THE PLANNING ACT 2008

M4 (JUNCTIONS 3 TO 12) (SMART MOTORWAY) DEVELOPMENT CONSENT ORDER APPLICATION

TR010019

Issue Specific Hearing - Environment - Traffic Safety

Appendix A - Highways England evidence to the Transport Select Committee

Deadline VII - 17 February 2016

Written evidence from Highways England (ALR0011)

1. Executive summary

1.1. Highways England welcomes the opportunity to contribute to this inquiry.

1.2. We are responsible for maintaining, operating and modernising England's strategic road network of motorways and major A roads which are among the safest in the world[1]. Within that network our motorways continue to have the best safety records of all. And that is the way we intend to keep them.

1.3. We are delivering a £15bn programme of improvements as part of the Government's Road Investment Strategy. That includes creating a spine of smart motorways that connect England's major cities and underpins the growth of our national and regional economies.

1.4. Smart motorways all lane running provides an additional 33% capacity on the strategic road network, with no reduction in safety, for 60% lower cost than traditional road widening.

1.5. All lane running also provides the opportunity to modernise and improve performance on far more of the motorway network than would be possible under previous approaches. This extra capacity is added in much shorter timescales as less new infrastructure is required.

1.6. Smart motorways have been operational since 1995 and are designed to ease congestion, improve traffic flow without compromising safety. All lane running (ALR) is the latest version, where extra capacity is added to routes by converting the hard shoulder to a traffic lane and using technology to provide a controlled, intuitive environment which encourages positive driver behaviour.

1.7. The first ALR schemes were introduced on the M25 in 2014. On 1 February we will be publishing interim reports[2] based on the first 12 months of performance data which indicate the concept is working well, in line with expectations. Journey times and reliability have improved, especially in peak periods and there have been overall reductions in collision and casualty rates. And by keeping traffic on the motorway or attracting traffic to it, more traffic is kept on our safest roads, meaning more road users are driving in a safer environment.

1.8. Driver behaviour continues to play a big part in the overall success of smart motorways and we have planned a comprehensive driver awareness programme this year, to raise awareness of key issues such as compliance with red X signals.

1.9. Conclusive evidence of the performance of ALR will come with three years of safety data. Evidence to date however gives us the confidence to proceed with our smart motorways programme. We accept there are concerns and lessons from these first schemes that will be incorporated into the future programme; however it is important these are viewed in the context of the overall high levels of safety which exist on all our motorways.

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[1] British Road Safety Statement, December 2015
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/487704/british_road_safety_statement_print.pdf

[2] http://www.highways.gov.uk/knowledge/projects/smart-motorway-all-lane-running-sm-alr-1st-scheme-monitoring-j5-7

http://www.highways.gov.uk/knowledge/projects/smart-motorway-all-lane-running-sm-alr-1st-scheme-monitoring-j23-27

2. Introduction

2.1. The first two ALR schemes were introduced on the northern section of the M25 between junctions 23 and 27 (Hertfordshire/Essex) and on the southern section between junctions 5 and 7 (Kent/Surrey). A further scheme will become operational on the M1 J39-42 by the end of January 2016. The ALR design is now the standard for smart motorways going forward. As set out in the Government's Road Investment Strategy, over the course of the 2015/16 - 2019/20 period we will start work on 480 lane miles of smart motorway, and will complete 286 miles.

2.2. ALR is the latest design of smart motorways[3] which has been an evolving concept designed to ease congestion and improve traffic flow for the benefit of road users on our busiest motorways. In 1995 the first approach was implemented on the western section of the M25 and involved the use of technology to manage traffic on existing traffic lanes.

2.3. In 2006 the concept of using the hard shoulder as a traffic lane at peak times was introduced in a pilot project between junctions 3a and 7 of the M42 in the Midlands. This had the benefit of increasing capacity (but limited to 60mph) and improving journey time reliability more efficiently, in terms of cost, time and impact, than traditional widening, while maintaining safety.

