1. Introduction

1.1 Purpose of this report

The purpose of this technical note is to collate and record all the options identified and considered at Binley Junction through the life of the project and provide supporting evidence of why the A46 elevated flyover grade separation at Binley was progressed in Stage 3 over other options.

The option selection workshop (held in Stage 2 October 2016) has been reviewed and revised based on the latest project information (refer to Appendix B). A high level review of an underpass or overpass solution has been discussed and compared for suitability at Binley junction.

1.2 Background

The A46 Coventry Corridor is a part of the National Strategic Road Network (SRN) connecting the M1/M6/M69 with the M40 and M5. It is an important link between the East and West Midlands and beyond, joining the M1 J21 with M40 J15, providing connections to the SRN and the rest of the country.

The purpose of the Highways England Roads Investment Strategy for the A46 Coventry Junctions Upgrade is to provide relief to the A46 Coventry Eastern Bypass traffic from congestion, improve journey times and reduce driver frustration by improving vehicular capacity at the Binley Junction (A428/A46 Coventry Eastern Bypass) and Walsgrave Junction on the A46 near Coventry, upgrading the trunk road sections of the A45 and A46 between the M6 and M40 considering future full Expressway standards.

Figure 1 – A46 Coventry Junctions Upgrade Scheme and Surrounding Area
1.3 Previous option development by others

The A46 Coventry Junctions Upgrade is being completed using Highways England Project Control Framework (PCF). This framework details stages and work required in each stage, as shown Figure 2.

Figure 2 – PCF Framework Stages

At Strategy, Option Identification and Selection Stages 0, 1 and 2 of the A46 Coventry Junctions Upgrade project, a number of do minimum, do something, and do maximum options were considered. These have been captured in a number of documents over the project life as listed below.

- A46 Coventry Options Assessment Report (OAR), (2015)
- A46 Client Scheme Requirements – Mouchel (May 2016)
- Mid-March – June 2016 Business Case (June 2016)
- A46 Coventry Junctions Upgrade Technical Appraisal Report (SGAR1) – Mouchel (May 2016)
- Options Comparison and Recommendation (Divisional Director’s) Technical Note’, HE551486-MOU-00-XX-TN-HW-0003, (September 2016)
- HE551486-MOU-00-XX-PC-PM-007 Business Case (Final SGAR1 product], (October 2016)
- ‘HE RIP – A46 Coventry Junctions Upgrade – A46 Options Workshop – Stage 2 Options selection summary, dated 5th October 2016
- Client Scheme Requirements V0.2 - HE551486-MOU-GEN-A46_A428-RP-Z-0205 CSR - Int SGAR3 For SRO sign off, dated 6th April 2017

The options, key points, and decisions from each document above have been summarised in chronological order in the following section for ease of reference.

1.4 Key Decisions and Milestones

A number of decisions were made during the life of the project which resulted in the progression of an elevated grade separation of the A46 from the signalised roundabout at A428 at Binley Junction for PCF Stage 3, preliminary design. The key decisions are as follows:

- **November 2015** – HE Workshop – 3 broad options were defined and considered further:
  - Option A – Grade separation at Binley roundabout only, no works at Walsgrave roundabout
  - Option B – Grade separation at Binley roundabout + Do Minimum improvement at Walsgrave (modification to existing roundabout to provide capacity for design year 2031
  - Option C – Grade separation at Binley roundabout + relocation and upgrading of Walsgrave roundabout to a grade-separated junction
December 2015 – Options Report produced following the workshop in November 2015. The following options were produced at Binley Junction:

- Option 1 – Grade separation at Binley roundabout – elevated A46, 2 bridge roundabout
- Option 2 – Diamond Arrangement, A46 at grade, A428 over via single bridge
- Option 3 – Diamond Arrangement, A428 at grade, A46 over via single bridge
- Options 4A and 4B – Signalised Hamburger style roundabout

Option 1 was selected for further development as it provided the greatest benefits with the least disadvantages of the options.

March 2016 – Business Case - the scheme was directed by Highways England to continue with the evaluation of a single solution (Option C) which aligns with the RIS.

May 2016 – The Highways England Divisional Director, in conjunction with the project team, identified four options to be reviewed to address the delivery cost issue, with the aim of seeking additional funding and/or amending the RIS scheme description through a change control process with the Department for Transport (DfT).

September 2016 – The ‘Options Comparison and Recommendation (Divisional Director’s Technical Note’, HE551486-MOU-00-XX-TN-HW-0003, summarises the assessment of the four options.

- Option 1: Two grade separated junctions at Binley and Walsgrave with a 70mph speed limit;
- Option 2: One grade separated junction at Binley with a 70mph speed limit;
- Option 3: One grade separated junction at Binley with a 50mph speed limit; and
- Option 4: Two grade separated junctions at Binley and Walsgrave with a 50mph speed limit.

For the reasons identified in the option matrix, a recommendation was made to progress Option 3: one grade separated junction at Binley with a 50mph speed limit.

October 2016 – Five options for a grade separated junction at Binley with a 50mph speed limit were then developed:

- Option 1: A46 at grade; A428, circulatory carriageway and slip roads elevated;
- Option 2: A46 elevated; A428 circulatory carriageway and slip roads at grade;
- Option 3: A428 and circulatory carriageway at grade and A46 elevated with compacted elevated slip roads;
- Option 4: A46 in full cut under the A428 and circulatory carriageway; slip roads at grade;
- Option 5: A428 and circulatory carriageway in full cut under the A46; slip roads in cutting.

A recommendation was made to progress Option 2: A46 elevated, A428 circulatory carriageway and slip roads at grade.

December 2016 – Highways England Investment Decision Committee (IDC) confirm that scheme is to progress at National Speed Limit to be expressway ready and meet RIS commitment.


February 2017 – Highways England requested that geometric design of a national speed limit option that could be delivered at Binley without physically impacting on the surrounding buildings was progressed.

April 2017 – An independent technical review of the 50mph solution was undertaken by a Mouchel Technical Manager - HE551486-MOU-GEN-A46_A428-RP-D-0213.
April 2017 – AECOM commissioned (with the Client Scheme Requirements V0.2 - HE551486-MOU-GEN-A46_A428-RP-Z-0205 CSR - Int SGAR3 For SRO sign off brief) to progress one grade separated junction at National Speed Limit at Binley to detailed design (Update Option 2 to National Speed Limit from October 2016 workshop).

Binley junction will proceed using the Highways Act powers, whilst Walsgrave junction will be placed on hold until the local authorities are in a position to unlock the surrounding development land, at which time additional RIS budget will be required to undertake such works.

November 2017 – AECOM submits Binley Value Engineering (VE) technical note with a 3 and 5 span elevated A46 flyover on open span piers and maintaining the existing roundabout at Binley Junction for approval. The open span structure provides better visibility on the roundabout and for NMUs and addressed feedback from the Public Information Exhibition (March 2017).

November 2017 – Binley VE5 option accepted – 5 span elevated A46 option progressed

March 2018 – Public Information Exhibition, A46 elevated grade separated junction at Binley (national speed limit) by raising the A46 on a flyover above the existing A428 and signalised roundabout was presented at a Public Information Exhibition.

2. Outline of Option Arrangements

The initial optioneering undertaken in December 2015 identified three major forms of junction and selected an option for further development and have been reviewed subsequently at a high level in Table 2-1.

Table 2-1: High level assessment of initial options

<table>
<thead>
<tr>
<th>Option</th>
<th>Grade Separated Junction (Roundabout)</th>
<th>Grade separated junction (Diamond)</th>
<th>Signalised Hamburger style roundabout</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comment</td>
<td>Meets expressway requirements and minimises land take by using roundabout junction on the existing footprint with only minimal land take. <strong>Viable</strong></td>
<td>Large land take required to provide the junction layout will potentially trigger DCO and severely impact key stakeholders <strong>Rejected</strong></td>
<td>Does not meet expressway requirements and will reduce benefits by not providing grade separation. <strong>Rejected</strong></td>
</tr>
</tbody>
</table>

The assessment above is consistent with the findings of the workshop report (Appendix A).

The workshop held on the 5 October 2016 to determine the layout for preliminary design stage, assessed 5 options:

- Option 1 - A46 at grade; A428, circulatory carriageway and slip roads elevated;
- Option 2 - A46 elevated; A428 circulatory carriageway and slip roads at grade;
- Option 3 - A428 and circulatory carriageway at grade and A46 elevated with compact elevated slip roads;
- Option 4 - A46 in full cut under the A428 and circulatory carriageway; slip roads at grade;
- Option 5 - A428 and circulatory carriageway in full cut under the A46; slip roads in cutting.

A consistent theme of these options is the interchangeability of over or under-pass solutions. Further details are described below and should be read with reference to the updated option selection matrix in Appendix B.
3. Options considered

3.1 Design Speed

3.1.1 Proposed Solution

A review of the design speed for Binley Junction was undertaken in December 2016 (HE551486-MOU-GEN-A46_A428-TN-C-0066) included in Appendix C. This note has been reviewed for the purposes of this technical note and the findings of the note are still relevant and are summarised below.

A 50mph solution would:

- Provide route consistency with the newly constructed Tollbar End Junction
- Have a lower level (fewer number or fewer steps below Standards) of departures (SSD), but may require speed enforcement
- Have a lower environmental impact (noise)

A national speed limit solution would:

- Achieve RIS requirements of an Expressway
- Have a higher level of departures (SSD) which may result in safety issues
- Have a higher environmental impact (noise)

The proposed option has been developed with a design speed of 120kph allowing for a 70mph posted speed limit.

3.1.2 A46 Speed Limit Route Consistency

Plans to improve the Walsgrave Junction are currently at PCF Stage 1, Options Identification. Currently, 85kph and 120kph design speeds are being considered. Should the design speed for the Binley Junction be reduced to 85kph then it is likely to prejudice the options selection for Walsgrave. It is possible that a 120kph design would not be possible for the Walsgrave junction and an 85kph design will be progressed instead.

This will either mean that:

- The speed limit will need to change from 50mph at Tollbar End to 70mph through Binley then back to 50mph at Walsgrave and finally increasing to 70mph on approach to M6 Junction 2
- The design speed at Binley will need to be reduced to 50mph.

Following conversations with Highways England it has been identified that it will be possible to provide Expressways with a 50mph speed limit should there be a strong enough case for it.

3.1.3 Impacts of 85kph Design Speed at Walsgrave

If a solution at Walsgrave is chosen with a design speed of 85kph the preferred approach would be to reduce the posted speed limit at Binley to 50mph. In order to achieve this it is recognised that alterations to the geometric design will be required. It is anticipated that the number Departures from Standard on the current 70mph design will be reduced by adopting a lower design speed.

By reducing the design speed from 120kph to 85kph, it is likely that the footprint of the proposed option will not be increased. This means the impact in terms of land take presented at the Public Inquiry will be the worst case. Should an 85kph design be presented at the Public Inquiry and a decision is made later to increase the design speed then it will be likely that the proposed footprint of the option will increase. This could potentially put the scheme at risk or lead to a need to repeat the statutory planning processes.

Having speed limits fluctuate between 50mph and 70mph along the corridor is not desirable and will not be progressed as a contingency at this stage.
3.2 A46 Overpass

The overpass option would consist of the A46 being carried by a structure or structures spanning a signalised roundabout at a maximum height of approximately 7.3m. The signalised roundabout would provide the junction between the A428 and slip roads to and from the A46 mainline at the existing ground level. The signalised roundabout would remain predominantly unaltered on the A428 arms but would need to be modified to suit the new slip road arrangement. The re-aligned slip roads each side of the viaduct would require permanent land take adjacent to the A46 corridor.

Whilst the structure would extend for approximately 130m in length, the A46 would be raised above the existing A46 levels over a total length of approximately 800m. The raised A46 beyond the structure would be constructed on reinforced earth ramps. The overall width of the flyover structure (to the outside of the A46 parapets) would be approximately 26m (Figure 3).

![Figure 3 - Flyover Typical Cross-section (m)](image)

3.2.1 Highways

Generally, the horizontal alignment will be similar in both the A46 overpass and underpass options. The sharp horizontal curve requires road users to see across the parapet on the edge of the structure. The parapet type will determine what Stopping Sight Distance (SSD) is achieved to the high object height across the majority of the length of the flyover.

The vertical alignment is constrained by a high voltage overhead powerline at the south of the junction and the proposed bridge height. Due to this, a sub-standard crest curve is required which results in sub-standard SSD on approach to the crest.

Substandard verge widths have been proposed but these widths will still allow vehicles to pull over in cases of emergency.

For NMUs to cross under the A46, a dedicated shared use path is provided that crosses between spans to allow for passive surveillance of the crossing.

Drainage will be a combination of filter drains, toe drains and kerb and channel with gully pits. On the structure the drainage will consist of a channel and combined kerb drains that will carry the water to discharge off the structure. Due to the volume of run off generated from the scheme, attenuation ponds will be required to both the north and south of the roundabout.

Lighting will be mounted centrally on the A46 mainline and verge mounted on the slip roads. The roundabout lighting will aim to be retained but will need to be modified where in close proximity to the flyover and for the NMU crossing locations. The environmental effect of lighting is discussed further in Section Error! Reference source not found..

By maintaining the existing roundabout it is anticipated that this option will minimise the diversion to existing services. Buildability impacts due to services are discussed in Section 7.1.
3.2.2 Structures

In the overpass option, the proposed new structure is a five-span composite bridge carrying the A46 dual carriageway. Both the south and north approach ramps will be retained by reinforced earth walls either side of the carriageway.

Span 1 (first south span) crosses over the combined pedestrian footpath / cycleway and underground services (water and gas mains). Span 2 crosses the westbound carriageway of the A428 within the existing roundabout. Span 3 crosses over the circular island of the roundabout. Span 4 crosses the eastbound carriageway of the A428 within the existing roundabout and Span 5 crosses over the underground services on the north side of the existing roundabout (gas and water mains).

The bridge is slightly curved in plan with a constant curvature radius of approx. 920m.

The superstructure comprises a continuous weathering steel-concrete composite deck, 25.75m wide, supported on reinforced concrete “Y” shaped piers, founded on bored piled foundations.

3.2.3 Geotechnical

The ground conditions in the vicinity of Binley Roundabout comprise Topsoil, pockets of Made Ground underlain by the Baginton Sand and Gravel, River Terrace Deposits and Mercia Mudstone. Due to the variability in thickness and consistency of these materials and the high bearing capacity required for the steel composite bridge a piled foundation will be adopted. Bored piles, founded below engineering rockhead, in the Mercia Mudstone at a depth of between 20 and 25m will be necessary in order to achieve the required design resistance.

In conjunction with the 5 span piled steel composite bridge the grade separation will involve the construction of reinforced earth ramps, to raise the A46 to a height of approximately 8m above its current level. This would require the importation of high quality fill, as the fill excavated on site during other earthworks activities is unlikely to comply with the HE Standards criteria. Given the variable nature of the subsoil conditions and the possibility of encountering either Made Ground or contaminated land it is recommended that excavation, other than topsoil strip be minimised to reduce the volume of material to be removed from site and of imported materials. Nevertheless, it is envisaged that some ground improvement, in the form of geogrid, will be required in order to satisfy global stability and bearing resistance and to restrict differential settlement.

3.3 A46 Underpass

The underpass option would consist of the A46 being lowered to approximately 7m below existing ground level, with contiguous bored pile retaining walls, supporting new A46 slip roads at existing ground level. The signalised roundabout junction would remain at the existing ground level and cross the A46 via two bridges. The overall width of the underpass structure (to the outside of the slip road parapets) would be approximately 28m and the length would be 800m (Figure 4).

The signalised roundabout would require significant modification to accommodate the underpass beneath and facilitate construction of the two bridges, which in addition to traffic, would also carry diverted utilities. The re-aligned slip roads each side of the underpass would require permanent land take adjacent to the A46 corridor. This land take requirement is larger than that for the overpass and would increase the impact on the stakeholders adjacent to the A46 corridor.

Figure 4 - Underpass Typical Cross-section (m)
3.3.1 Highways

As for the overpass, the sharp horizontal curve would result in substandard SSD. Both the low and high object height would be unable to be seen due to the retaining wall. Significant widening of the verge would be required to achieve full SSD throughout the underpass.

The vertical alignment would allow for a standard sag curve and full SSD at this point.

Substandard verge widths would likely cause issues during maintenance activities of the retaining wall or in emergencies.

For NMUs to cross over the A46, a dedicated shared use path would be provided that will follow the southern overbridge. Due to the proximity of the bridge to the circulatory it may not be possible to have a shared path following the south of the scheme as per the existing. To achieve a safe route multiple safe crossing locations may be required, however as these are not on desire lines there is potential for NMU to cross at undesirable locations (Refer to Appendix D). A Vehicle Restraint System should be considered to protect NMUs from the traffic lane as separation is not possible unless another structure is provided.

Drainage of the mainline in cutting would be kerb and channel with gully pits. The underpass would require water to be pumped up to the drainage network close to existing ground level. Due to the volume of run off generated from the scheme attenuation ponds would be required to both the north and south of the roundabout.

Lighting would be centrally mounted on the A46 mainline and verge mounted on the slip roads. The roundabout lighting would require to be verge mounted and attached to the proposed overbridges over the A46. The environmental effect of lighting is discussed further in Section Error! Reference source not found.

Due to the modification of the roundabout and the excavation of the A46 mainline the existing services would require to be diverted in this option. Buildability impacts due to services are discussed in Section 7.2.

3.3.2 Structures

In this option two new overbridges would be required to carry the Junction over the new A46 underpass.

Similarly to the previous option the overbridges would comprise a single span steel-concrete composite deck. The composite deck would be cast integral with the reinforced concrete diaphragms/pile caps supported on contiguous bored pile embedded abutments/foundations. This would eliminate the maintenance requirements of bearings and expansion joints.

The bridges would be constructed using a top-down construction sequence. This approach would limit the impact to local road users as once the bridge deck has been constructed the roundabout would be able to be opened to the final layout during A46 mainline excavation.

3.3.3 Geotechnical

Construction of an Underpass would involve excavating through the superficial materials into the Baginton Sand and Gravel. The groundwater table is approximately 4.5m below existing ground level and the carriageway level some 3.0m below this, necessitating the installation of a contiguous bored pile wall in order to carry out construction in the dry. This would cause particular issues at Binley Roundabout due to the high concentration of underground services. In view of the uplift pressure on the base of the underpass caused by the high groundwater table, it may be necessary to install anchors to ensure long term stability of the box. In addition, a permanent pumping station would be required within the underpass to help control groundwater and surface water runoff, thus increasing maintenance issues.

Although not identified during the Ground Investigation there is also the potential for encountering hazardous landfill deposits, which will require special handling on site and specialist disposal facilities Unforeseen ground conditions encountered during the excavation works constitute an additional risk.
4. **Traffic, economics and cost**

Both options (A46 overpass and A46 underpass) consist of a grade separated junction, allowing all possible movements between the A46 Northbound and Southbound carriageways and both sections of the A428 (Brandon Road and Rugby Road).

In terms of traffic benefits, provided that the slip roads and the circulatory carriageway layout are similar for both options, the improvements in travel time and vehicle operating costs should be the same.

In both cases, the main benefit of the scheme in traffic terms would be the reduction in congestion at the circulatory due to the removal of through traffic along the A46, which effectively results in a separation of local traffic from medium and long distance traffic.

There would be differences in the BCR between the two options. While the traffic-related benefits should be similar, if not the same, the environmental impacts of the scheme would differ significantly, especially in terms of noise, the underpass option being potentially better in this aspect.

On the other hand, the underpass option is expected to have a higher cost than the overpass option, mainly due to the need for large excavations, which would directly impact the BCR of the Scheme. The underpass will also be more disruptive to traffic, especially on the local roads, due to the significant changes required to the roundabout. This is expected to have a negative effect for traffic related benefits and therefore the BCR. A quantitative assessment of the two options has not been undertaken at this time to compare the two options BCR.

5. **Operation, Technology and Maintenance assessment**

For both underpass and overpass grade separation options there would be a positive impact on the local network through separating the significant proportion of traffic from the circulatory. This will reduce the likelihood of collisions on the roundabout and approaches and will have the same benefit for both options.

There are no significant existing accident problems at the junction and this would be further improved with the grade separation of the junction, for full details of the benefits of grade separation (under or overpass) can be found in the Safety Plan (HE551486-ACM-GHS-A46_SW_000_Z-RP-ZS-0002). Both options would improve the operation and efficiency of existing transport network and deliver capacity enhancements to the SRN.

Both options would use the same merge / diverge type. Whilst traffic forecasts indicate Type A merge layouts would be sufficient, Type B layouts would be used to improve safety, in particular at the sub-standard weaving length between south facing slip roads and services/business access.

Both options would provide improved safety due to the grade separation of the A46 which would remove the shunt type collisions currently experienced at the at grade junction.

