

ANNEX D

**DESIGNER'S RESPONSE TO ROAD SAFETY
AUDIT**

CONTENTS:	1	INTRODUCTION	1
	1.1	DOCUMENT PURPOSE	1
	2	DESIGNER’S RESPONSE TO MATTERS ARISING FROM STAGE 1 ROAD SAFETY AUDIT	2
	A	GENERAL	2
	B	LOCAL ALIGNMENT	13
	C	JUNCTIONS	13
	D	NON MOTORISED USER PROVISION	22
	E	ROAD SIGNS, ROAD MARKINGS AND LIGHTING	25
	3	CONCLUSIONS	29

ANNEXES:	ANNEX A:	ERA E2-B1 ANALYSIS (A5.9)
	ANNEX B:	ERA E1-A1 ANALYSIS (A5.10)

LIST OF TABLES:	TABLE 1:	EXCEPTIONS TO RSA	29
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1 INTRODUCTION

1.1 Document Purpose

This report provides a designers response to the results from a stage 1 road safety audit (RSA) carried out on the M4 Smart Motorway All Lane Running (MM-ALR) Junction 3 – Junction 12 scheme at the request of the Project Sponsor, Lynne Stinson (Highways Agency, Birmingham).

The RSA stage 1 report (Report Ref: 514451-MUH-00-ZZ-RP-HW-300354 dated 7th January 2015) was received by the design team and the recommendations made in the RSA report have been reviewed accordingly. The recommendations and exceptions have also been discussed at the Project Safety Review Control Review Group (PSCRG) held on 5th February.

This report is set out in the same format as the RSA stage 1 report with the RSA recommendation explained by the auditor. To show the designer's response an additional grey box has been included below the auditor's recommendation as follows:

RSA RECOMMENDATION: XXX

DESIGNERS RESPONSE: XXXX

Where an exception to the auditor's recommendation is proposed by the design team then the content of the above box will be displayed as follows:

RSA RECOMMENDATION: XXX

DESIGNERS RESPONSE: Exception - XXXX

2 DESIGNER'S RESPONSE TO MATTERS ARISING FROM STAGE 1 ROAD SAFETY AUDIT

A **GENERAL**

A1 **DEPARTURES FROM STANDARDS**

A list of the Departures from Standards as part of the M4 J3-J12 Smart Motorway All Lane Running scheme was provided to the audit team. At the time of carrying out this road safety audit, there is no indication that these have, or will be approved. However, the majority of the departures relate to the tolerance restrictions applied to the position of the gantries and the visibility of the signs mounted on the gantries.

The audit team have reviewed the Departures from Standards Checklist and can confirm that from the details provided there are no issues that were considered to be detrimental to the safety of road users.

A2 **DRAINAGE**

Drawings for this design element were not submitted as part of this stage 1 road safety audit. The below issue was noted during the site inspection.

A2.1 **PROBLEM**

Drawing(s): N/A

Location: Entire scheme.

Summary: Existing surface water ponding leading to loss of control collisions.

It was noted during the site inspection that water was ponding along the hardshoulder, junction 4b westbound. If these, and other lengths, of the carriageway suffer from ponding following the introduction of all lane running there is an increased risk of loss of control type collisions during periods of heavy rain.

RECOMMENDATION

During the detailed design stage ensure that the carriageway drains sufficiently to limit the risk of ponding occurring.

DESIGNERS RESPONSE:

The design team agree with this recommendation. This recommendation will be taken forward as part of the detailed design stage.

A3 LANDSCAPING**A3.1 PROBLEM**

Drawing(s): N/A

Location: Entire scheme.

Summary: Existing vegetation masking signs leading to collisions.

It was noted during the site inspection that areas of verge along the length of the scheme has mature vegetation coverage. If these areas are not affected by the works there is a risk that the vegetation may remain leading to new signage, located in the verge area, to be masked from approaching traffic. If signs are masked there is an increased risk of collisions occurring due to hesitation or lane manoeuvres.

RECOMMENDATION

During the detailed design stage ensure that areas of existing vegetation do not result in proposed signage being masked to approaching drivers or restricted forward visibility (SSD).

DESIGNERS RESPONSE:

The design team agree with this recommendation. An initial assessment of sight lines and vegetation clearance to Variable Message Signs (VMS) and Emergency Refuge Areas (ERA) has been undertaken. This has been included in the Environmental Statement. Stopping Sight Distance (SSD) for Lane 1 has also been assessed and details are included in the Design Strategy Record (DSR). Any areas where vegetation clearance is required to be maintained for the safe operation of the project will be detailed in the Maintenance Repair Strategy Statement (MRSS), at the detailed design stage.

A4 PUBLIC UTILITIES/SERVICE APPARATUS

Drawings for this design element were not submitted as part of this stage 1 road safety audit.

A5 LAY-BYS**A5.1 PROBLEM**

Drawing(s): N/A

Location: Entire scheme.

Summary: Retention of Maintenance Access Areas (MAA) may increase the likelihood of collisions occurring.

IAN 161/13 advocates the removal of MAAs unless justification for their presence can be promoted. There are concerns that if the existing MAAs remain on the M4 mainline, collisions with other road users in lane 1 may occur as maintenance vehicles attempt to enter or leave the mainline.

RECOMMENDATION

It is recommended that the existing MAAs along the route are removed from the MM-ALR scheme unless justification can be agreed. In the case where a MAA is justified a procedure for entering and leaving the MAAs in a forward gear should be incorporated into the relevant Safety Operational Manual.

DESIGNERS RESPONSE:

The design team agree with the recommendation. There are no Maintenance Hard Standings (MHS) proposed as part of the scheme.

A5.2

PROBLEM

Drawing(s): N/A

Location: Entire scheme.

Summary: Existing police observation platforms remaining along the M4 may increase the likelihood of collisions occurring.

Vehicles using the existing police observation platforms will be required to slow down in advance of the platforms and possibly attempt to reverse from lane 1 in front of following traffic. This may lead to heavy braking, loss of control and shunt type collisions involving following traffic.

RECOMMENDATION

Subject to agreement with the Police, remove existing observation platforms. If facilities are to be retained that there is sufficient hardened space available on the verge for police vehicles to leave and enter the mainline in a forward gear, rather than reversing into the refuge from lane 1.

DESIGNERS RESPONSE:

The design team agree with the recommendation. Discussions with the Police have been undertaken through this stage of the design. The Police have advised that they require platforms throughout the scheme. Where platforms are to be included they will be attached to an ERA.

A5.3 PROBLEM

Drawing(s): N/A

Location: Various ERAs.

Summary: Embankment slope leading to pedestrian falls and injury.

During the site inspection it was noted that a number of ERA will be located where the M4 is on embankment. If passengers of stationary vehicles seek refuge on the verge behind these ERAs there is a risk of falls and injuries occurring due to no protection of the embankments.

RECOMMENDATION

Provide post and wire fencing to protect embankment slopes behind ERA facilities.

DESIGNERS RESPONSE:

The design team agree with the recommendation. This recommendation will be taken forward as part of the detailed design stage.

A5.4 PROBLEM

Drawing(s): 514451-MUH-ML-ZZ-DR-GA-300329-1D.

Location: Junction 11 diverges.

Summary: Spacing of ERA leading to shunt type collisions.

