

# Smart motorways

Incident and infrastructure investigation

M1 Junction 10 to 13

Highways England response



# Contents

Executive summary .....	2
Introduction .....	6
Methodology .....	8
Review of potential interventions .....	9
Actions .....	27

# Executive summary

## Last year's *Smart motorway evidence stocktake and action plan* sought to gather the facts on smart motorway safety and set out an action plan to ensure smart motorways are as safe as possible.

The Action Plan included an action to investigate clusters of incidents at locations on the M6 and M1. An evidence-led independent incident and infrastructure investigation was commissioned by us at the four locations and a report produced for each. These investigations produced a series of potential interventions or control measures for the specific issues that have been linked to collisions and / or incidents. The schemes that were reviewed are:

- M6 J5 to 6 dynamic hard shoulder (part of M6 J5 to 8 scheme)
- M1 J10 to 13 dynamic hard shoulder scheme
- M1 J30 to 35 all lane running scheme (part of M1 J28 to 35a scheme)
- M1 J39 to 42 all lane running scheme

We have now reviewed the potential interventions, proposed by the independent review, to assess their viability and likely impact.

This report is our response to the independent infrastructure and incident investigation<sup>1</sup> report produced as part of the DfT Smart Motorway Safety: Evidence Stocktake and Action Plan, and addresses the M1 between junction 10 and 13 in both directions. Equivalent reports have been produced for the other three locations.

This report focuses on the M1 junction 10 to junction 13 in both directions. This section was subject to consideration in the Stocktake because of concerns about clusters of incidents happening in this section.

This section of the network has different highway operating regimes stretching over 15 miles (24 km) of the M1. The initial scheme was completed and opened for traffic in 2012 and is a dynamic hard shoulder (DHS) smart motorway, where the hard shoulder is utilised as a traffic running lane during peak times between junction 10 and junction 13. This creates four lanes of traffic at times of peak demand and through the junctions at junction 10, junction 11 and junction 12. In 2017, a new junction, 11a, was opened as part of the A5 to M1 link (Dunstable Northern Bypass) which has all lane running through the junction, with DHS on either side.

As outlined in the Highways England Delivery Plan 2020-25, this section of network will be upgraded from a DHS configuration to all lane running (ALR) by March 2024.

We have carried out an initial assessment and agreed that we will progress some of the recommendations, such as the proposed improvements to signing between junction 12 and Toddington Services. We are also carrying out a more detailed analysis of some of the more complex recommendations, such as removing part of the concrete barrier and extending the length of the southbound merge at Toddington Services. This will enable us to make a more informed decision about the feasibility of implementing these measures. We will consider cost, benefit and safety, as well as any potential impact of, and to, the forthcoming ALR upgrade at this location.

Some of the recommendations are not being taken forward, such as extending the auxiliary lane at junction 11 and upgrading the digital signs, because of the forthcoming ALR upgrade. Details of the interventions and an analysis can be found in sections 3 and 4 of this report. These measures are in addition to the installation of a stopped vehicle detection system as part of the project to upgrade this section to all lane running.

### Actions

A summary of the recommendations from the independent review report are set out on the next page. Alongside these actions are the actions we have already completed, are taking forward and those not being taken forward in response to these recommendations:

<sup>1</sup> Published separately

Independent review		
Key findings	Recommended actions	Response actions
1. Concerns over the reported mis-use of the hard shoulder and the potential risk of collisions given the live lane breakdown rate.	<b>Intervention 1</b> Display consistent and repeated messages confirming status of hard shoulder on existing signs	<b>Resolved by ALR upgrade:</b> repeated signage is already in place and any issues will be addressed by the upgrade of this scheme to ALR. Even more signage would overload drivers and potentially have a negative effect.
	<b>Intervention 2</b> Increase number of verge-side signs for DHS status after entry slip roads	<b>Resolved by ALR upgrade:</b> verge side signs are already present, the work involved to implement new signs would not give sufficient benefit as they would be removed shortly after installation for the ALR upgrade works. Also the upgrade to ALR will remove the issue.
2. J11 cluster of collisions with lane changing predominant factor	<b>Intervention 1</b> Review the viability of moving the start of the hard shoulder and provide additional signs	<b>Resolved by ALR upgrade:</b> the work involved to implement new signs and lining would not give sufficient benefit as they would be removed shortly after installation for the ALR upgrade works.
	<b>Alternative Intervention 1</b> Utilise existing MS4 to display additional merging message.	<b>To be taken forward:</b> completion due October 2021.
	<b>Alternative Intervention 2</b> Extend the auxiliary lane	<b>Resolved by ALR upgrade:</b> there is not enough evidence to suggest that the length of the auxiliary lane is an issue and issues resolved as part of ALR upgrade.
	<b>Alternative Intervention 3</b> Lane drop/lane gain	<b>Not taken forward:</b> altering the lane layout in this way would require substantial work and disruption to road users and safety during road works. Therefore it is proposed not to progress this option.

