Road safety factsheet: Smart motorways

June 2022

The Department for Transport has estimated that traffic on our road network will increase by between one-third and two-thirds in the next 30 years. Failing to provide sufficient capacity to cope with the forecast increase in traffic would increase congestion. Smart motorways were therefore introduced as a way to increase the capacity without the disruption and environmental impact of physically widening the road.
By the end of 2020 over 500 miles of smart motorways had been created [1].

Traditionally, a motorway had three (sometimes two) lanes of traffic and a hard shoulder for emergency use. The first Smart Motorway, originally called an Active Traffic Management System, on junctions 3A to 7 of the M42 comprises gantries with electronic variable speed limit signs, enforced by speed cameras, and the hard shoulder is opened as a running lane at times of peak congestion. Emergency refuges were placed along the nearside of the hard shoulder at intervals of 500 to 800 metres. This original design has been further developed, and there are now three types of smart motorway in operation in England.

Dynamic hard shoulder running (DHS)

This system is in operation on the M42, M1, M6, M4 and M5. Motorways with dynamic hard shoulder (DHS) running have a solid white line to differentiate it from the normal carriageway. The hard shoulder must not be used (except in an emergency) unless the electronic signs say that it may be used as a running lane.

All lane running (ALR)

This type of smart motorway uses the hard shoulder as a permanent 'live' running lane for traffic and was first trialled on the M25. All running lanes have broken white lines, with the former hard shoulder lane only being closed in an emergency. Emergency refuge areas are located on ALR motorways, as a place of relative safety for stranded vehicles. Currently, they appear every 1.5 miles, from 2020 Highways England has said that ALR motorways will have refuges every 1 mile.

Controlled motorways

This type of smart motorway has three or more lanes with variable speed limits controlled by electronic gantry signs, but a traditional hard shoulder that may only be used in a genuine emergency.

[1] National Highways, 2022, Smart motorways stocktake, Second year progress report 2022, https://nationalhighways.co.uk/media/uivj2zem/smart-motorways-stocktake-second-year-2022.pdf (Accessed 17 June 2022)

Driving on a smart motorway[2,3]

Around 10% of Englands motorway network is now made up of smart motorways. Driving on a smart motorway is similar in many respects to driving on a traditional motorway where you must follow the advice contained in the Highway Code and not exceed the national speed limit or the posted speed shown in the red circular sign above the lane, which is enforced by speed cameras.

On controlled motorways and DHS motorways, drivers should only use the hard shoulder as a running lane when the electronic gantry signs say they may do so. Be aware that the hard shoulder may only be open for traffic that is leaving the motorway at the next exit; the signs will indicate this.

As on all motorways, if overtaking a number of slower vehicles, return to the left hand lane as soon as you are safely past.

The red X sign

A red X shows that a lane is closed and MUST not be used. If you see a red X closing a lane, you should move out of that lane promptly. A red X is there for your safety and it is illegal to ignore it. The lane may be closed because there is an incident or broken down vehicle ahead, or a person, animal or be road workers in the road.

Never drive in a lane closed by a red X; it is dangerous and illegal. If you do drive in a lane closed by a red X, you could receive a £100 fine and three penalty points.

What to do in the case of a breakdown

Go left. Leave at the next junction or service area if you can. If that's not possible, move left onto the hard shoulder or nearest emergency area. Never put out a hazard warning triangle on a motorway or try to repair your vehicle yourself.

If you can, get yourself and any passengers out of the vehicle via the passenger door, and get over the safety barrier on to the verge. Keep clear of your vehicle and moving traffic at all times.

If your car stops unexpectedly and it isn't safe to get out, keep your seatbelt and hazard lights on and call 999 immediately.Switch on your hazard warning lights, call the police and inform the operator that you have broken down in live traffic on a motorway and let them know your location as accurately as possible. This will help National Highways to spot you as quickly as possible on CCTV or radar (smart motorways) and to close the lane you are in.

If you have a puncture, wait for a breakdown organisation rather than try to change the wheel yourself as they will have the necessary equipment to change the tyre quickly or to tow you to a garage if it cannot be repaired.

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[2] National Highways, Driving on motorways, https://nationalhighways.co.uk/road-safety/driving-on-motorways/ (Accessed 20 June 2022)

[3] GOV.UK, The Highway Code, updated March 2022, Motorways (253 to 274), https://www.gov.uk/guidance/the-highway-code/motorways-253-to-273 (Accessed 20 June 2022)

Unlike a traditional hard shoulder, which provides enough space to build up speed before re-joining the flow of traffic, the emergency refuges on a smart motorway do not have enough space for this. Therefore, do not exit an emergency area without speaking to National Highways first. National Highways will either send a traffic officer to help you or set the motorway signs to temporarily close lane one so you can safely re-join the motorway.