The drawings provided appear to indicate that the existing hardshoulders located on both the eastbound and westbound diverge slip roads will be removed as part of the proposed scheme. However, the spacing of the mainline ERAs appears to have used the junction diverge slip roads as ERA. IAN 161/13 states that an exit slip with a hardshoulder can be used as a refuge area. If the hardshoulders on the slip roads are removed it could result in spacing between ERAs becoming excessive. This would increase the risk of vehicles stopping in live running lanes leading to shunt type collisions.

RECOMMENDATION

Ensure that spacing between ERAs complies with IAN 161/13 by either providing hardshoulders on the diverge slip roads or increasing the number of ERAs on the mainline.

DESIGNERS RESPONSE:

The design team agree with the recommendation. The spacing between areas of refuge will meet the spacing requirements of IAN 161/13.

The location/provision of an ERA, or safe area, on a slip road is currently included within IAN 161/13. The subject of provision of an ERA or a hard shoulder on the slip road at J11 was discussed at the Project Safety Control Review Group (PSCRG). Originally a grasscrete area was proposed as the preferred option. PSCRG concluded (this included NetServ, TMD and NDD) that the preference was for no provision, as the use of a dedicated area would most likely be misused.

Following on from this it is proposed that IAN 161/15 will allow for non-provision on slip roads, and that whatever decision is made will need to meet the needs of stakeholders and be endorsed at PSCRG.

A5.5 PROBLEM

Drawing(s): 514451-MUH-ML-ZZ-DR-GA-300340-1D & 300341-1D.

Location: Junction 8/9 diverges.

Summary: Spacing of ERA leading to shunt type collisions.

The drawings provided appear to indicate that the existing hardshoulders located on both the eastbound and westbound diverge slip roads will be removed as part of the proposed scheme. However, the spacing of the mainline ERAs appears to have used the junction diverge slip roads as ERA. IAN 161/13 states that an exit slip with a hardshoulder can be used as a refuge area. If the hardshoulders on the slip roads are removed it could result in spacing between ERAs becoming excessive. This would increase the risk of vehicles stopping in live running lanes leading to shunt type collisions.

RECOMMENDATION

Ensure that spacing between ERAs complies with IAN 161/13 by either providing hardshoulders on the diverge slip roads or increasing the number of ERAs on the mainline.

DESIGNERS RESPONSE:

The design team agree with the recommendation. The spacing between areas of refuge will meet the spacing requirements of IAN 161/13.

The location/provision of an ERA, or safe area, on a slip road is currently included within IAN 161/13. The subject of provision of an ERA or a hard shoulder on the slip road at J11 was discussed at the Project Safety Control Review Group (PSCRG). Originally a grasscrete area was proposed as the preferred option. PSCRG concluded (this included NetServ, TMD and NDD) that the preference was for no provision, as the use of a dedicated area would most likely be misused.

Following on from this it is proposed that IAN 161/15 will allow for non-provision on slip roads, and that whatever decision is made will need to meet the needs of stakeholders and be endorsed at PSCRG.

A5.6 PROBLEM

Drawing(s): 514451-MUH-ML-ZZ-DR-GA-300342-1D.

Location: ERA E6-A1.

Summary: Vertical drop leading to personal injuries.

ERA E6-A1 appears to be located at a point where there is limited space and potential level differences. This may result in vertical drops to the back of the ERA leading to falls and personal injury.

RECOMMENDATION

Ensure that any vertical drop to the rear of the ERA is adequately protected or relocate the ERA.

DESIGNERS RESPONSE:

The design team agree with the recommendation. This recommendation will be taken forward as part of the detailed design stage.

A5.7 PROBLEM

Drawing(s): 514451-MUH-ML-ZZ-DR-GA-300345-1D.

Location: Junction 6 westbound diverge.

Summary: Spacing of ERAs leading to shunt type collisions.

The drawings provided appear to indicate that the existing hardshoulders located on the westbound diverge slip road will be removed as part of the proposed scheme. However, the spacing of the mainline ERAs appears to have used the junction diverge slip road as ERA. IAN 161/13 states that an exit slip with a hardshoulder can be used as a refuge area. If the hardshoulders on the slip roads are removed it could result in spacing between ERAs becoming excessive. This would increase the risk of vehicles stopping in live running lanes leading to shunt type collisions.

RECOMMENDATION

Ensure that spacing between ERAs complies with IAN 161/13 by either providing a hardshoulder on the diverge slip road or increasing the number of ERAs on the mainline.

DESIGNERS RESPONSE:

The design team agree with the recommendation. The spacing between areas of refuge will meet the spacing requirements of IAN 161/13.

The location/provision of an ERA, or safe area, on a slip road is currently included within IAN 161/13. The subject of provision of an ERA or a hard shoulder on the slip road at J11 was discussed at the Project Safety Control Review Group (PSCRG). Originally a grasscrete area was proposed as the preferred option. PSCRG concluded (this included NetServ, TMD and NDD) that the preference was for no provision, as the use of a dedicated area would most likely be misused.

Following on from this it is proposed that IAN 161/15 will allow for non-provision on slip roads, and that whatever decision is made will need to meet the needs of stakeholders and be endorsed at PSCRG.

The level of provision at this junction, if any will form part of the detailed design.

A5.8 PROBLEM

Drawing(s): 514451-MUH-ML-ZZ-DR-GA-300347-1D.

Location: ERA E4-B1 & E4-A1.

Summary: Reduced visibility leading to shunt type collisions.

ERA E4-B1 is located on the inside of a bend and E4-A1 is located just beyond a MS4 cantilever gantry. For these reasons visibility of, or from, the ERAs could be reduced resulting in an increased risk of collisions either due to sudden braking to enter the ERAs or vehicles exiting into the path of oncoming vehicles.

RECOMMENDATION

Ensure that the required visibility distance can be attained at these locations.

DESIGNERS RESPONSE

The design team agree with the recommendation. ERA E4-B1 is on the inside of a curve. The visibility has been checked and visibility of 215m to the high object of 1.05m is achieved over the barrier. This is in accordance with IAN 161.

ERA E4-A1 is located on the outside of a right hand bend, which means that sight lines to and from the ERA are unaffected by the gantry, or by any RRS in front of the gantry, and has visibility of over 295m.

A5.9 PROBLEM

Drawing(s): 514451-MUH-ML-ZZ-DR-GA-300351-1D.

Location: ERA E2-B1.

Summary: ERA located after the 1/3 mile ADS leading to collisions.

ERA E2-B1 is located after the 1/3 mile ADS sign. IAN 161/13 states this should be avoided due to the risk of drivers mistaking the ERA for the junction exit.

RECOMMENDATION

Reposition either the ERA or ADS such that the sign is located downstream of the ADS.

DESIGNERS RESPONSE: Exception

The design team have reviewed whether the ERA or ADS could be repositioned.

Appendix A provides further information on the location of the ERA and ADS within the link. This assessment identified greater disbenefit with repositioning the ADS or ERA to achieve the relationship recommended by the auditors.

A5.10 PROBLEM

Drawing(s): 514451-MUH-ML-ZZ-DR-GA-300353-1D.

Location: ERA E1-A1.

Summary: ERA located after the 1/2 mile ADS leading to collisions.

