs, July 2023

Date and Region	Alarms in 24hrs	Fail to change VMS count	Fail to change (%)
07/07/23 – North West	258	5	1.9%
07/07/23 – West Midlands	760	28	3.7%
13/07/23 – North West	429	2	0.5%
13/07/23 – West Midlands	272	14	5.2%

Table D.5 MIDAS availability, national total, monthly data, September 2022 to August 2023

	Sep 2022	Oct 2022	Nov 2022	Dec 2022	Jan 2023	Feb 2023	Mar 2023	Apr 2023	May 2023	Jun 2023	Jul 2023	Aug 2023
Availability %	98.2	98.3	98.3	98.1	98.5	98.4	98.7	95.0	94.0	94.9	94.1	93.8
Target %	**95**	**95**	**95**	**95**	**95**	**95**	**95**	**95**	**95**	**95**	**95**	**95**

Table D.6 Enforcement cameras availability, national total, monthly data, September 2022 to August 2023

	Sep 2022	Oct 2022	Nov 2022	Dec 2022	Jan 2023	Feb 2023	Mar 2023	Apr 2023	May 2023	Jun 2023	Jul 2023	Aug 2023
Availability %	98.3	97.7	97.8	96.6	92.4	97.1	97.1	97.7	96.6	95.1	97.0	97.0
Target %	**95**	**95**	**95**	**95**	**95**	**95**	**95**	**95**	**95**	**95**	**95**	**95**

Table D.7 Speed and Lane control signals availability, national total, monthly data, September 2022 to August 2023

	Sep 2022	Oct 2022	Nov 2022	Dec 2022	Jan 2023	Feb 2023	Mar 2023	Apr 2023	May 2023	Jun 2023	Jul 2023	Aug 2023
Availability %	97.2	96.3	96.5	96.7	95.5	95.9	96.0	94.6	94.6	95.4	95.2	94.8
Target %	**95**	**95**	**95**	**95**	**95**	**95**	**95**	**95**	**95**	**95**	**95**	**95**

Annex E: 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 alert is presented to the ROC operators, they utilise cameras to verify and classify the alert 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	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 detection rate is defined as the true positive rate, representing the proportion of ‘stopped vehicle events’ correctly identified by the SVD system.
Detection time (time to detect)	The time to detect is the elapsed time between a stopped vehicle event occurring and an SVD alert message with the status ‘alert’ being generated.
Delivery plan	National Highways' plan, which sets out in detail how it will deliver its strategic outcomes and measure success.
eCall	eCall is a system that phones the emergency services automatically if the vehicle it is fitted to is involved in an incident.

Terminology	Description
Emergency areas	A purpose-built place of relative safety which is located adjacent to the nearside of a mainline carriageway or diverge connector road.
False detection rate	The false detection rate is defined as the proportion of all SVD alerts reported incorrectly, because an SVD alert does not relate to a true stopped vehicle event.
Ground Truthing	Ground truthing is a process used by National Highways to assess and validate the operational performance of the Stopped Vehicle Detection (SVD) system. It involves testing the system against predefined operational requirements related to detection rates, detection time, and false detection rate. In the ground truthing process, recorded CCTV footage is employed, and this footage is later reviewed to monitor, verify, and time the alerts generated by the SVD system throughout a 24-hour period.
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.
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.

Terminology	Description
	Message signs are referred to as Variable Message Signs (VMS) or Warning Signs *Signals are also referred to as Speed and Lane Control Signals*
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)	Regional Operations Centres, used to 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.
Spearhead schemes	The Spearhead schemes are three initial pilot sites chosen by National Highways for the implementation and testing of potential software fixes intended to improve the performance of the SVD (Stopped Vehicle Detection) system. These schemes, located at M20 junction 3-5, M1 junction 16-19, and M6 junction 2-4, served as dedicated testing grounds where the identified software fixes were applied and evaluated for their effectiveness in the SVD system. Following successful testing and positive results at these spearhead schemes, the implemented fixes were then extended to the remaining All Lane Running (ALR) motorways.
Stopped vehicle event	One or more vehicles that have come to a complete stop within the Coverage Area as part of a single event. Stopped Vehicle Events do not include queuing vehicles that have stopped due to congestion or an incident.
Stopped vehicle detection (SVD) alarm	This refers to the notification of a stopped vehicle generated by the SVD system and passed on to National Highways' traffic management system. There can be multiple

Terminology	Description
	Alarms related to a single Stopped Vehicle Event
Stopped vehicle detection (SVD) alert	The message created by the SVD System relating to a Stopped Vehicle Event. This is the notification of a stopped vehicle that is presented to the operators. There can be multiple Alerts related to a single Stopped Vehicle Event
Stopped vehicle detection (SVD) system	The Stopped Vehicle Detection (SVD) system is defined as the roadside system responsible for sending alerts regarding stopped vehicles to the traffic management system. 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 alert 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 the 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).
Variable message signs	*See message signs above*

This publication is available at orr.gov.uk

Any enquiries regarding this publication should be sent to us at orr.gov.uk/contact-us