Research[1,4]

England's motorways are amongst the safest roads in the world and compared to other roads in England, motorways are comparatively the safest roads to travel on. Each smart motorway must be at least as safe as the traditional motorway it replaces.

In terms of fatality rates, smart motorways continue to be the safest roads in the country. Between 2016-2020, conventional motorways had a 5-year average of 0.15 fatal casualty rate per hmvm (hundred million vehicle miles travelled), while ALR, DHS and controlled motorways had a fatal casualty rate per hmvm of 0.12, 0.09 and 0.07 respectively. All of the above motorways performed better than A-roads which had a 5-year average fatal casualty rate of 0.41 for the same period.

Whilst smart motorways had a lower fatality rate than conventional motorways, data suggests that on smart motorways, some risks would be reduced, while others would increase.

- On ALR there is a expected reduction in the risk of drivers speeding or tailgating, but an increased expected risk of collisions involving vehicles stopped in a live lane
- Most collisions occur between moving vehicles, whilst stopped vehicle collision rates range from 2.36% for controlled motorways, 2.99% for conventional motorways, to 5.26% for ALR motorways. Whilst the risk of a live lane collision between a stopped and moving vehicle is greater on ALR and DHS motorways, the risk of collision involving only moving vehicles is lower
- Before and after data on DHS schemes suggest that personal injury collisions are reduced
- Overall, the evidence has demonstrated that while the nature of the risks varied between the motorway types, ALR was expected to reduce the overall level of risk by 20% and be as safe as, or safer than, conventional motorways
- Even though fatal casualty rates on the ALR network are lower, injury rates are higher
- DHS motorways have a lower fatal casualty rate and a slightly higher rate of slight and serious casualties

Vehicles stopped on hard shoulder or refuge areas

On conventional motorways, the hard shoulder is a place of relative safety to stop in an emergency, but there remains a risk to personal safety from doing so. On average, 8% of fatalities on motorways occur on the hard shoulder. Smart motorways have emergency refuge areas to stop in if drivers cannot make it to the nearest

[4] Department for Transport, Smart Motorway Safety, Evidence Stocktake and Action Plan, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/936811/smart-motorway-safety-evidence-stocktake-and-action-plan.pdf (Accessed 20 June 2022)

motorway service areas or exit the motorway. Emergency refuge areas are wider than hard shoulders, set further away from traffic and at regular intervals. Between 2016 and2020, there were no fatalities in emergency areas. National Highways' 'Smart Motorway All Lane Running Overarching Report' analysis shows that there has been a reduction in the average annual number of personal injury collisions involving vehicles in places of relative safety, following conversion to ALR.

Collisions involving vehicles stopped in a live lane

Evidence suggests that, when compared to the volume of traffic, breaking down and stopping in a live lane is an infrequent experience for road users and that most collisions occur between moving rather than moving and stopped vehicles. When a vehicle breakdown occurs, it is more likely to occur in a place of relative safety on a conventional motorway than it is on DHS or ALR.

Collisions tend to be infrequent, with an average of 19 collisions per year across nine of the 12 ALR schemes being far lower than the 9,206 live lane breakdowns per year across all ALR schemes. However, this is an increase from an average of three per year before the motorways were converted to ALR. This has been associated with an increase in risk to people who have stopped in the live lane. This is broken down into: 2.3 slight, 0.3 serious and zero fatal live lane collisions on average before; and 9.1 slight, 7 serious and 2.8 fatal live lane collisions on average afterwards.

Therefore, vehicles that reach refuge areas on ALR motorways are less likely to be involved in personal injury collisions. However, there remains a relatively small exposure to collisions with vehicles stopped in live lanes.

Safety headlines, based on headline metrics; PIC (personal injury collisions)[5]/FWI (fatal and weighted injuries)[6]/KSI (killed or seriously injured)

- No one motorway type performs best against all metrics and no one smart motorway type performs best against all metrics
- All three smart motorway types are safer than conventional motorways in terms of casualty-focused metrics i.e. FWI and KSI
- Conventional motorways have lower PIC rates than other road types. But as their casualty rates (FWI and KSI) are higher, this suggests that when a collision occurs on a conventional motorway it is more likely that it will involve a killed or seriously injured casualty than a collision on the three smart motorway types
- These headline metrics support that smart motorways continue to be as safe as, or safer than conventional ones for casualty-focused headline (FWI and KSI) metrics.

[5] the number of accidents that have happened, rather than the number of people injured e.g. if there was a coach crash and multiple people injured, that would still only class as one personal injury collision.

