

ORR Quality Assurance of All Lane Running Motorway Data

Highways England Response to ORR Key Findings & Recommendations

August 2021



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Introduction

In April 2021 the Secretary of State for Transport commissioned the Office of Rail and Road (ORR) to undertake quality assurance of the data and evidence underpinning the conclusions arrived at regarding All Lane Running (ALR) motorways. ORR was specifically asked to address the following four questions:

- Are the data and evidence used in the stocktake and the progress report reliable and robust and in line with established/best practice;
- Have comparisons been made in an appropriate way about the relative safety of ALR motorways, with reference to conventional motorways and other roads;
- Are there any other data that could be used to enhance our understanding of the relative safety of ALR motorways, or to support the monitoring and evaluation of the effectiveness of the measures we are putting in place to improve safety and perceptions of safety; and
- Are there data and evidence available which can compare the international experience of operating similar types of road?

To reach its conclusions, ORR drew on its experience and expertise as the monitor of England's strategic road network, the safety regulator of Britain's rail network and the publisher of official railway statistics. The ORR Review Team analysed detailed information, interviewed relevant staff at both Highways England and Department for Transport (DfT) and reviewed the evidence submitted to the Transport Select Committee's [Smart Motorway inquiry](#), which commenced in February 2021. To provide additional expertise and challenge, ORR took independent analytical advice from a specialist consultancy and involved the non-executive chair of its Highways Committee.

The ORR review report and supporting Annexes have been published [here](#). We welcome the review findings – particularly that ORR found no errors in the underlying calculations, and all the products and processes reviewed are in line with good practice. We are an organisation committed to continuous improvement, and we agree with all of the recommendations made and welcome the opportunities for improvement that ORR have highlighted. We will seek to act upon these in our action plan.

This report provides our response to ORR's review and outlines how we plan to address ORR's review recommendations.

The following section summarises the key findings from the ORR review report and our response to each finding.

Findings Summary

The findings summary sets out the review questions, their findings and our general response, with our detailed responses to each recommendation tabulated from page 5.

Review question & finding 1

Are the data and evidence used in the stocktake and the progress report reliable and robust and in line with established/best practice?

ORR concluded "all the data that was available for analysis have been used". ORR found "no errors in underlying calculations, for example formula errors in spreadsheets used to process raw data. However, there is a limited amount of data available. In 2019, there were only 141 miles of ALR motorway, the network having expanded from 29 miles in 2014. This means that only 29 miles of ALR has a full five years' worth of data associated with it, and much less data is available for the remaining 112 miles."

Our response: We welcome the findings that there are no errors in the underlying calculations and that all available data have been used. We note that while supporting data is currently limited, we are constantly collecting more data through several types of activities, such as safety reviews, evaluations and network-wide assessments, to continuously improve our understanding of the evidence.

ORR question & finding 2

Have comparisons been made in an appropriate way about the relative safety of ALR motorways, with reference to conventional motorways and other roads?

ORR concluded that “overall the comparisons about the relative safety of ALR motorways were made in an appropriate way”. ORR noted that in the high-level statistics, comparisons made did not always separate between the types of road, for example between controlled motorways, Dynamic Hard Shoulder Running (DHS) or ALR. While this is indeed the case for the [‘Smart Motorway Safety Evidence Stocktake and Action Plan’](#), published in March 2020, this has been addressed in the [‘Smart motorways stocktake - First year progress report 2021’](#) published in April 2021.

ORR suggested the ‘before and after’ analysis, that is the ‘Smart Motorway All Lane Running Overarching Safety Report 2019’ published in December 2019, could be strengthened further by reflecting the latest Highways England counterfactual methods and considering DHS schemes as an additional point of comparison.

Our response: We welcome ORR’s conclusion that overall the comparisons about relative safety of ALR motorways were made in an appropriate way. We also agree with ORR’s findings and address these in our action plan (as outlined in the next section).

ORR question & finding 3

Are there any other data that could be used to enhance our understanding of the relative safety of ALR motorways, or to support the monitoring and evaluation of the effectiveness of the measures we are putting in place to improve safety and perceptions of safety?

ORR recognised that Highways England’s risk and hazard assessment (ALR Generic Hazard Log development) relies on expert inputs “validated by wider information that is broader than the high-level statistics or ‘before and after’ studies”. To further validate the risk and hazard assessment outputs, ORR has recommended that additional forms of risk analysis could be used to complement the existing approach.