The Departures from Standards checklist for the overpass option has been included in Appendix E. 26 departures have been identified for the overpass option. It is anticipated that the horizontal departures identified for the overpass option will be consistent for the underpass option due to existing horizontal constraints and desired design speed. Details on proposed Design Speeds are detailed in Section 3.1.

The underpass option would remove the substandard vertical crest curve (GD04) and this in turn would improve the SSD specifically in the northbound direction. The SSD would still be substandard due to the horizontal curve but would SSD would be increased when compared with the overpass option.

The mainline cross section departures are anticipated to be similar in both options due to the land constraints. It is also anticipated that there will be no significant difference in slip road departures between both options.

In terms of maintenance, integrated wall lighting for the underpass would reduce the risk of maintaining lighting compared to maintaining lighting columns on a flyover structure.

For the underpass there would also be a reduced risk of ice forming in the winter compared to the flyover structure.

Both flyover structures and underpass structures would require maintenance for underside of the structure, and would need adequate access and maintenance laybys or hardstands. The underpass option, however, would need pumping stations for dewatering which would represent a significant maintenance liability and also increase the risk of flooding in the event of failure.
6. Environmental Assessment and Design

The elevation of the A46 as part of an overpass option has been shown in the Environmental Assessment Report to lead to significant effects on noise at residential receptors west of the carriageway without mitigation. A 300m length, 2.5m high noise barrier has been proposed to reduce this effect to minor. A number of residential receptors to the East in Binley will also experience minor effects, albeit not considered to be significant. Lowering the A46 as part of an underpass option may assist with the reduction of noise impacts in the surrounding environment. A positive impact would be expected at most receptors; although it is possible some close-by receptors may experience a slight worsening. If progressed, this would need to be tested through detailed dispersion modelling.

Air quality is not expected to be materially affected by the overpass option and is predicted to be negligible or minor effect. The lowering of the road as part of an underpass option would be expected to generate an overall positive impact on air quality emissions on most receptors, albeit of minor or negligible significance. Dispersion modelling would be required to confirm and quantify the effect.

Minor adverse effects on landscape and visual, as well as heritage, would be anticipated for the underpass option, due to the greater clearance of vegetation during construction and increased visibility of the road from local viewpoints and heritage assets; however, these impacts are not considered significant. A positive visual impact would also be expected following construction and landscaping due to the reduced awareness of the traffic on the lowered A46 and removal of a direct line of sight from several receptors. In turn, there may also be a slight improvement in the setting of some nearby heritage assets. The overpass option has a greater effect on landscape, visual and heritage setting, due to the intrusion of an overhead structure visual from multiple receptors, however the effect is considered minor adverse taking into account the localised and temporary nature of the construction phase and planting proposals.

The overpass option has the potential to impact local ecology and drainage. However the design presented in the Environmental Assessment Report avoids direct impact on local features such as ponds and ancient woodland, thus avoiding significant effects. The incorporation of attenuation ponds will offset increased runoff and will filter sediment and contaminants prior to discharge to the local watercourses.

The ecological impact of the underpass option would not be expected to be significant and it is anticipated that cleared vegetation could be replaced through like for like planting, with the potential for enhancement in some localised areas. The risk of encountering underground archaeology, contaminated land, and creating pathways to groundwater and affecting drainage would be the key considerations for this option. A suitable drainage strategy would need to be prepared that can discharge the runoff at an acceptable flowrate to the nearby watercourses, preferably via settling ponds.

Both options would ensure that the A46 does not sever the communities on either side by proving an upgraded shared use path. It is anticipated that the overpass option will provide a more direct route, whereas the underpass option would require a more convoluted alignment due to the overbridges. At this stage it is not envisaged that either option would impact communities further than stated above i.e. no impact on existing roundabout to west of A428.

In summary, the underpass option is considered to have the potential to lead to the least environmental impacts. The overpass option leads to greater impacts on landscape and visual, heritage setting, and noise and vibration, in particular. It is important to emphasise however that following incorporation of design measures, neither option is expected to lead to significant environmental impacts.
7. Buildability

7.1 Overpass

The overpass will be built in two main stages, the first stage is the construction of the new slip roads whilst the main traffic is running on the existing A46 mainline. In the second stage the traffic is swapped onto the new slip roads whilst the earth embankment and structure is constructed. The phasing diagrams of this option can be found in the Traffic Management Plan (HE551486-ACM-HGN-A46_SW_000_Z-RP-CH-0006). The total length of the construction programme is estimated to be 19 months.

The majority of the works will be able to be completed without severely impacting the local road network, some road closures will be required for lifting of the bridge beams. It is also anticipated that this option will minimise the amount of service diversions which will have a positive impact on programme and minimise disruption.

The modification of the overpass design from a reinforced earth solution in the circulatory to a 5-span bridge has resolved constructability issues surrounding bringing in fill and compacting the material. The pile and pier locations will have to consider the existing services to ensure clashes are mitigated.

7.2 Underpass

The construction phasing of the underpass is similar to the overpass. The slip roads would be constructed first and then the traffic would be switched onto them before starting the mainline works. The roundabout would need to be modified to allow the bridges to be constructed. Piling works would also commence after which the bulk excavation can begin. The phasing diagrams of this option can be found in Appendix D. The total length of the programme would be approximately 27 months.

The current proposal would be to use CFA piles for the retaining walls and would be needed to be completed at night to ensure a safety lane can be provided. Night shift piling may lead to unacceptable levels of noise and as such need to be completed during the day, reducing productivity and increasing disruption to customers. An anchored grid system solution similar to Tollbar has also been considered; however, this would require an additional width of 4m which would further impact stakeholders adjacent to the corridor.

The temporary land take requirements for the underpass option, along both sides of the existing A46 corridor, would be greater than the overpass option. During design and construction planning every effort would be made to minimise the direct impacts; however, there would be a greater risk of ongoing operations being made untenable at some adjacent landowners such as Greens Home and Garden and the Cocked Hat Hotel due to their proximity.

The initial works of constructing the slip roads would be completed without impacting local or strategic traffic. The piling of the retaining walls would impact strategic traffic, although the severity would depend on the time of day the work is carried out. The local traffic including NMUs would be severely affected whilst the construction of the overbridges is undertaken.

The underpass would also require all services to be diverted, increasing the cost of the scheme and the risk of programme delay. All services would require relocation into the structures.
8. Summary of benefits and dis-benefits

A comparison of benefits and dis-benefits of each option is discussed below (Table 8-1). A complete matrix of the options has been included in Appendix B.

Table 8-1: Comparison of benefits and dis-benefits between overpass and underpass options

<table>
<thead>
<tr>
<th>Benefits</th>
<th>Underpass</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retention of existing roundabout will result in cost savings and minimise disruptions to local traffic</td>
<td>Reduction in noise and visual impact</td>
</tr>
<tr>
<td>Retaining the existing roundabout reduces the required land take</td>
<td>Reduction in light pollution</td>
</tr>
<tr>
<td>Service diversions are minimised reducing risk and delay on programme</td>
<td>No departures anticipated on the vertical alignment</td>
</tr>
<tr>
<td>Shorter construction programme</td>
<td>Less susceptible to ice</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Dis-benefits</td>
<td></td>
</tr>
<tr>
<td>The flyover will result in worse environmental conditions, increasing noise and visual impact of the scheme</td>
<td>A greater width of construction will be required to accommodate visibility splays, road restraints and retaining wall. This will require a larger area of land take and may result in impacting stakeholders.</td>
</tr>
<tr>
<td>Light pollution will be higher</td>
<td>Overbridge construction requires roundabout modification increasing delay to local road users during construction</td>
</tr>
<tr>
<td>A departure is required for the SSD on the vertical crest curve</td>
<td>All services will require diverting and relocating onto the structure increasing cost and risk of delays</td>
</tr>
<tr>
<td>More susceptible to ice</td>
<td>Excavated material would require offsite disposal</td>
</tr>
<tr>
<td>Scheme cost estimate higher than RIS1 budget</td>
<td>Risk of contaminated ground requiring treatment</td>
</tr>
<tr>
<td></td>
<td>Permanent pumping will be required to control ground and surface water, increasing operating costs and risk of flooding in the case of pump failure</td>
</tr>
<tr>
<td></td>
<td>Increased land take may require an alternative statutory process and delay start of construction</td>
</tr>
<tr>
<td></td>
<td>Longer construction programme (27 months vs 19 months)</td>
</tr>
<tr>
<td></td>
<td>Temporary land take may impact ongoing operation of some businesses adjacent to the junction</td>
</tr>
<tr>
<td></td>
<td>Estimated that scheme cost estimate would be higher than RIS 1 budget</td>
</tr>
</tbody>
</table>

9. Conclusion

Improvements to the at-grade roundabout may result in minor improvements to traffic flows but not eliminate the disruption to strategic traffic movements caused by the existence of an at-grade roundabout. The decision to proceed with a grade separated junction at Binley Junction is appropriate. The question regarding whether an overpass or underpass solution should be progressed at Binley junction has been discussed above.

In summary, whilst both options present benefits with respect to the other, the number and nature of disbenefits arising from the underpass option are such that pursuing that option would significantly increase costs, land take, disruption and risk, increasing the likelihood of not being able to start works within the RIS 1 period. Furthermore the underpass option construction programme is estimated to be approximately 8 months longer than an overpass option. The underpass option does, however, have environmental benefits including a reduction in light pollution, reduction in noise and minimal visual impact.

The proposed overpass option cost estimate is already above the RIS 1 baseline of £52.5M. Whilst no Highways England commercial estimate of the underpass option has been completed it is expected to be significantly higher than the costed underpass option.

In October 2016, a recommendation was made to progress Option 2: A46 elevated, A428 circulatory carriageway and slip roads at grade (refer Appendix B for further details). In light of the above, the decision to proceed with an overpass solution remains valid. This solution for Binley Junction is a 70mph design, consistent with the requirement for A46 to be Expressway ready; however, the final decision on A46 design speed in this area will be influenced by the Walsgrave Junction solution, which is yet to be determined at this time.
### Appendix A – Stage 1 Option Selection Matrix (Mouchel)

#### Stage 1 - JUNCTIONS OPTION MATRICES

**Binley/TGI Junction Options Matrix**

<table>
<thead>
<tr>
<th>Safety</th>
<th>Traffic Throughput</th>
<th>Impact on local network</th>
<th>Environment</th>
<th>Geotechnical</th>
<th>Economic Growth</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Green</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Marginal positive impact</td>
<td>Marginal positive impact</td>
</tr>
<tr>
<td><strong>Amber</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Marginal positive impact</td>
<td>Marginal positive impact</td>
</tr>
<tr>
<td><strong>Red</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Marginal positive impact</td>
<td>Marginal positive impact</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Option 1</strong> - Two bridge roundabout, A46 Elevated, A428 At Grade</th>
<th><strong>Option 2</strong> - Diamond, A46 At Grade, A428 Elevated</th>
<th><strong>Option 3</strong> - Diamond Arrangement, A46 Elevated, A428 At Grade</th>
<th><strong>Option 4A</strong> - Signalled Hamburger (2 Lane) Roundabout</th>
<th><strong>Option 4B</strong> - Signalled Hamburger (3 Lane) Roundabout</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is safety improved for all users?</td>
<td>Grade separation provides free flow situation.</td>
<td>Positive impact through reduction of turning conflicts.</td>
<td>Are there any major issues which would significantly impact on cost?</td>
<td>Are there any major issues which would significantly impact on cost?</td>
</tr>
</tbody>
</table>
| Reduced traffic conflicts due to grade separation. Layout complies with DMRB standards. Departures from Standard may be required. | Grade separation provides free flow situation. | Positive impact through reduction of turning conflicts. | Lower - No major constraints. Moves traffic closer to hotel and workplaces, noise and air quality impacts. Land take from commercial property and rugby club. | Landfill (borrow pit) and river terrace deposits underlying junction - uncertainty in ground conditions.
| Reduced traffic conflicts due to grade separation. Possible reduced visibility due to A428 vertical alignment. Departures from Standard may be required. | Grade separation provides free flow situation. | Positive impact through reduction of turning conflicts. | Higher impact - Moves carriageways closer to hotel and workplaces, potential impact from noise and air. Results in demolition of commercial property and land take from rugby club / restaurant. Encroaches into Ancient Woodland and an eco-site. Elevated sections may result in visual impacts. | Landfill (borrow pit) and river terrace deposits underlying junction - uncertainty in ground conditions. Possible piling required for bridge structures- increased cost. Strengthened earthworks likely to be required between slip lanes and main carriageway. Possible additional land take to accommodate embankments/retaining walls for off slips. |
| Reduced traffic conflicts due to grade separation. | No grade separation but provides additional road space and an opportunity to prioritise A46 flow. | No grade separation but provides additional road space and an opportunity to prioritise A46 flow. | Medium impact - Moves carriageways closer to hotel and work places, potential impact from noise and air. Results in demolition of commercial property and land take from rugby club / restaurant. Encroaches into Ancient Woodland and an eco-site. | Landfill (borrow pit) and river terrace deposits underlying junction - uncertainty in ground conditions. At grade, so reduced risk of additional land take for earthworks. |
| | No grade separation but provides additional road space and opportunity to control traffic flows. However prioritising A46 may be at detriment of A428 flows. | | Lower - No major constraints. Moves traffic closer to hotel and work places, noise and air quality impacts. Land take from commercial property and rugby club. | Landfill (borrow pit) and river terrace deposits underlying junction - uncertainty in ground conditions. At grade, so reduced risk of additional land take for earthworks. |
| | | | Lower - No major constraints. Moves traffic closer to hotel and work places, noise and air quality impacts. Land take from commercial property and rugby club. | Landfill (borrow pit) and river terrace deposits underlying junction - uncertainty in ground conditions. At grade, so reduced risk of additional land take for earthworks. |
| | | | | | | | | |
### Stakeholders

<table>
<thead>
<tr>
<th>How will the option impact on them and does it meet their expectations?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net benefit except for those impacted by land take.</td>
</tr>
<tr>
<td>Net benefit except for those impacted by land take.</td>
</tr>
<tr>
<td>Net benefit except for those impacted by land take.</td>
</tr>
<tr>
<td>Marginal benefit due to reduced free flow on junction and does not mitigate pedestrian/vehicle interface.</td>
</tr>
<tr>
<td>Marginal benefit due to reduced free flow on junction and does not mitigate pedestrian/vehicle interface.</td>
</tr>
</tbody>
</table>

### Preferred Option

<table>
<thead>
<tr>
<th>Viable / Rejected</th>
<th>Selected</th>
<th>Rejected</th>
<th>Rejected</th>
<th>Rejected</th>
<th>Rejected</th>
</tr>
</thead>
</table>

### Appendix B – Stage 2 Option Selection Matrix (Updated from Mouchel)

#### Stage 2 - Option Selection – Rejected and Viable Options Matrix

<table>
<thead>
<tr>
<th>Colour</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green</td>
<td>Substantially better than baseline or substantially contributes towards scheme objective</td>
</tr>
<tr>
<td>Amber</td>
<td>Meets baseline/scheme objective</td>
</tr>
<tr>
<td>Red</td>
<td>Worse than baseline/detrimental towards scheme objective</td>
</tr>
<tr>
<td>Black</td>
<td>Substantially worse than baseline or substantially detrimental towards scheme objective</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Estimated Capital Cost (RIS 1 baseline £52.5M)</th>
<th>Benefit/disbenefit (RIS 1 baseline ‘high’ VfM) (SRN that supports and facilitates economic growth, supporting employment and residential development opportunities)</th>
<th>Programme/Statutory Process (RIS 1 baseline SoW RIS 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low likelihood of delivering within RIS 1 budget. Elevating the A428 and the slip roads require retaining walls on both sides of each slip road, as well as on the A46. There may be a slight impact on landfill sites under the slip roads, potentially requiring localised ground improvement.</td>
<td>Anticipated to return a BCR in the ‘High’ VfM category (2-4), estimated capital costs will have impact on BCR.</td>
<td>Improvement scheme. Highways Act statutory process likely to be less than 12.5ha, but increased statutory land requirements than Option 1 as A46 mainline carriageway elevated so contributes towards area total, however circulatory carriageway is at grade so does not contribute towards area total. Start of works within RIS 1.</td>
</tr>
<tr>
<td>Likely to be delivered within RIS 1 budget. Keeping the slip roads and A428 at grade reduces retaining wall requirement. Retaining walls required between A46 and slip road. Impact on landfill sites is likely to be greater due to the A46 mainline being elevated, potentially requiring ground improvement.</td>
<td></td>
<td>Improvement scheme. Highways Act statutory process likely to be less than 12.5ha, but increased statutory land requirements than Option 1 as A46 mainline elevated and slip roads require retaining walls on both sides of each slip road. Impact on landfill sites is likely to be greater due to both the A46 mainline and slip roads being elevated, potentially requiring ground improvement.</td>
</tr>
<tr>
<td>Low likelihood of delivering within RIS 1 budget. Elevating the A46 and the slip roads require retaining walls on both sides of each slip road. Impact on landfill sites is likely to be greater due to both the A46 mainline and slip roads being elevated, potentially requiring ground improvement.</td>
<td></td>
<td>Improvement scheme. Highways Act statutory process likely to be less than 12.5ha as circulatory carriageway and slip roads at grade. Circulatory carriageway likely to be within land boundary so will not contribute towards area total. Start of works within RIS 1 but risk of change to statutory process would impact delivery.</td>
</tr>
<tr>
<td>Very low likelihood of delivering within RIS 1 budget. Lowering the A46 and the A428/ circulatory carriageway will be more expensive than taking the A46 over the top (options 2 and 3). Large excavation necessary, including through landfill sites for the slip roads with associated disposal and possible treatment costs. A large impact on the existing services which would have to be diverted for the works to be carried out.</td>
<td></td>
<td>Improvement scheme. Highways Act statutory process likely to be less than 12.5ha as A46 at grade, which will not contribute towards area total when within land boundary. Start of works within RIS 1</td>
</tr>
</tbody>
</table>
### Environment

<table>
<thead>
<tr>
<th>Elevated A428 and circulatory carriageway that is lower speed road which may be more beneficial for noise impacts than elevating high speed A46.</th>
<th>Elevated A46 carriageway that is higher speed road which may have larger impact for noise than elevating lower speed A429.</th>
<th>Elevated A46 carriageway and slip roads that are higher speed road which may have larger impact for noise than elevating lower speed A429.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potential large adverse impact on visual receptors and likely significant effects.</td>
<td>Potential large adverse impact on visual receptors.</td>
<td>Potential large adverse impact on visual receptors.</td>
</tr>
<tr>
<td>Potential moderate adverse impacts to cultural heritage assets.</td>
<td>Potential moderate adverse impacts to cultural heritage assets.</td>
<td>Potential moderate adverse impacts to cultural heritage assets.</td>
</tr>
</tbody>
</table>

### Operations and Safety

- Grade separated, all movement junctions, all options propose the same merge/diverge type.
- Merge junction layouts increased from Type A to Type B to aid merging manoeuvres.
- Weaving distance between south facing slip roads and services/business access approximately 200m.
- 90mph speed limit provides partial mitigation of horizontal alignment and SSD being 2 steps below desirable minimum for design speed of 120kph.
- Not a significant existing accident problem.
- Walsgrave operating with severe congestion in 2021 with No Binley improvement. Walsgrave junction operation worsens with Binley improvement.

### Maintenance

- Rigid concrete barrier and hard central reserve priced through both junctions.
- Underside of structures for future maintenance
- Structures will require expansion joints and bearings
- Rigid concrete barrier and hard central reserve priced through both junctions.
- Maintenance liability to include pumping stations

### Building / major infrastructures impact

- NB Diverge slip: Private access road from Progress Way will be affected. Slip road in close proximity to Cocked Hat Hotel. Diverge in close proximity to the business access to the south.
- SB Merge Slip: Affects access to Green’s Home and Gardens sterilising the site and parking space. Merge in close proximity to services access to the south
- SB Diverge Slip: Encroaches on Broadstreet Rugby Club’s Parking
- Overhead power cable crossing A46 and A428 affected

### Impact on local network

- Grade separation reduces vehicle conflicts and results in better operation at junction for local network traffic. Complexities associated with elevating the A428 in a constrained site whilst maintaining access and all movements at the junction. Pedestrian facility crossing the A428 likely to be closed and replaced with an alternative facility during the works. Signalled facility retained in final solution. 5-6% gradient on A428 approaches are above guidance for NMUs.
- Grade separation reduces vehicle conflicts and results in better operation at junction for local network traffic. Complexities to maintain all movements at the junction. Lower impact on businesses to the west as a result of reduced work on the A428. Pedestrian facility crossing the A428 likely to be closed and replaced with an alternative facility during the works. Signalled facility retained in final solution.
- Grade separation reduces vehicle conflicts and results in better operation at junction for local network traffic. Complexities associated with elevating both the slip roads and mainline A46 in a constrained site whilst maintaining access and all movements at the junction. Pedestrian facility crossing the A428 likely to be closed and replaced with an alternative facility during the works. Signalled facility retained in final solution. Existing services to be diverted prior to starting works on site.
- Grade separation reduces vehicle conflicts and results in better operation at junction for local network traffic. Complexities associated with lowering the A428 in a constrained site whilst maintaining access and all movements at the junction. Pedestrian facility crossing the A428 likely to be closed and replaced with an alternative facility during the works. Signalled facility retained in final solution. 5-6% gradient on A428 approaches are above guidance for NMUs. Existing services to be diverted prior to starting works on site.

