

5. ENGINEERING AND DESIGN

For the applicant; WBerksC; WokBC; RBC; RBWM; BFC; BCC; SBDC; SBC; LBHill; LBHours; GLA; RAC; AA; EA.

ED5.1 To what extent have the local authorities and road user bodies been involved in the engineering and design of the project?

1. As the mainline carriageway of the M4 is operated by Highways England, there is no need to consult the local authorities on the engineering and design of the mainline. However, these bodies have been consulted in relation to the Scheme, as set out in the Consultation Report (Application Document Reference 5.1), and described below. Some local authority roads (“side roads”) are affected by the overbridge replacements and underbridge widening works and therefore Highways England has taken additional steps to engage with them accordingly in relation to these roads.
2. In relation to the necessary overbridge replacements and associated side road changes, Highways England has engaged with Slough Borough Council, South Bucks District Council, Buckinghamshire County Council and the Royal Borough of Windsor and Maidenhead throughout the preliminary design stage, commencing in March 2013, as they are the authorities directly affected by the proposed works. Proposals developed for the side road realignments were forwarded to each of the local authorities relative to their administrative boundaries. Responses to the specific proposals varied between the authorities, with Slough Borough Council participating to the greatest extent and being content with the preliminary proposals. User bodies were not contacted as part of the process. However, meetings were held with some interested parish councils.
3. In addition to the direct contact made by Highways England, the local authorities have had two opportunities to comment and agree on the proposals for the Scheme, firstly on the information presented in the Preliminary Environmental Information Report (issued November 2014) (<http://www.highways.gov.uk/publications/m4-junction-3-to-12-smart-motorway-consultation-documents/>) during the formal consultation under s. 42 of the Planning Act 2008, and secondly in their relevant representations on the made application, in accordance with s.56 of the Planning Act 2008.
4. Slough Borough Council’s Relevant Representation raised general issues regarding:
 - 4.1 Overbridge replacements; and
 - 4.2 Diversion routes.
5. Buckinghamshire County Council’s relevant representation raised issues regarding:
 - 5.1 Access to the bridge sites;
 - 5.2 Severance caused by closing Old Slade Lane;
 - 5.3 Diversion routes;
 - 5.4 Retention of cycle route at Thames Bray;
 - 5.5 Improvement of the Thames National Trail; and
 - 5.6 Enabling Old Slade Lane to be used by walkers, cyclists and horse riders.

6. Royal Borough of Windsor and Maidenhead did not submit a Relevant Representation. The GLA's Relevant Representation did not raise any concerns in relation to the engineering and design of the Scheme.
7. Highways England has responded to the Relevant Representations as part of its submission at Deadline I, and has also engaged with the local authorities to agree Statements of Common Ground, as provided with Deadline II. Highways England will continue to liaise with the local authorities during the detailed design stage.
8. At Scheme level there has been no direct contact with the road user bodies as this relationship is managed at a higher level within Highways England. The AA and RAC meet with Highways England on a regular basis in a number of forums. The one most relevant is the national Survive working group. They have been briefed on the smart motorway proposals across the network through this forum, and the Survive Best Practice Guide is being re-issued to all recovery agents to enable them to operate safely on smart motorways.
9. Highways England has engaged with the Environment Agency ("EA") throughout the development of the Scheme. Details of the Relevant Representation from the EA are available via the link in item 7 above. In addition, a Statement of Common Ground has been prepared and discussions for its agreement will continue following Deadline II.

ED5.2 What measures [(Intelligent Transport Systems [ITS] or Integrated Demand Management [IDM])] are currently in place on M4 J3 to 12 to improve journey time reliability, reduce congestion and increase highway capacity as recommended by the TVMMS in 2003?

1. Since the publication of the Thames Valley Multi Modal Study in 2003, the following systems have been provided on the M4 to improve journey time reliability, reduce congestion and increase highway capacity:
 - 1.1 Variable Message Signs;
 - 1.2 Motorway Incident Detection Automatic System;
 - 1.3 Closed Circuit Television; and
 - 1.4 Ramp Metering.
2. However, even with these measures in place, the 2037 forecast traffic flow during peak periods between junctions 7 to 12 eastbound and junctions 5 to 6 and junctions 7 to 8/9 of the M4 will reach capacity without the Scheme. Forecast ratios of traffic flow to capacity without implementation of the Scheme are shown in Table 2, Paragraph 4.3.3 of the Engineering and Design Report ("EDR") (Application Document Reference 7.3).
3. The evidence for the benefits of the Scheme in reducing congestion can be seen in table 3 of the EDR, which shows the reduced flow to capacity ratios with implementation of the Scheme. It is notable that congestion will increase without the Scheme, but its implementation is calculated to bring demonstrable benefits. This is addressed further in Highways England's response to question ED 5.3.