Additionally, “there are fields within the Stats19 data (the official statistics which the police provide about personal injury road traffic accidents) that could be made available to Highways England to better understand risk exposure to specific road users”. Going further, ORR recommends that “Highways England could work with motor insurers to get access to information regarding no-injury collisions”.

Our response: We welcome ORR’s finding that the risk and hazard assessment process followed (i.e. development of the hazard log through facilitated workshops) is in line with established practices across sectors. We also recognise that whilst the overall outcome is considered sound, improvements are needed in the tools used. Noting that the above activities aim to further enhance the existing risk and hazard assessment, we address these in our action plan.

ORR question & finding 4

Are there data and evidence available which can compare the international experience of operating similar types of road?

ORR did not find “any readily available data and evidence relating to ALR operation internationally”. ORR has recommended that “the Conference of European Directors of Roads (CEDR) is a forum with which Highways England should continue to engage, specifically to improve its understanding of the risks associated with the removal of the hard shoulder”.

Our response: We agree with this finding and address this in our action plan.

Conclusion: We consider ORR’s findings reassuring that no errors have been identified in any of the review areas, and the products and processes reviewed are in line with good practice, while we note areas to improve with some of the tools we use. As part of our continuous improvement, we agree with all the recommendations and address these in our action plan, as set out in the following section.

Responses

The following table consolidates all recommendations from the ORR review report and supporting Annexes and outlines how we will aim to address these. In summary, we agree with all recommendations and will aim to address as outlined against each recommendation below.

We will also seek to adopt these recommendations into our business as usual processes and procedures, providing updates as appropriate in our planned publications as described in the table below.

Item	Document reference	ORR recommendations	Our responses
1	Main Report - Specific to the high-level statistics	We recommend that a smaller number of ‘headline’ metrics should be used to communicate safety.	Agreed While a wide set of evidence/ data will continue to be generated to assess safety on smart motorways for key publications, a smaller number of ‘headline’ measures will be used to summarise the safety performance of smart motorways. We have started this and will demonstrate how we have done this in the next smart motorways progress report, following on from the ‘Smart motorways stocktake - First year progress report 2021’ published in April 2021. This report is expected to be completed in Spring 2022.

Item	Document reference	ORR recommendations	Our responses
2	Annex A. High-level statistics	<p>A.23 Undertaking significance testing on the headline figures in future would help explain the levels of uncertainty around the results. We recommend that this is developed to be included with Highways England's published annual update of safety performance on smart motorways using 2020 road casualty statistics.</p> <p>A.30 We understand that this [statistical significance testing] is something DfT and Highways England are working towards and we recommend that Highways England puts this place in time for the company's published annual update of safety performance on smart motorways using 2020 road casualty statistics.</p> <p>A.33 The value of the analysis should be improved by quantifying the levels of uncertainty that exist around the high-level statistics, for example by undertaking statistical significance testing on the fatality rates on each road type. We recommend that Highways England should put this in place in time to be included with the company's published annual update of safety performance on smart motorways, using 2020 road casualty statistics.</p>	<p>Agreed</p> <p>We have started this and we will incorporate this in the (i) next smart motorways progress report (following on from the 'Smart motorways stocktake - First year progress report 2021') and (ii) updated ALR & DHS Overarching Safety Report.</p> <p>The updated ALR & DHS Overarching Safety Report will reflect the individual scheme data. This is expected to be completed in Winter 2022.</p> <p>Following advice by the ORR Review Team, the updated Overarching Safety Report will:</p> <ul style="list-style-type: none"> ■ Reflect scheme- specific data (similar to the 'Smart Motorway All Lane Running Overarching Safety Report 2019'); ■ Consider up-to-date data for all schemes (in line with the latest road casualty statistics); ■ Expand list of schemes to include both ALR and DHS schemes; ■ Incorporate the updated significance testing methodology.