Independent review		
Key findings	Recommended actions	Response actions
3. Constrained layout at J12 mainline and Toddington Motorway Service Area (MSA) Southbound	<b>Intervention 1 &amp; Alternative intervention 1</b> Improve visibility at southbound entry slip road (concrete barrier)	<b>Being taken forward:</b> conduct further assessment during 2021/2022.
	<b>Intervention 2</b> Extend length of southbound entry slip roads	<b>Being taken forward:</b> conduct further assessment in August 2021.
	<b>Intervention 3</b> Additional signing and markings showing status of hard shoulder	<b>Resolved by ALR upgrade:</b> limited space in this area means installing additional signing and marking would be disruptive and costly prior to the ALR upgrade which will remove this issue.
	<b>Intervention 4</b> Additional "traffic merging" hazard signs	<b>Being taken forward:</b> during 2021/2022.
4. Pedestrian incidents	<b>Intervention 1</b> Use Walking Cycling and Horse Riding (GG 142) assessment process to review pedestrian facilities / access to motorway	<b>Being taken forward:</b> assessment due for completion September 2021.
	<b>Intervention 2</b> Consider suicide prevention measures	<b>Being taken forward:</b> assessment due for completion September 2021.
5. Efficiency of 'fixed text message signs' indicating whether hard shoulder open or closed	<b>Intervention 1</b> Investigate upgrading to digital / sign items	<b>Resolved by ALR upgrade</b>
6. Transition between J10 to 13 DHS and J13 to 16 ALR operating regimes	<b>Intervention 1</b> J13 to 16 ALR scheme reviewing if risk mitigation measures are required.	<b>Complete:</b> continue to monitor. Upgrade to ALR will also remove this potential issue.

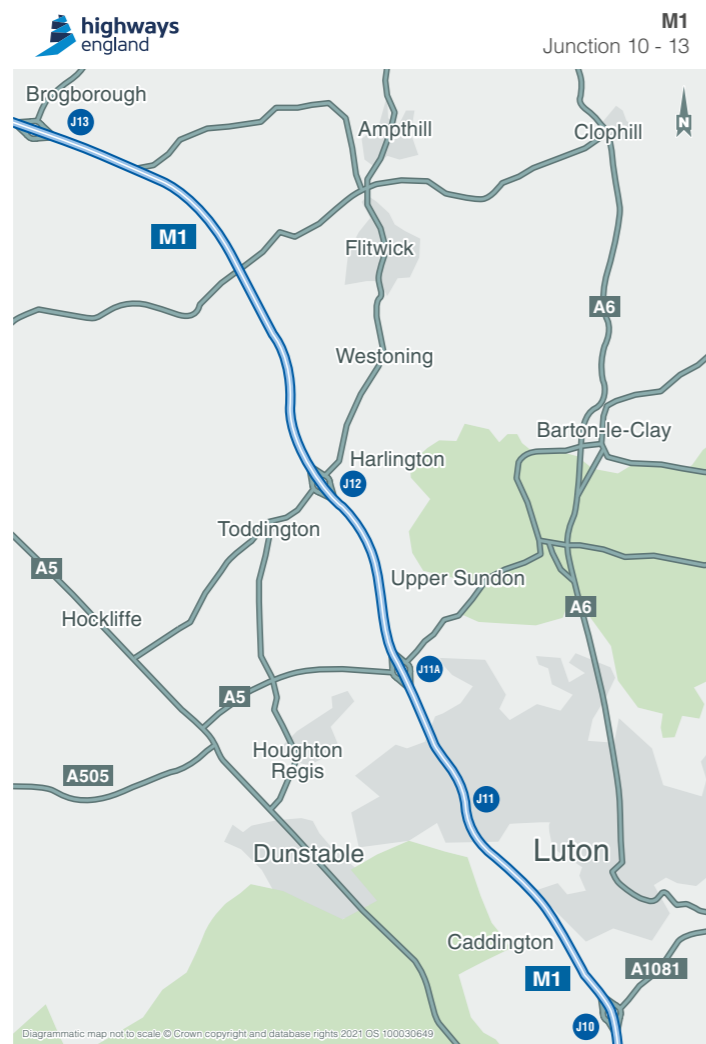
# Introduction

## Scheme background

The M1 J10 to 13 smart motorway scheme was a Highways England major project to improve 15 miles (24 km) of the M1. The scheme aimed reduce congestion and improve journey time reliability through conversion of the hard shoulder to DHS. The scheme opened in December 2012 and included:

- Smart motorway between junction 10 and junction 13
- Enhanced on-road technology to manage flow (e.g. signs showing variable speed limits)
- Four lanes of traffic at times of peak demand
- Through junction running (maintaining four full-time running lanes at junctions 10, 11 and 12).