ED5.3 Does Table 2 of the applicant's EDR APP-096 take into account the use of any ITS and/or IDM?

1. The tables in the EDR are produced using data collected in respect of 2013 traffic flows. As such, the data represents the motorway operating with existing Ramp Metering¹, Closed-circuit television "(CCTV)", Motorway Incident Detection and Automatic Signalling ("MIDAS" – inductive loops in the road to detect slow moving, queuing or stationary traffic) and message signs in place.
2. Table 2 of the EDR shows forecast ratios for each link without implementation of the Scheme. Strategic traffic models, such as the M3/M4 model, do not explicitly model the effects of motorway technology. Instead, they assign traffic on the basis of speed-flow curves that reflect the number of traffic lanes present on a carriageway. The traffic flow forecasts used in Table 2 (reproduced below) are taken directly from the traffic model and take no specific account of existing ITS or IDM technology. Two years' data are shown - 2022 (Opening Year) and 2037 (Design Year) - for the morning and evening peak periods. In each case, without the Scheme, the number of links shaded red (where the ratio of flow to capacity exceeds 85%, which indicates that the links are predicted to become congested) increases over time. Similarly, the number of links where flow has reached capacity (shaded black) is also forecast to increase. The links which are shaded yellow in Table 2 are those which are predicted to be near to having a ratio of flow to capacity exceeding 85%. Those links shaded green do not have capacity issues.
3. Table 2 - Forecast ratios of traffic flow to capacity without implementation of the Scheme

| | Morning peak-hour (07:00-08:00) | | | | Evening peak-hour (17:00-18:00) | | | |
|----------|---------------------------------|-------|-----------|------|---------------------------------|-------|-----------|-------|
| | Eastbound | | Westbound | | Eastbound | | Westbound | |
| | 2022 | 2037 | 2022 | 2037 | 2022 | 2037 | 2022 | 2037 |
| J12-J11 | 99.4 | 100.0 | 82.1 | 88.9 | 94.5 | 100.0 | 88.2 | 90.8 |
| J11-J10 | 100.0 | 100.0 | 85.7 | 92.1 | 96.1 | 100.0 | 92.8 | 96.1 |
| J10-J8/9 | 96.7 | 100.0 | 82.7 | 87.2 | 85.1 | 90.1 | 94.7 | 97.9 |
| J8/9-J7 | 97.0 | 100.0 | 80.1 | 84.9 | 83.8 | 87.7 | 100.0 | 100.0 |
| J7-J6 | 91.6 | 93.5 | 82.9 | 88.6 | 83.0 | 85.5 | 94.5 | 98.6 |
| J6-J5 | 96.9 | 99.6 | 87.9 | 93.0 | 91.4 | 95.0 | 97.3 | 100.0 |
| J5-J4b | 74.0 | 76.2 | 73.1 | 75.2 | 75.1 | 78.2 | 80.0 | 82.3 |
| J4b-J4 | 77.2 | 78.5 | 73.7 | 74.9 | 77.9 | 79.6 | 77.0 | 77.7 |
| J4-J3 | 84.2 | 88.5 | 86.8 | 88.0 | 91.6 | 91.4 | 83.7 | 83.9 |

¹ Ramp metering is described in paragraph 9.5.1 of the Engineering and Design Report (Application Document Reference 7.3).

Key

| | | | |
|------------------|--------------------------------|--------------------------------------|--------------------|
| Capacity reached | Ratio of flow to capacity >85% | Ratio of flow to capacity nearly 85% | No capacity issues |
|------------------|--------------------------------|--------------------------------------|--------------------|

4. Over recent years other forms of technology have been introduced on the M4 between junctions 3 and 12 to help manage traffic on this congested section. This includes Ramp Metering, CCTV, MIDAS and message signs. However, although these measures are in place and make a positive contribution to the management and safety of traffic, the forecast traffic flow during peak periods in substantial areas of the Scheme will approach or exceed the available capacity without the Scheme and the further benefits to be derived through the provision of the additional capacity and enhanced control systems are now necessary. See Tables 2 and 3, Paragraph 4.3.3 of the EDR.

ED5.4 Why was the Controlled All Lane Running (ALR) design chosen in preference to a Managed Motorway (MM) with use of the hard shoulder restricted to periods of congestion?