Item	Document reference	ORR recommendations	Our responses
3	Annex A. High-level statistics	A.31 We recommend that Highways England makes high-level statistics available through an updated SMALR Overarching Safety Report at an individual scheme level. This will support better understanding of the underlying variation across schemes and highlight any instances where the safety performance for an individual scheme is below average.	<p>Agreed</p> <p>See item 2 above for more detail.</p>
4	Annex A. High-level statistics	A.33 We recommend that Highways England's future analysis should always consider conventional and controlled motorways (which include a hard shoulder) separately from other types of smart motorway when comparing high-level casualty statistics.	<p>Agreed</p> <p>We have started this and will demonstrate how we have done this in the next smart motorways progress report (following on from the 'Smart motorways stocktake - First year progress report 2021'). This is expected to be completed in Spring 2022.</p>
5	Main Report - Specific to the before and after studies	The counterfactual used is relatively simple and based on national trends. We recommend that steps are taken to refine the counterfactual and strengthen it.	<p>Agreed</p> <p>We will incorporate the latest Post Opening Project Evaluation (POPE) counterfactual methodology, which already addresses this recommendation, in the updated ALR & DHS Overarching Safety Report. This is expected to be completed in Winter 2022.</p>

Item	Document reference	ORR recommendations	Our responses
6	Main Report - Specific to the before and after studies	We are recommending that Highways England considers a review of whether the timing of the safety evaluation at one- and five-years of new highways schemes remains appropriate.	Agreed An independent review considering the timing of post-opening project evaluation was completed in March 2021. The review will shape future evaluation approaches.
7	Annex B. Before and after studies	B.21 We recommend that Highways England should update the project level and pooled before and after analysis reported in the Overarching Safety Report with outturn data for 2019 and 2020 (subject to data for that year being suitably comparable).	Agreed See item 2 above for more detail.
8	Annex B. Before and after studies	B.35 We think that Highways England's new approach represents an improvement to the method used in the Overarching Safety Report. We also support the concept of identifying a confidence interval, or sensitivity testing a range, around the counterfactual to reflect the uncertainty involved in its calculation, and/or how trends could be smoothed to avoid year-on-year fluctuations artificially impacting on the adjustment applied. We recommend these developments to the counterfactual are incorporated into the updates to the overarching analysis as well as in future POPE analysis.	Agreed See item 2 above for more detail.

Item	Document reference	ORR recommendations	Our responses
9	Annex B. Before and after studies	B.36 We recommend that Highways England reviews techniques employed elsewhere, including safety performance functions, and consider whether they provide feasible options for improving safety analysis of the SRN.	Agreed We will consider the application of the recommended approaches within safety evaluation as part of an ongoing process of methodological improvement and wider review of evaluation timing.
10	Annex B. Before and after studies	B.49 There are several other areas of development where we recommend Highways England should improve the robustness of its approach and/or how the results are interpreted in the future: (a) Casualty numbers are not independent of one another, which negatively affect the robustness of the statistical tests on casualties and KSIs. We understand that Highways England is developing a method to account for this in confidence intervals and statistical tests. While this approach is being developed, Highways England should include a clear health warning around significance tests on casualty numbers or avoid carrying them out and focus on collisions. (b) Linked to the point above, for transparency Highways England should set out its approach, and the assumptions that underpin it, more fully. This would not increase robustness in itself but would improve credibility and make it easier to understand the robustness of the evidence.	Agreed See item 2 above for more detail.

Item	Document reference	ORR recommendations	Our responses
10	Annex B. Before and after studies	<p>(c) Highways England's analysis of uncertainty in the Overarching Safety Report focused heavily on the tests of statistical significance. There is very little sensitivity testing to demonstrate the robustness of results to other sources of uncertainty. We think this should be strengthened in future and could cover areas such as the counterfactual (as discussed in the previous section) and testing the impact of individual projects on the overall ALR-level results.</p> <p>(d) The high-level statistics by road type offer a comparison between ALR motorways and other motorways, including other forms of smart motorway. And the before and after analysis compares ALR motorways to what safety might have looked like on those roads if they had not been converted. Extending the scope of the before and after analysis to include DHS projects on a consistent basis would offer an extra level of comparison of the relative safety impact of different forms of smart motorway.</p>	<p>Agreed</p> <p>See item 2 above for more detail.</p>