ERA E1-A1 is located after the 1/2 mile ADS sign. IAN 161/13 states this should be avoided due to the risk of drivers mistaking the ERA for the junction exit.

RECOMMENDATION

Reposition either the ERA or ADS such that the sign is located downstream of the ADS.

DESIGNERS RESPONSE: **Exception**

The design team have reviewed whether the ERA or ADS could be repositioned.

Appendix B provides further information on the location of the ERA and ADS within the link. This assessment identified greater disbenefit with repositioning the ADS or ERA to achieve the relationship recommended by the auditors.

A5.11 PROBLEM

Drawing(s): 514451-MUH-ML-ZZ-DR-GA-300353-1D.

Location: ERA E1-B1.

Summary: Spacing of ERAs leading to shunt collisions.

ERA E1-B1 is located 2.7km after the preceding ERA. IAN 161/13 states the maximum distance between refuge areas should be no greater than 2.5km. Excessive spacing will increase the risk of shunt collisions due to vehicles stopping on the mainline.

RECOMMENDATION

Review the positioning of the ERA to reduce the distance between consecutive ERAs to 2.5km or less.

DESIGNERS RESPONSE:

The design team agree with the recommendation and have reviewed the positioning of the ERAs. The previous area of refuge to ERA E1-B1 is the off-slip at J4. ERA E1-B1 is therefore located 1885m downstream and therefore meets the requirements of the IAN 161/13 standard.

A6 ACCESS

A6.1 PROBLEM

Drawing(s): 514451-MUH-ML-ZZ-DR-GA-300331-1D.

Location: Existing maintenance building; chainage 52000.

Summary: Accessibility of the existing maintenance building may lead to collisions between maintenance vehicles and other road users.

There is an existing building located at approximate chainage 52000 within the eastbound nearside verge that is currently accessed via the mainline carriageway. If the building and access is required to remain under the proposed SM-ALR, there are concerns that collisions may occur between road users travelling within lane 1 and maintenance vehicles as they enter and leave the carriageway.

RECOMMENDATION

Provide sufficient surfacing for vehicles to enter and leave the mainline in a forward gear and that the procedure for entering and leaving this area in a forward gear is incorporated into the relevant Safety Operational Manual. Alternatively, review the possibility of accessing the building from Lower Earley Way.

DESIGNERS RESPONSE:

The design team agree with the recommendation. The current design allows for access via the existing bell mouth to the gas site on Lower Earley Way.

A6.2

PROBLEM

Drawing(s): 514451-MUH-ML-ZZ-DR-GA-300327-1D.

Location: Eastbound Motorway Services Area (MSA).

Summary: Late or sudden lane change manoeuvres leading to collisions.

The eastbound MSA is located approximately 2km beyond the start of all lane running (4 lanes). There is a risk that drivers wishing to access the MSA will continue to run in LBS2 and will not appreciate the need to cross an additional lane resulting in potential collisions as a result of sudden or late lane change manoeuvres.

RECOMMENDATION

Ensure that the proposed signage for the MSA takes into consideration the change in road layout.

DESIGNERS RESPONSE:

The design team agree with the recommendation. The lane markings at the merge and diverge for the MSA will take into account the change in road layout.

A6.3 PROBLEM

Drawing(s): M4MM-MUH-ST-S2-DR-BD-300001-1A

Location: Maintenance steps.

Summary: Lack of MAA leading to collisions

No MAA have been detailed within the vicinity of the maintenance steps. If operatives park in a hazardous location there is an increased risk of collisions.

RECOMMENDATION

Ensure safe parking locations are provided on the side roads for operatives accessing the maintenance steps.

DESIGNERS RESPONSE:

The design team agree with the recommendation. Off network access has been assessed as part of the preliminary design and areas where access can be provided identified. Further detail of the access provision will be undertaken during the detail design.

A6.4 PROBLEM

Drawing(s): 514451-MUH-ML-ZZ-DR-GA-300599

Location: Maintenance steps.

Summary: Lack of MAA leading to collisions

No MAA has been detailed within the vicinity of the existing maintenance steps. If operatives park in a hazardous location there is an increased risk of collisions.

RECOMMENDATION

Ensure safe parking locations are provided on the side roads for operatives accessing the maintenance steps.

DESIGNERS RESPONSE:

The design team agree with the recommendation. Off network access has been assessed as part of the preliminary design and areas where access can be provided identified. Further detail of the access provision will be undertaken during the detail design.

A7 SKID RESISTANCE

Drawings for this design element were not submitted as part of this stage 1 road safety audit.

A8 AGRICULTURE

No issues that were considered to be detrimental to the safety of road users were identified in relation to this subject.

A9 FENCES & ROAD RESTRAINT SYSTEMS

Drawings for this design element were not submitted as part of this stage 1 road safety audit.

A10 BRIDGE PARAPETS

See Section D2

A11 ADJACENT DEVELOPMENTS & ROADS

No issues that were considered to be detrimental to the safety of road users were identified in relation to this subject.

B LOCAL ALIGNMENT

B1 VISIBILITY

No issues that were considered to be detrimental to the safety of road users were identified in relation to this subject.

B2 NEW/EXISTING ROAD INTERFACE

No issues that were considered to be detrimental to the safety of road users were identified in relation to this subject.

C JUNCTIONS

C1 LAYOUT

No issues that were considered to be detrimental to the safety of road users were identified in relation to this subject.

C2 VISIBILITY**C2.1 PROBLEM**

Drawing(s): 514451-MUH-ML-ZZ-DR-GA-300345-1D.

Location: Junction 6 Eastbound Merge.

Summary: Reduced visibility leading to side swipe or shunt type collisions.

The proposed layout results in lane two of the merge slip road approaching the mainline at a sharp angle. This along with the level differences between the slip-road and the mainline may result in visibility on approach and at the merge area being reduced. If there is reduction in available visibility there is an increased risk of collisions involving vehicles entering the mainline into the path of traffic in LBS1 and high speed collisions may occur.

RECOMMENDATION

Ensure that adequate visibility can be attained at the merge area.

DESIGNERS RESPONSE:

The design team agree with the recommendation. This recommendation will be taken forward as part of the detailed design stage.

C2.2 PROBLEM

Drawing(s): 514451-MUH-ML-ZZ-DR-GA-300349-1D.

Location: Junction 5 Eastbound Merge.

Summary: Reduced visibility leading to side swipe or shunt type collisions.

The proposed layout results in lane two of the merge slip road approaching the mainline where the level differences between the slip-road and the mainline is heightened. This may result in visibility on the approach and at the merge area being reduced. If there is reduction in available visibility there is an increased risk of collisions involving vehicles entering the mainline in conflict with passing traffic.

RECOMMENDATION

Ensure that adequate visibility can be attained at the merge area.

DESIGNERS RESPONSE:

The design team agree with the recommendation. This recommendation will be taken forward as part of the detailed design stage.

C3 SIGNING

C3.1 PROBLEM

Drawing(s): 514451-MUH-ML-ZZ-DR-GA-300325-1D.

Location: Sign G9-19.

Summary: Poor sign positioning leading to collisions.

The proposed sign is positioned at a point where the lane drop diverge flares from one to two lanes which may result in lane arrows not being directly over the relevant running lanes. If the lane arrows are not centralised there is an increased risk of vehicles straying from their running lane leading to shunt or side swipe type collisions.