1. The implementation of smart motorways to increase capacity and improve performance is outlined within paragraph 2.23 of the National Policy Statement for National Networks ("NN NPS"). Smart motorways (previously known as managed motorways) is the generic term for motorways where technology is combined with operating procedures to actively control traffic flow. (The link below provides greater detail https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/363960/Englands_motorways_are_getting_smart_leaflet.pdf). Techniques such as varying the speed limit, making the hard shoulder available to traffic and ramp metering are used to make journey times more reliable, improve traffic flow and reduce congestion. At the same time, safety is better than that of a normal 3 lane motorway. Currently Highways England has 3 types of smart motorway on its network:
 - 1.1 controlled motorways ("CM");
 - 1.2 hard shoulder running ("HSR") – sometimes called Dynamic Hard Shoulder running ("DHS"); and
 - 1.3 all lane running ("ALR").
2. In 2008, Ruth Kelly, Transport Secretary, announced a £6 billion investment package to improve and make better use of England's motorways and other key roads. She also published the Command Paper 'Roads - Delivering Choice and Reliability' setting out more detail on her innovative plans to tackle congestion, both on strategic routes and in towns and cities. (The link to the first announcement on the then Managed Motorway programme in 2008 is http://webarchive.nationalarchives.gov.uk/20081201222039/autoindustry.co.uk/press_releases/17-07-08).
3. In 2009 the weakening of the UK economy resulted in an even greater need to reassess the capital and operating cost of a typical section of smart motorways, whilst maintaining the journey time reliability and safety benefits identified in the programme's aims and objectives.
4. Key programme level objectives were established to reduce the estimated whole of life scheme costs and reduce timescale for construction whilst ensuring no reduction in safety performance compared with the baseline of a "standard" motorway.
5. The then Highways Agency utilised the momentum, learning and evidence generated by the success of the M42 Pilot (an HSR scheme) and initial roll out of hard shoulder running on key sections of the 'Birmingham Box', to reassess the hazards associated with evolving the smart motorways design.
6. In 2010, the then Highways Agency began investigating what further changes could be made to the technical specification in order significantly to reduce costs and timescales for scheme delivery. The Highways Agency developed a revised smart motorway concept based upon the permanent conversion of the hard shoulder to a running lane, using the knowledge and experience gained from constructing and operating the M42 Pilot and Birmingham Box schemes. The aim was to optimise the quantity of infrastructure required to operate the motorway safely without the hard shoulder i.e. ALR, whilst continuing to deliver schemes that tackled the problem of growing congestion and unreliable journeys. This optimised approach required fewer overhead gantries and made greater use of cantilever gantries to

present information to drivers in a simpler way, whilst minimising the whole of life cost of expensive infrastructure.

DHS or ALR

7. The Managed Motorways All Lane Running Generic Safety report Ref: 1039092-GSR-016, August 2013 source: <http://assets.highways.gov.uk/specialist-information/knowledge-compendium/2011-13-knowledge-programme/MM-ALR%20generic%20safety%20report%20final.pdf>) provides further background information to explain why the ALR design became Highways England policy as the preferred operating solution to address congestion issues on the network.

8. The Managed Motorways All Lane Running Generic Safety report (referenced above) states:

“In January 2009 the Government announced that hard shoulder running (HSR) would be extended to some of the busiest parts of the Highways Agency’s major road network and this initiated the managed motorways (MM) programme. The MM concept built upon the success of the M42 Active Traffic Management Pilot (M42 MM) scheme. IAN 111/09 “Managed Motorways Implementation Guidance – Hard Shoulder Running (MM-HSR)” and IAN112/08 “Managed Motorways Implementation Guidance – Through Junction Hard Shoulder Running” provide designers with guidance on the implementation of managed motorways with dynamic hard shoulder running and the option for including through junction hard shoulder running.

Further knowledge and experience of operating managed motorways schemes indicated that there was scope to further reduce capital and operating costs, whilst meeting congestion objectives and not reducing safety performance compared to the baseline.

Managed motorways all lane running (MM-ALR) has been developed by the Highways Agency to enable a reduction in the amount of infrastructure necessary for a managed motorway scheme, resulting in significant cost savings without a reduction in safety.

Permanent conversion of the hard shoulder to a running lane along with the ability to dynamically control mandatory speed limits is a key aspect of MM-ALR. This removes the complex operating regime of opening and closing a dynamic hard shoulder.”

9. Highways England's experience of operating HSR has shown that it is resource intensive (to open and close the hard shoulder). It has a number of technology points of failure, which means that the hard shoulder regularly cannot be opened. For example, the opening of the hard shoulder as a running lane on an HSR scheme requires the operator to be able to view the full length of hard shoulder. When a camera develops a technology fault and a section of hard shoulder cannot be viewed by the operator, then the operator will not be able to open the hard shoulder to traffic. This also results in a high maintenance burden which itself results in more risk exposure to Highways England's workforce. All of these factors impact on the financial and operational benefits of managed motorways. All lane running ("ALR") reduces these risks of technology failure and to the workforce.
10. Optimising the smart motorways design, and subsequent operations, has enabled Highways England to find a balance between designing/operating efficient schemes that provide value for money, whilst maintaining safety above baseline levels.
11. These efficiencies have made it possible to deliver a far greater number of smart motorway carriageway miles and deliver significant benefits more quickly than would have been possible by replicating the heavily engineered M42 pilot scheme.