### Conclusion

| VIABLE | VIABLE | REJECTED (On cost) | REJECTED | REJECTED |
**Stage 2 - Option Selection – Viable Option Comparison Matrix**

| Green                                                                 | Substantially better than baseline or substantially contributes towards scheme objective |
|                                                                     |                                                                                      |
| Amber                                                                | Meets baseline/scheme objective                                                       |
| Red                                                                  | Worse than baseline/detriment towards scheme objective                                |
| Black                                                                | Substantially worse than baseline or substantially detrimental towards scheme objective |

<p>| Estimate Capital Cost (RIS 1 baseline £52.5M)                         | Option 1 – A46 at grade and A428, circulatory carriageway and slip roads elevated      | Option 2 – A46 elevated and A428 circulatory carriageway and slip roads at grade |
|                                                                     | £64.7M most likely                                                                 | £54.9M most likely                                                                 |
|                                                                     | £53.3M to £89.7M (Min – Max)                                                        | £45.3M to £76.0M (Min – Max)                                                       |
|                                                                     | Retaining walls utilised throughout majority of the junction, circa 3.5km             | Retaining walls utilised between slip roads and mainline carriageway,               |
|                                                                     | of retaining wall, 1465m (42%) &lt;2m high, 1170m (33%) &gt;6m high                       | circa 1.8km of retaining wall                                                     |
|                                                                     |                                                                                       | 525m (29%) &lt;2m high, 585m (33%) &gt;6m high                                           |
| Benefit/disbenefit (RIS 1 baseline ‘high’ VfM)                        | Anticipated to return a BCR in the ‘High’ VfM category (2-4).                        | Anticipated to return a BCR in the ‘High’ VfM category (2-4).                      |
| (SRN that supports and facilitates economic growth, supporting employment and residential development opportunities) |                                                                                       |                                                                                     |
| Program/ Statutory Process (RIS 1 baseline SoW RIS 1)                | Alteration scheme. Highways Act statutory process (8.80ha inc. 25% area risk) 7.04ha without risk provision, less than 12.5ha. Start of works within RIS 1 | Alteration scheme. Highways Act statutory process, but slightly higher risk of triggering DCO (11.89ha inc. 25% area risk) 9.51ha without risk provision. Start of works within RIS 1 |
|                                                                     |                                                                                       |                                                                                     |</p>
<table>
<thead>
<tr>
<th>Environment</th>
<th>Operations and safety</th>
<th>Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Reducing/minimising impact on wider environment, whilst seeking to bring enhancement)</td>
<td>Improve the operation and efficiency of the existing transport network, delivering capacity enhancements to the SRN</td>
<td>Operation maintenance to balance cost and disruption</td>
</tr>
<tr>
<td>The elevated A428 and roundabout could result in noise impacts to the surrounding properties. The lower speed road is elevated. Therefore, it is anticipated that this option could result in slightly reduced noise impacts. The difference is not thought to be significant. The majority of visual receptors immediately adjacent to the junction are of low sensitivity (Rugby club, Premier Inn hotel, restaurant chain, Cocked Hat Hotel), the magnitude of impacts arising from the relative height and proximity of the proposed retaining walls, lying on the outer extents of the proposed junction arrangement, are likely to be high and therefore resulting effects would remain significant. No significant effects to the south and west of Binley junction are likely due to the adjacent Industrial and Business Parks and large intervening buildings. A further 9 properties on The Stoop would have direct views to the north western end of the works to the new slip road and have open views onto the carriageway once the belt of hawthorn currently screening views is cleared and therefore significant impacts (further properties within the surrounding estate would potentially have views but would be unlikely to have significant impacts as a result. On the assumption that sufficient mitigation planting could be achieved as mentioned above it would reduce the likelihood of significant effects while screen mounding would help reduce these further. This option is likely to result in moderate impacts to cultural heritage - The Cocked Hat and Romano British remains. Opportunities to mitigate potentially significant effects are constrained by the extent and height of the proposed retaining structures proposed to the outer limits of the junction.</td>
<td>Grade separated, all movement junction, all merge/diverge layout types the same as other options.</td>
<td>Grade separated, all movement junction, all merge/diverge layout types the same as other options.</td>
</tr>
</tbody>
</table>
### Building/major infrastructures impact
(SRN that balances the needs of individuals and businesses that use and rely upon it.)

<table>
<thead>
<tr>
<th>AMBER/RED</th>
<th>AMBER/GREEN</th>
</tr>
</thead>
<tbody>
<tr>
<td>• NB Diverge slip: Private access road from Progress Way will be affected. Slip road in close proximity to Cocked Hat Hotel. Diverge in close proximity to the business access to the south.</td>
<td>• NB Diverge slip: Private access road from Progress Way will be affected. Slip road in close proximity to Cocked Hat Hotel. Diverge in close proximity to the business access to the south.</td>
</tr>
<tr>
<td>• SB Merge Slip: Affects access to Green’s Home and Gardens, sterilising the site and parking. Merge in close proximity to services access to the south.</td>
<td>• SB Merge Slip: Affects access to Green’s Home and Gardens, sterilising the site and parking. Merge in close proximity to services access to the south.</td>
</tr>
<tr>
<td>• NB Merge Slip: Slip road in close proximity to new M&amp;S store north of Premier Inn hotel.</td>
<td>• NB Merge Slip: Slip road in close proximity to new M&amp;S store north of Premier Inn hotel.</td>
</tr>
<tr>
<td>• SB Diverge Slip: Encroaches on Broadstreet Rugby Club’s Parking</td>
<td>• SB Diverge Slip: Encroaches on Broadstreet Rugby Club’s Parking</td>
</tr>
<tr>
<td>• A428: overhead power cable affected</td>
<td>• A46 mainline: overhead power cable</td>
</tr>
</tbody>
</table>

### Impact on local network

<table>
<thead>
<tr>
<th>RED/AMBER</th>
<th>AMBER/GREEN</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Grade separation reduces vehicle conflicts and results in better operation at junction for local network.</td>
<td>• Grade separation reduces vehicle conflicts and results in better operation at junction for local network.</td>
</tr>
<tr>
<td>• Complexities associated with elevating the A428 in a constrained site whilst maintaining access and all movements at the junction.</td>
<td>• Complexities associated with elevating the A428 in a constrained site whilst maintaining access and all movements at the junction.</td>
</tr>
<tr>
<td>• Signalled NMU crossing facility retained in final solution, currently only on 1 side of the junction.</td>
<td>• Signalised NMU crossing facility retained in final solution, currently only on one side of the junction.</td>
</tr>
<tr>
<td>• 5-6% gradient on A428 approaches are above guidance for NMUs.</td>
<td>• A428 closely matches existing terrain, providing lower gradients.</td>
</tr>
</tbody>
</table>

### Comments / Conclusion (Preferred and rejected)

<table>
<thead>
<tr>
<th>REJECTED</th>
<th>PREFERRED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retaining walls so close, more impact on visual more resistance and potential objections to scheme.</td>
<td>Higher chance to meet budget. More space to minimise noise impacts.</td>
</tr>
</tbody>
</table>

### Key risks/issues

| Statutory process prolonged, possibly more objections. Statutory utilities would be affected Acceptability of changes to local network to B&Q trade etc. Buildability issues, local network would need to be temporarily closed whilst work is undertaken Time periods to assess mitigation plans/visual/noise. Could temporary land requirement throw scheme into DCO. Opportunity – NMU facilities currently one way, possibility for both ways. | Queuing from B&Q roundabout tail back, possible effects on local business. Reputation – would need to address existing queueing problem at B&Q. Proximity of slip roads to access roads, mitigation against accidents Opportunity – NMU facilities currently one way, possibility for both ways. |
Appendix C – Design Speed Technical Note
Appendix D – Underpass Constructability Details
Appendix E – Departures from Standard Checklist
Appendix 1 C.02: A46 COVENTRY OPTIONS ASSESSMENT REPORT (OAR) (2015)
A46 Coventry Junctions
Upgrade

Options for the Binley and Walsgrave Junctions – Workshop Outcome

December 2015
Produced for
Highways England

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2 Existing Junction Layouts ......................................................................................................... 2

3 Proposed Layout Options .......................................................................................................... 4

4 Workshop Outcomes ............................................................................................................... 9

Appendix A – Drawings

Appendix B – Junction Option Matrices
Introduction

This report provides a summary of the outcome of a workshop held on Thursday 19 November 2015 to discuss a number of alternative layout options considered for both the Binley and Walsgrave Junctions. These options were developed following the initial layouts produced by Atkins as part of earlier work on the project. Conversion of the two existing at-grade junctions to grade separation is seen as the most appropriate option to provide mitigation to the congestion experienced at the two junctions.

Notwithstanding this further options were developed for consideration as part of Stage 1, Options Identification, and were included in the report - *Outline Layout Options for the Binley and Walsgrave Junctions* (Ref 1068659-R-0100A) dated November 2015. The details relating to the existing and proposed layouts contained in the above report are included in sections 2 and 3 of this report for the sake of completeness. The outcomes of the workshop are included in Section 4.
2 Existing Junction Layouts

The existing layouts of the Binley and Walsgrave junctions are shown on drawings 1068659-SK-20 and 26 respectively.

A46 Binley/TGI Junction

The A46 Binley/TGI junction comprises a four arm at-grade partially signalised roundabout providing access to the A428.

Other than a strip of wooded area on each side of the A46 north of the roundabout, the constraints at this location are a mix of social and private enterprises varying in description. All have commercial interests and any proposal is likely to have an impact on their business operations in varying degrees. These constraints are listed below and identified to a relevant quadrant of the current A46 / A428 roundabout interchange arrangement.

- Southwest: Cocked Hat Hotel / Restaurant
- Northwest: T.G.I Fridays, Premier Inn and Wooded Area
- Northeast: Broadstreet Rugby Club and Wooded Area
- Southeast: Greens Home and Garden / Humbugs.

In addition there are significant statutory undertakers apparatus located within the existing roundabout and A428 which will require diverting to accommodate any proposed option. The status and function of the apparatus has yet to be established.

A46 Walsgrave Junction

The A46 Walsgrave roundabout is a three arm at grade junction providing a link with the B4082, and provides access into Coventry. The location of the existing Walsgrave roundabout is in close proximity to the adjacent Coombe Pool, and an associated Site of Special Scientific Interest (SSSI), located to the east of the A46. Proposals for this junction should avoid any impact on the SSSI.

In contrast to Binley, other than a listed property to the northwest of the existing roundabout, the constraints are a mix of utilities and environmental elements.
including the SSSI referred above. These constraints are listed below and identified to a relative quadrant of the current A46 / B4082 roundabout layout.

Southwest
National Grid - Pylon foundation / overhead cables and Culvert

Northwest
National Grid - Pylon foundation / overhead cables, River Sowe, Hungerley Hall farm (grade II listing) and bridge over A46

Northeast
Coombe Pool banks / spillways, Culvert and Wooded Area

Southeast
Wooded Area

There is a flood plain associated with the River Sowe to the west of the A46 corridor which will need to be considered as part of any proposal that may encroach into it.

A cantilevered matrix sign (MS3) is located in the northbound verge approximately 950m to the north of the roundabout. Whilst most of the options in this report do not extend that far, it is a consideration to be taken acknowledged as part of options 1, 2 and 5.
3 Proposed Layout Options

A46 Binley/TGI Junction

3.1 Option 1 – Original Proposal (see drg 1068659-SK-21)

Grade separation of the junction is achieved by raising the A46 over the A428 Rugby Road minor road (a two bridge roundabout as detailed in TD 22/06 – Layout of Grade Separated Junctions) and providing entry and exit slips roads to an at grade gyratory junction. It is anticipated the elevated section of the A46 will be retained through a combination of retaining walls and embankments.

The grade separation should mitigate the need for any signalisation on the gyratory however this will need assessed as part of the traffic modelling work and the need to accommodate pedestrian movements along the A428.

3.2 Option 2 – Diamond Arrangement, A46 At Grade (See Drg 1068659-SK-22)

This diamond arrangement maintains the A46 at grade with the A428 elevated over the A46 via a single bridge. The north and south bound off slips will be formed on ramps through a combination of retaining walls and embankments as appropriate to mitigate land take.

The north and southbound on slips would be at grade with some elevation where they exit the A428. However the indicated layouts have significant impact on adjacent development in order to achieve a stagger between the junctions on the A428. The length of the staggers would need to be assessed, as part of the traffic modelling, for stacking capacity for right turn traffic exiting the A428 onto the A46.

The vertical profile required to elevate the A428 over the A46 may lead to substandard visibility to the signalised junctions without commencing the approach ramps some distance back along the A428. This may have an impact on the nearby existing junctions.

The requirement to accommodate pedestrian movements within the signal phasing may impact on the traffic capacity of the junction.
As a result of the various issues identified it is considered this option should not be taken forward for further development.

### 3.3 Option 3 – Diamond Arrangement, A428 At Grade (See Drg 1068659-SK-23)

This diamond arrangement maintains the A428 at grade with the A46 elevated over the A428 via a single bridge. The A46 will require a combination of retaining walls and/or embankments to retain the elevated section. The north and south bound on and off slips will be formed at grade. However, as with option 2, the indicated layouts for the on-slips have significant impact on adjacent development in order to achieve a stagger between the junctions on the A428. The length of the staggers would need to be assessed, as part of the traffic modelling, for stacking capacity for right turn traffic exiting the A428 onto the A46.

Visibility to the signalised junctions may impact on the required bridge span but it is not anticipated that this will be a significant issue.

As with option 2 the need to accommodate pedestrian movements within the signal phasing may impact on the traffic capacity of the junction.

### 3.4 Options 4A and 4B – Signalised Hamburger style roundabout (See Drg 1068659- SK-24 and 25)

These options are signal controlled hamburger roundabouts with the ICD filling the open area available at each quadrant. The proposed arrangements are at grade but clearly they do not provide the aspiration for grade separation and would not be appropriate for future development of the A46 corridor as an Expressway.

Traffic modelling work would be required to assess whether this form of junction would provide the required capacity for both the opening and design years.

It is considered these layouts would not be appropriate for further development given the shortfalls identified above.
A46 Walsgrave Junction

3.5 Option 1 – Original Proposal (See Drg 1068659-SK-27 and 28)

This option replaces the current roundabout with a right hand bend (viewed travelling north) and provides a grade separated junction (two bridge junction) some 1000m further north, although there is some flexibility in the location of this junction along the route of the A46 partially determined by the proposed link into Coventry immediately to the south of the University Hospital Coventry & Warwickshire.

It is anticipated the replacement of the existing Walsgrave roundabout and stopping up of the B4082 will result in a re-assignment of traffic on the local road network, the impact of which is unknown at this stage.

The radius of the right hand bend, which replaces the Walsgrave Roundabout, is 255m and will require a reduction in the speed limit to 50mph. It is not possible to accommodate a larger radius without encroaching into the area of the Coombe Pool SSSI, and the adjacent vegetated embankment. This realignment may also move the road closer to Hungerley Hall.

Consideration will need to be given to the impact the new junction will have on the existing Matrix Sign / Cantilevered Gantry.

3.6 Option 2 – Removal of Walsgrave Roundabout with Remote Left In Left Out Slips (LILO) (See Drg 1068659-SK-29 and 30).

As with option 1 there are two separate design provisions within this option, the replacement of the existing Walsgrave roundabout with a right hand bend as option 1 and the provision of northbound LILO slips only, approximately 1km further to the north. There is some flexibility in the location of the LILO slips along the route of the A46 partially determined by the proposed link into Coventry immediately to the south of the University Hospital Coventry & Warwickshire.

The stopping up of the B4082 will take away the possible to leave or join the A46 from the local road network at this location. This, combined with the reduced provision for access onto the A46 with the LILO slips, will impact on traffic using the
local road network. The extent of any traffic re-assignment as a result of these proposals is unknown.

The existing Matrix Sign / Cantilevered Gantry could be accommodated within the design of the LILO slips provided visibility lines are not compromised, however the impact on its function will need to be considered.

3.7 **Option 3 – Removal of Walsgrave Roundabout replace with In Left Out Slips (LILO) (See Drg 1068659-SK-31).**

Similar to Option 2 but with the LILO slips located at the site of the existing roundabout. This option provides a link to the existing B4082 and therefore would reduce the re-assignment of traffic elsewhere on the local road network.

3.8 **Option 4A – A46 At-grade with Elevated Slip Roads and Offline All Movements Roundabout Junction (See Drg 1068659-SK-32).**

This option provides full grade separation at the existing location of the Walsgrave roundabout and therefore mitigates any impact on the local road network due to traffic re-assignment. However it impacts on a large area to accommodate the proposed slip roads and off line roundabout.

The southbound off and southbound on slip roads, which are elevated on bridges to pass over the at-grade A46, impact on the Coombe Pool SSSI. Additionally the elevated carriageways will have a detrimental visual impact on the grade II listed Hungerley Hall Farm. The northbound on slip will also bring traffic closer to Hungerley Hall.

The roundabout and slip roads are located beneath overhead high voltage power lines and the northbound off slip crosses a watercourse and associated flood plain.

The location of the proposed northbound on-slip and the southbound off-slip will impact on the accommodation works bridge located to the north. It may be possible to modify the slip road merges to mitigate this impact otherwise the accommodation bridge will need to be relocated.

3.9 **Option 4B – A46 At-grade with Elevated Slip Roads and Offline All Movements Roundabout Junction (See Drg 1068659-SK-33).**
This option is a variation on 4A above. It provides similar advantages and disadvantages.

3.10 Option 5 – Realigned A46 At-grade with Elevated Slip Roads and Offline All Movements Roundabout Junction (See Drg 1068659-SK-34 & 35).

This option does not attempt to conform to the general south to north direction of the existing A46. As an alternative it fits between the two constraint of the Hungerley Hall farm and a National grid pylon. As a consequence, the access to Hungerley Hall farm is completely severed with the only feasible access coming via the redundant A46 / proposed roundabout and passing under the re-aligned A46.

There are further constraints to be accommodated such as the River Sowe, the associated flood plain and pylons.

The centreline horizontal geometry deviates significantly west of the existing A46 corridor linking back to it some 1600m (approximately 1 mile) to the north. Whilst this revised alignment of the A46 provides a horizontal geometry that will accommodate a 70mph speed limit, and hence comply with Expressway expectations, it has very significant environmental impacts and would considerable exceed the scheme budget.
4 Workshop Outcomes

4.1 Assessment Criteria

The options presented were reviewed in turn and the issues relating to each option discussed. Tables 1 and 2 contained in Appendix B summarise the benefits and dis-benefit for each option against the following criteria;

- Safety – Is safety improved for all users?
- Traffic Throughput – Is there a benefit for A46 traffic?
- Impact on Local network – Is there a benefit for traffic on the local network?
- Geotechnical issues – Are there any major issues which would significantly impact on cost?
- Economic Growth – Will the option facilitate economic benefit in the area?
- Cost – The options, other than Option 1, have not been costed therefore the comments indicate the likely cost relative to Option 1 Order of Magnitude Estimate(OME –see section 4.4) used as a baseline.
- Stakeholders – How will the option impact on them and does it meet their expectations.

The tables have been colour coded (RAG assessment) to reflect the level of benefit each option provides against the current situation. Green equates to a significant benefit, Amber equates to marginal benefit or dis-benefit, Red is a significant dis-benefit.

4.2 A46 Binley/TGI Junction

The assessment shows that Option 1 (full grade separation of the junction with the A46 elevated over the A428 Rugby Road minor road on two bridges) provides the greatest benefits with the least dis-benefits.

It was considered that whilst it would provide only marginal improvements for economic growth it would address traffic congestion experienced at the junction through the removal of A46 through traffic, therefore reducing traffic conflicts. This in turn would improve safety at the junction. Congestion is experienced on the A428 in both directions at times of peak flow.
Geotechnical issues may result in increased costs due to the uncertainty of underlying ground conditions, but these issues are common to all the options but have a more significant impact where structures are required.

4.3 **A46 Walsgrave Junction**

The assessment again shows that Option 1 (replace the current Walsgrave roundabout with a right hand bend and provide a grade separated junction elevated over the A46 some 1000m further north) provides the greatest benefits and the least dis-benefits.

From table 2 it can be seen that geotechnical issues and re-assignment of traffic on the local network, due to the closure of the Walsgrave roundabout, are the main dis-benefits to this option. In addition it is not clear at this stage where the link to the west will connect back to the local road network. Further discussions will be required with the local authority to understand how this can be achieved.