RECOMMENDATION

Ensure the sign is positioned in advance of the flare such that all lane arrows are centralised over their relevant running lanes.

DESIGNERS RESPONSE:

The design team agree with the recommendation. The exact design of the sign and the position of the lane arrows will take place during the detailed design, and will be placed centrally over the lanes. In this location the auxiliary lane has been maximised, but the sign cannot be placed over the start of the auxiliary lane due to the presence of the railway bridge. The gantry sign has been placed as close as possible to the start of the taper without affecting the bridge, and at a point where the 2nd lane has only just started to develop.

C3.2 PROBLEM

Drawing(s): 514451-MUH-ML-ZZ-DR-GA-300325-1D.

Location: Westbound diverge slip road.

Summary: Poor lane choice leading to lane change collisions.

The exit slip flares from two to four lanes on approach to the roundabout control point. The existing approach does not provide sufficient advance information to enable drivers to choose the correct lane on the approach to the roundabout, this could lead to unnecessary and late lane change manoeuvres occurring and increasing the risk of collisions.

RECOMMENDATION

Introduce additional signage in advance of the flare point to encourage early lane choice.

DESIGNERS RESPONSE:

The design team agree with the recommendation. The introduction of additional signage will be taken forward during the detailed design stage. Discussions will be held with NDD accordingly.

C3.3 PROBLEM

Drawing(s): 514451-MUH-ML-ZZ-DR-GA-300326-1D & 300327-1D

Location: ERA E9-B3 & ERA E9-A2.

Summary: Sign positioning leading to collisions.

There is an existing MSA signs located in the vicinity of the proposed ERA facilities. There is a risk that the signs will create a barrier to visibility in the vicinity of the ERA leading to potential collisions. Additionally, the signs may create driver confusion if they are located before the ERA with the risk of drivers inadvertently mistaking the ERAs for the exit points for the MSA.

RECOMMENDATION

Ensure the signs do not impede visibility or cause driver confusion.

DESIGNERS RESPONSE:

The design team agree with the recommendation. The assessment of verge signs and their impact on visibility along with their relocation will be dealt with during the detailed design stage.

C3.4 PROBLEM

Drawing(s): 514451-MUH-ML-ZZ-DR-GA-300329-1D & 300330-1D.

Location: Junction 11 diverges.

Summary: Missing signage leading to shunt or lane change type collisions.

Both diverges for junction 11 are double diverges but there is no advance signage detailed to convey this to approaching drivers. Signage has been detailed for junction 8/9 that has a similar diverge. There is a risk that the majority of drivers, being unaware of the second diverge, will exit into lane one. As the slip road flares from two to four lanes at the roundabout there is an

increased risk of late and sudden lane change manoeuvres leading to collisions.

RECOMMENDATION

Introduce signage that informs approaching drivers of the double diverge. It would be preferable if this signage, or additional signage, conveyed the destinations reached via the two diverges. This would further reduce the need for drivers to change lanes on the slip road.

DESIGNERS RESPONSE

The design team agree with the recommendation. Two tiger tail signs have been provided on the approach to junction 11 in each direction.

C3.5

PROBLEM

Drawing(s): 514451-MUH-ML-ZZ-DR-GA-300343-1D.

Location: Sign G6-02.

Summary: Sign masking leading to shunt or lane change collisions

Gantry sign G6-02 is located after Lake End Road overbridge structure. There is a risk that the higher portion of the sign, the exit sign, will be masked by the bridge structure reducing the forward visibility. If the forward visibility is reduced there is an increased risk of shunt or lane change type collisions on approach to the diverge area.

RECOMMENDATION

Relocate the sign to ensure the appropriate forward visibility of the entire sign face can be attained.

DESIGNERS RESPONSE

The design team agree with the recommendation. The visibility of the sign has been checked within a 3D environment to ensure that the sign is visible for vehicles. The sign has an x height of 300 and has the required visibility of 180m. In this location the sign is visible for 200m.

C3.6 PROBLEM

Drawing(s): 514451-MUH-ML-ZZ-DR-GA-300343-1D.

Location: Eastbound and Westbound merge slip roads.

Summary: High entry speeds leading to collisions.

The layout of Huntcombe Spur may result in higher than normal approach speeds to the merge areas. If the M4 is subject to a reduced speed limit there is an increased risk of collisions involving vehicles attempting to merge at a higher speed.

RECOMMENDATION

Introduce AMIs onto the link to reduce vehicle speeds in advance of the merge areas.

DESIGNERS RESPONSE:

The design team agree with the recommendation. AMIs have been provided on the linking road leading to the slip road. These are placed at the split between eastbound and westbound so that drivers are informed should the motorway be closed. This option was reviewed and endorsed at PSCRG.

C3.7 PROBLEM

Drawing(s): 514451-MUH-ML-ZZ-DR-GA-300344-1D.

Location: Sign G5-08.

Summary: Confusing sign leading to lane change collisions

Gantry sign G5-08, exit sign, is located over lanes 3 and 4, this results in the sign looking unusual compared to all other signs along the route. There is a risk that this sign will result in driver confusion and potential collisions.

RECOMMENDATION

Reposition the sign such that it is over lane 1.

DESIGNERS RESPONSE:

The design team agree with the recommendation. This is purely an illustration of what the gantry will carry rather than the final configuration which will form part of the detailed design stage.

C3.8 PROBLEM

Drawing(s): 514451-MUH-ML-ZZ-DR-GA-300351-1D.

Location: Sign G2-15.

Summary: Sign location leading to lane change type collisions.

Sign G2-15 is located approx. 100m in advance of the hatched median between lane 1 and 2 of the merge slip road. The final sign design may indicate individual destination reached via the two lanes, this may encourage drivers to make sudden lane change manoeuvres in advance of the hatched median. If this occurs the likelihood of lane change type collisions is increased.

RECOMMENDATION

Reposition the sign such that the offset between the sign and the hatched median is maximised.

DESIGNERS RESPONSE: Exception

If the sign is located further away from its current location the visibility of the sign will be compromised by the tight right hand bend of the slip road, which may encourage drivers to make sudden lane change manoeuvres in advance of the hatched median. If this occurs the likelihood of lane change type collisions is increased. The sign is readable to vehicles for 180m in advance of the sign, and visible in excess of this, giving additional time for lane manoeuvres. It is proposed to mitigate the short distance with road markings in advance of the sign indicating the destinations as shown on the sign.

C3.9 PROBLEM

Drawing(s): 514451-MUH-ML-ZZ-DR-GA-300352-1D.

Location: Sign G2-02.

Summary: Sign location leading to lane change type collisions.

Sign G2-02 is located approx. 50m in advance of the hatched median between lane 1 and 2 of the merge slip road. The final sign design may indicate individual destination reached via the two lanes, this may encourage drivers to make sudden lane change manoeuvres in advance of the hatched median. If this occurs the likelihood of lane change type collisions is increased.

This sign may also result in unnecessary lane changes taking place as both lanes merge into a single lane while the sign does not clearly convey.

RECOMMENDATION

Reposition the sign such that the offset between the sign and the hatched median is maximised and review the sign face design drawing detailed design stage.