Selection of motorway technology for the M4

12. With regard to the M4 J3-12 Scheme, the operational options considered for the Scheme are detailed in Table 4, Paragraph 5.1.11 of the Engineering and Design Report (Application Document Reference 7.3). The options considered included dynamic use of the hard shoulder and also the ALR concept. Paragraph 5.1.11 notes that *“The four operational regime options and design concepts were identified (Table 4), developed and reviewed, by Highways England based on the knowledge gained from delivering Managed Motorway schemes and incorporating the latest emerging concepts.”* Paragraph 5.1.12 goes on to say that the *“design and cost assessments were undertaken in 2010 for each of the above design solutions, although work on developing engineering options was halted pending the completion of a traffic model and the development of a second generation Managed Motorway solution”*.
13. These assessments undertaken concluded that the smart motorway solution proposed for the M4 is the most suitable option for this stretch of motorway. It allows Highways England to deliver the additional capacity that is required to tackle congestion by making best use of the available road space, and avoiding the problems experienced with the HSR design.

ED5.5 The EDR APP-096 identifies a requirement for further detailed design. The possible changes include online solutions changing to offline solutions. Section 7 of the EDR provides a link by link description and different options for certain works are included². The applicant is requested to produce a schedule of those works for which options have not been decided. The schedule should indicate whether all the options are shown on the relevant works plan and provide the works plan reference; provide references to the ES where the options have been considered; and indicate the implications for land take, referring to the land plans/Book of Reference (BoR) for each option.

1. The EDR (Application Document Reference 7.3) addresses the preliminary design, which was complete at the time of the application and is shown on the annexes to the EDR (Application Document Reference 7.4) and the engineering drawings and sections, (Application Document Reference 2.5 and 2.6). It is anticipated that as detailed design progresses then some design details may change. However, Highways England will not deviate from the Works Plans (Application Document Reference 2.3) except as provided for in Article 6 of the draft DCO “Power to deviate”. Where different options are awaiting detailed design decisions, then the work boundaries on the Works Plans cover the worst case scenario which in all cases includes sufficient area for the other options under consideration. It is important to note that the Rochdale Envelope for the Scheme, the reasonable worst case on which it is assessed, is set by the power of deviation and not the preliminary design. As such, it is not appropriate to seek an exhaustive list of changes that may be made. The approach is acceptable to Parliament, as it is adopted in the Crossrail Act 2008, which similarly relates to a linear project.
2. Paragraph 5.2.7 of the EDR states: *“During detailed design, the options will be subject to further review following stakeholder engagement and subsequent value engineering with the appointed contractor. This may identify benefits that could be achieved by re-considering some of the alternatives once more details about the proposed construction of the wider Scheme are established.”* However, any such changes would be limited by the power to deviate, within the parameters assessed in the ES and constrained by the provisions of the DCO, as explained in response to first written question ED 5.6. Examples of details include gantry foundations, bridge detail dimensions, siting of apparatus, etc. None of these would affect the assessments carried out.
3. Paragraph 5.2.8 of the EDR lists certain changes which may become desirable under particular circumstances. These are included in the table below along with a status update. The table also lists other options currently under consideration are tabulated below. Further changes may be identified within the power of deviation as the detailed design progresses but at this point in time the preliminary design remains current and no such change has yet been identified.
4. Please also refer to the response to ED9.4, which identifies various plots of land which might be needed for temporary works dependant on condition surveys and construction methodology.

² No works plan references are provided in the EDR to aid the understanding of the options in relation to the parameters of the draft DCO.