4.4 **Scheme Costs**

It was agreed at the MP IDC Meeting held on 23.11.15, that with an OME at £118.591m (option 1 at both Binley and Walsgrave priced) and SOBC figures of £52.5m that Stage 1 must focus on developing option’s that deliver affordable solutions. Therefore the scheme cost going forward is £52.5m. No breakdown has been provided to show how the OME is split between the two junctions, this will be required to understand the costs of the constituent parts and how, and where, savings can be achieved.

4.5 **Stage 1 options.**

Taking into account the above constraints on scheme costs the outcome of the workshop was to consider three options for Stage 1. These are detailed in Table 4.1 below.

It is recognised that Option C is unlikely to be deliverable within the budget of £52.5m, however it meets stakeholder expectations by opening up land for development opportunities and as such there is significant potential to secure developer contributions from sites which would be “unlocked” by the relocation of Walsgrave junction under this option.
<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Grade separation of Binley/TGI junction only. Do nothing at Walsgrave.</td>
<td>Subject to confirmation of OME cost breakdown, the scheme budget may only fund this one junction. Of the two junctions improvements to Binley/TGI junction would provide the most significant benefits to road users.</td>
</tr>
<tr>
<td>B</td>
<td>Option A above + Do minimum at Walsgrave (modifications to the existing roundabout to provide capacity for the design year (2031).</td>
<td>As above but would also improve Walsgrave junction at minimal cost</td>
</tr>
<tr>
<td>C</td>
<td>Option A above + relocation and grade separation of Walsgrave junction.</td>
<td>Grade separation of both Binley/ TGI and Walsgrave meet the original scheme objective and provide for economic growth in the area. It is recognised that this option is unlikely to be deliverable within the budget of £52.5m, but that there is significant potential to secure developer contributions from sites which would be “unlocked” by the relocation of Walsgrave junction.</td>
</tr>
</tbody>
</table>

### 4.5 Traffic Modelling

The Tollbar End junction to the south of the Binley/TGI roundabout is still under construction, consequently it will not be possible to establish true traffic flows on the A46 until sometime after it is fully open to traffic. Therefore traffic modelling for the above options will be done using the Coventry Area Strategic Model (CASM) to forecast impacts of the scheme. A review of CASM is to be carried out to ascertain if the model is fit for appraising the A46. Traffic data surveys have been undertaken (17 – 30 Nov) in order to validate the CASM. Receipt of the traffic data is anticipated by 14 December.
4.5 Next Steps

Mouchel to develop the above three options, in particular option B. This work will comprise:

- T&E team to undertake preliminary operational assessments of junction capacity based on a proportionate approach to traffic flow forecasting (as detailed in methodology section above)
- Highways team to develop physical layouts in collaboration with other disciplines, taking account of key constraints and results of preliminary operational assessments
- T&E team to continue to liaise with holders of CASM model to agree a collaborative approach to the calibration/validation of the base year model and forecasting.
- T&E team to meet Peter Grant of TAME to formally agree the revised approach.

In addition the following further activities will be undertaken;

- A breakdown of the OME to be obtained to enable assessment of the likely cost for the three options, A, B and C. A meeting was held on 30 November 2015 with HE commercial at which this information was requested,
- Liaison with stakeholders to obtain their view on the selected options, in particular option C.
- Identify any further constraints that may impact on the options proposed, in particular obtain further information on the Statutory Undertakers apparatus and potential costs of any diversions works.
- Develop the form of the proposed structures in greater detail to to enable more accurate cost estimates.
APPENDIX A

A46 Coventry Junctions Drawings
APPENDIX B
A46 Junction Option Matrices
## JUNCTIONS OPTION MATRICES

### Table 1 – Binley/TGI Junction Options Matrix

<table>
<thead>
<tr>
<th>Safety</th>
<th>Option 1 - Atkins Design</th>
<th>Option 2 - Diamond, A46 At Grade, A428 Elevated</th>
<th>Option 3 - Diamond Arrangement, A46 Elevated, A428 At Grade</th>
<th>Option 4A - Signalised Hamburger (2 Lane) Roundabout</th>
<th>Option 4B - Signalised Hamburger (3 Lane) Roundabout</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduces traffic conflicts due to grade separation. Layout complies with DMRB standards. No departures anticipated</td>
<td>Reduces traffic conflicts due to grade separation. Possible reduced visibility due to A428 vertical alignment. Departures from Standard may be required.</td>
<td>Reduces traffic conflicts due to grade separation. Departures from Standard may be required.</td>
<td>Layout complies with DMRB standards. No departures anticipated Additional traffic signals may result in additional collisions</td>
<td>No grade separation but provides additional road space and opportunity to prioritise A46 flow</td>
<td>No grade separation but provides additional road space and opportunity to prioritise A46 flow</td>
</tr>
<tr>
<td>Traffic Throughput</td>
<td>Grade separation provides free flow situation.</td>
<td>Grade separation provides free flow situation.</td>
<td>Grade separation provides free flow situation.</td>
<td>No grade separation but provides additional road space and opportunity to control traffic flows. However prioritising A46 may be at detriment of A428 flows.</td>
<td>No grade separation but provides additional road space and an opportunity to control traffic flows. However prioritising A46 may be at detriment of A428 flows.</td>
</tr>
<tr>
<td>Impact on local network</td>
<td>Positive impact through reduction of turning conflicts</td>
<td>Positive impact through reduction of turning conflicts</td>
<td>Positive impact through reduction of turning conflicts</td>
<td>No grade separation but provides additional road space and an opportunity to control traffic flows. However prioritising A46 may be at detriment of A428 flows.</td>
<td>No grade separation but provides additional road space and an opportunity to control traffic flows. However prioritising A46 may be at detriment of A428 flows.</td>
</tr>
<tr>
<td>Lower - No major constraints. Moves traffic closer to hotel and workplaces, noise and air quality impacts. Higher impact - Moves carriageways closer to hotel and workplaces, potential impact from noise and air. Results in demolition of commercial property and land take from rugby club / restaurant Enroaches into Ancient Woodland and an eco site.</td>
<td>Lower - No major constraints. Moves traffic closer to hotel and workplaces, noise and air quality impacts. Land take from commercial property and rugby club.</td>
<td>Lower - No major constraints. Moves traffic closer to hotel and workplaces, noise and air quality impacts. Land take from commercial property and rugby club.</td>
<td>Lower - No major constraints. Moves traffic closer to hotel and workplaces, noise and air quality impacts. Land take from commercial property and rugby club.</td>
<td>Lower - No major constraints. Moves traffic closer to hotel and workplaces, noise and air quality impacts. Land take from commercial property and rugby club.</td>
<td></td>
</tr>
<tr>
<td>Geotechnical</td>
<td>Landfill (borrow pit) and river terrace deposits underlying junction - uncertainty in ground conditions. Possible piling required for bridge structures - increased cost. Length of retaining walls - increased cost. At grade, so reduced risk of additional land take for earthworks.</td>
<td>Landfill (borrow pit) and river terrace deposits underlying junction. Increased footprint covering larger area of landfill - uncertainty in ground conditions. Possible piling required for bridge structures - increased cost. Strengthened earthworks likely to be required between slip lanes and main carriageway.</td>
<td>Landfill (borrow pit) and river terrace deposits underlying junction. Increased footprint covering larger area of landfill - uncertainty in ground conditions. Possible piling required for bridge structures - increased cost. Strengthened earthworks likely to be required between slip lanes and main carriageway.</td>
<td>Landfill (borrow pit) and river terrace deposits underlying junction - uncertainty in ground conditions. Possible piling required for bridge structures - increased cost. At grade, so reduced risk of additional land take for earthworks.</td>
<td>Landfill (borrow pit) and river terrace deposits underlying junction - uncertainty in ground conditions. Possible piling required for bridge structures - increased cost. At grade, so reduced risk of additional land take for earthworks.</td>
</tr>
<tr>
<td>Economic Growth</td>
<td>Marginal positive impact</td>
<td>Marginal positive impact</td>
<td>Marginal positive impact</td>
<td>Marginal positive impact</td>
<td>Marginal positive impact</td>
</tr>
<tr>
<td>Cost</td>
<td>OME assumed as base line</td>
<td>Lower</td>
<td>Lower</td>
<td>Lower</td>
<td>Lower</td>
</tr>
<tr>
<td>Stakeholders</td>
<td>Net benefit except for those impacted by land take.</td>
<td>Net benefit except for those impacted by land take.</td>
<td>Net benefit except for those impacted by land take.</td>
<td>Marginal benefit due to reduced free flow on junction and does not mitigate pedestrian/vehicle interface.</td>
<td>Marginal benefit due to reduced free flow on junction and does not mitigate pedestrian/vehicle interface.</td>
</tr>
<tr>
<td>Preferred Option</td>
<td>Selected</td>
<td>Rejected</td>
<td>Rejected</td>
<td>Rejected</td>
<td>Rejected</td>
</tr>
</tbody>
</table>

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### Table 2 – Walsgrave Junction Options Matrix

<table>
<thead>
<tr>
<th></th>
<th>Option 1 - Atkins Design</th>
<th>Option 2 - A46 At Grade A46 - A4082 Stopped Up - Northbound 'On' And 'Off' Slips (Page 1)</th>
<th>Option 3 - A46 At Grade With Northbound 'On' And 'Off' Slips</th>
<th>Option 4A - A46 At Grade - Elevated Southbound Slip Roads</th>
<th>Option 4B - A46 At Grade - Elevated Southbound Slip Roads</th>
<th>Option 4B - A46 At Grade - Elevated Southbound Slip Roads</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Traffic Throughput</strong></td>
<td>Grade separation provides free flow situation. Grade separation provides free flow situation for A46.</td>
<td>Grade separation provides free flow situation for A46.</td>
<td>Grade separation provides free flow situation for A46.</td>
<td>Grade separation provides free flow situation for A46.</td>
<td>Grade separation provides free flow situation for A46.</td>
<td>Grade separation provides free flow situation for A46.</td>
</tr>
<tr>
<td><strong>Impact on local network</strong></td>
<td>Reassignment of traffic away from B4082 will increase journey distance for some users.</td>
<td>Limits access to A46. Reassignment of traffic away from B4082. Will increase journey distance for some users.</td>
<td>Maintain current level of service.</td>
<td>Maintain current level of service.</td>
<td>Maintain current level of service.</td>
<td>Maintain current level of service.</td>
</tr>
<tr>
<td><strong>Environment</strong></td>
<td>Lower impact - May take land from an eco site. The link in the option has not been considered. Adjacent to and potential encroachment to SSSI but avoids Listed Buildings. Potential Environmental Statement.</td>
<td>Lower impact - May take land from an eco site. The link in the option has not been considered. Adjacent to and potential encroachment to SSSI but avoids Listed Buildings. Potential Environmental Statement.</td>
<td>Medium impact - Adjacent to and potential encroachment to SSSI. Slightly closer to the Listed buildings and potential realignment of the Smite Brook to accommodate slips. Greater land take from eco site. Moves carriageways closer to residential properties, potential impact from noise and air. Potential Environmental Statement.</td>
<td>Medium impact - Adjacent to and potential encroachment to SSSI. Slightly closer to the Listed buildings and potential realignment of the Smite Brook to accommodate slips. Greater land take from eco site. Moves carriageways closer to residential properties, potential impact from noise and air. Potential Environmental Statement.</td>
<td>Medium impact - Adjacent to and potential encroachment to SSSI. Slightly closer to the Listed buildings and potential realignment of the Smite Brook to accommodate slips. Greater land take from eco site. Moves carriageways closer to residential properties, potential impact from noise and air. Potential Environmental Statement.</td>
<td>Higher impact - Adjacent to and potential encroachment to SSSI. Closer to the Listed buildings and within land with a higher potential for archaeology. Realignment of the Smite Brook to accommodate slips. Greater land take from eco site. Moves carriageways closer to residential properties, potential impact from noise and air. Elevated elements may have visual impacts. Potential Environmental Statement.</td>
</tr>
<tr>
<td><strong>Geotechnical</strong></td>
<td>Landfill underlies southern section of the existing roundabout - excavation and replacement, significant cost in removing material. Borrow Pit underlies northern end of bridge junction - uncertain ground conditions - possible excavation and replacement. Alluvium deposits underlying proposed earthwork (right hand bend) - excavation and replacement (depending on thickness).</td>
<td>Landfill underlies southern section of the existing roundabout - excavation and replacement, significant cost in removing material. Borrow Pit underlies northern end of LILO slips - uncertain ground conditions - possible excavation and replacement. Alluvium deposits underlying proposed earthwork (right hand bend) - excavation and replacement (depending on thickness).</td>
<td>Landfill underlies southern section of the existing roundabout junction - excavation and replacement, significant cost in removing material. Alluvium deposits underlying proposed earthwork (right hand bend. NB off slip, SB on slip) - excavation and replacement. Wide footprint - increased land take required.</td>
<td>Landfill underlies southern section of the existing roundabout junction - excavation and replacement, significant cost in removing material. Alluvium deposits underlying proposed earthwork (right hand bend. NB off slip, SB on slip) - excavation and replacement. Possible piling for on/off SB slip roads. Wide footprint - increased land take required.</td>
<td>Landfill underlies southern section of the existing roundabout junction - excavation and replacement, significant cost in removing material. Alluvium deposits underlying proposed earthwork (right hand bend - excavation and replacement. Possible piling for on/off SB slip roads. Wide footprint - increased land take required.</td>
<td>Landfill underlies southern section of the existing roundabout junction - excavation and replacement, significant cost in removing material. Borrow Pit underlies northern end of bridge junction - uncertain ground conditions - possible excavation and replacement. Alluvium deposits &amp; river terrace deposits underlying proposed earthwork (right hand bend) - excavation and replacement (depending on thickness).</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Stakeholders</th>
<th>Option 1 - Atkins Design</th>
<th>Option 2 - At Grade A46 - A4092' Stepped Up - Northbound 'On' And 'Off' Slips</th>
<th>Option 3 - A46 At Grade With Northbound 'On' And 'Off' Slips</th>
<th>Option 4A - A46 At Grade - Elevated Southbound Slip Roads</th>
<th>Option 4B - A46 At Grade - Elevated Southbound Slip Roads</th>
<th>Option 4B - A46 At Grade - Elevated Southbound Slip Roads</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preferred Option</td>
<td>Selected</td>
<td>Rejected</td>
<td>Rejected</td>
<td>Rejected</td>
<td>Rejected</td>
<td>Rejected</td>
</tr>
</tbody>
</table>

- Option 1 - Atkins Design: Marginal dis-benefit due to additional vehicle journey lengths. Dis-benefit for those impacted by land take. Location of link to west may change impact on Stakeholders.
- Option 2 - At Grade A46 - A4092' Stepped Up - Northbound 'On' And 'Off' Slips: Dis-benefit due to additional vehicle journey lengths as a result of limited access to A46. Dis-benefit for those impacted by land take. Location of link to west may change impact on Stakeholders.
- Option 3 - A46 At Grade With Northbound 'On' And 'Off' Slips: Dis-benefit due to additional vehicle journey lengths as a result of limited access to A46. Dis-benefit for those impacted by land take. Neutral impact except for those impacted by land take.
- Option 4A - A46 At Grade - Elevated Southbound Slip Roads: Neutral impact except for those impacted by land take.
- Option 4B - A46 At Grade - Elevated Southbound Slip Roads: Neutral impact except for those impacted by land take.

Neutral impact except for those impacted by land take.
Appendix 1 C.03: THE BINLEY VALUE ENGINEERING (VE) TECHNICAL NOTE (2017)
Technical Note supporting the AECOM Proposal at Binley Junction

Client name
Highways England

Discipline
Scheme-wide

Date
15 January 2018

Reference addition number
551486

Project number
60547444

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Approved By
J Waterman
1. Introduction of proposal

The proposed scheme involves the grade separation of Binley junction by raising the A46 over the A428 Rugby Road maintaining National Speed Limit, with entry and exit slip roads to an at-grade circulatory signalised junction.

Mouchel developed a proposal in PCF Stage 2 (hereafter referred to as Option 1), where the total out-turn cost was £67.9m. In order to improve the scheme cost forecast, AECOM has developed alternative proposals:

- Option 2 – 5 span structure over the existing roundabout (Figure 1)
- Option 3 – 3 span structure over the existing roundabout

These options maintain the existing roundabout and replace the retaining wall, located in the central island of the circulatory, with a bridge passing over the junction. The existing roundabout has an internal diameter of 50m and a 15m carriageway width and can accommodate the bridge piers for the proposed flyover. The A46 will have four slip roads tying into the existing four arms of the existing circulatory aligned to the North and South. The A428 and Rugby Road to the East and West respectively and their related roundabout arms, would not be affected by the proposed scheme.

The purpose of this Technical Note is to outline the AECOM’s Proposals and the differences compared to the Option 1 to facilitate a decision by Highways England on whether to proceed in adopting and developing the Proposal.

Figure 1: Option 2, 5 Span Bridge Proposal

The technical and capacity analysis is discussed below.

2. Analysis of Proposal

Option 2 does not exceed the previous Stage 2 scheme boundaries, and the constraints from existing properties located along A46 and around the existing roundabout are respected.
Significant benefit is expected in terms of the utilities crossing beneath the existing roundabout. The extent of diversions required is considerably reduced and the bridge piers are specifically located in order not to clash with water mains. Any diversion still required, would be placed under the bridge providing easy access during the works and for future maintenance.

An additional significant benefit would come from maintaining the existing circulatory, thereby permitting less disruption to road users and NMUs during construction. This also allows for a reduction of the construction programme of 5 months as summarised in Table 1.

3. Impacts on technical disciplines

3.1 Traffic Analysis

The LinSig analysis of the A46/A428 roundabout has been re-run using the Stage 3 traffic flows with an amendment to the lane allocation for the A46 northbound off-slip. The offside lane is now allocated for both ahead and left turning traffic, with the nearside lane allocated for left turning traffic only. This followed an earlier LinSig test that showed queues forming on the nearside lane on this approach to the signalised roundabout when the offside lane was allocated for ahead traffic only. The A46 southbound off-slip was also modified to a single lane, widening to two lanes at the stop line. This reflects demand at this approach, and the length of the short lane was designed to accommodate anticipated maximum queue lengths.

The results indicate that the junction would operate within capacity in 2036 in both the AM and PM peaks. Mean Maximum Queues (MMQs) on the circulatory carriageway are predicted not to exceed 60% of the storage capacity of the associated lane and therefore blocking of exits would not occur.

At the pedestrian crossing on the A46 southbound on-slip, there would only be nominal transient queuing (on average less than one pcu in each lane) for the AM and PM 2036 scenarios.

3.2 Highways design

Compared to Option 1, the new proposal replaces the minimum radius along the mainline R720m with a bigger radius R800 in order to achieve the SSD (stopping sight distance) of 160m on the north side of the junction. All merges and diverges, tapers, nose ratios and length of auxiliary lanes, have been designed to a 120kph design speed. Slip road design speeds, out of the merge/diverge sections, have been fixed to 70kph.

The mainline vertical alignment climbs over the junction with a 4.00% grade and only one crest with value K58 over the centre of the roundabout. Minimum headroom on the existing roundabout is provided. The K58 crest is substandard for the design speed but matches the SSD that is restricted by the horizontal alignment along the same section, but it will require a departure against 120kph design speed.

The cross section of the mainline is compliant with DMRB TD27, with the exception of the width of the central reserve (2.15m against 2.50m) and 2m verges (2.5 minimum). This was adjusted after consultation with SES to achieve a greater setback to the central concrete barrier on the offside in the northbound direction. A typical proposed cross section is shown in Figure 2.

Cross sections of the slip roads are departures against TD27 due to the urban constraints in the vicinity of the existing roundabout. At the submission of the Departure from Standards Checklist a total of 23 departures have been identified, representing a significant reduction in the number of departures compared to the design submitted at the end of the previous stage.
Figure 2: Typical Cross Section
3.3 Structural design

Two structure options are considered as part of the Proposal developed by AECOM for the A46 Coventry Binley Junction improvement scheme.

In the cost plan and the Options Report prepared by Mouchel in May 2017, the preferred solution was identified as being “Option A”, which comprised 3 independent portal frame structures and a reinforced soil retaining wall for the ramps and the section between the two under bridges and the pedestrian underpass. This option presented several disadvantages, including the requirement for complex traffic management arrangements and the placing of backfill in enclosed areas between the portal frames. The access to those areas would have interacted with the live traffic passing through the junction, making the whole construction process more complex and less safe. This option was still identified as being the most cost effective, although the traffic management and public disruption were believed not to have been taken into account in the cost estimation.

With the new proposed highway alignment, which retains the existing roundabout layout, the solution of building a retained earth embankment in the central island of the roundabout was not considered feasible due to the limited space and was discarded after consultation with the buildability contractor. The new proposal is to span over the existing roundabout with an open structure comprising 5 or 3 spans as explained below, similar to Options B1 and B2 in the Mouchel report.