2.4. By 2014 a new version, the ALR design was implemented which requires less new infrastructure to be constructed. By avoiding the need to open and close a hard shoulder, the additional capacity created can be used at the national 70mph speed limit. This reduces the risk of part time use of the hard shoulder and instances of drivers being unsure of the hard shoulder status, as well as reducing the amount of infrastructure needed to manage the environment. In summary a simpler, more intuitive driving environment.

2.5. ALR converts the hard shoulder to a permanent traffic lane, and includes overhead variable message signs, full CCTV coverage, traffic monitoring and refuge areas. It has been designed to provide an environment that encourages positive driver behaviour. This additional capacity and controlled environment leads to smoother traffic flow, reduced speed differences between lanes, discouraging weaving and resulting in safer, more reliable journeys.

2.6. Capital delivery costs indicate that ALR is some 60% more cost efficient than delivering increased capacity through traditional widening and 40% more cost efficient than using the hard shoulder at peak times.

2.7. The decision to permanently convert the hard shoulder under ALR has been underpinned by extensive safety assessments, using the body of evidence gathered through earlier schemes and other similar operating environments.

2.8. On 1 February we will be publishing interim reports based on data from the first 12 months of operation[4] of the ALR schemes on the M25. The data shows journey times improved, congestion reduced and the safety objective is likely to be achieved.

2.9. We recognise, however, the challenges this new environment presents and the need for continuous improvement and so our submission outlines what we are doing to drive further improvement in the key focus areas under the Committee's terms of reference.

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[3] Smart motorways is an umbrella term for schemes which encompass any of the following operating types: controlled motorways (CM), hard shoulder running (HSR) and all lane running (ALR). An overview of these smart motorway types are provided in attachments A and B.

[4] The ALR 12 month reports are based on 12 months of operational data from May 2014 to April 2015, which includes 12 months of data for M25 J23-25 and J5-7, with 6 months of data for J25- 27 which opened in November 2014.

3. The impact of all lane running on the safety of motorway users

3.1. The strategic road network in England is one of the safest in the world. Within that network motorways are the safest.

3.2. Conclusive results will come with three years of safety data, however data relating to the first 12 months of ALR on the M25 shows the schemes are safe. And by keeping traffic on the motorway or attracting traffic to it, more traffic is kept on our safest roads.

3.3. Overall collision and casualty rates have decreased compared to the previous three years and no fatal collisions have taken place on either scheme attributable to the ALR concept.

Figure 1 - Collision and casualty rates for M25 J23-27 and J5-7 ALR schemes

Scheme	Collision rates	Casualty rates
J23-27	19% reduction	15% reduction
J5-7	15% reduction	27% reduction

3.4. There was an annual average increase, from 5 to 9, in recorded serious collisions on J5-7, which has contributed to an increased collision severity index. There was a reduction in the average serious collision rate on J23-27. Accidents are caused by a number of factors. Analysis of these collisions indicates that the road environment was a contributory factor in only a minority of these cases, with driver/rider error being the major contributory factor. The increases are not considered to be statistically significant (with only one year of data).

3.5. As part of our safety modelling prior to the scheme opening we predicted an increase in live lane breakdowns to 0.35 per carriageway mile per day. Our experience to date is that the number of live lane breakdowns has increased but not to the level we predicted with less than 0.3 breakdowns per carriageway mile per day on both schemes.

3.6. The initial evidence indicates that even though live lane breakdowns have increased as predicted, there has not been the same scale increase in the number of live lane collisions with stationary vehicles resulting in injury. There was one slight injury collision on each scheme in the first 12 months of operations; there had been one such collision on J23-27 in the preceding three-year assessment period.

3.7. The ALR design incorporates the provision of regular refuge areas. It should be noted that while commonly regarded as a safe place of refuge, the hard shoulder on a traditional motorway is not a safe environment – between 2010 and 2014, 8% of the fatal collisions on all motorways happened on hard shoulders. ALR eliminates non-emergency hard shoulder stops and provides opportunities for drivers to stop off the carriageway in dedicated refuge areas. These include purpose-built emergency refuge areas (ERAs), hard shoulders on exit slip roads, or Motorway Service Areas. They are provided at a general spacing of up to 2,500m and at a speed of 60 mph drivers will still pass one (an area of refuge) roughly every 90 seconds.