| Work No | Description of Option | Plot Nos | Environmental Statement Reference |
|--|--|--|-----------------------------------|
| 7a, 8c, 10c, 11c, 12e, 13c, 14c, 19c, 20c, 22c, 25 | <p>Bridges, General</p> <p>EDR paragraph 5.2.8.a states: “span arrangements, if temporary works and detailed cost estimates demonstrate significant benefits”</p> <p>Update, October 2015: The form and number of spans of the proposed Old Slade Lane Overbridge (Work No. 25) will require change if the Scheme is to accommodate the new railway forming part of Slough International Freight Exchange (“SIFE”) development All other proposed span arrangements remain as shown in the bridge general arrangement drawings in EDR Annex F3 (Application Document Reference 7.4)</p> | Various plots within current motorway boundary and at side roads | 4.3 to 4.11 |
| 7a, 8c, 10c, 11c, 12e, 13c, 14c, 19c, 20c, 22c, 25 | <p>Bridges, General</p> <p>EDR paragraph 5.2.8.b states: “reinforced concrete abutments/wing-walls being replaced by reinforced soil where appropriate and where a cost saving can be demonstrated”</p> <p>Update, October 2015 Detailed design is still underway and this option remains a possibility. However at this point in time the preferred abutment and wingwall types remain as shown in the bridge general arrangement drawings in EDR Annexes F2 and F3 (Application Document Reference 7.4)</p> | Various plots within current motorway boundary and at side roads | 4.3 to 4.11 |
| 7a, 8c, 10c, 11c, 12e, 13c, 14c, 19c, 20c, 22c, 25 | <p>Bridges, General</p> <p>EDR paragraph 5.2.8.c states: “online solutions changing to offline solutions if diversion routes are considered undesirable</p> <p>Update, October 2015: No change is currently proposed to the online/offline side road solutions described in the application. However, as a ‘matter not agreed’ in the Statement of Common Ground, Buckinghamshire Country Council requests that access is maintained while the new Old Slade Lane Overbridge is built (Work No 25)</p> | Various plots within current motorway boundary and at side roads | 4.3 to 4.11 |

| | | | |
|---|---|---|------------------------|
| <p>7a, 8c, 10c, 11c, 12e, 13c, 14c, 19c, 20c, 22c, 25</p> | <p>Bridges, General</p> <p>EDR paragraph 5.2.8.d states “online solutions changing to offline solutions if significant costs are associated with utility diversions and, directional drilling of services under the M4 carriageways is not feasible”</p> <p>Update, October 2015: Detail design of utility diversions has not yet commenced</p> | <p>Various plots within current motorway boundary and at side roads</p> | <p>4.3 to 4.11</p> |
| <p>18</p> | <p>Water and Gas Main Subway.</p> <p>Assessed Option: symmetrical extension of the subway by 2.1 m to north and south. See drawing ref 514451-MUH-ST-S2-DR-UB-301334 in EDR annex F2 (Application Document Reference 7.4)</p> <p>Alternative option: infill the structure to eliminate the need for future access. This option is currently being discussed with Thames Water and would require a new, sleeved, main to be constructed through the subway with consequential local diversions at either end of the structure. This would be easier and less costly to construct therefore causing less disruption to motorway users. It could potentially reduce the requirement for temporary land take and hence reduce the impact on local land use at the Myrke.</p> | <p>23-02, 23-03, 23-04</p> | <p>4.8.8 and 4.8.9</p> |
| <p>21</p> | <p>Water Main Subway</p> <p>Assessed Option: symmetrical extension of the subway by 3.1 m to north and south See drawing ref 514451-MUH-ST-S2-DR-UB-301333 in EDR annex F2 (Application Document Reference 7.4)</p> <p>Alternative option: infill the structure to eliminate the need for future access. This option is currently being discussed with Thames Water and would require a new, sleeved, main to be constructed through the subway with consequential local diversions at either end of the structure. This would be easier and less costly to construct therefore causing less disruption to motorway users. It could potentially reduce the requirement for temporary land take and hence reduce the impact on parkland and allotments.</p> | <p>23-34, 23-35</p> | <p>4.8.19</p> |

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|--|--|---|-----------------------------|
| <p>Various linear works</p> <p>Notably: 7b, 8a, 9a, 12f, 16b and 16c</p> | <p>Earthwork alternatives</p> <p>A range of proposed solutions for widening existing embankments are included in the Earthworks Standard Details (Application Document Reference 2.7) The location where each solution is proposed is noted in the Mainline General Arrangement Drawings in Annex F1 of the EDR (Application Document Reference 7.3) or in the Side Road Plan and Profile drawings (Application Document Reference 2.6). However, in some locations more than one solution is quoted. A final decision on the most appropriate solution at each location cannot be made until completion of the Ground Investigation Survey in 2016</p> | <p>Various plots within current motorway boundary and at side roads</p> | <p>Drawings 4.1 and 4.2</p> |
|--|--|---|-----------------------------|

ED5.6 Para 6.1.6 of the EDR APP-096 states that any changes to the detailed design would be within previously assessed parameters, and that this will be secured through the wording of the draft DCO APP-026. Please provide the references for those parts of the draft DCO which provide this security