In both proposals the superstructure will comprise a continuous weathering steel-concrete composite deck, 25.75m wide, supported on reinforced concrete “Y” shaped piers, founded on bored piled foundations. The retaining walls supporting the approach ramps are located in close proximity to the slip-roads which will carry live traffic during construction. Building the retaining walls in reinforced concrete would have required extensive temporary works, more complex operations and additional time for the concrete to reach strength before work on placing the fill could commence. Therefore, as part of the Proposal the approach ramps will be retained using reinforced earth walls. The reinforced earth solution offers a variety of finishes and can better achieve an appearance that compliments the surroundings. The final finish of the walls will be selected after consultation with environmental specialists and the client.

The main advantages of the Proposal when compared with Option 1 are:

- The steel concrete composite deck facilitates a shallower construction depth than the precast pre-stressed concrete beam option. A shallower construction depth leads to shorter approach ramps reducing the construction costs and time on site.
- Lower maintenance costs are facilitated through the use of weathering steel and by realising a semi-integral or potentially a fully integral structure.
- The deck has a lower total weight which leads to smaller infrastructure elements and potentially reduces the extent of the foundations and the length of piles.
- Steel girders are lifted in pairs and have a lower weight than pre-stressed concrete equivalents. This requires fewer lifting operations over the roundabout which can only be done during full lane closures (potentially during night shifts), thereby reducing time on site and potential for traffic disruption.
- Steel girders do not require temporary bearings to be placed on the piers during construction, resulting in more slender piers and fewer operations, especially working at height, during construction.
- The solution which was previously considered with separated structures and long walls created a barrier effect and was identified as being visually intrusive by the members of the public during the Public Information Exhibition. The proposed solution with an open structure is considered to improve this and is likely to be regarded as more agreeable by the public.

3.3.1 Option 2 with a 5 Span Overbridge

In this option the overbridge will have 5 spans as follows: 25m, 25m, 30m, 25m, & 27.5m. The first south span goes over the pedestrian route and cycleway. It also spans over the water main which would not require diversion in this case. The last span in the north goes over underground services (gas and water main) and offers the possibility for the slip roads to widen beneath the deck’s cantilever.
In addition to those listed above, the main advantages and disadvantages of this proposed option are as follows:

- The pedestrian route and cycleway are better situated as separated from traffic by passing underneath a separate span away from the road, making it safer and more appealing to the users.
- Offers the possibility of positioning the pedestrian crossing on the SE slip road further away from the roundabout which allows for greater stacking of vehicles and thus not blocking the circulatory.
- Fewer service diversions are required than Option 3 as the water mains and the gas main on the north side can be avoided but would still require protective measures before pilling can begin.
- The retaining walls are shorter and also the maximum retained height is being reduced by introducing a new span, reducing construction programme and the duration of activities working at height.
- Offers the possibility of widening the slip roads closer to the roundabout underneath the deck’s cantilevers.
- The construction cost of the structure will be higher than Option 3. This will be partially offset by considering the reduction in the service diversions and the risks associated with these operations (potential delays on site).

3.3.2 Option 3 with a 3 Span Overbridge

In this option the overbridge will have 3 spans, all equal at 30m long.

The main advantages and disadvantages of this proposed option:

- Less construction cost for the structure compared with the 5 span option. This difference will be reduced due to the extra services diversions and risk associated with such operations (potential delays on site).
- Requires more services diversion which might have a negative impact on the construction programme and could potentially cause unforeseen delays on site.
- The pedestrian and cycle routes are positioned adjacent to the circulatory increasing probability of collision with vehicles.
- There is no possibility of placing the pedestrian crossing on the SE slip road further away from the roundabout.

3.3.3 Recommended structure option

The recommended option for the Proposal is the 5 span option. The option will be more expensive due to the extra spans however this cost will be offset by the provision of a safer NMU facility, less statutory diversions and a shorter construction programme (see Section 3.4).

3.4 Buildability information

In order to make an accurate comparison between the Proposals (Options 2 and 3) and Option 1, the buildability consultant, Vinci, has prepared construction plans and programmes for three options as follows:

- Option 1 – original Mouchel solution with 2 independent structures separated by a reinforced earth retaining wall and a new roundabout layout;
- Option 2 – AECOM solution with a 5 span structure over the existing roundabout;
- Option 3 – AECOM solution with a 3 span structure over the existing roundabout.

The input provided by Vinci is attached to this Technical Note in Appendix A. Their analysis has shown that both Options 2 and 3 are more feasible and quicker to construct than Option 1.

Option 1 was shown to have the longest construction duration mainly due to the more extensive roundabout works in the initial phase and the central section constructed as a reinforced earth wall. This requires additional time and sequencing with the bridge structures, which impact the critical path of the programme and therefore the overall duration. The approach ramps in Option 1 are also longer due to the greater
construction depth of the bridges and they require additional time to construct in comparison with Options 2 & 3.

As summarised in Table 1, Option 2 has the shortest duration of 89 weeks, closely followed by Option 3 at 93 weeks, with Option 1 requiring the longest time of 108 weeks to complete. Options 2 & 3 are therefore expected to have a positive impact on the total cost and will cause less disruption to the public. The durations for Options 2 and 3 are both governed by the ramp construction and the marginally longer duration of Option 3 is a result of a longer ramp length.

The information provided by the buildability contractor confirms that the Proposal has a beneficial impact on the construction programme. It also confirms that the proposed solutions are buildable within the restrictions of the existing and operational junction.

The durations for each option are summarised in the table below. For each of the options Phase 1 includes alterations to the roundabout and construction of the slip-roads and Phase 2 includes the main structure and approach ramps. It should be noted that the programmes were prepared based on a 5 day working week and a 6 hour work day (due to access constraints and heavy traffic).

The programme durations for each option have been determined on the assumption that any utility diversions are completed as enabling works before the start of construction. The construction durations provide are the periods for main site work and additional durations will need to be allowed for enabling works, mobilisation and for documentation closeout. As these are believed to have the same duration for each of the options they were considered not relevant for the purpose of this comparison.

<table>
<thead>
<tr>
<th>Option</th>
<th>Working Days</th>
<th>Weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option (1) - Overall</td>
<td>538</td>
<td>108</td>
</tr>
<tr>
<td>Option (1) - Phase 1</td>
<td>178</td>
<td>36</td>
</tr>
<tr>
<td>Option (1) - Phase 2</td>
<td>332</td>
<td>66</td>
</tr>
<tr>
<td>Option (2) - Overall</td>
<td>444</td>
<td>89</td>
</tr>
<tr>
<td>Option (2) - Phase 1</td>
<td>141</td>
<td>28</td>
</tr>
<tr>
<td>Option (2) - Phase 2</td>
<td>270</td>
<td>54</td>
</tr>
<tr>
<td>Option (3) - Overall</td>
<td>466</td>
<td>93</td>
</tr>
<tr>
<td>Option (3) - Phase 1</td>
<td>141</td>
<td>28</td>
</tr>
<tr>
<td>Option (3) - Phase 2</td>
<td>286</td>
<td>57</td>
</tr>
</tbody>
</table>

3.5 Geotechnical design

The Proposal will have no effect on the geotechnical design being put forward for this scheme.

3.6 Environmental

There is no significant change to environmental aspects arising from the Proposal, although there will be some minor improvements concerning ecology and noise/vibration impacts; however these changes are not expected to be significant when compared with Option 1.

A summary of each aspect is presented below.

- Air Quality: The reduced Scheme footprint and elimination of construction activities on Rugby Road (east and west of the Binley Roundabout) may slightly reduce atmospheric pollutants at the nearest sensitive receptors to this junction during the construction phase compared with Option 1; however, given the set back of the most sensitive receptors from this part of Rugby Road it is expected that this impact would have been considered of negligible or minor adverse significance in the impact assessment and therefore not significant. There is not expected to be a discernible change to air quality impacts during the operational phase as a result of the revised Scheme.
- Noise and Vibration: The elimination of construction works on Rugby Road, east and west of the Binley Roundabout, may slightly reduce noise levels during the construction phase at the nearest noise sensitive receptors to this junction. Given the set back of the most sensitive receptors from this part of Rugby Road,
the impact from Option 1 would have generally been considered of minor adverse significance, with some potential for a moderate, short term impact at nearby commercial/retail properties. The Proposal Scheme footprint may reduce the impact at these receptors to Minor or Negligible, although quantitative testing is still being conducted. It is not expected that the revised Scheme design will materially change the conclusions of the Noise and Vibration assessment for the operational phase of the Scheme, although some minor benefit from the revised Scheme is expected.

- **Cultural Heritage:** The Proposal has the potential for direct impacts to several heritage assets, which may potentially be impacted upon visually, and potential disturb unknown archaeology. The impact is considered the same as for Option 1, although the Proposal slightly reduces the likelihood of disturbing buried archaeology due to the smaller footprint of construction works.

- **Landscape:** The main impact on landscape remains unchanged by the revised Scheme; the elevated road will lead to an increased awareness of the A46 corridor and associated traffic. The reduction in footprint at the Binley Roundabout will slightly reduce the number of receptors directly affected by construction and operational impacts, although the general impact and mitigation required for the Scheme is not expected to change as a result of the revised Scheme when compared with Option 1.

- **Biodiversity:** The Proposal is considered marginally better than Option 1 on impacts to biodiversity. The reduced footprint will increase the distance between the construction works and local sensitivities such as the Binley Common Farm Local Wildlife Site and three ponds. The Wildlife Site was immediately adjacent to the Option 1 footprint, and the three ponds were within 500 m of the modified Binley Roundabout. Two of these ponds have been identified by Mouchel's surveys as having low potential for great crested newts, but the third (located 450m south of Option 1) has resisted efforts to gain access and survey. In general therefore, the revised Scheme is not considered to alter the expected impacts on biodiversity during construction or operation, but it does reduce the risk of objection to impacts on great crested newts which could not be entirely ruled out for these ponds.

- **Geology, Soils and Materials:** The revised Scheme is not expected to change the impacts on geology, soils or materials. The potentially contaminated areas will still be directly impacted by the revised Scheme, although the Ground Investigation, now completed, did not identify any contamination, reducing the likelihood of this impact.

- **People and Communities:** The revised Scheme is not expected to change the impacts on People and Communities. The revised Scheme is slightly smaller and therefore may lead to less investment and jobs in the local area, but this change is not expected to be substantial.

- **Road Drainage and Water:** The revised Scheme is not expected to change the impacts on drainage and water.

- **Climate:** The revised Scheme is not expected to change the impacts on climate, although it is expected there will be a slight reduction in Greenhouse Gas (GHG) emissions as a result of the smaller footprint compared with Option 1.

- **Health:** The revised Scheme is not expected to change the impacts on health, although a negligible or small change may result as a result of the reduced footprint at Binley Roundabout, which will increase the distance between some receptors and construction works.

4. **Impacts on statutory processes**

Statutory approval for this scheme is likely to take one of two routes: Highways Act (1980), or the Planning Act (2008), with the latter requiring a Development Consent Order (DCO). A DCO would be triggered by landtake, or the need for an Environmental Statement, if the scheme is likely to have significant environmental impact.

The Proposal does not trigger the land-take requirements, as it is a decrease in landtake against Option 1. There are currently environmental surveys being carried out, and a quantitative noise and air quality assessment to ascertain whether the scheme will trigger a DCO. The most likely scenario is that the scheme will not require a DCO.

With regards to land-take: the Highways Act allows a Compulsory Purchase Order where land is needed from owners, who are not Highways England. It is possible to procure the land by agreement, prior to activating the CPO process. Landtake for the Option 2 is significantly less than the Option 1, as a result of retaining the existing roundabout.
5. Impact on Statutory Undertakers

Mouchel submitted C3 requests based on their proposal and the following Statutory Undertakers (SU) responded that diversions would be required:

- BT
- National Grid
- Severn Trent (Water)
- Severn Trent (Sewerage)
- Western Power
- Vodafone

Since Option 2 (5 span) would maintain the existing circulatory and the positioning of the piers would avoid SU apparatus, less diversion of existing SU equipment would be required. New C3 requests were submitted for Option 2 and the responses detailed in Table 2 show the savings generated.

<table>
<thead>
<tr>
<th>Statutory Undertaker</th>
<th>Saving (inc. VAT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vodafone</td>
<td>£64,015.00</td>
</tr>
<tr>
<td>Western Power</td>
<td>£46,325.12</td>
</tr>
<tr>
<td>Severn Trent (Water)</td>
<td>£178,529.36</td>
</tr>
<tr>
<td>National Grid</td>
<td>£73,759.00</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>£362,628.48</strong></td>
</tr>
</tbody>
</table>

Two statutory undertakers responded to the revised scheme with the same proposal and would not revise the previous estimate until a detailed estimate (C4) was requested, currently programmed for January 2019.

6. Revised cost estimate

To provide confidence that Option 2 was going to generate savings, AECOM worked alongside Highways England Cost Estimators to finalise the revised cost. The method chosen for this cost estimation exercise was an “ad-hoc” cost estimate. Elements that fed into the revised estimate included but were not limited to:

- Revised quantities from Civil 3D model
- Updated project Risk Register
- Updated land costs
- Updated Statutory Undertakers Estimate
- Updated project programme including the construction phase

A summary of the revised cost estimate is included in Table 3 below.

<table>
<thead>
<tr>
<th></th>
<th>Option 1 (Million)</th>
<th>Option 2 (Million)</th>
<th>Difference (Million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Historical Costs</td>
<td>£1.4</td>
<td>£3.2</td>
<td>£1.8</td>
</tr>
<tr>
<td>Pre-Construction Design and Preparation</td>
<td>£4.2</td>
<td>£3.7</td>
<td>-£0.5</td>
</tr>
<tr>
<td>Lands</td>
<td>£4.2</td>
<td>£2.5</td>
<td>-£1.7</td>
</tr>
<tr>
<td>Cost of Construction</td>
<td>£29.7</td>
<td>£33.7</td>
<td>£4.0</td>
</tr>
<tr>
<td>Other Costs (RA, SU, NR, VAT, Supervision)</td>
<td>£5.0</td>
<td>£4.3</td>
<td>-£0.7</td>
</tr>
<tr>
<td>Project Risk and Uncertainty Allowance</td>
<td>£5.6</td>
<td>£5.9</td>
<td>£0.3</td>
</tr>
<tr>
<td>Inflation</td>
<td>£14.0</td>
<td>£9.6</td>
<td>-£4.4</td>
</tr>
<tr>
<td>Portfolio Risk</td>
<td>£3.8</td>
<td>£3.6</td>
<td>-£0.2</td>
</tr>
<tr>
<td><strong>Total Out-Turn Cost</strong></td>
<td><strong>£67.9</strong></td>
<td><strong>£66.5</strong></td>
<td><strong>-£1.4</strong></td>
</tr>
</tbody>
</table>
A comparison of the cost estimate between the Option 1 and Option 2 has been used as a simple means to assess whether one option is more financially viable than another. However, the cost estimate for Option 1 from Stage 2 used different assumptions to the current cost estimate such as the construction programme start date and the construction programme duration. The construction duration for Option 1 was previously estimated to be 392 days but the revised programme duration for this option shows an increase to 538 days. It is conceivable that the previous estimate of £67.8M would have increased if the Proposals were not pursued.

7. Recommendation and Next steps

The following benefits of the Option 2 over Option 1 have been identified:

- Reduced utility diversions
- Less disruption during construction and reduced construction duration
- Fewer Departures from Standards
- Safer and more open NMU crossing
- Minor reduction in environmental impacts
- Reduced landtake and likelihood of triggering DCO
- Reduced costs of £1.4 Million

Based on these benefits outlined above it is recommended that Option 2 is adopted by Highways England for design development through the remainder of Stage 3 and beyond. Confirmation of the decision by Highways England is required.

If the Proposal is taken forward as the scheme proposal, there will be some extra activities required, such as:

- Environmental Public Consultation, including a Public Information Exhibition, and potentially a fly-through model. Feedback from the public will also need analysis against the design;
- Update the Environmental scoping report: this document was submitted in August against the existing proposal;
- Non-Motorised Users Assessment will need to be carried out again, as a result of amended NMU routes;
- GPR survey to be undertaken to determine service locations and to finalise pier locations
- Further liaison with statutory undertakers to formalise diversions, C4 requests and meetings
Appendix A – Buildability Information
Appendix 1 C.04: OPTIONS COMPARISON AND RECOMMENDATION (HE DIVISIONAL DIRECTOR'S) TECHNICAL NOTE (2016)
1 Summary

1.1 This technical note summarises the assessment of four options identified by the Highways England Divisional Director in conjunction with the Project Team. These options were identified due to the current budget being insufficient to deliver the scheme requirements as defined in the Roads Investment Strategy (RIS) (period 1).

1.2 The RIS scheme description is 'grade separation of the Binley and Walsgrave roundabouts on the A46 near Coventry, upgrading the trunk road sections of the A45 and A46 between the M6 and M40 to full Expressway standard'.

1.3 The RIS budget is currently £52.5M.

1.4 The four options are:
   - Option 1: Two grade separated junctions at Binley and Walsgrave with a 70mph speed limit;
   - Option 2: One grade separated junction at Binley with a 70mph speed limit;
   - Option 3: One grade separated junction at Binley with a 50mph speed limit; and
   - Option 4: Two grade separated junctions at Binley and Walsgrave with a 50mph speed limit.

1.5 Engagement with Operations Directorate has identified that both junctions should be improved, with grade separation of Binley being the priority. Due to the uncertainty surrounding any development at Walsgrave, grade separation of Walsgrave may not be viable. Any improvement to Binley should take into account the operational performance of Walsgrave once Tollbar and Binley are open to traffic.

1.6 Initial operational assessments of Walsgrave, based on Tollbar being open to traffic and with no improvement at Binley, reveal severe congestion would be expected in 2021 (Binley open to traffic), with excessive queues on the A46. With grade separation of Binley initial demand forecasting indicates a further increase in traffic flows through Walsgrave roundabout, causing the junction operation to worsen.

1.7 The conclusion of the assessment summarised in this technical note is that whilst it provides low compliance with the current RIS 1 announcement, Option 3 should be progressed during RIS 1, as this option provides:
   - The most viable option to be delivered within the available budget;
• Likely to return a BCR in the ‘high’ value for money (VfM) category;
• A start of works that is viable within RIS 1, based on the Highways Act statutory process;
• Likely to provide benefits to safety and environment due to reduced speed limit when compared to other options; and
• Provides road user continuity with the 50mph speed limit being introduced as part of the A45/A46 Tollbar End improvement.

1.8 Of the top five project risks identified, three are relevant for Option 3, namely:
• RIS scheme description is not deliverable within the available budget;
• Impact of Tollbar post open to traffic on traffic modelling and design year flows; and
• Delivery of Binley only solution results in increase in congestion and/or accidents at Walsgrave, resulting in intervention being required as part of the scheme.

1.9 Of the top five opportunities, one is relevant for Option 3, namely:
• Challenge solution for Binley, including a review of large direct works costs to identify potential savings.

1.10 Recommendations
• Pursue a Department for Transport (DiT) change control to amend the RIS description to ‘grade separation of the Binley roundabout on the A46 near Coventry’, removing reference to grade separation of Walsgrave and expressways between M40 and M6;
• Seek additional funding of £12.2M, to increase the most likely scheme budget from £52.5M to £64.7M;
• Progress option selection for a Binley only at 50mph solution in parallel with the DiT change control to protect RIS 1 delivery programme;
• Identify requirements for any interim Walsgrave intervention;
• Hold public information exhibition following DiT change control announcement;
• Recommend inclusion of Walsgrave grade separated junction within RIS 2; and
• Recommend inclusion of expressway on A45/A46 between M40 and M6 within RIS 2.

2 Introduction

The announced Roads Investment Strategy (RIS) 1 scheme description for A46 Coventry junction upgrades is ‘grade separation of the Binley and Walsgrave roundabouts on the A46 near Coventry, upgrading the trunk road sections of the A45 and A46 between the M6 and M40 to full Expressway standard.’

During project control framework (PCF) stage 1 the options estimate produced by the project team and Highways England Commercial totalled £138.5M. This estimate was to deliver two grade separated junctions, at Binley and Walsgrave, with a mainline alignment at Walsgrave limited to 50mph to retain Hungerley Hall. This estimate significantly exceeds the available RIS budget of £52.5M. Neither the cost estimate nor budget include for provision of upgrading the A45 and A46 between M6 and M40 to full expressway standard, as per the RIS description.

To address the delivery cost issue, in May 2016 the Highways England Divisional Director in conjunction with the Project Team identified four options to be reviewed in relation to the RIS period 1 announced scheme. The aim being to seek additional funding and/or amend the RIS
scheme description through a change control process with the Department for Transport (DfT). The four options that were identified are summarised in Table 1.