DESIGNERS RESPONSE: Exception

The sign is located in the only position where it will be visible for an adequate length of time to allow lane manoeuvres. It is visible from the start of the slip road and if moved away from the hatching there would not be sufficient time to read the sign, this could cause drivers to make erratic manoeuvres leading to incidents. It is proposed to mitigate the short distance with road markings in advance of the sign indicating the destinations as shown on the sign.

C3.10 PROBLEM

Drawing(s): 514451-MUH-ML-ZZ-DR-GA-300354-1D.

Location: Westbound 1 1/3 mile ADS, Junction3.

Summary: Sign position leading to shunt type collisions.

The sign is positioned on an overbridge structure in advance of junction 3 westbound merge area. There is a risk that drivers will not appreciate the sign is 1 1/3 miles in advance of the diverge area. As such, drivers may misinterpret the road layout resulting in driver hesitation, inappropriate manoeuvres or attempting to exit into the merge area. Due to this there will be an increased risk of collisions occurring within the mainline merge area.

In addition to this the audit team are concerned that fixing the proposed sign to the bridge structure will be problematic and may create ongoing maintenance issues.

RECOMMENDATION

Reconsider the requirement/need for providing this ADS considering the design also details a 1/4 and 1/2 mile ADS in advance of the westbound junction 4 diverge slip road.

DESIGNERS RESPONSE

The design team agree with the recommendation and have reviewed the need for providing the ADS.

The inclusion of this sign was requested by NetServ as mitigation for not having ADS until the 1/2 mile location due to the short length of the link. The low risk of a driver misinterpreting the sign would be outweighed by informing motorists that they were approaching the interchange with the M25, so mitigating against late lane changes.

C4 ROAD MARKINGS

Drawings for this design element were not submitted as part of this stage 1 road safety audit.

C5 TRAFFIC SIGNALS**C5.1 PROBLEM**

Drawing(s): N/A

Location: Ramp metering at merge slip roads within the extents of the scheme.

Summary: Existing ramp metering facilities conflict with the proposed road layout.

It is unclear from the details provided at this stage whether or not the ramp metering located at the junction merge slip roads is to remain under the MM-ALR scheme. Due to the change in road layout, there are concerns that if the facility remains, drivers may not be expecting to stop on the merge slip road leading to late braking and shunt type collisions occurring.

RECOMMENDATION

It is recommended that the ramp metering is either removed or the control point is relocated in conjunction with the proposed road layout.

DESIGNERS RESPONSE:

The design team agree with the recommendation. Ramp Metering will either be removed or will be recalibrated in conjunction with the proposed road layout.

There are six existing RM sites within the scheme. As per the requirements of IAN 161/13 these sites have been assessed against the criteria of IAN 103/08 to determine if they will continue to provide benefit following implementation of the scheme. PSCRG endorsed Retain and Recalibrate for all but one of the sites. (J12 eastbound is to be further reviewed during detailed design). The decision to retain or decommission the sites will need to be agreed to by Specialist Technical Support Services (STSS) / Netserv during the detailed design stage.

C5.2 PROBLEM

Drawing(s): 514451-MUH-ML-ZZ-DR-GA-300343-1D

Location: MS4 sign G6-07.

Summary: Limited space leading to vehicle strikes.

It was noted during the site inspection that at the point G6-07 is detailed there is limited verge width which may result in inadequate lateral clearance to the sign assembly. If sufficient lateral clearance is not achieved there is an increased risk of any collision severity being increased if an errant vehicle was to leave the carriageway at this location.

RECOMMENDATION

It is recommended that G6-07 is relocated to a point where additional verge width is available.

DESIGNERS RESPONSE

The design team agree with the recommendation. This location has been checked and there is sufficient verge width available to locate G6-07.

D NON MOTORISED USER PROVISION

D1 ADJACENT LAND

No issues that were considered to be detrimental to the safety of road users were identified in relation to this subject.

D2 FOOTWAYS/CYCLETRACKS

D2.1 PROBLEM

Drawing(s): N/A

Location: Various side roads.

Summary: Restricted shared facility width leading to conflicts.

A number of shared facilities are detailed as 2m in width, this is the absolute minimum width permitted over long lengths of facility. There is a concern that only providing the minimum width will increase the risk of NMU conflicts if the routes are to be utilised by cyclists.

RECOMMENDATION

Where the footways are to be designated as shared facilities the potential of increasing the width of the facilities to a minimum of 2.5m needs to be investigated during detailed design.

DESIGNERS RESPONSE

The design team agree with recommendation and such aspects will be investigated during detailed design and in collaboration with the local authority. The proposals presented are at this stage are based on matching the existing provisions.

D2.2 PROBLEM

Drawing(s): 514451-MUH-SR-ZZ-DR-GA-300599.

Location: Ascot Road side road.

Summary: Continuity of cycle track facility leading to NMU collisions.

The shared facility is detailed as ending at the northern extents of the scheme. At this point no facilities have been detailed to enable users to access and egress the facility.

RECOMMENDATION

At detailed design the shared facility should be furnished with access/egress and crossing points to ensure the facility can be used safely.

DESIGNERS RESPONSE

The design team agree with recommendation and such aspects will be investigated during detailed design and in collaboration with the local authority.

D2.3 PROBLEM

Drawing(s): 514451-MUH-SR-ZZ-DR-GA-300601.

Location: Marsh Lane side road.

Summary: Continuity of shared facility leading to NMU collisions.

The drawing details a cycle track on both sides of the carriageway for the extents of the re-alignment works. It was noted during the site inspection that there are only existing facilities on a single side of the carriageway. It is not clear how this short length of shared facility will be accessed from the carriageway, if adequate facilities are not provided there is an increased risk of collisions involving NMUs.

RECOMMENDATION

At detailed design the shared facility should be furnished with access/egress and crossing points to ensure the facility can be used safely.

DESIGNERS RESPONSE

The design team agree with recommendation and such aspects will be investigated during detailed design and in collaboration with the local authority.

D2.4 PROBLEM

Drawing(s): 514451-MUH-SR-ZZ-DR-GA-300606 & 300611.

Location: Oldway Lane & Old Slade Lane side road.

Summary: Parapet height resulting in NMU falls.

As this route is not open to traffic there is likely to be higher usage by cyclists and equestrians. If the parapets are of not a sufficient height to protect users there is an increased risk of falls from the structure.

RECOMMENDATION

At detailed design ensure that the parapet heights are of a sufficient height to protect all users from the hazard.

DESIGNERS RESPONSE

The design team agree with recommendation and such aspects will be investigated during detailed design and in collaboration with the local authority. However it should be noted that the proposed bridges at Oldway Lane and Old Slade Lane have narrow raised verges resulting in NMU usage being within the “carriageway” and not directly adjacent to the parapets. Whilst both routes are not “open” to traffic, some vehicle usage of the structures is likely.

D2.5 PROBLEM

Drawing(s): 514451-MUH-SR-ZZ-DR-GA-300607, 300608, 300609 & 300610.

Location: Wood Lane, Datchet Road, Riding Court Road & Recreation Ground side roads.

Summary: Parapet height resulting in NMU falls.

It is unclear if the proposed footways will be designated as shared facilities. If they are and the parapets are of not a sufficient height to protect users there is an increased risk of falls from the structure.