3.8. There is a balance between providing enough dedicated ERAs to give sufficient opportunity for safe stops, and not so many that they encourage an increase in non-emergency stops. The average refuge area spacing on the M25 ALR schemes is 2011m, with a maximum spacing of 2,645m and a minimum of 590m.

3.9. While we have increased the distances between these features from previous smart motorway designs, we remain focussed on ensuring their locations are appropriate to the

local environment and topography to provide road users with a safe and controlled environment. To support this we have further strengthened the design requirement related to the maximum distance between refuge areas.

3.10. Overall the insight provided by the data provides confidence that the safety risk assessment underpinning ALR is robust. Notwithstanding the initial evidence, however, we are committed to identifying opportunities and learning lessons to help further refine the concept including:

- testing innovative technologies such as radar to detect stationary vehicles, to understand whether this could further mitigate the hazard of live lane stops.
- the addition of new requirements into our design guidance to ensure refuge areas are visible from the nearest overhead variable message signs ahead of the areas. This will enable these signs to be used more effectively, to warn road users of vehicles exiting the refuge area ahead.

4. The effectiveness of all lane running in managing capacity and congestion on the Strategic Road Network

4.1. Smart motorways have been designed to optimise capacity and ease congestion. ALR improves upon the previous smart motorways design by maximising the effectiveness of the extra capacity, by having an extra lane where traffic can operate at 70mph.

4.2. Improvements in average journey times, the reliability of journey times, and traffic flows on the M25 ALR schemes mean the motorway is now less prone to recurrent congestion and frustrating stop-start conditions; in short it is more resilient.

4.3. Journey times have improved, especially in peak periods - Monday to Thursday morning and evening peak periods, where performance was historically worst.

Figure 2 - Journey time performance improvements

Time period	J23-27 Clockwise	J23-27 Anti-clockwise	J5-7 Clockwise	J5-7 Anti-clockwise
AM peak Mon-Thurs	7%	19%	3%	-2%
PM peak Mon- Thurs	4%	7%	0%	6%

4.4. Journeys which were previously only lightly congested and where vehicle speeds were relatively high, such as mornings anti-clockwise J5-7, have maintained performance.

4.5. In terms of journey time reliability, improvements have been recorded at peak times.

Figure 3 - Journey time reliability performance improvements

Time period	J23-27 Clockwise	J23-27 Anti-clockwise	J5-7 Clockwise	J5-7 Anti-clockwise
AM peak Mon-Thurs	6%	22%	11%	0%
PM peak Mon- Thurs	12%	7%	1%	5%

4.6. The worst journeys on J23-27 used to take nearly 40 minutes; these have now almost halved (25 minutes), significantly reducing congestion at the busiest times.

4.7. The volume of traffic using the ALR sections has increased. In particular, between junctions 23 and 25 traffic flows in the morning peak period from Monday to Thursday have increased by 10-12% in both directions, with more moderate increases of 4-9% in the afternoon peak. Between junctions 5 and 6, Monday to Thursday morning peak flows have increased between 2% and 14%, with increases of up to 10% in the afternoon peak.

5. Impact on maintenance

5.1. The ALR design requires less roadside equipment compared to the dynamic hard shoulder schemes where the hard shoulder is opened at peak times. This means less overall maintenance and reduced exposure time needed for roadworkers to spend at the roadside, which in turn manages risk, and causes less disruption for customers. It also includes features such as concrete central reservation barriers, instead of steel, as they are more resilient, require less maintenance and repair; they also help to prevent vehicles from crossing the central reservation which can have serious consequences.

5.2. The schemes were designed with maintenance in mind and a 6-week cycle of lane closures was established for routine activities so as much maintenance as possible can be carried out in a single night-time possession.

5.3. We are currently reviewing maintenance of technology, barriers and road surface to further optimise our maintenance activity.

6. Incident rates, the management of incidents, vehicle recovery, and the provision of refuge areas where all lane running is used

6.1. Details of collision, casualty and live lane breakdown rates are provided in section 3.

6.2. We predicted around half of breakdowns would reach a place of refuge. J23-27 data confirms this, showing more than 45% of the approximately 5,000 breakdowns recorded over the first 12 month period did so.