1. The development that may be constructed pursuant to the draft DCO is constrained by the terms of the draft DCO in a number of way, as follows:
 - 1.1 Article 3(1) grants development consent to Highways England, as the undertaker, for the authorised development to be carried out and operated within the Order limits. As such, any changes that result from the detailed design process, must be constructed within the Order limits, which is the area assessed in the ES within which the development would occur (see section 1.7.2 of the ES at Chapter 1 (Application Document Reference 6.1). A common sense interpretation is also important - the main line of the M4 will not be diverted, regardless of the limits shown for instance.
 - 1.2 Article 3(3) provides that, subject to the power to deviate under Article 6, the development authorised by the Order is to be constructed in the lines or situations shown on the Works Plans and in accordance with the drawings specified in the requirements. Consequently, the construction of the authorised development is constrained by reference to the Works Plans and the drawings specified in Requirement 6, subject to modification, as explained below.
 - 1.3 The power to deviate, referenced in Article 3(3) is provided for in Article 6. This enables Highways England, in carrying out the authorised development, to deviate laterally and vertically to the extent provided for in Article 6. As a result of Article 6, any changes to the detailed design must be within the limits of deviation set out in that Article. The extent of that deviation was assessed in the ES (see section 5.10 of the ES at Chapter 5 (Application Document Reference 6.1)). This provides the reasonable worst case 'Rochdale Envelope'.
 - 1.4 Requirement 3 provides that details of the layout, scale, siting, design, dimensions and external appearance of the works listed in that requirement, which relate to the construction of bridges, must be approved by the relevant planning authority, so far as they do not accord with the plans listed under requirement 6, which is explained below. This means that even if the designs differ they must be within the limits of deviation and approved by the relevant planning authority.
 - 1.5 Requirement 6 provides that the authorised development must be carried out in accordance with the approved plans submitted with the application, which are listed in that requirement. Consequently, the development is constrained by reference to those plans, unless otherwise approved by the relevant planning authority, but within the deviation power.
2. The development authorised by the DCO, if made, would be constrained by the power of deviation given by Article 6 as set out in the draft DCO. As noted above, the scope of the power of deviation was specifically considered by Highways England's expert professional team.
3. Effectively, the assessed, authorised Scheme is that shown on the works plans and described in the draft DCO at Schedule 1. The design shown on the engineering drawings and sections (Application Document Reference 2.5-2.9) is one design capable of being implemented

within the proposed Scheme and an alternative must be capable of being built within that assessed envelope, effectively a different design within the limits of the approved Scheme.

4. Further, the development is constrained by the requirement to seek approval under requirements 3 and 6. As explained in detail in the answer to first written question DCO8.20, requirements 3 and 6 can only be used to allow development that has been authorised by the DCO. It would not be lawful for an authority to authorise works going beyond the scope of the DCO as governed by the limits of deviation shown on the Works plans and described in Article 6 of the draft DCO. Accordingly, following the detailed design of the Scheme, it would be impossible to authorise works that fell outside the scope of what had been assessed in the ES, and consequently approved under the DCO.
5. It is critical to a major infrastructure project in the nature of the Scheme that an ability to deviate and vary within assessed limits is given. Otherwise, it is not possible to refine or improve the project and necessary changes cannot be made without a new application. Critically this does not circumvent the variation procedures laid out by law since the powers granted would provide the limits of the consented Scheme. Changing those limits would demand a fresh application or an application to modify. There are two direct analogies: first, outline planning permissions; and second, works authorised by hybrid bills. In each case, the extent of deviation is akin to that sought here and has been found to be acceptable.

ED5.7 Are the local authorities satisfied that the solution chosen for each of the overbridges or underbridges in their Council area are appropriate?

1. Details of the consultation that was undertaken with the local authorities is provided in the response to first written question ED 5.1 above. That consultation included the forwarding of the proposals developed for the side road realignments to each of the local authorities relative to their administrative boundaries and adjacent authority interests in some cases. In relation to the necessary overbridge replacements and associated side road changes, Highways England has engaged with Slough Borough Council, South Bucks District Council, Buckinghamshire County Council and Royal Borough of Windsor and Maidenhead Council throughout the preliminary design stage, commencing in March 2013, as the authorities affected by the proposals.
2. The level of engagement by the local authorities affected by the overbridge replacements has been mixed. Slough Borough Council agreed to meet in relation to the overbridge replacement proposals within its area of interest and was broadly content with the preliminary design proposals.
3. Where on-line and off-line solutions were both technically feasible solutions, then both options were included in the Preliminary Information Exhibitions held during 18 March 2014 to 29 March 2014. The preferred option was then presented during the statutory consultation held between 10 November 2014 and 21 December 2014. At that stage concern was raised by Dorney Parish Council over the online proposals for Lake End Road Overbridge and Marsh Lane Overbridge.
4. The on-line replacement proposal for Lake End Road overbridge included the temporary closure of Lake End Road and a temporary diversion along Marsh Lane. Following comments received at the March 2014 Public Consultation exercise, and in consultation with Buckinghamshire County Council, Highways England reviewed the use of each road and changed the preferred option to off-line so that no temporary diversion would be required.
5. During the consultation, concerns that the temporary closure of Marsh Lane overbridge would impact on bus, pedestrian and cycle routes to Dorney School were raised. Further consultation with Buckinghamshire County Council, Dorney Parish Council and the bus operating company concluded that Lake End Road could be used as a suitable diversion.
6. Highways England considers that the relevant stakeholders have been provided with all the necessary information, and no other objections have been raised.