The following map illustrates the M1 junction 10 to 13 geographical area:



Since 2017 there has been an overall decrease in the average number of injury collisions per year, but an increase in the average number of serious injury collisions.

Misuse of the dynamic hard shoulder has been highlighted in the finding of the incident and infrastructure investigation report. There is potential for lane change collisions (particularly regarding left hand drive heavy goods vehicles) being an issue. Pedestrian incidents were prevalent at the southern end of the scheme, where it passes through the built-up area between Luton and Dunstable.

# Methodology

## Identification of issues

The incident and infrastructure investigation report for the M1 between junction 10 and 3 was produced based on analysis and study of a range of information, including:

- source data, where necessary, including historic scheme operational safety analysis (Road Safety Audits RSA Stage 4, specific scheme safety reviews, project Post Opening Evaluation reports (POPE) reports
- targeted CCTV analysis to understand traffic conditions that may be influencing the clusters
- discussions with the Regional Operations Centre who manage the network in this location

## Review of potential interventions

Each proposed mitigation was reviewed, looking at the:

- likely impact on safety
- estimated cost range
- duration of applicability (including DHS to ALR upgrade) and timescales to implement the mitigation
- other dependencies, for example need for authorisations and change to policy

Where potential interventions are not feasible, we have proposed and assessed alternative intervention.

## Alternative interventions

Where necessary, we have proposed alternative mitigations to target the root cause of the collision cluster. We have reviewed these against the same factors as the initial potential interventions.

# Review of potential interventions

Data analysis was carried out within the 'Smart Motorway Incident and Infrastructure Investigation report'. It found that following the scheme becoming operational on 1 December 2012 and up to 30 November 2019 there were 71 serious injury collisions. Of these, six may have been related to the design or operation of the smart motorway. A number of collision clusters were identified at:

- North of Junction 10, Junction 11
- Vicinity of Toddington services
- Junction 12
- South of Junction 13

These locations form the basis of the proposals outlined in the Executive Summary, and have been assessed in more detail for this report. The issues identified and potential interventions are detailed below.

## Issue 1 – Reported mis-use of the hard shoulder and the potential risk of collisions given the live lane breakdown rate

### Issue identified

The incident and infrastructure investigation report for M1 J10 to 13 found a typical rate of five to six live lane breakdown incidents per day across the entire 15 mile scheme. Actual collisions relating to vehicles stopping in live lanes are highest between junction 12 and 13, indicating a rate of 1.3 collisions per km over a seven-year period.

Figures show a decrease in serious collisions in the last two years of data (2018-2019). This could be a result of the recalibration of the motorway operating systems, specifically the opening and closing of the hard shoulder between junction 10 to 13, and the associated revised operating protocols.

Some potential causes identified include:

- Drivers misunderstanding or not complying with DHS signage
- The level of signing used to provide information on whether the hard shoulder is open or closed

### Potential interventions

Anecdotal observations by operational staff note that following the re-calibration of the operating system, incidents of live lane stopping has decreased. This is also supported by the data reviewed in the Smart Motorway Incident and Infrastructure Investigation – M1 Junction 10 to 13 report. The proposed intervention measures that we have reviewed are:

#### 1. Display consistent and repeated messages confirming status of hard shoulder on existing signals

This relies on enhancing consistent and repeated messaging of the hard shoulder status via variable message signs. For example, displaying the message “*Hard shoulder for emergency use only*” and red X remaining available whenever the hard shoulder is closed to traffic to remove any ambiguity. Similarly, when the hard shoulder is open for traffic, consistently display “*Congestion Use Hard Shoulder*” or similar message at all times.

#### 2. Increase number of verge-side signs for DHS status after entry slip roads

Increasing the number of verge signs for the transition from through junction running to DHS downstream of the junction entry slip roads. This gives additional warning and instruction for all drivers, but particularly those in the hard shoulder and adjacent lane. The signing is currently limited to one sign, with the exception of the northbound approach to junction 10 where two signs are provided. The proposal is to provide a more consistent approach across the scheme.



Figure 1 Verge sign showing the status of the downstream hard shoulder © Google

### Summary

#### Intervention 1

Consistent and repeated messages confirming the status of the hard shoulder have already been implemented on every other variable message sign (VMS) and introduced nationally in 2015. Evidence suggests that this mitigation is working, and it is unlikely that more messages would make a positive difference. There is likely to be very little benefit and some disadvantages from putting a third message in after every entry slip road on top of the fixed text message signs (FTMS) in the verges and VMS. It is felt it would undermine any incident management signs.