Item	Document reference	ORR recommendations	Our responses
11	Annex B. Before and after studies	B.81 As part of this update, Highways England should implement a set of relatively minor improvements to its approach, including applying its latest method for counterfactual adjustments. Also, to allow comparisons to be drawn, we recommend that Highways England extends its scope to include equivalent analysis for DHS schemes.	<p>Agreed</p> <p>See items 2 and 5 above for more detail.</p>
12	Annex B. Before and after studies	B.82 Over a longer timescale, we recommend that Highways England undertakes a broader review of its approach to the safety evaluation of new highway schemes. This should be informed by a review of the full range of statistical methods used elsewhere to evaluate the safety impacts of highway schemes. Consideration should also be given to the timing of such analysis and whether the default approach of relying on one- and five-year POPE reports is appropriate.	<p>Agreed</p> <p>See item 9 above for more detail.</p>
13	Main Report - Specific to risk modelling	We recommend that the ALR Generic Hazard Log is completed with the relevant information inputted into the missing fields.	<p>Agreed</p> <p>Noting that this is a presentational and non-material omission, we are updating this and we plan to complete this work summer 2021.</p>

Item	Document reference	ORR recommendations	Our responses
14	Main Report - Specific to risk modelling	In any regular review of the log, Highways England should specifically consider whether hazards are becoming inaptly fractionalised (i.e. dividing hazards into a number of sub-hazards are principally the same).	Agreed We will consider this in future review iterations of the ALR Generic Hazard Log. We review the hazard log periodically with the next review commencing in January 2022.
15	Main Report - Specific to risk modelling	Highways England 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 Highways England, to provide stakeholders with greater confidence in the consultations.	Agreed We will use additional types of risk analysis tools to validate the existing ALR Generic Hazard Log and this will be a two-step activity. The first step will be to identify the tools, assess them and decide which, if any, will be applied to the risk and hazard assessment process. We have started this work and we expect it to be completed in September 2022. The second step will be to apply these to the risk and hazard assessment process across all relevant business areas (not limited to ALR motorways). This will be incorporated in future risk and hazard assessment iterations.

Item	Document reference	ORR recommendations	Our responses
16	Annex C. Modelling of potential and outturn safety risks	C.31 We recommend that this is reviewed in line with current work that Highways England has planned to carry out. We also recommend that best practice tools and techniques (such as root cause analysis tools) should be adopted to provide confidence that the risks relating to ALR motorways are well- understood and that the right risk mitigation measures are in place.	Agreed See item 15 above for more detail.
17	Annex C. Modelling of potential and outturn safety risks	C.38 We recommend that Highways England conducts a trial of precursor indicator data, to determine the benefit to effort ratio, by establishing any restrictions or difficulties in the data and the value those data can add to Highways England's understanding of risk. Highways England should also consider intelligence gained from the use of the additional risk tools in the previous recommendation to better understand what metrics could act as indicators.	Agreed We will undertake a high-level scoping study which summarises the available data sources, the level of cost/ effort required and limitations in getting/ using this data. This is expected to be completed in Spring 2022 and will require agreement with DfT before proceeding with any further changes or investments.
18	Annex C. Modelling of potential and outturn safety risks	C.44 We recommend that DfT, in collaboration with Highways England, review what additional data within STATS19 could be made available to allow Highways England to better assess the risk exposure to specific users. For example, understanding country of origin and/or involvement of "high risk" vehicles in vehicle collisions on ALR.	Agreed We are exploring this with DfT based on whether additional data within STATS19 will add value to smart motorway safety analyses.

Item	Document reference	ORR recommendations	Our responses
19	Annex C. Modelling of potential and outturn safety risks	C.50 However, we recommend that given the limitations of the data available to assess the safety of ALR motorways there is an opportunity for Highways England to engage with CEDR to share lessons learnt from each National Authority's experience of defining hazards and modelling risk. This will allow Highways England to benchmark identified hazards and provide an opportunity to review controls in the spirit of continuous improvement.	<p>Agreed</p> <p>We will continue engaging with CEDR and raise this opportunity with CEDR to assess the group's appetite.</p> <p>It should be noted that CEDR priorities are governed by the 29 countries who are members and generally tend to be focused on environment and technology. The reduced comparability of motorways (as ALR motorways are not widely adopted yet by CEDR members) or appetite by other CEDR members to focus on this area may impact the outcomes of this action.</p> <p>We will also continue to engage with other national authorities, such as Australia, to share our experiences on managing similar high speed roads.</p>