ED5.8 Has the drainage strategy for the project been agreed with the EA?

1. To date the Environment Agency ("EA") has not made any comment on the Drainage Strategy (Application Document Reference 7.5).
2. A meeting between Highways England and the EA took place on the 25th September 2015 to allow further discussion, with a view to agreeing matters regarding flood risk and drainage in the Statement of Common Ground, with the EA, which is to be submitted at Deadline II.
3. At the meeting on the 25th of September 2015, the EA confirmed that, as from April 2015, surface water drainage is the remit of the lead Local Flood Authorities and that Highways England should liaise with them on this matter. Highways England will therefore consult with the relevant lead local flood authorities to seek their approval of the drainage strategy for the Scheme.

ED5.9 Is the EA satisfied that adequate compensation for any loss of floodplain can be provided?

1. Highways England understands that, following a meeting held between HE and the EA on the 25th of September 2015, it was agreed that calculations should be completed at a selection of sites to quantitatively prove the principle that floodplain compensation for works within the floodplain can be achieved within the Scheme. Following consideration of the results of these calculations by the Environment Agency, any agreement subsequently reached will be confirmed to the Examination.
2. Highways England considers that the commitment to and principle of providing sufficient compensation storage where works are necessary in the floodplain is established in paragraphs 5.1.21, 5.1.22, 5.1.26, 5.1.36 and 5.1.45 of the Flood Risk Assessment (Application Document Reference 5.3) and paragraphs 15.4.64 to 15.4.68 and Table 15.5 of the Environmental Statement (“ES”) (Application Document Reference 6.1). The Flood Risk Assessment (Application Document Reference 5.3) presents the results of analysis at key worksites within the floodplain, for example at Ascot Road (River Bourne) and Monkey Island Lane (River Thames) where works to existing overbridges are required. The mitigation required to ensure that there would be no increase in flood risk is described in paragraphs 15.4.64 to 15.4.66 of the ES (Application Document Reference 6.1), where it is stated that compensatory floodplain storage volume will be created where storage losses occur by removing and reconfiguring parts of existing embankments.
3. Since submission of the DCO application, further work has been undertaken to provide additional information to confirm the requirements for compensation storage provision and to verify the feasibility of its provision on a volume for volume and, where possible, level for level basis. The results of this work have been submitted to the Environment Agency as an appendix to the Statement of Common Ground (“SoCG”) between the EA and Highways England and are also appended to this response as Appendix D to the responses the first written questions at Section 4: Environment.
4. The further work is being informed by flood water level data supplied by the EA and LiDAR topography information. A total of 45 sites (both offline and along the main carriageway) are currently being reviewed in order to confirm whether works are necessary within the floodplain, and to confirm the feasibility of the provision of sufficient compensation storage at those sites identified as being in the floodplain.
5. Current assessments show that 29 of the 45 sites where widening works need to take place do not encroach into the 1 in 100 year plus climate change floodplain (Flood Zone 3). Therefore, works at these locations will result in no flood risk impacts and no mitigation is required. At five of the 45 sites, the feasibility of floodplain compensation provision on a volume for volume basis has been proven and at a further two sites with the largest volumetric compensation requirements, provision of this storage on a level for level basis has been demonstrated to be feasible. At the nine remaining sites, results are pending, with flood data currently awaited from the EA for some of these sites. This will be used to further demonstrate that flood compensation, where required, is feasible within the Scheme, verifying the conclusion within the ES (Application Document Reference 6.1) and the Flood Risk Assessment (Application Document Reference 5.3) that the Scheme will not increase flood risk elsewhere.

ED5.10 Have discussions been held with the Police regarding the positioning of Police Observation Platforms?

1. The M4 between junctions 3 and 12 currently contains a number of Police Observation Platforms ("POPs"). Initially, Highways England proposed to remove all POPs from the Scheme in line with Highways England Guidance (Ref: Major Projects Instruction MPI-32-082014 - Provision of Observation Platforms on Smart Motorway Schemes (August 2014)). However, discussions were held with Thames Valley Police and Metropolitan Police where the two forces confirmed that they wished Highways England to retain the platforms on a number of links on the Scheme.
2. Due to the permanent conversion of the hard shoulder to a running lane it is necessary for all POPs to be re-located adjacent to emergency refuge areas ("ERAs"). The current POPs would have utilised the hard shoulder to gain speed prior to joining the main carriageway, which is not available following the opening of the Scheme. By locating the POP adjacent to the ERA the Police can safely enter the relevant ERA and then reverse back into the POP area (freeing up the ERA for use by breakdowns). The co-location of POPs with ERAs provides mitigation against the public misusing the adjacent ERAs for unnecessary stops.
3. This was confirmed at the Project Safety Control Review Group ("PSCRG") meeting held on 19th June 2014. The positioning of POPs was then agreed with the Police at a number of meetings and subsequent discussions. This includes a meeting with Thames Valley Police on 4th November 2014 (Ref: 514451-MUH-00-ZZ-MI-OS-400122) where the observation platforms were agreed. Minutes of this meeting are appended to this response at Appendix A.
4. The agreed locations of the proposed POPs are as follows (these POPs are shown on the General Arrangement drawings in Annex F1 to the Engineering and Design Report (Application Document Reference 7.4) as referred to in the table below):