Figure 2 Example of a VMS confirming the status of the hard shoulder

#### Intervention 2

There are fixed FTMS in the verge across the scheme which show the status of the hard shoulder after each entry slip road. With the VMS also showing the status of the hard shoulder, there would be little benefit from putting a third sign in after every merge. The installation of new signs needs to be considered holistically with other communication elements such as the number of Hard Shoulder Cameras (HSM). Initial investigation also highlighted potential issues with available verge space.

**Action**

We do not propose to progress these interventions because the mitigations implemented in 2015 appear to show improvements. The verge constraints of installing new signs would mean solutions would not be possible in the short term. Also, as the area is programmed to be converted to ALR in 2022, any interventions would provide limited, if any timely benefit, prior to being removed in readiness for construction. The conversion to ALR will eliminate the mis-use of the hard shoulder.

**Issue 2 – Junction 11 cluster of collisions with lane changes predominant****Issue identified**

Junction 11 southbound on slip was highlighted as a location where vehicles were moving early to lane 2 in anticipation that lane 1 downstream was closed. They were then moving back to lane 1 once visibility to the fixed text rotating traffic sign was achieved, causing excessive lane changing.

We have reviewed all injury collision data at junction 11, specifically in relation to the mainline at the exit and entry slip roads. There has been a general decrease in recorded injury collisions, particularly after year 5 (December 2017 onwards). This corresponds with the recalibration of the smart motorway operating systems (optimising the opening and closing of the hard shoulder between junction 10 to 13), revision of control room operating protocols and signing upgrades on approach to junctions. It also coincided with the opening of junction 11a (2017), which potentially relieved some traffic from junction 11.

On the southbound carriageway at junction 11, the overhead structures combine with the high nearside retaining wall to create a tunnel-like effect. The horizontal alignment may also increase the effect of the 'blind spot' particularly when moving from the hard shoulder to the adjacent lane. Of the fourteen collisions recorded near the southbound entry slip road, there have been seven lane change collisions, four of which involved a left-hand drive vehicle, and four shunts.

Advance signing of the transition from through junction running to hard shoulder running on the southbound carriageway is limited to one sign without a distance plate. Visibility to the sign is also reduced, particularly from the hard shoulder due to the bridge just before it.

**Potential intervention 1****Review the viability of moving the start of the hard shoulder and provide additional signs**

Review the viability moving the start of the dynamic hard shoulder downstream to allow a more complete set of signing and give more space to lane changes and merges. The additional signing would highlight the transition between through junction running and dynamic hard shoulder.

**Action**

We have considered the local constraints, including the location of the emergency area and physical obstructions enabling suitable locations for new signs. To carry out this work we would need to add white lines to the carriageway to indicate the new start of the hard shoulder. With the associated design, traffic management and construction requirements of this proposed intervention we do not anticipate that this suggestion is a viable short-term solution, and would only be valid for a short period of time at most, prior to the start of the ALR upgrade. The upgrade will remove the issue of communicating the hard shoulder status (as there will no longer be a hard shoulder). We propose not to progress this intervention for these reasons.



## Alternative interventions

We identified three alternative interventions. We do not propose to progress with two of these as they would not be suitable as short-term measures, due to requiring major construction works. However, we do propose a short-term solution that would utilise an existing variable message sign (VMS). Details of the alternatives we have considered are as follows:

### Alternative Intervention 1 – Utilise existing VMS

Utilising the existing VMS within the junction on the overhead gantry (location 54/4 southbound) to display an image showing the downstream hard shoulder status. This is already in place at J10 of the M1 (shown below).



Figure 3 VMS showing the status of the downstream hard shoulder © Google

This solution would not inform traffic merging at J11, but would inform mainline traffic of the downstream hard shoulder status, helping to mitigate the issue.

We are carrying out further exploratory work to assess the technical requirements. Initial feasibility suggests this would be possible and at minimal cost with no requirement for road closures or traffic management.

### Alternative Intervention 2 – Extend the auxiliary lane (not taken forward)

For this option there would be a requirement for major construction work and land take because of the physical constraints in the vicinity. These include being the existing bridges, 5 to 6 metre high retaining wall and other structures (within 400 metres) of the entry slip road. Two bridges crossing the carriageway would also need widening and compulsory purchase would be required to acquire land and properties. This would potentially cost upwards of £50 million.