Item	Document reference	ORR recommendations	Our responses
20	Annex C. Modelling of potential and outturn safety risks	C.54 When changes to the UK road infrastructure are implemented, a gap exists on how updated mandatory rules and guidance are communicated to both domestic and international road users. We recommend that the DfT and Highways England consider how future changes to the infrastructure and road rules are communicated to both the domestic and international road user.	<p>Agreed</p> <p>We are determined to do all we can to help all drivers feel safe and be safer on all our roads.</p> <p>This year, besides high-profile campaigns and ongoing public engagement, we have enabled a planned update of The Highway Code, which will enable drivers to more easily find information on how to drive on high-speed roads, including smart motorways. The updated Code is due to published in Autumn 2021, ahead of the original commitment of March 2022.</p> <p>We have delivered campaigns specifically addressing smart motorways and safety targeting both domestic and international road users.</p> <p>We continue to invest in road safety initiatives and public awareness campaigns and work with partners and stakeholders to amplify our messages.</p> <p>We continually look at where we can improve and will work with DfT and Driver and Vehicle Standards Agency (DVSA) to review how mandatory rules and guidance are communicated to both domestic and international road users and take any further necessary action.</p>

Item	Document reference	ORR recommendations	Our responses
			<p>Agreed</p> <p>We will continue to listen to public concerns and tailor our public information campaigns and engagement, and on-road advice, accordingly, to continue to raise awareness and provide clarity to all drivers.</p>
21	Main Report - Specific to perceptions and communication	The publication of data relating to the safety of ALR should continue, and the before and after analysis should be updated regularly, including the overarching assessment of ALR as a concept.	<p>Agreed</p> <p>We will continue to reflect this in future smart motorways progress reports (following on from the ‘Smart motorways stocktake - First year progress report 2021’). The next one is expected to be completed in Spring 2022.</p>
22	Main Report - Specific to perceptions and communication	We recommend that, in addition to the actions taken in response to the Stocktake, DfT and Highways England review how future changes to the infrastructure and road rules are communicated to both the domestic and international road user.	<p>Agreed</p> <p>See item 20 above for more detail.</p>

Annex Glossary of terms

Term	Explanation
All Lane Running (ALR) motorways	All Lane Running (ALR) motorways apply the controlled motorway technology, permanently converts the hard shoulder as a running lane, and feature emergency areas. Emergency areas are places to stop in an emergency. They are approximately 100 metres long (the average length of a football pitch) by 4.6 metres wide and set back from the left-hand edge of the motorway. An emergency telephone from which to alert Highways England of an issue and call for help is provided in each emergency area and all of them have orange surfacing to make them more visible. Emergency areas are for when a driver has no alternative but to stop and it has not been possible to leave the motorway or reach a motorway service area. Other places to stop in an emergency include sections of remaining hard shoulder, such as on slip roads at junctions. The distance between places to stop in an emergency varies across the smart motorways, from 0.3 miles apart to 1.6 miles apart.
Controlled Motorways (CM)	Controlled Motorways apply technology to a conventional motorway to control the speed of traffic retaining a permanent hard shoulder. 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.

Term	Explanation
Dynamic Hard Shoulder Running (DHS) motorways	Dynamic Hard Shoulder Running (DHS) motorways apply the controlled motorway technology and temporarily increase capacity by utilising the hard shoulder, and feature emergency areas. The hard shoulder is some of the time, but not always, used as a live running lane, with electronic signs to guide drivers when it is safe to use for live running. Emergency areas are installed as on ALR motorways.
POPE	Highways England produces Post Opening Project Evaluation (POPE) reports '1 year after' and '5 years after' following the opening of a road scheme.
Smart motorway	A smart motorway is a section of motorway that uses traffic management methods to increase capacity and reduce congestion in particularly busy areas. These methods include using the hard shoulder as a running lane and using variable speed limits to control the flow of traffic.
STATS19	STATS19 database is a collection of all road traffic accidents that resulted in a personal injury and were reported to the police within 30 days of the accident. More information can be found at: https://data.gov.uk/dataset/cb7ae6f0-4be6-4935-9277-47e5ce24a11f/road-safety-data
Strategic road network	In England, the strategic road network is made up of motorways and trunk roads (the most significant 'A' roads). They are administered by Highways England, a government-owned company.

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