6.3. Incidents on our motorways are managed by our Traffic Officer Service (TOS), comprising staff in Regional Control Centres (RCC), in key outstations, and on the road. On the M25 there are regional control centres at South Mimms in Hertfordshire (J23) and at Godstone in Surrey (J6).

6.4. Traffic officers are trained to operate in the ALR environment and new procedures were developed for this new environment. We worked with emergency service partners to develop a new Regional Operating Agreement. In addition, the Executive Operations Group (Emergency services and Highways England) provided an oversight role and identified opportunities to further improve operations. The latter group has recently completed its work and agreed that operations can now be handled through normal business arrangements.

6.5. To support monitoring of conditions, full CCTV coverage built into the ALR design provides control centre operators with greater intelligence than previously on the network and allows quicker and more accurate verification of the location of incidents. This enables the more accurate setting of signs and signals to manage the site both before the response crews arrive and during incident management.

6.6. We plan to reach 80% of all incidents within 20 minutes. This has been maintained on J23-27; however, on J5-7 the average recorded rate has reduced to 64%, although it should be noted that the overall regional incident clearance time for the South East is consistently met which optimises the flow of traffic around key routes.

6.7. We continually look for ways to improve operations. One measure is to provide further opportunities for response crews to better access the scene of incidents from the junction

ahead. Known as ‘reverse access’, this was successfully implemented on five occasions within the first 12 months. Resource plans being considered include the greater use of single-crewed vehicles, in addition new technologies, such as a system to detect vehicles stopped on the motorway, are being piloted to explore the opportunities for quicker detection and verification of incidents in live lanes.

6.8. Another measure, identified in incident debriefs held with emergency service partners, is that to keep traffic moving when an incident initially happens. This makes it easier for responders to reach the scene and helps to minimise delays to other road users.

6.9. When clearing incidents our priority is to complete the clearance as quickly as it is safe to do so, to minimise disruption. The performance indicator for incident clearance time - 85% within one hour - has been maintained across the two ALR schemes over the first year. To assist incident clearance, our TOS vehicles have been fitted with special equipment known as ‘load cells’ which allow vehicles to be towed to refuge areas without the need to wait for specialist equipment to arrive. This speeds up recovery and so reduces the disruption to other road users. This was used on more than 700 occasions on J23-27 during the first 12 months.

6.10. Our ability to clear incidents quickly is supported by signs and signals, particularly the red X signals used to isolate the incident, create a priority access lane, and a safe environment. It is also supported by reduced speed limits displayed to slow traffic on the approach to reduce risk to those involved with the incident.

6.11. Non-compliance with red X and reduced speed limits increases risk and there has been an increase in reported near misses related to red X non-compliance; this is not unique to ALR. The further measures we are taking to improve compliance by road users are detailed in section 9.

6.12. Further to the ERA evidence in the safety section, it should be noted that on the M25 ALR schemes a high level of ERA misuse has been recorded. Some 85% from a sample of 392 stops were determined to be non-emergency (for example, comfort stop, or driver drove off without exiting vehicle). This problem appears to be acute for HGVs with 96% of 135 stops appearing non-emergency. We have also observed numerous instances where road users could have left the carriageway at junctions or ERAs, but instead have continued and stopped in a live lane putting themselves and others at unnecessary risk. Advice on appropriate and safe use of ERAs will be included in the national driver education and safety campaign, as further explained in section 9.

7. How policy on all-lane running should evolve, whether application of the policy should be expanded, and whether the policy is sustainable

7.1. The Road Investment Strategy (https://www.gov.uk/government/publications/road-investment-strategy-for-the-2015-to-2020-road-period) sets out an ambitious vision for the future of the network. The vision is for the all lane running policy to be expanded such that by 2040 the busiest sections of the network will have been transformed by introducing smart motorways delivering safer, more free-flowing and reliable journeys for our customers.

7.2. By 2020 alone we will have started work on 480 lane miles of smart motorways and completed 286 miles. By the end of the second Roads Period, there will be continuous smart motorway corridors linking London, Leeds, Manchester and Birmingham, offering a reliable and consistent level of service to road users.