### Alternative Intervention 3 – Lane drop/lane gain (not taken forward)

We have considered a lane-drop and lane-gain arrangement with a reduction to three lanes through the junction to ease merging. This would however introduce additional weaving on the approach to the lane-drop, and as traffic flows increase the three lanes through the junction would provide insufficient capacity. This would potentially introduce a problem of weaving, congestion and increased collision risk. In addition traffic flows are expected to grow at this location and by 2025 a lane-drop and lane-gain arrangement may need to be reverted back to the current layout, giving this alternative a very short design life.

### Action

This section is within the most densely populated area of the M1 between junction 10 to 13. There are several major physical structures including bridges supporting the integration with the surrounding urban towns of Dunstable and Luton, that are within the direct vicinity of junction 11. This restricts the opportunities available for any potential suitable short-term Intervention measures.

Given the context that collisions have reduced over the last five years and the proposed upgrade to ALR (commencing work mid-2022). We would not want to pursue costly works that would become redundant relatively quickly. We do however proposed to progress with the Alternative Intervention 1 which will provide a timely and cost appropriate solution in the short term, prior to the conversion to ALR.

### Issue 3 – Mainline at J12 Toddington Motorway Service Area southbound entry slip road

#### Issue identified

The incident and infrastructure investigation report for M1 J10 to 13 compared the before and after collision data near the Toddington motorway service area. Findings indicate that the introduction of the DHS has not increased collisions overall. While the overall number of collisions between junction 10 and 13 have decreased, a reduction in collisions near Toddington motorway services has not been achieved. Our focus has been directed at the southbound entry slip road where a high proportion of the lane change collisions have been recorded.

South of junction 12 is a short length of ALR through the Toddington services area, with DHS sections upstream and downstream of it. This removes the issues around an intermittent hard shoulder. However, a cluster of collisions have occurred, specifically shunts and lane changing.

Many factors are attributed to the potential issues including the geometry of the southbound entry slip road from the service area, and the signs and lines indicating the transition:

- Layout geometry restricting exit and visibility from the service area southbound
- Length of the southbound merge
- Signs and lines prior to the service area giving little warning of requirement to entry slip road from the hard shoulder to lane 1 (when the hard shoulder is closed)
- Confusion around operational regimes with the section looking like an ALR section and then going straight into DHS after the southbound entry slip road

#### Potential interventions

By amending the layout we could better accommodate exit manoeuvres and address potential visibility issues from the motorway service area southbound entry slip road. In line with the earlier intervention, there is scope to improve the signing relating to the transition from through junction running to a dynamic hard shoulder.

There are ways of highlighting merging traffic at junction 12 southbound which should help to reduce late manoeuvres or braking.

A package of measures was recommended to improve the southbound entry slip road at Toddington service area and the mainline southbound at Junction 12 and are detailed below:

#### Potential intervention 1

A review of the type of barrier being used at the Toddington motorway service area southbound entry slip road to determine whether an alternative type of barrier could improve visibility to and from the southbound entry slip road.

There is currently a concrete barrier in place. This could, in part, be removed and replaced with a lower height steel barrier to improve visibility to the M1 mainline from the entry slip road entry from the motorway service area. There were five injury collisions recorded at this location, and the existing nearside concrete barrier appears to partially obscure the views of drivers.



Figure 4 Toddington Motorway Service Area southbound merge showing concrete barrier  
© Google

#### Action

Our initial assessment highlights some challenges that require a more in-depth assessment before we can fully determine viability. This includes the vertical concrete barrier, which is in place to protect a footbridge structure linking the northbound and southbound service areas. Any alteration to the concrete barrier must not impede the level of protection offered to this structure. There is also a drive through refreshment facility in very close vicinity to the existing barrier which would need to be taken into consideration. The age and construction of the existing footbridge will inevitably require asbestos surveys to determine likely mitigation and control measures if disturbed. It is on the Asbestos register and scheduled for replacement between 2025 and 2030. We will need to carry out further assessment and it is a possibility that improvements to signs could alleviate the requirement for this intervention.

## Potential intervention 2

### Extend the southbound motorway services area merge

Assess the potential to extend the southbound motorway service area merge. This would enable better sight lines, and more time for motorists to react and merge while re-joining the main lane of the M1.

#### Action

Initial assessment highlights potential constraints. These include the proximity of an electricity pylon, geometry constraints (the adjoining embankment is a steep incline) and the proximity of the railway line. There is an existing departure from standard which reflects past difficulties when the DHS was constructed. These factors will create issues with the required land available to extend the merge to the desired length, and it is very likely that the cost of this option will be disproportionate to any potential benefit.

However, we do agree there is merit in a longer merge length. We need to carry out a detailed feasibility study, which would then enable a more informed decision for the potential intervention proposed. Any potential scheme would need to align with the design of the forthcoming ALR upgrade and its construction schedule.