<table>
<thead>
<tr>
<th>Option Reference</th>
<th>Option Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option 1</td>
<td>Two grade separated junctions at Binley and Walsgrave with a 70mph speed limit</td>
</tr>
<tr>
<td>Option 2</td>
<td>One grade separated junction at Binley with a 70mph speed limit</td>
</tr>
<tr>
<td>Option 3</td>
<td>One grade separated junction at Binley with a 50mph speed limit</td>
</tr>
<tr>
<td>Option 4</td>
<td>Two grade separated junctions at Binley and Walsgrave with a 50mph speed limit</td>
</tr>
</tbody>
</table>

Table 1: Options for assessment

This technical note reviews the assumptions made in the strategic outline business case (SOBC) and the status of scheme delivery commitments that have been made. A recommendation of which one of the four options should be pursued into option selection and preliminary design has been made based on the assessment against the following:

- RIS compliance;
- Buildability;
- Programme and statutory process;
- Estimated capital cost;
- Anticipated benefits and disbenefits;
- Environment;
- Safety, operations and maintenance; and
- Risks and opportunities.

A summary of this assessment is included in Appendix A.

3 Strategic Outline Business Case (SOBC)

The SOBC was produced in July 2014 prior to the commencement of PCF Stage 0. The SOBC scheme description is ‘Grade separation of the Binley/TGI junction in its current location, grade separation and relocation of the Walsgrave junction.’ Key SOBC assumptions and conclusions are summarised in Table 2. The discrepancy between the RIS budget of £52.5M and SOBC estimated scheme cost of £55M is not supported by any available information.

<table>
<thead>
<tr>
<th>SOBC conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lead in time</td>
</tr>
<tr>
<td>Start of works</td>
</tr>
<tr>
<td>Construction duration</td>
</tr>
<tr>
<td>Estimated cost</td>
</tr>
<tr>
<td>Value for money</td>
</tr>
<tr>
<td>Statutory Process</td>
</tr>
<tr>
<td>Funding</td>
</tr>
<tr>
<td>Assumptions</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

Table 2: SOBC conclusions
4 Highways England Commitments

The delivery commitments that have been made in the RIS, Delivery Plan and Management Plan are summarised in Table 3, along with their status.

<table>
<thead>
<tr>
<th>Commitment</th>
<th>Source</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>RIS description and budget (as per section 2).</td>
<td>Roads Investment Strategy</td>
<td>Not met – DfT change control required</td>
</tr>
<tr>
<td>Q1 2014 Initiate procurement for design consultants, needed to work up and assess a range of options. This stage will typically take six to nine months to complete, following which we will be in a position to start engaging stakeholders in the development and assessment of the options.</td>
<td>Delivery Plan</td>
<td>Met</td>
</tr>
<tr>
<td>Produce tender documents for contractor procurement, Stage 3 (March 2017).</td>
<td>2016/17 Management Plan</td>
<td>Ongoing: procurement strategy being produced during PCF stage 3</td>
</tr>
</tbody>
</table>

Table 3: Delivery commitments

5 RIS Compliance

Table 4 summarises the RIS compliance of each option. All options provide **partial compliance with the RIS announcement** through the provision of grade separation of at least one junction. None of the options incorporate the A45 and A46 between M6 and M40 being upgraded to comply with Expressway requirements. However, the proposed grade separated junction designs future proof the cross section to facilitate the incorporation of a variable message sign located downstream of the back of each diverge nose. Options 3 and 4 are both based on a 50mph speed limit being introduced, which does not meet the Expressway core requirement of national speed limit. **However, it should be noted that the adjacent improvement on the A45 between Stivichall and Tollbar that is currently under construction implements a permanent 50mph speed limit once open to traffic.**

<table>
<thead>
<tr>
<th>RIS Compliance</th>
<th>Grade separated at Binley and Walsgrave</th>
<th>National speed limit (Expressway core requirement)</th>
<th>Expressway between M40 and M6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option 1: Two grade separated junctions at Binley and Walsgrave to 70mph</td>
<td>Partial: Highest compliance</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>RIS Compliance</td>
<td>Grade separated at Binley and Walsgrave</td>
<td>National speed limit (Expressway core requirement)</td>
<td>Expressway between M40 and M6</td>
</tr>
<tr>
<td>----------------</td>
<td>------------------------------------------</td>
<td>---------------------------------------------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td>Option 2: One grade separated junction at Binley to 70mph</td>
<td>Partial</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Option 3: One grade separated junction at Binley to 50mph</td>
<td>Partial: Lowest compliance</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Option 4: Two grade separated junctions at Binley and Walsgrave to 50mph</td>
<td>Partial</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

Table 4: RIS compliance

6 Buildability

Early buildability input has been gained from Vinci, summarised for each junction option below. Whilst the nature of both sites is constrained, the impact on the constraints is most evident dependant on the mainline alignment design geometry and speed limit at Walsgrave.

6.1 Binley

The site presents a constrained location to accommodate a grade separated junction. The site contains industrial/commercial properties to the west, with the land to the east being less developed, but includes ancient woodland at Binley Common. The site contains a high level of statutory undertakers’ plant that will be effected, including overhead power cables crossing the A46 and A428. Diversion routes may be onerous and costly.

A Binley A46 mainline alignment that follows the existing creates a pinch point to accommodate the scheme cross section between the Cocked Hat pub in the south west quadrant and the ancient woodland to the south east quadrant. The alignment is more appropriate to the geometry and visibility parameters when a 50mph speed limit is in place, but as a result of the constrained site the same alignment has been utilised for the 70mph speed limit option as well.

Elevating either the A428 or the A46 within the constrained site requires significant lengths of retaining walls, and results in the proposed roundabout bridges overlaying the existing junction footprint.

The constrained nature of the site is likely to result in a significant level of temporary works and traffic management phases to facilitate construction. The existing pedestrian facility that crosses to the southern side of the roundabout is anticipated to require closure during the works with a replacement facility provided. Accesses to the businesses to the west and residential properties to the east will be impacted during construction. Further work is required on construction phasing and traffic management as diversion routes are either long and/or through residential areas.
6.2 Walsgrave

Whilst rural in nature, Walsgrave is a constrained site with a site of special scientific interest (SSSI), grade II listed building Hungerley Hall, flood plain, overhead power cables and existing structures all influencing the design.

Option 4 includes a Walsgrave mainline alignment designed with a 50mph speed limit in place that deviates from the existing alignment over a short length and retains Hungerley Hall. The 70mph Walsgrave alignment that is included in Option 1 however passes through Hungerley Hall and generates a larger amount of off line dual carriageway construction.

Both Options 1 and 4 result in the new Walsgrave junction being located approximately 1km north of the existing junction, requiring the B4082 being stopped up and necessitating the provision of a new link road through to the local authority network. The provision of the link road is not currently within the scheme scope and is to be provided by others. Both Options 1 and 4 offer opportunities for offline construction, but the new link road must be open to traffic prior to the B4082 being stopped up, providing a programme constraint.

7 Programme and Statutory Process

Table 5 shows the current planned statutory process route, start of works and open to traffic dates for each option. All options are scheduled to achieve the committed RIS start of works date of March 2020. In the case of Options 1 and 4 this is based on Binley being delivered first under Highways Act, with Walsgrave following later under a Development Consent Order.

During the development and construction timeframes of the A46 Coventry junctions scheme significant other works that are ongoing in the vicinity are:

- **A45/A46 Tollbar End Improvement** – **Open to traffic January 2017**. Design influenced by available traffic data once Tollbar is operational. No direct impact on construction.
- **M6 J2-4 Smart Motorway** – **Start of Works Summer 2017, open to traffic winter 2018**. Design influenced by available traffic data once operational. No direct impact on construction.
- **HS2 Phase 1** (including Birmingham Interchange Train station located near M6 J4) – **Phase 1 construction duration 2017 to 2026**. No direct impact on design. Construction indirectly impacted by proximity of works.
- **M42 Junction 6** – **Start of works March 2020, open to traffic March 2023**. No direct impact on design. Construction impacted by overlapping construction durations of two key north-south routes within the Midlands.

<table>
<thead>
<tr>
<th>Option Reference</th>
<th>Statutory Process</th>
<th>Start of Works</th>
<th>Open to Traffic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option 1: Two grade separated junctions at Binley and Walsgrave to 70mph</td>
<td>Highways Act and Development Consent Order</td>
<td>October 2019 (Binley) October 2021 (Walsgrave)</td>
<td>October 2021 (Binley) October 2023 (Walsgrave)</td>
</tr>
<tr>
<td>Option 2: One grade separated junction at Binley to 70mph</td>
<td>Highways Act</td>
<td>October 2019 (Binley)</td>
<td>October 2021 (Binley)</td>
</tr>
<tr>
<td>Option 3: One grade separated junction at Binley to 50mph</td>
<td>Highways Act</td>
<td>October 2019 (Binley)</td>
<td>October 2021 (Binley)</td>
</tr>
</tbody>
</table>
Option Reference | Statutory Process | Start of Works | Open to Traffic
--- | --- | --- | ---
Option 4: Two grade separated junctions at Binley and Walsgrave to 50mph | Highways Act and Development Consent Order | October 2019 (Binley) October 2021 (Walsgrave) | October 2021 (Binley) October 2023 (Walsgrave)

Table 5: Statutory process and construction dates

8 Estimated Capital Cost

Mouchel has produced high level estimates for the four options utilising quantities for key items including road restraint, drainage, earthworks, pavement, traffic signals, variable message signs, street lighting, retaining walls, gantries and bridges. The estimated direct works cost have then been factored to account for anticipated accommodation works, statutory undertakers, landscaping, contingency and preliminaries. Staff costs, land costs, risk, inflation and non-recoverable VAT (for assumed value of work outside of land boundary) have then been added. The estimates do not allow for Highways England or other internal third party project costs e.g. legal costs. The PCF stage 1 options estimate costs are included in Table 6, the four cost estimates are summarised in Table 7 and included in Appendix B. All options exceed the available RIS budget of £52.5M, with Binley only at 50mph being the closest at approximately £12.2M above budget at £64.7M.

<table>
<thead>
<tr>
<th>Option</th>
<th>Highways England Estimated Most Likely Cost</th>
<th>Mouchel Estimated Most Likely Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Binley only</td>
<td>£61.54M</td>
<td>£146.29M</td>
</tr>
<tr>
<td>Binley and Walsgrave (Walsgrave as per 50mph mainline alignment, not impacting grade II listed building)</td>
<td>£138.52M (£61.54M+ £76.98M)</td>
<td>£71.06M</td>
</tr>
</tbody>
</table>

Table 6: PCF stage 1 options estimate

<table>
<thead>
<tr>
<th>Option Reference</th>
<th>Mouchel Estimated Most Likely Cost</th>
<th>Commentary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option 1: Two grade separated junctions at Binley and Walsgrave to 70mph</td>
<td>£146.29M</td>
<td>Exceeds PCF Stage 1 estimate by approximately £8M. Includes additional direct costs as a result of 70mph mainline alignment through Hungerley Hall. Note option 2 Binley comments as well.</td>
</tr>
<tr>
<td>Option 2: One grade separated junction at Binley to 70mph</td>
<td>£71.06M</td>
<td>Exceeds PCF Stage 1 estimate by approximately £10M. Includes additional direct costs associated with longer slip roads with wider verges to improve visibility where practicable than the Binley 50mph design.</td>
</tr>
<tr>
<td>Option 3: One grade separated junction at Binley to 50mph</td>
<td>£64.70M</td>
<td>Exceeds PCF Stage 1 estimate by approximately £3M. Includes additional direct costs, including increased provision for statutory undertakers’ diversion works, including an allowance for diversion of an overhead power cable.</td>
</tr>
</tbody>
</table>
### Anticipated Benefit and Disbenefits

At the time of writing, PCF Stage 1 modelling and appraisal tasks have not yet been finalised and signed off by Highways England TAME. However, broad conclusions may be drawn around the likely value for money (VfM) range of Options 1-4 by comparison with emerging high level results of the ongoing Stage 1 work.

The current Stage 1 modelling and appraisal work includes Option 2 (Binley only at 70mph) and also includes a scenario very similar to Option 1 (Binley and Walsgrave at 70mph) – the only difference being that under the Stage 1 work there remains a short section of the A46 which will operate at 50mph in the vicinity of Hungerley Hall. However, the likely impact of the short section of the A46 being subject to a 50mph rather than a 70mph limit is anticipated to be marginal and it is therefore considered that the emerging results from the Stage 1 work represent a reasonable approximation of the likely benefits, and hence VfM category, for Options 1 and 2.

High level results from Stage 1 work indicates that the benefit cost ratio (BCR) for Option 2 would fall within the "high" VfM category and most likely within the top half of this category with an anticipated BCR of 3-4.

For Option 1, the expected VfM is also anticipated to fall within the "high" category but will be lower than that for Option 2, as the relative BCR for the Walsgrave element is lower than that for Binley.

Regarding Options 3 and 4, it is anticipated that the level of user benefits would be reduced as a consequence of the lower speed limit of 50mph on the A46 mainline. They would therefore be lower than each corresponding 70mph option. It is further anticipated that the proportionate reduction in benefits for each option would be greater than the proportionate reduction in cost, and that therefore the BCRs for Options 3 and 4 would be lower than those for the equivalent Options 1 and 2, albeit that these would remain within the "high" VfM range with an anticipated BCR of between 2 and 4.

In summary, it is anticipated that all four options would fall within the "high" VfM category (BCR of 2-4). Overall, the options involving the upgrade of the Binley junction only are likely to produce higher BCR values than those for the combined Binley and Walsgrave options.

Highways England Operations Directorate (OD) have recently engaged with stakeholders regarding the status of the development site east of the proposed relocated Walsgrave junction. This site falls within the jurisdiction of Rugby Borough Council (RBC) and recent interest had been shown by a private developer (Roxhill) to bring forward a scheme at this location.

#### Option cost estimates

<table>
<thead>
<tr>
<th>Option Reference</th>
<th>Mouchel Estimated Most Likely Cost</th>
<th>Commentary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option 4: Two grade separated junctions at Binley and Walsgrave to 50mph</td>
<td>£118.67M</td>
<td>Lower than PCF Stage 1 estimate by approximately £20M as a result of lower direct costs estimated at Walsgrave, including reduction in retaining wall requirements. Note Option 3 Binley comments as well.</td>
</tr>
</tbody>
</table>

Table 7: Option cost estimates
It is understood that RBC do not propose to allocate the site to the east of the A46 within this Local Plan (2011 to 2031). The key reasons for this are:

- There are more desirable sites outside of the Green Belt;
- Roxhill’s employment aspirations does not sit with RBC’s aspirations to align employment and housing closer within the Borough; and
- Landscape and visual impacts of development on Coombe Abbey (a key concern for English Heritage).

It is anticipated that in order to bring forward a combined scheme, agreement would need to be reached with potential developers to part fund the construction of the new junction and link road to tie the relocated Walsgrave junction back into the local road network. This is contrary to the assumption made in the SOBC of 100% funding by Highways England.

The uncertainty around the development of the land at Walsgrave and the risk this presents to the project do not affect the two Binley only solutions, Option 2 and 3.

### 10 Environment

This environment summary has been produced with reference to both Web Based Transport Analysis Guidance (WebTAG) and Design Manual Roads and Bridges Vol. 11 Guidance relating to the options identified in Table 1.

The impacts identified below have been informed by the submitted WebTAG Worksheets / Appraisal Summary Tables (AST), the Environmental Study Report (ESR) (Report No. HE551486-MOU-00-XX-PC-EN-0002), the Environmental / Ecological Constraints Plans (Drawing Number: HE551486-MOU-EGN-A46-DR-EN-0004, 5, 6, 7) and the AST in Section 10.3 of the Technical Appraisal Report.

#### 10.1 Binley

Both the 70mph and 50mph alignment works that is in all options at Binley will have large adverse impacts on visual receptors and will require detailed mitigation plans to reduce these impacts to acceptable levels.

The 70mph option is likely to result in increases in noise levels of a higher magnitude, in comparison to the 50mph option, for sensitive receptors in close proximity to Rugby Road, Oakdale Road, Ellis Park Drive and Brinklow Road. However, without noise assessment based on the traffic model it is not possible to determine whether these impacts or differences would be significant.

In relation to Nature Conservation both options would result in direct impacts to a small section of scrub land which forms part of Binley Common Ancient Woodland Ecosite. The removal of this section of land, to allow access to the commercial property to south east of the junction, is not likely to significantly impact the integrity of the site. The ecosite has been identified as potential habitat for both great crested newt (and other amphibians) and bat species. Therefore, appropriate measures, specifically during construction, would be required to protect this area to avoid impacts to the aforementioned species.

Works at Binley would result in slight to moderate adverse physical and setting impacts to at least seven Cultural Heritage Assets.
All Binley options avoid the flood zones associated with the River Sowe and tributaries. There will be similar challenges for each option, locating outfalls for the upgraded drainage and the avoidance increased run off into surrounding water courses / bodies such as Coombe Pool and the River Sowe.

All Binley options are likely to result in adverse air quality impacts at properties along Ellis Park, Donny Brook Drive and Kings Park Drive. However, it is not anticipated that this would result in new exceedances as background levels of pollutants, close to these locations, are relatively low. Similarly, as the options are located on the edge of the Coventry City air quality management area (AQMA), it is unlikely that either option would result in a worsening in air quality. However, a detailed air quality assessment would be required in order to determine the magnitude of impacts to air quality, as a result of each options.

Finally, all Binley options are likely to result in similar impacts to Geology and Soils, All Travellers and People and Communities.

10.2 Walsgrave

There are significant differences between the 50mph and 70mph Walsgrave Junction works as set out in Options 1 and 4. The demolition of Hungerley Hall Farm and out buildings, as a result of the Option 1 at 70mph, would be considered a likely significant environmental effect. The statutory process (obtaining Listed Building Consent) and developing appropriate mitigation measures would require a minimum 13 week decision period for obtaining planning permissions from the local planning authority, Coventry City Council. This additional consideration could have adverse impacts on the present construction programme. In comparison the Option 4 50mph would avoid any requirements for an additional decision making period. In comparison Option 4 50mph would avoid any requirements for an additional decision making period, in relation to Cultural Heritage, and would not impact the construction programme. In addition both options would result in similar adverse impacts to several designated heritage assets.

In relation to Nature Conservation both options avoid direct impacts to Coombe Pool SSSI. Both options may result in increased disturbance to bird assemblages at the SSSI due to the increase in traffic speeds. The potential for disturbance increases the closer the road is to the SSSI however it is not thought that this is a significant difference. In addition, Option 1, 70mph at Walsgrave, results in land take and severance of the Hungerley Hall Ecosite – a locally designated wildlife site. The 50mph option avoids this site.

The Option 1 70mph at Walsgrave is likely to result in increases in noise levels of a higher magnitude, in comparison to Option 4 at 50mph, for sensitive receptors in proximity to Valencia Road, Gainford Road and Royston Close. Without a detailed traffic model and noise assessment it is not possible to determine whether the difference in these impacts would be significant. However, it is anticipated for both the 50mph and 70mph options, should a significant impact be derived from the noise modelling assessment, these impacts could be mitigated through the implementation of low noise surfacing and noise barriers, or a combination of both methods.

In relation to Landscape and Visual Effects both Options 1 and 4 are likely to result in local adverse impacts to Landscape Character and Visual receptors.

Both of the Walsgrave options avoid the flood zones associated with the River Sowe and tributaries. However, there will be similar challenges associated with locating outfalls for the
upgraded drainage and the avoidance of increased run off into surrounding water courses / bodies; Coombe Pool and the River Sowe.

Option 1 and 4 will result in changes in Air Quality. However, these changes are unlikely to result in new exceedances at relevant sensitive receptors or within the Coventry City AQMA. However, without detailed air quality dispersion modelling the magnitude of difference in impacts between a 50mph option and 70mph option is not possible to predict as traffic routing, speeds and flows will be different for each.

Finally, both of the Walsgrave options are likely to have similar impacts on Geology and Soils, All Travellers and People and Communities.

11 Operations, safety and maintenance

11.1 Operations

The South Midlands Route Strategy Evidence Report (Highways England, April 2014) has identified that the A46 Coventry Bypass corridor suffers from poor journey time, with peak hour speed in the range of 20 mph to 30 mph. However, construction works at Tollbar End which commenced in January 2014 has distorted the current traffic conditions. Traffic data from Traffic Flow Data System (TRADS) indicates that peak hour flows have reduced by 5% - 20% during the construction works.

The key junctions A46/A428 (Binley) and A46/B4082 (Walsgrave) are operating close to capacity during weekday peak period conditions with traffic tailbacks particularly on A428 west of the A46. To a lesser extent than at Binley junction, a rolling queue of vehicles on the B4082 westbound in the AM peak, tails back towards the westbound exit from the existing Walsgrave roundabout.

Engagement with OD has been ongoing since early 2015 by the project team over the transport problem, proposed solutions and issues being faced regarding the available budget and uncertainty around development plans at Walsgrave. Whilst Binley is identified as the priority junction, OD are clear that both junctions should be improved, with a grade separated junction at Walsgrave in addition to Binley their preference. However, there is acceptance that due to the uncertainty surrounding any development at Walsgrave, grade separation may not be viable, but the operational performance at Walsgrave should be considered once based on Tollbar and Binley being open to traffic. Currently the proposed Binley only solutions (Options 2 and 3) do not include interventions at Walsgrave, this is a top five project risk.