[6] The Fatal and Weighted Injuries Index gives a fatality 10 times the weight of a serious casualty, and a serious casualty 10 times the weight of a slight casualty. It is calculated as: Fatal casualties + (Serious Casualties * 0.1) + (Slight Casualties * 0.01).

The future of smart motorways[7, 8]

In 2018, the Department for Transport estimated that traffic on the road network will increase by between one-third and two-thirds in the next 30 years and that failing to provide sufficient capacity to cope with the forecast increase in traffic would increase congestion. They concluded that failing to increase capacity would harm the economy and could also lead to more deaths and serious injuries on Britain's roads, because drivers would choose to use less safe, local roads to avoid congestion.

In March 2020, the Government confirmed that all future smart motorway schemes are expected to be all-lane running motorways. Throughout 2021, the Transport Select Committee reviewed the safety and roll-out of smart motorways (published in January 2022) one of its recommendations was that this roll-out should be paused until five-years of safety data is available for all-lane running motorways introduced before 2020. The Government agreed with this recommendation, therefore it will immediately pause the roll-out of ALR smart motorway schemes yet to commence construction until five-years of safety data is available for ALR motorways introduced before 2020. Any scheme that was over 50% constructed will be completed, but with extra safety measures, such as Stopped-Vehicle Detection (SVD) and additional emergency areas.

National Highways was also in the process of converting the seven DHS schemes into ALRs, since January 2022, this conversion has now been paused, so that alternative operating approaches can be considered, such as consistent times of operation. No new DHS schemes are planned for construction.

The Transport Select Committee also recommended that National Highways revisit the business case for controlled motorways. For both controlled motorways and DHS, National Highways will continue to collect data and analyse the safety performance of these motorways to help inform their thinking.

At the same time, National Highways will oversee an investment of £900m to improve the safety measures across the whole smart motorway network. This will include measures targeted at reducing collisions between stopped and moving vehicles as well as include collecting and considering further safety and economic data. The action plan includes 18 measures to be put into place, which aim to increase public confidence in smart motorways as well as making them safer. The key parts of the action plan are:

- Making the deployment of "stopped vehicle detection" (SVD) systems faster (the systems will be installed along the entire all lane running smart motorway network within 36 months – several years earlier than originally planned). The systems are radar-based and can identify stationary vehicles in around 20 seconds, automatically changing the electronic signs, and alerting a National Highways

[7] GOV.uk, Transport Select Committee, Rollout and safety of Smart motorways, Third session report, 2021-22, 2nd November 2022, https://publications.parliament.uk/pa/cm5802/cmselect/cmtrans/26/report.html (Accessed June 2022)

[8] GOV.UK, Action plan announced to boost smart motorway safety, March 12, 2020, https://www.gov.uk/government/speeches/strategic-roads-update-smart-motorways-evidence-stocktake (Accessed 20 June 2022)

operator so a traffic officer can be dispatched. Note: all current smart motorways already possess a MIDAS (Motorway Incident Detection and Automatic Signalling) system which monitors traffic volumes and can also change the electronic signs, however this system is not designed specifically to detect stationary vehicles.

- Measures to ensure that the distance between emergency refuge areas is one mile maximum, ideally ¾ of a mile. This means that motorists will reach a refuge every 45 seconds when travelling at 60mph.
- Consideration will also be given to retrofitting emergency areas on existing smart motorways where places to stop in an emergency are more than one mile apart
- Emergency refuge areas will be made more visible: they will be given a bright orange road surface, dotted lines on the surface that indicate where to stop, more signs on the approach to the area to indicate where it is, and new signs inside the area that show what to do in an emergency.
- Increase signage to show distance to next emergency refuge. Typically, these will be between approximately 330 and 440 yards apart and will show how far it is to the next place to stop in an emergency, to help motorists reach one and avoid stopping in a live lane.
- A £5 million national communications campaign to make motorists more aware of not only how to use smart motorways, but how to use them safely.
- To help the police bring compliance, to drivers not using the red X lane, closer to 100%. The law has now changed to enable automatic detection of red X violations and enforcement using cameras.
- Investigations are to be made into specific parts of the smart motorway network by Highways England, namely the M6 and M1, where there have been many incidents.

RoSPA welcomes the commitment to increasing the safety of England's smart motorway system as set out in the action plan. RoSPA would like to see a commitment to have emergency refuge areas situated every ¾ mile on all new and existing smart motorways. RoSPA would also like to see a widespread and effective education campaign to raise awareness of how to drive safely on smart motorways and what to do in the event of a breakdown. We are hopeful that the delivery of all the actions outlined by the Department for Transport in their smart motorway plan will play a vital role in improving public confidence and perception of smart motorways.