RECOMMENDATION

At detailed design ensure that the parapet heights are of a sufficient height to protect users from the hazard.

DESIGNERS RESPONSE

The design team agree with recommendation and such aspects will be investigated during detailed design and in collaboration with the local authorities.

E ROAD SIGNS, ROAD MARKINGS AND LIGHTING**E1 ROAD SIGNS****E1.1 PROBLEM**

Drawing(s): 514451-MUH-ML-ZZ-DR-GA-300340-1D & 300341-1D.

Location: Junction 8/9 diverges.

Summary: Lack of speed limit signs leading to collisions.

The existing speed limit does not change as you exit the M4 onto the connecting road network therefore there are no existing speed limit signs on the diverge slip roads. Under the Smart Motorway scheme vehicles leaving the mainline could be doing so under a lower posted speed limit but there will not be any signage to inform them of the speed limit on the local network. This will result in driver confusion with regarding the proposed speed limit and potential conflicts due to variations in vehicle speeds.

RECOMMENDATION

Ensure terminal speed limit signage is provided for the local road network.

DESIGNERS RESPONSE

The design team agree with the recommendation. De-restriction signs are required at this location.

E1.2 PROBLEM

Drawing(s): 514451-MUH-ML-ZZ-DR-GA-300345-1D.

Location: Junction 6 diverges.

Summary: Lack of speed limit signs leading to collisions.

The existing speed limit does not change as you exit the M4 onto the connecting road network therefore there are no existing speed limit signs on the diverge slip roads. Under the Smart Motorway scheme vehicles leaving the mainline could be doing so under a lower posted speed limit but there will not

be any signage to inform them of the speed limit on the local network. This will result in driver confusion with regarding the proposed speed limit and potential conflicts due to variations in vehicle speeds.

RECOMMENDATION

Ensure terminal speed limit signage is provided for the local road network.

DESIGNERS RESPONSE

The design team agree with the recommendation. The End of Motorway Regulation signs are located at the end of the off slips before traffic joins the local road network. These signs cancel all motorway regulations including variable speed limits which may be on display.

E1.3 PROBLEM

Drawing(s): 514451-MUH-ML-ZZ-DR-GA-300352-1D.

Location: Eastbound permanent 60mph signs.

Summary: Uncertain speed limits leading to collisions.

It is unclear how the permanent 60mph will interact with the variable speed limit associated with the Smart Motorway scheme. If it is unclear what the correct speed limit is there is an increased risk of collisions due to differentials in vehicle speeds.

RECOMMENDATION

Remove the fixed speed limit signage from this length of Smart Motorway.

DESIGNERS RESPONSE

The design team agree with the recommendation. The fixed 60mph signs should be removed from the design. The permanent 60mph section is required to be retained in the design to meet Air Quality requirements. Work is ongoing to establish whether the MS4 message signs will operate 24/7 to show a reduced speed limit or whether a Fixed Text Message Sign (FTMS) will be used to show a 60mph sign when the VMSL is not in operation.

E2 LIGHTING

E2.1 PROBLEM

Drawing(s): N/A.

Location: All junctions diverge/merge slip roads.

Summary: Reduced visibility increasing the risk of collisions.

No details have been provided regarding changes to be made to ensure a smooth transition between proposed and existing lighting. If a consistent or smooth transition in lighting is not provided there is a risk of dark patches and associated collisions.

RECOMMENDATION

Ensure adequate lighting levels are maintained.

DESIGNERS RESPONSE

The design team agree with the recommendation. The proposed road lighting will tie-in with the existing lighting that is to be retained at all locations. The proposed columns at the top of each merge/diverge slip road has been positioned to ensure that there are no unlit sections or dark patches. The compliant lighting layout will be finalised at the detailed design stage.

PSCRG endorsed an option to provide lighting from J3 to J6 and at J8/9. This was subject to further investigating the impact on safety risk for sections where there are constraints/features (such as retaining walls or environmental fencing) that would prevent drivers from reaching areas of safety away from the carriageway. Subsequent to the meeting the HA Project Team instructed that the scheme will proceed retaining the current lighting layout to mitigate the risk of challenge to the progression of the DCO (i.e. all lit except for J8/9-10 link).

E2.2 PROBLEM

Drawing(s): 514451-MUH-ML-ZZ-DR-GA-300586-1R.

Location: Junction 7 slip roads.

Summary: Lack of street lighting increasing the risk of shunt or side swipe type collisions.

The westbound diverge & merge facilities are detailed as being realigned as part of the scheme. The drawings provided do not indicate any new lighting on the realigned slip road facilities. If lighting is not provided the merge and diverge areas will have reduced illumination increasing the risk shunt or side swipe type collisions.

RECOMMENDATION

Provide street lighting on all the slip roads associated with junction 7.

DESIGNERS RESPONSE

The design team agree with the recommendation. The lighting of the slip roads at Junction 7 was upgraded, using the latest LED technology and aluminium lighting columns, in 2012. The proposed lighting and the existing lighting will be tied-in to ensure that there are no unlit sections. The compliant lighting layout, to allow for any road realignment, will be finalised at the detailed design stage.

E2.3 PROBLEM

Drawing(s): 514451-MUH-ML-ZZ-DR-GA-300594-1R.

Location: Chainage 14,600 to 15,500.

Summary: Lighting columns conflict with ERAs.

The lighting columns are detailed in the verge area between Ch.14,600 – 15,500. Within this section there is an eastbound and westbound ERA (Ch.15,100). If the lighting columns are set back to accommodate the ERAs there is a risk that the mainline may not be sufficiently illuminate leading to potential collisions due to dark patches.

RECOMMENDATION

Ensure the lighting design accommodates the ERAs and the additional off-set from the mainline carriageway.

DESIGNERS RESPONSE:

The design team agree with the recommendation. Where lighting is located at the back of ERAs, and therefore with an additional setback, higher wattage luminaires with appropriate photometry are to be proposed to ensure the necessary lighting levels are achieved. The compliant lighting layout will be finalised at the detailed design stage.

E3 ROAD MARKINGS

Drawings for this design element were not submitted as part of this stage 1 road safety audit.

E4 POLES & COLUMNS

No issues that were considered to be detrimental to the safety of road users were identified in relation to this subject.

3 CONCLUSIONS

All recommendations made within the RSA stage 1 report have been reviewed and considered accordingly.