## Potential intervention 3

### Signs and markings showing the status of the hard shoulder

This intervention involves improving the signs and markings ahead of the transition from the motorway service area (MSA) entry slip road to the start of the southbound dynamic hard shoulder. Drivers are currently given little warning that they need to merge from the hard shoulder to the adjacent lane.

#### Action

Messages confirming the status of the hard shoulder on existing VMS were introduced nationally in summer 2015, and locally much earlier on this section of the M1.

An additional Fixed Text Messaging Sign (FTMS) could be included to supplement the current FTMS in the verge indicating the status of the hard shoulder (open or closed) (refer to figure 7 for an image of an existing FTMS sign). However, there would be limited benefit as most messages are delivered to road users through the overhead VMS. In addition, the FTMS would need to be removed when ALR construction is commenced in 2022 and the issue is eliminated by the ALR upgrade.

## Potential intervention 4

### Additional “traffic merging” hazard signs and improved lining

Introduce signs to warn of merging traffic at southbound at junction 12 and/or potentially Toddington MSA. Improve road line markings where required.



Figure 5 Sign warning of traffic merging from left © Google

#### Action

Our initial assessment demonstrates that there are potential locations available for increased signs, and there are locations available which would provide minimal disruption. It was found the lines at the start of the DHS have degraded, so we could improve these to make them clearer. We are therefore making sure this is implemented at the earliest opportunity.

### Alternative intervention 1

Initial assessment indicated that there was some minor vegetation clearance that could be carried out. This would need to be done under roadworks and will be incorporated into the installation of new signs and lines.

#### Actions

This section looks like an ALR section and then goes straight into DHS after the southbound entry slip road. This is potentially the cause of the cluster of lane change collisions and is an issue which will be resolved as part of the planned upgrade to ALR.

We will start construction on this in 2022. This will help reduce the level of lane changing throughout the section due to the intermittent use of lane 1, and potentially accentuated by the reduced lengths of road where traffic weaves between lanes.

However, there are some relatively short-term measures that we will progress which should have a notable impact. As the proposed upgrade currently does not provide a scope for lengthening the southbound merge, we will revisit this issue.

#### Issue 4 – Pedestrian incidents

##### Issue identified

There have been a number of injury collisions with pedestrian involvement and we know there are potential risk factors, particularly through the southern section of the scheme and the built-up areas of Luton and Dunstable.

We have looked at the incident and infrastructure report analysis of accident data in combination with operational feedback and incident data relating to regular pedestrian incidents. This has prompted us to analyse data to establish other pedestrian related trends on this section of the network.

Three injury collisions with pedestrian involvement have been identified over seven years:

- A fatality in 2017 involving a pedestrian who had gained access to the carriageway from the southbound exit slip road at junction 11.
- A serious injury collision in 2019 which began possibly because of a medical episode. Several people stopped to help the driver and were then struck by the vehicle which lurched forward resulting in injuries. The collision occurred at the southbound exit slip road at junction 10. It is assumed those helping were other motorists as there are no pedestrian facilities at junction 10.
- A slight injury collision, also in 2017, involving an intoxicated pedestrian in the carriageway approximately one kilometre north of junction 11a. The collision occurred along a section where a public footpath runs parallel to the M1 on its east side for approximately a kilometre. There are public rights of way linking Upper Sundon with Fancott and Chalton across the motorway at this point via two accommodation bridges.



Figure 6 Public rights of way parallel to and across the motorway north of M1 J11  
© Google

We have reviewed incident data referenced as ‘pedestrian on the network’ and identified that, on average, 134 incidents per year were recorded. These included:

- Clusters recorded at junction 10 and 11 which are located adjacent to the built-up areas of Luton and Dunstable.
- Between junction 10 and 11a where the incidents appear linked to local routes which cross the M1, for example High Street, or potentially offer short cuts between residential areas.
- Between junctions 11a and 13 where the incidents are recorded near emergency areas.

##### Causes

Some potential causes include; local ‘desire’ lines and the proximity of local rights of way and built up areas. Quality and provision of facilities, such as fences and signs for public rights of way are areas potentially requiring improvement. Incidents have been reported of pedestrians in, or close to, the live lane of the motorway, who have demonstrated confusion and an unfamiliarity of their surroundings. These instances usually happen close to emergency areas and in and around Toddington Services, which is often the first stop for vehicles travelling to the country upon their arrival from Dover Port and is used as

a drop off point or has been an opportunity for illegal immigrants to alight the vehicle and make their own way.

### Potential interventions

The process for assessing if suitable facilities are provided for walking, cycling and horse riding are set out in the design standard, GG142. The M1 DHS J10 to 13 scheme was designed prior to the introduction of GG142. We are also now part of a cross-government National Suicide Prevention Strategy and as such we have our own strategy that has been developed post design and opening of this scheme.