Proposed Observation Platforms Location

| Motorway Link- Eastbound ("EB"), Westbound ("WB") | Proposed POP location | General Arrangement Drawing Number |
|---|--------------------------------------|--|
| J3 – J4 EB | POP re-located with ERA E1-B1 | 514451-MUH-ML-ZZ-DR-GA-300825, Sheet 59 of 61 |
| J3 – J4 WB | POP re-located with ERA E1-A1 | 514451-MUH-ML-ZZ-DR-GA-300825, Sheet 59 OF 61 |
| J4 – J4b WB | POP re-located with ERA E2-A1 | 514451-MUH-ML-ZZ-DR-GA-300821, Sheet 55 of 61 |
| J4b – J5 EB | POP re-located with ERA E3-B1 | 514451-MUH-ML-ZZ-DR-GA-300817, Sheet 51 of 61 |
| J4b – J5 WB | Retain existing observation platform | 514451-MUH-ML-ZZ-DR-GA-300817, Sheet 51 of 61 |
| J5 – J6 EB | POP re-located with ERA E4-B2 | 514451-MUH-ML-ZZ-DR-GA-300811, Sheet 45 of 61 |
| J8/9 – J10 EB | POP re-located with ERA E7-B1 | 514451-MUH-ML-ZZ-DR-GA-300796, Sheet 30 of 61 |
| J8/9 – J10 WB | POP re-located with ERA E7-A3 | 514451-MUH-ML-ZZ-DR-GA-300792, Sheet 26 of 61 |

| Motorway Link- Eastbound ("EB"), Westbound ("WB") | Proposed POP location | General Arrangement Drawing Number |
|---|-------------------------------|--|
| J10 – J11 EB | POP re-located with ERA E8-B1 | 514451-MUH-ML-ZZ-DR-GA-300782, Sheet 16 of 61 |
| J10 – J11 WB | POP re-located with ERA E8-A2 | 514451-MUH-ML-ZZ-DR-GA-300782, Sheet 15 of 61 |

ED5.11 EDR para 7.6.21e) App_096 states both new bridges at Huntercombe Spur will have two lanes of traffic in each direction. Please clarify whether this means one bridge will carry two lanes southbound and one will carry two lanes northbound.

1. Highways England confirms that the position as stated in the question is correct. The replacement structure at junction 7 (Huntercombe Spur), will comprise two separate bridges. The western bridge will carry two northbound lanes and the eastern bridge will carry two southbound lanes. Details of the proposed highway cross section over the two bridges can be seen on section 3 on sheet 2 of the General Arrangement drawing in Annex F3 of the EDR (Drawing Number 514451-MUH-ST-S2-DR-OB-301426) (Application Document Reference 7.4).

ED5.12 EDR para 7.8.7 APP-096 please confirm there will not be ALR westwards from J4b to J5?

1. The Engineering and Design Report (“EDR”) (Application Document Reference 7.3) paragraph 7.8.7 states:

"In the westbound direction, TJR will not be implemented at junction 4b. The westbound slip road from the M25 to M4 will be configured to create a lane gain so that there will be four driving lanes from junction 4b to junction 5. This link already has four lanes and a hard shoulder and the existing hard shoulder will be retained as far as the junction 5 exit slip road. TJR will be provided at junction 5".

2. The westbound carriageway from junction 4b to junction 5 already has four lanes and a hard shoulder. This configuration will be retained and all lane running (“ALR”) will not be required.

ED5.13 EDR para 7.8.8 APP-096 refers to retention of hard shoulder and existing ERA. Is this correct?

1. The Engineering and Design Report (“EDR”) (Application Document Reference 7.3) paragraph 7.8.8 contains an error. The feature to be retained is a Police Observation Platform (“POP”) not an Emergency Refuge Area (“ERA”). As the hard shoulder in this location will be retained there is no need to remove the POP.
2. The retained POP is identified on sheet 26 of the Works Plans (Application Document Reference 2.3), labelled in light blue at approximate chainage 18+800.