The traffic demand forecasts of A45/A46 Tollbar End Improvement (Hyder, July 2012) show that the capacity improvement at Tollbar would lead to a 6% increase in Annual Average Daily Traffic (AADT) through the Tollbar End and Binley junctions in its opening year of 2016. Initial operational assessment reveals that severe congestion congestion would be expected at Walsgrave in 2021 (Binley open to traffic), with excessive queues on the A46 arms.

Initial demand forecasting work for A46 Coventry Junctions Upgrade indicate that a further increase is anticipated when the Binley roundabout is grade-separated. These would lead to a further increase in traffic flows through Walsgrave roundabout causing the forecast junction operation to worsen when Binley (only Options 2 and 3), opens with its improvements in 2021.
11.2 Safety

There is not a significant accident problem on the A46 in the study area, as confirmed by the recorded link and junction accident rate being below that which could be expected for the road standard and level of traffic flow. Over a 5 year period (2008 to 2012) 15 accidents (all slight) occurred within a 300m radius of Binley and 8 accidents (1 serious and 7 slight) occurred within 300m of Walsgrave.

The design speed for the road based on TD22 figure 1, subject to confirmation with Professional and Technical Solutions (PTS) is 120kph. The proposed Binley alignment is constrained by the surroundings resulting in a mainline alignment suitable for 85kph geometry and visibility. The Binley 50mph design (Options 3 and 4), whilst below desirable minimum standards for the design speed (120kph), has the risk partially mitigated through the reduced speed limit. This mitigation would not be afforded to the Binley 70mph designs, Options 1 and 2. As a result of the increased speed limit and comparative reduction in visibility the 70mph solution is less safe than the 50mph solution. Both designs options have been discussed with a geometric representative of PTS, and whilst there is further work and engagement to progress they were not concerned with the departures proposed against the Binley 50mph solution. Both the Mouchel highways team and PTS have concerns with the departures proposed against the 70mph option. Further evidence, options, mitigation and engagement to remove or reduce the departures will need to be progressed during preliminary design.

Once completed, the A46 from Stivichall to north of Tollbar will operate to a 50mph speed limit, providing continuity for the Binley 50mph solution, Options 3 and 4. All Binley solutions result in the south facing slip roads being in close proximity to the existing left in/left out access for a petrol station and businesses to the south, creating a potential weaving issue. This will be subject to further work during preliminary design.

The 50mph (Option 4) and 70mph (Option 1) solutions at Walsgrave both provide a good level of design standard on the mainline and slip roads. Locating the new junction to the north of the existing does introduce a substandard weaving length, which at this stage has been partially mitigated through the inclusion of lane gain/lane drop between the M6 J2 and the new junction. Both options have been discussed with a geometric representative of PTS, and whilst there is further work and engagement to progress they were not concerned with the departures proposed against either Walsgrave option. However, further evidence, options, mitigation and engagement to remove or reduce the departure will need to be progressed.

11.3 Maintenance

All scheme option cost estimates include rigid concrete barrier (RCB) and hard central reserve. Whilst not mandated on the all-purpose network this provides benefits to the maintainer and is consistent with the approach adopted at Tollbar. The inclusion of RCB in the central reserve is a core requirement of the emerging Expressway interim advice note. During preliminary design the inclusion of RCB and a hard central reserve will be assessed.
12 Key Risks and Opportunities

Top five risks and opportunities are identified in Tables 8 and 9 respectively, referencing which option(s) they relate to.

<table>
<thead>
<tr>
<th>Description</th>
<th>Option Impacted</th>
<th>Pre mitigation risk rating</th>
<th>Mitigation comments</th>
<th>Post mitigation risk rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>RIS scheme description is not deliverable within the available budget</td>
<td>All</td>
<td>Critical</td>
<td>• Assess four Divisional Director options</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Submit IDC note</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Submit IDC decision request</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Submit DfT change control</td>
<td></td>
</tr>
<tr>
<td>Impact of Tollbar post open to traffic, on traffic modelling and design year flows</td>
<td>All</td>
<td>Critical</td>
<td>• TAME engagement and agreement to assessment methodology during Tollbar construction</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Traffic data collection post opening</td>
<td></td>
</tr>
<tr>
<td>The provision of Walsgrave grade separated junction is aligned with development opportunities that may not materialise</td>
<td>1 and 4</td>
<td>High</td>
<td>• Delay delivery of Walsgrave solution to RIS 2</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Construct grade separated junction at existing Walsgrave junction location (only feasible for variant of Option 1)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Seek additional funding and incorporate link road into design</td>
<td></td>
</tr>
<tr>
<td>Delivery of Binley only solution results in increase in congestion and/or accidents issue at Walsgrave resulting in intervention as part of the scheme</td>
<td>2 and 3</td>
<td>High</td>
<td>• Operational assessment of existing Walsgrave layout</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Identify requirements for any interim measures</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Stakeholder liaison</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Early engagement, identify RIS 2 opportunity</td>
<td></td>
</tr>
<tr>
<td>Extended development phase due to impact of demolishing grade II listed building at Walsgrave to accommodate a mainline speed limit of 70mph</td>
<td>1</td>
<td>High</td>
<td>• Identify preferred solution</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Undertake environmental assessment</td>
<td></td>
</tr>
</tbody>
</table>

Table 8: Top five risks
<table>
<thead>
<tr>
<th>Description</th>
<th>Option Impacted</th>
<th>Opportunity rating</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Challenge solution for Binley, including a review of large direct works costs to identify potential savings</td>
<td>All</td>
<td>High</td>
<td>Taking A46 over the A428 with extended slip roads reduces retaining wall requirements, but may have increased impact on services and business access to the south.</td>
</tr>
<tr>
<td>Reduced construction duration by overlapping delivery timescales of Binley and Walsgrave construction</td>
<td>1 and 4</td>
<td>Medium</td>
<td>Offline elements offer opportunity for parallel construction activities. Greater opportunity for Walsgrave 70mph design.</td>
</tr>
<tr>
<td>Delivering 50mph solution at Binley and 70mph solution at Walsgrave</td>
<td>1 and 4</td>
<td>Medium</td>
<td>Funding for Walsgrave 70mph solution needs to be secured and additional environmental impacts assessed. Funding and delivery of Walsgrave grade separation within RIS 2 to be established. No developer options available at present during RIS 1. Larger plot of land to the east of Walsgrave not in RBC local plan.</td>
</tr>
<tr>
<td>Locating Walsgrave grade separated junction closer to existing junction increasing weaving length between M6 J2/M69 and utilising existing B4082 link road</td>
<td>1</td>
<td>Low</td>
<td>Funding for Walsgrave 70mph solution needs to be secured, additional environmental impacts assessed and links with development aspirations explored further.</td>
</tr>
<tr>
<td>Convert A45/A46 between M40 and M6 to expressway standard.</td>
<td>All</td>
<td>Low</td>
<td>Potentially linked with grade separation of Walsgrave presenting RIS 2 opportunity.</td>
</tr>
</tbody>
</table>

Table 9: Key Opportunities
13 Conclusion / recommendations

13.1 Conclusion

A summary of the assessment of each of the four options is included in Appendix A. The following is concluded:

- SOBC conclusions, except estimated cost of £55M and potential 100% Highways England funding source remain valid;
- The announced RIS scheme description cannot be met for the current budget;
- Management plan consultation commitments cannot be met until the above RIS description and budget is resolved and re-announced through a DfT change control;
- All options offer partial RIS compliance, with option 1 (Binley and Walsgrave to 70mph) providing the closest scheme description to that announced in the RIS;
- Both Binley and Walsgrave present constrained sites to construct the options, at Binley this could result in complex temporary works and traffic management phases;
- All options are identified for a start of works in RIS 1, with Binley progressing under Highways Act and Walsgrave under a Development Consent Order;
- High Speed 2 (including Birmingham interchange train station at M6 J4) and M42 J6 are both under construction during the proposed construction timeframe of the A46;
- All options exceed the RIS budget, with Option 3 (Binley to 50mph) providing the closest scheme cost estimate to the RIS budget (£64.7M to £52.5M);
- All options are anticipated to return a BCR in the ‘High’ VfM category (2-4), with the Binley only solutions returning a higher BCR than combined Binley and Walsgrave solutions and 70mph solutions returning a higher BCR than the 50mph solutions;
- The business case for grade separating Walsgrave during RIS 1 is linked to developer funding being sought. The development of the land to the east of the new Walsgrave junction is not supported by Rugby Borough Council;
- Engagement with Operations Directorate has identified that both junctions should be improved, with grade separation of Binley being the priority. Due to the uncertainty surrounding any development at Walsgrave, grade separation of Walsgrave may not be viable. Any improvement to Binley should take into account the operational performance of Walsgrave once Tollbar and Binley are open to traffic;
- Initial operational assessments of Walsgrave, based on Tollbar being open to traffic and with no improvement at Binley, reveal severe congestion would be expected in 2021 (Binley open to traffic), with excessive queues on the A46. With grade separation of Binley initial demand forecasting indicates a further increase in traffic flows through Walsgrave roundabout, causing the junction operation to worsen;
- Given that the Walsgrave Junction (70mph option) would result in the demolition of Hungerley Hall Farm and out buildings and the likely significant visual effects relating to the Binley Junction, Option 1 (Binley and Walsgrave to 70mph) would be the least favourable option in relation to the potential for environmental impacts;
- Option 3 would be the most favourable option in relation to the potential for environmental impacts; however, Option 3 does have the potential to result in impacts to Visual Receptors and Cultural Heritage Assets that would potentially require significant mitigation;
- Binley only 70mph solution, Option 2 presents a potential safety issues resulting from constrained geometry and visibility that concern the highways project team and PTS;
These risks are partially mitigated on the 50mph options due to the lower speed limit; and
- RCB and a hard central reserve have been priced through both junctions for all options.

The conclusion of the assessment summarised in this technical note is that whilst it provides low compliance with the current RIS 1 announcement, Option 3 should be progressed during RIS 1, as this option provides:
- The most viable option to be delivered within the available budget;
- Likely to return a BCR in the ‘high’ VfM category;
- A start of works that is viable within RIS 1, based on the Highways Act statutory process; and
- Likely to provide benefits to safety and environment due to reduced speed limit when compared to other options; and
- Provides road user continuity with the 50mph speed limit being introduced as part of the A45/A46 Tollbar End improvement.

Of the top five project risks identified, three are relevant for Option 3, namely:
- RIS scheme description is not deliverable within the available budget;
- Impact of Tollbar post open to traffic on traffic modelling and design year flows; and
- Delivery of Binley only solution results in increase in congestion and/or accidents at Walsgrave, resulting in intervention being required as part of the scheme.

Of the top five opportunities, one is relevant for Option 3, namely:
- Challenge solution for Binley, including a review of large direct works costs to identify potential savings.

13.2 Recommendations

It is recommended to:
- Pursue a DfT change control to amend the RIS description to ‘grade separation of the Binley roundabout on the A46 near Coventry’, removing reference to grade separation of Walsgrave and expressways between M40 and M6;
- Seek additional funding of £12.2M, to increase the most likely scheme budget from £52.5M to £64.7M;
- Progress option selection for a Binley only at 50mph solution in parallel with the DfT change control to protect RIS 1 delivery programme;
- Identify requirements for any interim Walsgrave intervention;
- Hold public information exhibition following DfT change control announcement;
- Recommend inclusion of Walsgrave grade separated junction within RIS 2; and
- Recommend inclusion of expressway on A45/A46 between M40 and M6 within RIS 2.
### Appendix A: Conclusions RAG Table

<table>
<thead>
<tr>
<th>Option 1: Two grade separated junctions at Binley and Walsgrave to 70mph</th>
<th>Option 2: One grade separated junction at Binley to 70mph</th>
<th>Option 3: One grade separated junction at Binley to 50mph</th>
<th>Option 4: Two grade separated junctions at Binley and Walsgrave to 50mph</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RIS Compliance</strong></td>
<td>Partial. No expressway between M40 and M6.</td>
<td>Partial. No expressway between M40 and M6 and no Walsgrave improvement.</td>
<td>Partial. No expressway between M40 and M6, no Walsgrave improvement and not to national speed limit.</td>
</tr>
<tr>
<td><strong>Buildability</strong></td>
<td>Constrained site at Binley between the Cocked Hat pub and Ancient woodland. Complex temporary works and traffic management phase potentially required.</td>
<td></td>
<td>Constrained site at Walsgrave, but rural setting provides less issues than at Binley. Opportunity for offline construction activities.</td>
</tr>
<tr>
<td><strong>Estimated Cost</strong></td>
<td>£146.3M. No likelihood of delivering within available RIS budget of £52.5M.</td>
<td>£71M. Potential, but low likelihood to deliver for available RIS budget of £52.5M.</td>
<td>£64.7M. Potential to deliver for available RIS budget of £52.5M.</td>
</tr>
<tr>
<td><strong>Programme and Statutory Process</strong></td>
<td>Start of works date deliverable within RIS 1. Highways Act statutory process at Binley and Development Consent Order at Walsgrave.</td>
<td></td>
<td></td>
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<tr>
<td><strong>Benefits/Disbenefits</strong></td>
<td>High VfM but lower than Option 2. Development of Walsgrave land and provision of link road is uncertain.</td>
<td>High VfM between 3-4</td>
<td>High VfM but lower than option 2.</td>
</tr>
<tr>
<td><strong>Environment</strong></td>
<td>Demolition of grade II listed building at Walsgrave. Potential moderate adverse impacts to cultural heritage assets at Binley Junction. Potential large adverse impact on visual receptors at both junctions.</td>
<td>Speed limit of 70mph may generate increased noise impacts. Potential large adverse impact on visual receptors. Potential moderate adverse impact on cultural heritage assets.</td>
<td>Speed limit of 50mph may be more beneficial for noise impacts than 70mph options. Potential large adverse impact on visual receptors. Potential moderate adverse impacts to cultural heritage assets.</td>
</tr>
<tr>
<td><strong>Operation</strong></td>
<td>Both junctions grade separated.</td>
<td>Binley improvement, but Walsgrave left at grade.</td>
<td>Binley improvement, but Walsgrave left at grade.</td>
</tr>
<tr>
<td><strong>Safety</strong></td>
<td>Binley visibility and geometry not mitigated through reduced speed limit. Walsgrave junction located below desirable minimum weaving length from M6 J2/M69.</td>
<td>Binley visibility and geometry not mitigated through reduced speed limit.</td>
<td>Binley visibility and geometry mitigated through reduced speed limit. Provides route continuity with 50mph Tollbar End.</td>
</tr>
<tr>
<td><strong>Maintenance</strong></td>
<td>Rigid concrete barrier and hard central reserve priced through both junctions.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Conclusions</strong></td>
<td>Not recommended: Very high cost, environmental impact and safety concerns. Requires developer to provide link road.</td>
<td>Not recommended: High cost and safety concerns.</td>
<td>Recommended: lower cost than other solutions, offering environmental and safety benefits. Operational and safety risk at Walsgrave.</td>
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<tr>
<td><strong>Comments</strong></td>
<td></td>
<td></td>
<td>Could be combined with interim Walsgrave measure, dependant on issue and affordability. Could be considered in the future with 50, 60 or 70mph speed limit solution at Walsgrave</td>
</tr>
<tr>
<td>Option</td>
<td>Brief Description</td>
<td>Roadworks</td>
<td>Structures</td>
</tr>
<tr>
<td>--------</td>
<td>------------------</td>
<td>-----------</td>
<td>------------</td>
</tr>
<tr>
<td>1</td>
<td>Binley &amp; Walsgrave Junctions - 70mph</td>
<td>£28,242,098</td>
<td>£12,412,518</td>
</tr>
<tr>
<td>3</td>
<td>Binley Junction Only - 50mph</td>
<td>£9,876,371</td>
<td>£8,746,525</td>
</tr>
<tr>
<td>4</td>
<td>Binley &amp; Walsgrave Junctions - 50mph</td>
<td>£21,897,012</td>
<td>£11,411,175</td>
</tr>
</tbody>
</table>

As noted within each option estimate summary.
Project: A46 Coventry Junction Upgrades
Title: Cost Estimate for A46 Binley Junction - 50mph Option
Price Base: Q2 2016
Estimate Prepared: August 2016

Based on drawings HE551486-MOU-HGN-A46_A428-DR-D-0001 and HE551486-MOU-HGN-A46_A428-DR-D-0002

Construction | Qty | Unit | Rate | Amount
--- | --- | --- | --- | ---
0200 Roadwork's |  |  |  |  
Site Clearance | 11 | ha | £4,500.00 | 50,871
0300 Fencing |  |  | none detailed |
0400 Road Restraint Systems |  |  |  |
Concrete Safety Barrier | 1,400 | m | £275.00 | 385,000
Single Sided Steel Safety Barrier | 6,046 | m | £130.00 | 785,980
0500 Drainage and Ducts |  |  |  |
Kerb and Gully | 5,622 | m | £138.21 | 777,041
V Channel | 978 | m | £30.38 | 29,607
Bridge Deck Unit |  |  | £120.00 | 10,440
0600 Earthworks |  |  |  |
Excavation | 10,875 | m³ | £5.00 | 54,373
Extra Over Hard Dig | 1,270 | m³ | £15.00 | 19,052
Disposal of material off site | 1,270 | m³ | £30.00 | 38,103
Deposition of Fill | 100,176 | m³ | £12.00 | 1,202,115
0700 Pavement |  |  |  |
100mm Thick Resurfacing | 22,240 | m² | £46.64 | 1,037,337
1060mm Thick Full Construction | 27,647 | m² | £118.71 | 3,281,975
Surfacing Over Structures | 466 | m² | £100.00 | 46,600
Hard Central Reserve | 4,412 | m² | £98.46 | 434,406
1100 Kerbs, Footways and Paved Areas |  |  |  |
Footway/cycleway | 2,529 | m² | £42.50 | 107,483
1200 Traffic Signs and Road Markings |  |  |  |
Traffic Signs and Road Markings | 50,353 | m² | £3.00 | 151,059
Road Traffic Signal | 8 | set | £21,250.00 | 170,000
Pedestrian Traffic Signal | 2 | set | £12,500.00 | 25,000
1300 Road Lighting Columns, Brackets & CCTV Masts | 173 | no | £2,500.00 | 432,000
1400 Electrical Work for Lighting and Signs | item |  | £172,800 |
1500 Motorway Communications | none detailed |

Sub-Total (1) | 9,876,371 |

Sub-Total (2) | 8,746,525 |

Add allowances for: |  |
2700 Accommodation Works | 2% | £9,876,371.21 | 197,527 |
2700 Works for Statutory Undertakers and Others | 15% | £9,876,371.21 | 98,764 |
3000 Landscape and Ecology | 3.5% | £9,876,371.21 | 345,675 |
Construction contingency | 5% | £18,622,896.21 | 931,145 |
Preliminaries(20%) including Temporary Works(5%) | 32.5% | £20,196,005.15 | 6,563,702 |
Traffic Management (7.5%) |  | |
- Works by Statutory Undertakers and Others | 15% | £26,759,706.83 | 4,013,956 |

Sub-Total (3) | 12,150,767 |

Estimated Construction Costs | 30,773,663 |

Add allowances for: |  |
Surveys / investigations / design / procurement / supervision / management & liaison | 14% | £30,773,662.85 | 4,308,319 |
HE and Others internal costs | Not included |

Sub-Total (4) | 4,308,313 |

Sub-Total (5) | 3,508,198 |

Future |  |
Optimism Bias(Based on HE guideline max non complex schemes/DFT TAG A1.2) | 45% | £38,590,173.22 | 17,365,578 |

Sub-Total (6) | 17,365,578 |

Estimated scheme costs incl Construction, Design, Risk & OB allowances | 55,955,751 |

Land estimate |  |
- Land outside existing HE boundaries(excl 25% for claims/legal/fees) | 3.34 | ha | £293,158.97 | 977,779 |

Cost Estimate Total including Land Costs but excluding Future Inflation | 56,933,324 |

Inflation estimate |  |
- Inflation from estimate date to start of construction | 8.20% | 3.5% per annum to 2020 | 4,668,549 |

Cost Estimate Total including Land Costs allowance | 61,602,073 |

Cost Estimate Total including Land Costs and Future Inflation allowance | 63,419,576 |

Historic Costs | 1,280,202 |

Total Cost Estimate including Historic Costs | 64,699,778 |
## Construction Costs