#### Potential intervention 1

##### Review the pedestrian provision, fencing and other deterrents for Walking, Cycling and Horse Riding assessment.

This should focus on the southern section of the scheme where the M1 passes through the built-up areas of Luton & Dunstable and service areas.

### Action

We are currently conducting assessments and expect these to conclude by summer 2021, this will then enable us to establish a programme to provide any infrastructure improvements.

#### Potential intervention 2

##### Consider suicide prevention measures

We are currently working on any specific interventions that need to be progressed. Although it should be noted that this is not an area with a high historic rate of suicide incidents.

### Alternative interventions

No alternative interventions have been determined.

### Actions

Reviewing pedestrian provision and applying the suicide prevention toolkit is a short-term measure which can be applied immediately, and work is currently underway. However, 31 network access points have been identified so this process which will potentially require further investment which needs to be assessed in terms of benefit and cost. We will also need to assess this in light of the planned ALR J10 to 13 upgrade to make sure we do not propose solutions which will be redundant when this happens. Works for suicide prevention and pedestrian safety will also form part of the upgrade project and ensure that this work is continued.

## Issue 5 – Efficiency of fixed text message signs

### Issue identified

The Incident and Infrastructure Investigation Report suggests that there are concerns over the reliability of the fixed text message (rotating prism) signs. These indicate the status of lane 1 after each entry slip road.

Some potential causes include:

- Issues with the technology provided
- Issues with the maintenance contract and delivery of services

#### Potential intervention 1

##### Investigate upgrading to digital / sign items

Assess the maintenance regime associated with the rotating fixed text message signs (FTMS) and ensure repair response times align with the signs' operational importance. If necessary, investigate replacing or supplementing with aspects on existing digital signs.



Figure 7 Verge FTMS showing the status of the downstream hard shoulder © Google

## Actions

The initial issues regarding the rotating fixed text message signs and maintenance has improved and reports of failure are less frequent. New motors are potentially available that could reduce the need for future maintenance, however it is felt that this could prove an unproductive solution given the lead in times for attaining the parts required, particularly as they will be removed once the ALR upgrade goes into construction in 2022. Similarly, we do not think installing new electronic signs for this purpose is a suitable solution as they would be removed as part of the ALR upgrade. The upgrade to ALR will eliminate this issue.

The maintenance issues have been addressed and are less frequent, however we will continue to look at improvements. We do not feel it is appropriate to replace the signs at this stage prior to the ALR upgrade, as the issue will be eliminated by the upgrade to ALR and the signs removed when the scheme goes into construction.

## Issue 6 – Transition between DHS to ALR J13

The current conversion of the M1 J13 to 16 from a conventional motorway to all lane running could introduce another transition between operating regimes and cause confusion for drivers. The M1 J13 to 16 is due to open for traffic in 2021 but the M1 J10 to 13 upgrade is not due to start on site until the latter end of 2022, so there will be an interim period before all sections of the M1 covering junction 13 are converted to ALR.



Figure 8 M1 J13 where there is a transition between different schemes © Google

## Issue identified

Transitions between ALR and DHS operational regimes can create potential issues associated with drivers anticipating the opening of the hard shoulder or using the hard shoulder outside of the scheme limits. This will have more impact for southbound traffic. The M1 junction 10 to 13 will be converted to ALR by the end of March 2024. The M1 junction 13 to 16 smart motorway project is currently expected to be completed in 2022-2023 with the first phase (from junction 13) expected to open to traffic first. This indicates that M1 junction 10 to 13 ALR upgrade works are unlikely to be underway at the time the adjacent ALR section opens. The Incident and Infrastructure Investigation report does not give specific examples of issues identified but is detailed as a cautionary issue.

Some potential causes attributed to the change in operational regimes:

- Drivers anticipating the opening of lane 1
- Drivers using the hard shoulder of the DHS section outside of the scheme limits

## Potential interventions

### Potential intervention 1

**Consider the specific risks during the transition period between ALR from scheme M1 13 to 16 and the upgrade J10 to 13 and provide mitigation accordingly**

It is recommended that a review of the risks associated with the interim transition between the ALR scheme between junction 13 to 16 of the M1 and the DHS at junction 13 is carried out.

### Action

The M1 J13 to 16 ALR scheme has continually been assessed throughout the design stages of the scheme development. We have evaluated any potential operational risks associated with the transition period through the process of design approvals, road safety audits (RSAs) and Highways England's safety risk assessment processes.

It is worth noting for information that through junction running (TJR) i.e. 4 lanes were not proposed at junction 13 as part of the J13 to 16 scheme due to:

- The constraints at Ridgmont railway underbridge which restricts any capacity improvement
- Operational safety concerns of through junction running on the southbound carriageway in off peak when the hard shoulder is closed.