There are 4 exceptions and these are shown below in Table 1. These were discussed with the PSCRG held on 5th February 2015:

Table 1: Exceptions to RSA

	Summary	RSA Recommendation	Designers Response
A5.9	ERA located after the 1/3 mile ADS leading to collisions	Reposition either the ERA or ADS such that the sign is located downstream of the ADS	<p>Exception. The design team have reviewed whether the ERA or ADS could be repositioned.</p> <p>Appendix A provides further information on the location of the ERA and ADS within the link. This assessment identified greater disbenefit with repositioning the ADS or ERA to achieve the relationship recommended by the auditors</p>
A5.10	ERA located after the 1/2 mile ADS leading to collisions	Reposition either the ERA or ADS such that the sign is located downstream of the ADS	<p>Exception. The design team have reviewed whether the ERA or ADS could be repositioned.</p> <p>Appendix B provides further information on the location of the ERA and ADS within the link. This assessment identified greater disbenefit with repositioning the ADS or ERA to achieve the relationship recommended by the auditors.</p>
C3.8	Sign location leading to lane change type collisions	Reposition the sign such that the offset between the sign and the hatched median is maximised	<p>Exception. If the sign is located further away from its current location the visibility of the sign will be compromised by the tight right hand bend of the slip road, which may encourage drivers to make sudden lane change manoeuvres in advance of the hatched median. If this occurs the likelihood of lane change type collisions is increased. The sign is readable to vehicles for 180m in advance of the sign, and visible in excess of this, giving additional time for lane manoeuvres. It is proposed to mitigate the short distance with road markings in advance of the sign indicating the destinations as shown on the sign.</p>
C3.9	Sign location leading to lane change type collisions	Reposition the sign such that the offset between the sign and the hatched median is maximised and review the sign face design drawing detailed design stage	<p>Exception. The sign is located in the only position where it will be visible for an adequate length of time to allow lane manoeuvres. It is visible from the start of the slip road and if moved away from the hatching there would not be sufficient time to read the sign, this could cause drivers to make erratic manoeuvres leading to incidents. It is proposed to mitigate the short distance with road markings in advance of the sign indicating the destinations as shown on the sign</p>

Annex A: ERA E2-B1 Analysis (A5.9)

Introduction

A PSCRG was held on 5th February 2015 where the RSA recommendations were reviewed and discussed. It was agreed at the PSCRG that the ERA at E2-B1 needs to be retained on the J4b-4 Eastbound link but a further review should be undertaken to confirm whether the ERA was positioned in the most appropriate location or whether it should be moved closer to the merge at J4b.

Design Review

Moving the Signage

The location of the signage on the M4 J4b-4 link is constrained by the short length of carriageway. The length of the link is 2.9km (centre of J4b to centre of J4) which limits the possible locations where the signage on the link can be located. The GA drawing attached (Ref: 514451-MUH-ML-ZZ-DR-GA-300351-2F) shows that moving the signs on a short link provides greater disbenefit to road users. The 1/3 mile sign at G2-09 could be moved and changed to be a ¼ mile sign and be located on gantry G2-07 as this would meet the RSA recommendations (as the sign would be located after the ERA). However, it is considered that moving the signage to this location would provide too much information at one location and the information would be presented later on the link which could result in late weaving by drivers looking to exit at this particularly busy junction.

Moving the ERA

Due to the short length of the link there are constraints as to where the ERA can be located. Moving the ERA east (downstream) from its currently proposed location would move it closer to the junction which would not address the RSA recommendation. The GA drawing provides an illustration of two alternative locations west (upstream) of its currently proposed location and demonstrates that there are greater disbenefits with locating the ERA at these locations.

Moving the ERA west as illustrated would mean that the ERA is located closer to the entry datum point at J4b. This would mean that there is greater likelihood that drivers merging could be in direct conflict with drivers who may be trying to reach the ERA. The ERA in its currently proposed position is located approximately 850m from the previous location of refuge. Moving the ERA further west to the illustrated locations on the GA drawing would mean that the ERA is likely to be less than 500m from the previous area of refuge. Therefore locating the ERA to the positions illustrated would result in the ERA providing less benefit to drivers on the M4 scheme.

It is recognised that the M42 SM Pilot and Birmingham Box schemes have a similar layout at some locations. Feedback has been sought from the Traffic Officer Service (TOS). Comments received are that the TOS do not see these locations as an issue and there have been no particular observations of drivers mistaking the ERA as the exit.

Hazard Analysis Review

A hazard analysis has been undertaken in order to consider moving the ERA further west. A qualitative approach has been adopted for this assessment. Key hazards which will be affected by the moving of the ERA have been assessed to determine the change in risk if the ERA were to be change location to a position further west.

- Eliminated: means the risk would be eliminated if there was no ERA at this location
- '-': means the risk for this hazard would reduce if there was no ERA at this location
- '+': means the risk would increase if there was no ERA at this location
- '=' means no change in risk expected if there was no ERA at this location

The assessment is shown in Table A below.

Table A: Key hazards from M4 J3-J12 Sm hazard log affected by moving the ERA further west

Hazard	Hazard score for implementation of ALR (with ERAs)	Effect on score if ERA is removed	Comments
Hazards relating to entry/exit of ERA			
H9 - Driver changes mind about entering ERA	E5.5	+	This hazard would increase as the driver would have to cross lanes with increased conflict from merging traffic
H116 - Vehicle misjudges entry to ERA	E7.0	+	This hazard would increase as the driver would have to cross lanes with increased conflict from merging traffic
H14 - Driver mistakes ERA for exit slip	E6.0	-	This hazard would reduce in risk as moving the ERA closer west would mean the ERA is located prior to 1/3m sign.
H48 - Legal-illegal pedestrian(s) in path of vehicles in ERA	E6.0	=	No change
H74 - Person on off-side of vehicle in ERA	S6.5	=	No change
H113 - Vehicle exits ERA	E7.5	+	This hazard would increase as the driver would have to exit with increased conflict from merging traffic
H141 - HGV-LGV-Bus exits ERA	E7.5	+	This hazard would increase as the driver would have to exit with increased conflict from merging traffic
H152 - Vehicle recovered from ERA	E8.0	+	This hazard would increase as the driver would have to exit with increased conflict from merging traffic
H150 - Vehicle in ERA (or verge) obtrudes into lane 1 (applies only to ALR)	S7.0	=	No change
Other affected hazards			
H112 – Vehicle enters main carriageway unsafely	E7.8	+	This hazard would increase as the drivers entering the M4 from the M25 could come into conflict with drivers trying to enter or exit the ERA

Hazard	Hazard score for implementation of ALR (with ERAs)	Effect on score if ERA is removed	Comments
H32 - Health deterioration of vehicle occupant	E7.1	=	No change
H155 - Vehicle stops in running lane - Peak	E7.5	+	Moving the ERA west means more vehicles are forced to stop in a live lane when they cannot reach the next refuge point.
H135 - Vehicle Stops in Running Lane - Off Peak (Event)	E08	+	Moving the ERA west means more vehicles are forced to stop in a live lane when they cannot reach the next refuge point.
H147 - Pedestrians walking in lane 1 (applies to ALR only)	S7.0	+	Moving the ERA west means more live lane stops.
H22 - Emergency staff -TO etc on foot at scene of an incident	S6.0	+	Moving the ERA means more live lane stops to attend
H34 - Incident management - rolling block	E6.5	+	Moving the ERA means more live lane stops. Rolling road block may be required more often e.g. to move stopped vehicle to next place of refuge

The most significant hazards (i.e. those with a risk score of 7.5 or higher) affected by the decision whether to move the ERA are:

- H152 - Vehicle recovered from ERA (E8.0)
- H135 - Vehicle Stops in Running Lane - Off Peak (Event) (E8.0)
- H112 – Vehicle enters main carriageway unsafely (E7.8)
- H113 - Vehicle exits ERA (E7.5)
- H141 - HGV-LGV-Bus exits ERA (E7.5)
- H155 - Vehicle stops in running lane – Peak (E7.5)

H14 - Driver mistakes ERA for exit slip (E6.0) is a relatively minor hazard. If we assume the risk at this location is an order of magnitude higher than at other locations that would make H14 an E7.0 (risk is 10 times greater), which would still not make it one of the highest scoring risks.