7.3. The smart motorways concept has evolved greatly. Not only has this evolution led to greater cost efficiency, it has also led to improved traffic flows and increased journey reliability for road users, while maintaining safety. It is clear that the concept has to continue to evolve

and take advantage of technological advancement to continue to improve safety, improve our service to customers and to enable further step changes in efficiency.

8. The implications of the policy for future motorway widening schemes

8.1. Transport policy is set by the Department for Transport; however, we believe evidence to date indicates that all lane running provides an efficient and safe option to manage the impact of congestion and offers a positive alternative to widening.

8.2. We are mandated under licence to deliver the Government's policy as set out in the "National Policy Statement for National Networks (NPSNN)". https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/387222/npsnn-print.pdf

8.3. The current policy to develop the existing Strategic Road Network is focussed on three key areas: junction improvements, implementing smart motorways (all lane running)[5] and making improvements to trunk roads.

8.4. The findings from the M25 12 month ALR reports indicate that the concept is delivering positive results and delivering them much more quickly and at significantly reduced cost compared to widening, particularly in relation to environmental and land impacts, while providing additional lane capacity more efficiently than the previous design solution.

8.5. Capital delivery costs from the M25 ALR schemes indicate that ALR is far more cost effective than traditional widening or hard shoulder running and the very significant reduced cost of ALR means that we are able to bring about improvements to many more motorways compared to traditional approaches. ALR supports the Governments' vision of a national network to "support and improve journey quality, reliability and safety".

8.6. We have a programme of 30 smart motorway all lane running schemes to the value of circa £6 billion over the next 9 years. This will bring about considerable benefits to the strategic road network and support the Government in achieving its vision and objectives as outlined in the NPSNN.

9. The extent to which road users understand and comply with signs where all-lane running is in operation, and the changes that are needed in driver education and behaviour

9.1. Ahead of smart motorway projects being introduced, targeted 'Get Smart, know your motorways' public information campaigns are undertaken with stakeholders and partners. These set out the different types of smart motorways, key elements of the smart motorways system (red X, mandatory speed limits) and their role/ meaning, in addition to targeted safety and driver information messages. Project related materials are also distributed to provide tailored information on the specific smart motorways.

9.2. Our formal research shows while the majority of people seem to understand what they need to do, there remain some who are non-compliant and wilfully disobey traffic signs set for their safety. These issues however are not unique to ALR and should be considered in the wider context of the higher safety performance of motorways compared to other roads.

9.3. The J23-27 evaluation incorporated interview-based surveys conducted with more than 1,200 road users[6]. These found that in spite of poor awareness of the term 'smart

[5] Where smart motorways are implemented the hard shoulder is transformed into a permanent additional running lane and traffic flow is moderated by the use of variable speed limits. (Footnote page 15, NPSNN 2014)

[6] 603 Local Road Users (LRU) at households within 5km of the scheme were surveyed along with 677 Non Local Road Users

motorways' (57% of motorway drivers were not aware of the term) and of the scheme itself (37% of users were unaware), correct interpretation of signage associated with all lane running was extremely high. Almost 100% of drivers knew, or would have assumed that a red X meant that a lane was closed to traffic, and 97% of local users of the scheme knew that speed limits displayed within a red circle were mandatory.

9.4. The evaluation found on average 8% non-compliance with red X lane signals and while compliance with the national speed limit at enforcement sites was above 90%, compliance with lower speed limits was greatly reduced, between 50% to 65% compliance at 60mph and as low as 20% at 50mph. Perhaps more concerning was that 12% of local road users[7] who undertook additional behavioural based questions, indicated they disregard the speed limit on a motorway. And as indicated in section 6 there has been a reported increase in near misses related to red X non-compliance.

9.5. There is no clear evidence as to why some road users comprehend yet refuse to comply with a red X. In the West Midlands we issued 30,000 encouragement letters (and supplementary literature) to motorists who misused the hard shoulder on smart motorways to highlight the risks. Further locations are due to be taken forward in 2016 and are set to expand to include encouragement letters on red X non-compliance.