The southbound lane drop arrangement to junction 13 has been progressed by the M1 J13 to 16 scheme. It includes the appropriate appropriate lane destination markings in conjunction with comprehensive over-lane gantry direction signing at one mile, half mile and the final junction exit slip road, to inform road users of the lane-drop arrangement. We feel that these measures are adequate to mitigate against any possible confusion between operating regimes. We will reassess this prior to the section of road becoming open for traffic through the next road safety audit. Further assessments are also taking place as part of the design process of the planned ALR upgrade for junction 13 to 16 the results of which will determine any future changes.

**Actions**

Appropriate mitigation measures have been installed as part of the current works on the M1 junction 13 to 16 smart motorway scheme and we will continually review to manage any issues that may arise prior to the (ALR) scheme J10 to 13 being completed. We therefore will not be taking any further action with this intervention.

However, the junction is being reviewed in terms of safety and capacity as part of the design process for the ALR upgrade of the M1 junction 10 to 13 scheme, this review will then inform any future changes that need to be made.

# Actions

A summary of the recommendations from the independent review report are set out below. Alongside these actions are the actions we have already completed, are taking forward and those not being forward in response to these recommendations:

Independent review		
Key findings	Recommended actions	Response actions
1. Concerns over the reported mis-use of the hard shoulder and the potential risk of collisions given the live lane breakdown rate.	<b>Intervention 1</b> Display consistent and repeated messages confirming status of hard shoulder on existing signs	<b>Resolved by ALR upgrade:</b> repeated signage is already in place and any issues will be addressed by the upgrade of this scheme to ALR. Even more signage would overload drivers and potentially have a negative effect.
	<b>Intervention 2</b> Increase number of verge-side signs for DHS status after entry slip roads	<b>Resolved by ALR upgrade:</b> verge side signs are already present, the work involved to implement new signs would not give sufficient if any benefit as they would be removed shortly after installation for the ALR upgrade works. Also the upgrade to ALR will remove the issue.

Independent review		
Key findings	Recommended actions	Response actions
2. J11 cluster of collisions with lane changes predominant factor	<b>Intervention 1</b> Review the viability of moving the start of the hard shoulder and provide additional signs	<b>Resolved by ALR upgrade:</b> the work involved to implement new signs and lining would not give sufficient benefit as they would be removed shortly after installation for the ALR upgrade works.
	<b>Alternative Intervention 1</b> Utilise existing MS4 to display additional merging message.	<b>To be taken forward:</b> completion due October 2021.
	<b>Alternative Intervention 2</b> Extend the auxiliary lane	<b>Resolved by ALR upgrade:</b> there is not enough evidence to suggest that the length of the auxiliary lane is an issue and issues resolved as part of ALR upgrade.
	<b>Alternative Intervention 3</b> Lane drop/lane gain	<b>Not taken forward:</b> altering the lane layout in this way would require substantial work and disruption to road users and safety during road works. Therefore it is proposed not to progress this option.
3. Constrained layout at J12 mainline and Toddington Motorway Service Area (MSA) Southbound	<b>Intervention 1 &amp; Alternative intervention 1</b> Improve visibility at southbound entry slip road (concrete barrier)	<b>Being taken forward:</b> conduct further assessment during 2021/2022.
	<b>Intervention 2</b> Extend length of southbound entry slip roads	<b>Being taken forward:</b> conduct further assessment in August 2021.
	<b>Intervention 3</b> Additional signing and markings showing status of hard shoulder	<b>Resolved by ALR upgrade:</b> limited space in this area means installing additional signing and marking would be disruptive and costly prior to the ALR upgrade which will remove this issue.
	<b>Intervention 4</b> Additional "traffic merging" hazard signs	<b>Being taken forward:</b> during 2021/2022.

Independent review		
Key findings	Recommended actions	Response actions
4. Pedestrian incidents	<b>Intervention 1</b> Use Walking Cycling and Horse Riding (GG 142) assessment process to review pedestrian facilities / access to motorway	<b>Being taken forward:</b> assessment due for completion September 2021.
	<b>Intervention 2</b> Consider suicide prevention measures	<b>Being taken forward:</b> assessment due for completion September 2021.
5. Efficiency of 'fixed text message signs' indicating whether hard shoulder open or closed	<b>Intervention 1</b> Investigate upgrading to digital / sign items	<b>Resolved by ALR upgrade</b>
6. Transition between J10 to 13 DHS and J13 to 16 ALR operating regimes	<b>Intervention 1</b> J13 to 16 ALR scheme reviewing if risk mitigation measures are required.	<b>Complete:</b> continue to monitor. Upgrade to ALR will also remove this potential issue.



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