Conclusions

It is recommended that the ERA as currently proposed remains in the optimum position. There are disbenefits with moving the signage on the link and moving the ERA west (upstream) increases the risk of conflict with merging traffic. Moving the ERA west would also mean a less balanced refuge provision is provided on the scheme. The relationship between the location of the signage and ERA will be further reviewed in the detailed design stage.

If concerns remain that drivers could become confused there is an option to provide designated lane markings immediately upstream of the ERA to make it clear that the lane continues and also the green studs can be removed from the ERA to discourage drivers from thinking it is the exit at J4. These mitigations will be reviewed during the detailed design stage and will be informed by evidence from other operational SM schemes.

Annex B: ERA E1-A1 Analysis (A5.10)

Introduction

A PSCRG was held on 5th February 2015 where the RSA recommendations were reviewed and discussed. It was agreed at the PSCRG that the ERA at E1-A1 needs to be retained on the J3-4 Westbound link but a further review should be undertaken to confirm whether the ERA was positioned in the most appropriate location.

Design Review

Moving the Signage

The location of the signage on the M4 J3-4 link is constrained by the short length of carriageway. The length of the link is 3km (centre of J3 to centre of J4) which limits the locations where the signage on the link can be located. The GA drawing attached (Ref: 514451-MUH-ML-ZZ-DR-GA-300353-2F) shows that moving the signs on a short link provides greater disbenefit to road users. The 1/2 mile sign at G1-03 could be moved and be changed to be a 1/3 mile sign as this would meet the RSA recommendations (as the sign would be located after the ERA). However, it is considered that moving the signage to this location would mean that information would be presented later on the link which could increase the likelihood of late weaving by drivers looking to exit at this busy junction.

Moving the ERA

Due to the short length of the link there are constraints as to where the ERA can be located. Moving the ERA west (downstream) from its currently proposed location would move it closer to the junction which would not address the RSA recommendation. The GA drawing provides an illustration of two alternative locations east (upstream) of its currently proposed location and demonstrates that there are greater disbenefits with locating the ERA at these locations.

Moving the ERA east as illustrated would mean that the ERA is located closer to the entry datum point at J3. This would mean that there is greater likelihood that drivers merging could be in direct conflict with drivers who may be trying to reach the ERA. The ERA in its currently proposed position is located approximately 1100m from the previous location of refuge. Moving the ERA further west to the illustrated locations on the GA drawing would mean that the ERA is likely to be less than 800m from the previous area of refuge. Therefore locating the ERA to the positions illustrated would result in the ERA providing less benefit to drivers on the M4 scheme.

It is recognised that the M42 SM Pilot and Birmingham Box schemes have a similar layout at some locations. Feedback has been sought from the Traffic Officer Service (TOS).

Comments received are that the TOS do not see these locations as an issue and there have been no particular observations of drivers mistaking the ERA as the exit.

Hazard Analysis Review

A hazard analysis has been undertaken in order to consider moving the ERA further east. A qualitative approach has been adopted for this assessment. Key hazards which will be affected by the moving of the ERA have been assessed to determine the change in risk if the ERA were to be change location to a position further east.

- Eliminated: means the risk would be eliminated if there was no ERA at this location
- '-': means the risk for this hazard would reduce if there was no ERA at this location
- '+': means the risk would increase if there was no ERA at this location
- '=' means no change in risk expected if there was no ERA at this location

The assessment is shown in Table B below.

Table B: Key hazards from M4 J3-J12 Sm hazard log affected by moving the ERA further east

Hazard	Hazard score for implementation of ALR (with ERAs)	Effect on score if ERA is removed	Comments
Hazards relating to entry/exit of ERA			
H9 - Driver changes mind about entering ERA	E5.5	+	This hazard would increase as the driver would have to cross lanes with increased conflict from merging traffic
H116 - Vehicle misjudges entry to ERA	E7.0	+	This hazard would increase as the driver would have to cross lanes with increased conflict from merging traffic
H14 - Driver mistakes ERA for exit slip	E6.0	-	This hazard would reduce in risk as moving the ERA east would mean the ERA is located prior to 1/2m sign.
H48 - Legal-illegal pedestrian(s) in path of vehicles in ERA	E6.0	=	No change
H74 - Person on off-side of vehicle in ERA	S6.5	=	No change
H113 - Vehicle exits ERA	E7.5	+	This hazard would increase as the driver would have to exit with increased conflict from merging traffic
H141 - HGV-LGV-Bus exits ERA	E7.5	+	This hazard would increase as the driver would have to exit with increased conflict from merging traffic
H152 - Vehicle recovered from ERA	E8.0	+	This hazard would increase as the driver would have to exit with increased conflict from merging traffic
H150 - Vehicle in ERA (or verge) obtrudes into lane 1 (applies only to ALR)	S7.0	=	No change
Other affected hazards			
H32 - Health deterioration of vehicle occupant	E7.1	=	No change

Hazard	Hazard score for implementation of ALR (with ERAs)	Effect on score if ERA is removed	Comments
H155 - Vehicle stops in running lane - Peak	E7.5	+	Moving the ERA east means more vehicles are forced to stop in a live lane when they cannot reach the next refuge point.
H135 - Vehicle Stops in Running Lane - Off Peak (Event)	E08	+	Moving the ERA east means more vehicles are forced to stop in a live lane when they cannot reach the next refuge point.
H147 - Pedestrians walking in lane 1 (applies to ALR only)	S7.0	+	Moving the ERA east means more live lane stops.
H22 - Emergency staff -TO etc on foot at scene of an incident	S6.0	+	Moving the ERA means more live lane stops to attend
H34 - Incident management - rolling block	E6.5	+	Moving the ERA means more live lane stops. Rolling road block may be required more often e.g. to move stopped vehicle to next place of refuge

The most significant hazards (i.e. those with a risk score of 7.5 or higher) affected by the decision whether to move the ERA are:

- H152 - Vehicle recovered from ERA (E8.0)
- H135 - Vehicle Stops in Running Lane - Off Peak (Event) (E8.0)

H14 - Driver mistakes ERA for exit slip (E6.0) is a relatively minor hazard. Although the current proposed design for ERA E1-A1 does not meet all aspects of IAN161 this is not expected to have a significant impact on risk, at this location or for the overall scheme.

The drawings show that moving the signs on a short link is not practical. The 1/2 mile sign could be moved to a 1/3 mile sign. This would however provide information much later on the link and would therefore increase the level of risk on this link.

Conclusions

It is recommended that the ERA as currently proposed remains in the optimum position. There are disbenefits with moving the signage on the link and moving the ERA east (upstream) increases the risk of conflict with merging traffic. Moving the ERA east would also mean a less balanced refuge provision is provided on the scheme. The relationship between the location of the signage and ERA will be further reviewed in the detailed design stage.

If concerns remain that drivers could become confused there is an option to provide designated lane markings immediately upstream of the ERA to make it clear that the lane continues and also the green studs can be removed from the ERA to discourage drivers from thinking it is the exit at J4. These mitigations will be reviewed during the detailed design stage and will be informed by evidence from other operational SM schemes.