9.6. We also note a Transport Focus report in March 2015 which found some drivers were aware of smart motorways; those who had driven on them were not always familiar with the term, and did not understand clearly how they operated; those who were knowledgeable were generally very positive about the introduction; across different road user groups there were concerns about safety, particularly around the use of the hard shoulder and breakdowns.

9.7. The evaluation reaffirms the need to provide drivers with continued information on key issues. Over summer 2015 a national speed awareness campaign was delivered with a strong message that speed limits are enforceable and highlighting the consequences of speeding. These materials are still regularly used.

9.8. And in 2016 we will conduct a national driver awareness campaign, which will include information about how to use smart motorways, what to do in the event of a breakdown and will further explain key safety features such as red X signals and emergency refuge areas.

9.9. We remain committed to providing accurate, timely and reliable information to road users and minimising instances where sign setting may appear inappropriate, as this will increase road user confidence in the signs.

9.10. We will continue to work with our road safety and industry partners to ensure that motorists understand the importance of this advice. We are also working closely with police forces and casualty reduction partnerships to encourage greater compliant behaviour. We have also worked with the National Driver Offender Retraining Scheme (NDORS) to bolster existing programmes with more smart motorways education and learning material.

9.11. We are exploring with DfT and DVSA additions to the Hazard Perception component of the Driver Theory Test to include aspects of smart motorways, particularly in relation to the importance of red X compliance.

9.12. In addition changes in legislation to support improved compliance with red X are being considered. This includes further investigations into the legislative framework required for the automatic enforcement of red X offences. This would complement the existing manual power of enforcement and would help further deter this hazardous behaviour.

(NLRU) at Motorways Service Areas (MSA) in the vicinity of the scheme.

[7] Sample of 534 local road users

January 2016

Attachment A

Different types of smart motorway include:

Controlled motorway

Controlled motorways have three or more lanes with variable speed limits. The hard shoulder should only be used in a genuine emergency.

All lane running

There is no hard shoulder on these sections of motorway. Obey variable speed limits and do not stop on the motorway. If you need to stop in an emergency, use an emergency refuge area (shown in the picture above), motorway service area or leave at the next junction.

Hard shoulder running

*The hard shoulder will be opened at busy times and the speed limit will be reduced. Do **NOT** use the hard shoulder unless overhead signs show that you can do so.*

Red X

*A red **X** symbol on a gantry sign over the motorway* or *A red **X** sign on an gantry sign at the side of the motorway*

*We use a red **X** symbol to show that a lane is closed because of an incident or people working on the road. Driving in a lane with a red **X** symbol is dangerous and drivers must **NOT** use it.*

Attachment B

Versions of smart motorways

Name	Schemes in operation with date opened	Key features
Controlled motorway	M25 J15-16 (2002) M1 J6a-10 (2008) M42/M40 (2009) M42 J7-9 (2009) M1 J25-28 (2010) M20 J4-7 (2010) M25 J7-10 (2011) M25 J2-3 (2012)	• variable speed limits • hard shoulder retained • ability to close individual lanes • automatic queue protection system • CCTV coverage

Name	Schemes in operation with date opened	Key features
	M25 J16-23 (2012) M25 J27-30 (2012)	
Active traffic management	M42 J3a-7 (2006)	• variable speed limits (maximum 60mph when hard shoulder is in use as a running lane) • pilot of hard shoulder running during congested periods • emergency refuge areas • ability to close individual lanes • hard shoulder monitoring system • automatic queue protection system • comprehensive CCTV coverage
Hard shoulder running	M6 J4-5 (2009) M6 J8-10a (2011) M1 J10-13 (2012) M62 J25-30 (2013) M4/M5 (2014) M6 J5-8 (2014)	• signal gantry spacing increased from 500-800m to 800-1000m • emergency refuge area spacing increased from 500-800m to 800-1000m
All lane running	M25 J5-7 (2014) M25 J23-27 (2014) M1 J39-42 (2016)	• variable speed limits (national speed limit (70mph) unless reduced for; congestion, incident or traffic management purposes) • conversion of hard shoulder to a running lane • emergency refuge areas • ability to close individual lanes • automatic queue protection system • full CCTV coverage