<table>
<thead>
<tr>
<th>Description</th>
<th>Qty</th>
<th>Unit</th>
<th>Rate</th>
<th>Amount</th>
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<tr>
<td>Roadwork's</td>
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</tr>
<tr>
<td>Site Clearance</td>
<td>11</td>
<td>ha</td>
<td>£4,500.00</td>
<td>48,505</td>
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<td>Fencing</td>
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<tr>
<td>Concrete Safety Barrier</td>
<td>1,400</td>
<td>m</td>
<td>£275.00</td>
<td>385,000</td>
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<tr>
<td>Single Sided Steel Safety Barrier</td>
<td>6,310</td>
<td>m</td>
<td>£180.00</td>
<td>1,136,800</td>
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<td>Drainage and Ducts</td>
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<tr>
<td>Kerb and Gully</td>
<td>5,622</td>
<td>m</td>
<td>£136.21</td>
<td>777,041</td>
</tr>
<tr>
<td>V Channel</td>
<td>919</td>
<td>m</td>
<td>£30.38</td>
<td>27,987</td>
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<td>Bridge Deck Unit</td>
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<td>m</td>
<td>£120.00</td>
<td>11,670</td>
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<td>Earthworks</td>
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<tr>
<td>Excavation</td>
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<td>m³</td>
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<td>Extra Over-Head Dig</td>
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<td>24,873</td>
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<td>m²</td>
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<td>Surfacing Over Structures</td>
<td>466</td>
<td>m²</td>
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<td>Hard Central Reserve</td>
<td>2,451</td>
<td>m²</td>
<td>£39.46</td>
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<td>Kerbs, Footways and Paved Areas</td>
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<td>Footway/cycleway</td>
<td>2,529</td>
<td>m²</td>
<td>£42.50</td>
<td>107,483</td>
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<td>Traffic Signs and Road Markings</td>
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<td>Traffic Signs and Road Markings</td>
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<tr>
<td>Pedestrian Traffic Signal</td>
<td>2</td>
<td>set</td>
<td>£12,500.00</td>
<td>25,000</td>
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<tr>
<td>Road Lighting Columns, Brackets &amp; CCTV Masts</td>
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<td>no</td>
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<td>451,250</td>
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<td>Electrical Work for Lighting and Signs</td>
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<tr>
<td>Motorway Communications</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>Bridges</td>
<td>741</td>
<td>m²</td>
<td>£2,800.00</td>
<td>2,074,800</td>
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<td>Retaining Walls</td>
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<td></td>
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<tr>
<td>Sheet pile</td>
<td>3,916</td>
<td>m²</td>
<td>£300.00</td>
<td>1,174,746</td>
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<tr>
<td>Reinforced earth</td>
<td>13,607</td>
<td>m²</td>
<td>£475.00</td>
<td>6,463,373</td>
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</tbody>
</table>

**Sub-Total (1)**: 10,589,542

**Structures**
- Bridges
- Retaining Walls
- Sheet pile
- Reinforced earth

**Sub-Total (2)**: 9,712,918

**Add allowances for:**
- 2700 Accommodation Works 2 % £10,589,542.26 211,791
- 2700 Works for Statutory Undertakers and Others 3.5 % £10,589,542.26 370,634
- 3000 Construction contingency 5 % £20,302,460.46 1,015,123
- Preliminary works(50% including Temporary Works(5%)) 32.5 % £22,005,903.73 7,151,919
- Works by Statutory Undertakers and Others 15 % £29,157,822.45 4,373,673

**Sub-Total (3)**: 13,229,035

**Estimated Construction Costs**: 33,531,494

**Add allowances for:**
- Surveys / investigations / design / procurement / supervision / management & liaison 14 % £3,333,015,852.82 4,694,409
- HE and Others internal costs Not included

**Sub-Total (4)**: 4,694,409

**General overhead risk allowance on identified works in the absence of a scheme specific QRA** 10 % £3,822,591

**Sub-Total (5)**: 3,822,591

**Optimum Bias (Based on HE guideline max non complex schemes/DFT TAG A1.2)** 45 % £42,048,495.75 18,921,823

**Sub-Total (6)**: 18,921,823

**Estimated scheme costs incl Construction, Design, Risk & OB allowances** 60,970,319

**Land estimate**
- Land outside existing HE boundaries(nois 25% for compensation/claims/legal/fees) 4.05 ha £293,158.97 1,187,558

**Cost Estimate Total including Land Costs but excluding Future Inflation** 62,157,877

**Inflation estimate**
- Inflation from estimate date to start of construction 8.20% 3.5% per annum to 2020 5,096,946

**Cost Estimate Total including Land Costs and Future Inflation allowance** 67,254,822

**Historic Costs** 1,280,202

**Total Cost Estimate Including Historic Costs** 71,035,024
## Project:
A46 Coventry Junction Upgrades

## Title:
Cost Estimate for A46 Walsgrave Junction - 50mph Option

## Price Base:
Q2 2016

## Estimate Prepared:
August 2016

Based on drawings HESS51486-MOU-HGN-A46_A428-DR-D-0005 to HESS51486-MOU-HGN-A46_A428-DR-D-0008

### Construction

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<thead>
<tr>
<th>Construction</th>
<th>Qty</th>
<th>Unit</th>
<th>Rate</th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Roadwork's</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Site Clearance</td>
<td>19</td>
<td>ha</td>
<td>£4,500.00</td>
<td>85,150</td>
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<td>Fencing</td>
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<td>none detailed</td>
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<tr>
<td><strong>0400 Road Restraint Systems</strong></td>
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<tr>
<td>Concrete Safety Barrier</td>
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<td><strong>0500 Drainage and Ducts</strong></td>
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<td>Kist and Cutty</td>
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<td>m</td>
<td>£150.00</td>
<td>9,000</td>
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<td><strong>0600 Earthworks</strong></td>
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<td>Excavation</td>
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<td><strong>0700 Pavement</strong></td>
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<tr>
<td>100mm Thick Resurfacing</td>
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<td>m²</td>
<td>£100.00</td>
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<td><strong>1100 Kerbs, Footways and Paved Areas</strong></td>
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<td></td>
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<tr>
<td>Roadway/cycleway</td>
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<td><strong>1200 Traffic Signs and Road Markings</strong></td>
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<td>2</td>
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<td>£12,500.00</td>
<td>25,000</td>
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<tr>
<td>M63 to be demolished</td>
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<td>£6,000.00</td>
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<td>M63 to be built</td>
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<td>200,000</td>
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<td><strong>1300 Road Lighting Columns, Brackets &amp; CCTV Masts</strong></td>
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<td>Road Lighting Columns</td>
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<td><strong>1400 Electrical Work for Lighting and Signs</strong></td>
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<td></td>
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<tr>
<td><strong>1500 Motorway Communications</strong></td>
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<tr>
<td></td>
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<td></td>
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| Sub-Total (1) | 12,020,641 |
| Add allowances for: | |
| 2700 Accommodation Works | 2% | £12,020,640.97 | 240,413 |
| 2700 Works for Statutory Undertakers and Others | 1% | £12,020,640.97 | 120,206 |
| 3000 Landscape and Ecology | 4% | £12,020,640.97 | 480,772 |
| Construction contingency | 5% | £14,855,251.37 | 745,365 |
| Preliminary (20%) including Temporary Works (2.5%) Traffic Management (5%) | 27.5% | £16,200,897.60 | 4,455,247 |
| Works by Statutory Undertakers and Others | 7.5% | £20,085,144.44 | 1,549,211 |

| Sub-Total (2) | 7,520,064 |
| Add allowances for: | |
| Surveys / investigations / design / procurement / supervision / management & liaison | 14% | £22,205,355.28 | 3,108,750 |
| HE and Others internal costs | | | Not included |

| Sub-Total (3) | 22,205,355 |
| Add allowances for: | |
| General overall risk allowance on identified works (not potential to demolish & build new accommodation bridge) in the absence of a scheme specific QRA | 12.5% | £25,314,105.02 | 3,164,263 |

| Sub-Total (4) | 3,164,263 |
| Add allowances for: | |
| Optimism Bias (Based on HE guideline max non complex schemes DFT TAG A1.2) | 45% | £28,478,368.14 | 12,815,266 |

| Sub-Total (5) | 12,815,266 |

| Land estimate | |
| Land outside existing HE boundaries (incl 5% for compensation/claims/legal fees) | 4 ha | £1,079,720.20 | 4,635,140 |

| Inflation estimate | |
| Inflation from estimate date to start of construction 2022 | 14.9% | 6,843,387 |

| Cost Estimate Total including Land Costs allowance | 52,772,161 |
| Add non recoverable works outside existing boundaries | 20% | 22.69% | 1,197,246 |
| Cost Estimate Total Including Land Costs and Future Inflation allowance | 53,969,407 |
| Historic Costs | |
| All allowed on priority scheme Binley junction | | 0 |

| Total Cost Estimate including Historic Costs | 53,969,407 |
## A46 Coventry Junction Upgrades

### Cost Estimate for A46 Walsgrave Junction - 70mph Option

**Price Base:** Q2 2016  
**Drawings used:** Based on drawings HE551486-MOU-HGN-A46_A428-DR-D-0009 to HE551486-MOU-HGN-A46_A428-DR-D-0012  
**Prepared:** August 2016

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### Additional allowances:

- **2700 Accommodation Works:** 2% £17,652,555.66 353,051
- **2700 Works for Statutory Undertakers and Others:** 1% £17,652,555.66 176,526
- **3000 Landscape and Ecology:** 4% £17,652,555.66 617,839
- **Construction contingency:** 5% £20,352,155.66 1,017,608
- **Preliminary(20%) including Temporary Works(2.5%) Traffic Management (5%)** 27.5% £22,517,179.56 6,192,224
- **Works by Statutory Undertakers and Others:** 7.5% £28,709,403.93 2,153,205

**Sub-Total (3):** 10,510,454

### Additional allowances for:

- **Surveys / investigations / design / procurement / supervision / management & liaison:** 14% £30,862,609.23 4,320,765

**Sub-Total (4):** 4,320,765

- **General overall risk allowance on identified works incl potential to demolish & build new accommodation bridge in the absence of a scheme specific QRA:** 12.5% £35,183,374.52 4,397,922

**Sub-Total (5):** 4,397,922

- **Optimism Bias (Based on HE guideline max non complex schemes/DFT TAG A1.2):** 45% £39,581,296.34 17,811,583

**Sub-Total (6):** 17,811,583

**Estimated scheme costs incl Construction, Design, Risk & OB allowances:** 57,392,880

### Land estimate:

- **Land estimate:** £523,717.12 4,906,479

**Cost Estimate Total including Land Costs but excluding Future Inflation:** 62,301,359

### Inflation estimate:

- **Inflation from estimate date to start of construction:** 14.9% 3,392,962

**Cost Estimate Total including Land Costs allowance:** 71,584,261

- **Non recoverable works outside existing boundaries:** 20% 50.93% 3,645,739

**Cost Estimate Total including Land Costs and Future Inflation allowance:** 75,230,000

**Total Cost Estimate including Historic Costs:** 75,230,000
A46 Coventry Junctions Upgrade – Appraisal Specification Report (ASR)

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<td>Malcolm Mitson</td>
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<td>Janet Wong</td>
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Approvals

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1 Introduction

1.1 Purpose of the ASR

The Appraisal Specification Report (ASR) is one of a number of required products as part of Highways England’s Project Control Framework (PCF). The overarching aim of the ASR is to set out the methodologies for the transport modelling and appraisal, including data collection; traffic forecasting; variable demand modelling and all other components; economic, environmental and operational assessments; and how the interactions between the different disciplines will be handled. Therefore the report provides a reference for undertaking the work and ensures all parties are familiar with the assumptions being made and the likely impacts, timescales and risks associated with the detailed work.

This ASR has been prepared for the A46 Coventry Junction Improvements Scheme in accordance with IAN 176/13 ‘Guidance Note for the Preparation of an Appraisal Specification Report.’

1.2 Scheme Background

The Road Investment Strategy (RIS) sets out a list of schemes that are to be developed by Highways England over the RIS period 2015 – 2020, of which the A46 Junctions Upgrade Scheme is one.

The A46 Corridor forms part of the national strategic highway network connecting the M1/M6/M69 with the M40. It is an important link between the East and West Midlands and beyond, joining the M1 J21 with M40 J15, and provides connections to the Strategic Road Network and the rest of the country. Figure 1-1 shows the location of the scheme corridor.

Stages 1 and 2 of the PCF process considered a number of schemes for improving the junctions on this section of the A46. The schemes assessed are summarised below:

- Binley Only - the grade separation of Binley roundabout only
- Binley + Walsgrave – the grade separation of Binley and Walsgrave roundabouts
- Binley 50 – the grade separation of Binley roundabout and reduction of A46 speed limit to 50 mph through the scheme

Within this process the Binley 50 scheme was identified as the preferred option. PCF Stage 3 therefore considers the Binley 50 scheme only.
1.3 The current Stage of the project and the Stage(s) to which the ASR relates

As part of the PCF process, all major projects are expected to follow a standard lifecycle which has been divided into defined stages as shown in Figure 1-2. The ASR is one of the products identified in the Scope section of the PCF product matrix (see Figure 1-3). Although it is intended to relate to the work to be undertaken in the following stage, it should also function as a living document to be updated through the stage it refers to (Section 2, IAN 176/13).

This ASR sets out a methodology to progress assessment of the A46 Junction Upgrades Scheme from PCF Stages 1 and 2 to PCF Stage 3. Stages 1 and 2 covered optioneering and were focussed on testing a range of options to identify a “preferred” option to be carried forward for full appraisal.

Stage 3 covers the preliminary design of the preferred option supplemented by detailed modelling and full economic appraisal.

The ASR appears as a product within the Scope section of the PCF product matrix, signifying its relative importance. Figure 1-3 indicates how the ASR appears in the matrix.

Furthermore, IAN 176/13 states:

“It is important to understand that the contents of the ASR relate primarily to the work undertaken in the following stage, although consideration must be given within the report to modelling considerations over the remaining lifetime of the project.”
2 Transport Modelling

2.1 Introduction
The following section of the report summarises the modelling work undertaken at PCF Stage 1 and details the proposed approach to be taken at Stage 3. It is proposed to retain the base model developed at Stage 1. The only changes to the modelling will be to the forecast models which will be updated using the latest DfT guidance, primarily updates to the traffic growth forecasts and values of time.

2.2 Review of Available Models and Choice of CASM
One of the early requirements of the ASR is to examine existing traffic models that cover the area of interest and identify a model to be used for scheme appraisal. A review of available and emerging models was undertaken during Stage 1, including:

- Midlands Regional Traffic Model
- Tollbar End SATURN Model
- Coventry Area Strategic Transport Model (CASM)

At that time, the Midlands Regional Model was still under development and therefore not available for use, and the Tollbar End SATURN Model was considered to be too limited in its geographic coverage and based on data that was too old. The agreed modelling approach for Stage 1 therefore utilised the CASM Model to provide future year forecast flows for economic, operational and environmental assessments.

Further discussions with Highways England TAME have been undertaken to agree the approach to Stage 3 modelling and appraisal. The completion of the Midlands Regional Model base year and forecasts is currently anticipated for spring 2017, which will not be in time for the A46 Coventry Junctions Upgrade scheme. Therefore it has been agreed with Highways England TAME that it will not be used for Stage 3. This does not preclude its use during later stages, including the cumulative impact of all RIS schemes.

The agreed approach is to make continued use of the CASM Model.

2.3 Coventry Area Strategic Transport Model (CASM)
The suggested modelling approach at PCF Stage 3 of the A46 Junctions Upgrade Scheme is to make continued use the Coventry Area Strategic Model (CASM) to provide future year forecast flows for economic, operational and environmental assessments. CASM was originally developed on behalf of Highways England and Coventry City Council to assess the impact of the M6 Junctions 2 – 4 Smart Motorway Programme (SMP) and Coventry City Council’s Local Plan proposals.

The CASM covers an area including North Warwickshire, Nuneaton, Bedworth, Coventry, Rugby, Solihull, Warwick, Stratford-on-Avon, and Daventry with focus on Coventry and the M6 corridor Junctions 2 – 4. The model uses the VISUM software and is based on the highway and public transport PRISM models. It is Multi-Modal model comprising both highway and public transport assignment models together with a demand model component. Details of the model’s development can be found in CASM Model Development and Calibration Report (WSP, Mar 2016).

At PCF Stage 1 a review and refinement of the local validation of CASM on and adjacent to the A46 corridor was undertaken, prior to forecasting taking place. This exercise focussed on the section between M6 and the Tollbar End junction (A45 / A46 Coventry Eastern Bypass). Details of the model validation and calibration are contained in the Local Model Validation Report (Mouchel, Oct 2016). The CASM network structure, in the vicinity of the scheme, is shown in Figure 2-1.
Forecasting at Stage 3 will adopt a methodology in line with WebTAG Unit M4.

2.4 Age and Availability of Existing Data and New Data Collection

As part of the development of CASM, traffic data was collected in 2013 to develop screenlines for the base year model calibration and validation as shown in Figure 2-2. They capture a wide range of movements in the modelled area covering:

- Movements along the M6, M40, A45, A423, A425, A428, A452 and other minor radial routes east and west of Coventry (1 in Figure 2-1)
- Movements in and out of Coventry (2 in Figure 2-1)
- Movements in and out of Coventry City Centre (3 in Figure 2-1)
- North-south movements along M69, A444 and other minor roads just north of the M6 Junctions 2 - 4 (4 in Figure 2-1)
Journey time data was also collected in 2013 on a wide range of routes including the A46 corridor Coventry Bypass and routes that would be affected by the A46 Upgrade scheme as shown in Figure 2-3. They include:

- The Coventry Bypass (A45 & A46)
- Strategic movements using the A46 corridor via A5, M1, M6, M40, M42, M45 and M69
- Key radial routes in and out of Coventry and its surrounding areas, namely, A45, A46, A423, A428, A444, A4114, A4600 and B4098
Details of the data collection for the development of CASM are documented by in the CASM Model Development and Calibration Report (WSP, Mar 2016).

Some of these data have been used for the review and refinement of CASM to appraise the A46 Junctions Upgrade scheme at PCF Stage 1. In particular traffic counts and journey time surveys on the A46 in the vicinity of the scheme were used. Details of the model validation and calibration for the purpose of the A46 Junction Upgrade scheme are contained in the Local Model Validation Report (Mouchel, Oct 2016).
2.5 WebTRIS
The Web-based Traffic Information System (WebTRIS) is a traffic database maintained by Highways England. It holds traffic information flows from roadside inductive loops at most sites on the trunk road network. Long term WebTRIS count data was downloaded for six sites on the A46 links north and south of the Binley and Walsgrave junctions. Historic annual and average flow values have been reviewed to provide an indication of trends in traffic flow. The information has also been used to estimate the impact of Tollbar End construction works on traffic flows.

2.6 CASM Structure
CASM was developed with the VISUM software. Figure 2-4 shows an overview of the structure of CASM. It is Multi-Modal consisting of:

- Highway assignment model;
- Public transport assignment model;
- Demand model with trip generation, mode choice and distribution responses.

(Source: Coventry Area Strategic Transport Model Appraisal Specification Report, WSP, Feb 2015)

2.7 Model Year
At PCF Stage 1 the base year remained as 2013, which is when the CASM was last updated. It was considered inappropriate to update the model base year due to the construction works at the Tollbar End junction, starting in 2014, which have had a material impact on flows in the vicinity of the scheme. The base year model developed at Stage 1 will be retained at Stage 3.

2.8 Time Periods
All the time periods used in the model were retained at Stage 1. The demand phase of CASM considers ‘all day’ trips and is split into time periods in line with PRISM:

- AM: 0700 – 0930
For the highway assignment model, there are three time periods:

- AM peak hour 0800 – 0900
- Interpeak average hour 1100 – 1400
- PM peak hour 1700 – 1800

The public transport assignment model follows the PRISM approach of modelling average two-hour peak periods:

- AM: 0700 – 0900
- IP: 1000 – 1200
- PM: 1700 – 1800

The above time periods will be retained at PCF Stage 3.

2.9 Network Checks

The model network was checked and reviewed at PCF Stage 1 to ensure that it is appropriate for the scheme area. This included checking the following:

- Link delays and speed flow curves applied
- Link lengths and speeds
- Model parameters
- Junction saturation flows
- Signalised junction data

2.10 Junction Modelling

There are three junction types used in the model:

- Signalised junctions
- Uncontrolled junctions
- Two-way (priority) junctions

Delays and flows through the junctions are modelled using the Intersection Capacity Analysis (ICA) tool in VISUM. This function calculates node impedance based on the Highway Capacity Manual (HCM) 2000/2001 guidelines based on the junction geometry, traffic volumes and signal timing.

2.11 User Classes

The user classes from the 2013 Base Year model were used in the Stage 1 modelling and will be retained in Stage 3. These are:

- Car work
- Car non-work
- LGV
- HGV

2.12 Zone Structure

The zone structure of the 2013 base year model was reviewed in Stage 1, in particular in the vicinity of the scheme, and retained for the purpose of the assessment. The zone structure will also be retained for the Stage 3 modelling.
2.13 Demand Model Structure, Realism and Sensitivity Testing

2.13.1 Variable Demand Modelling

The Demand Model in CASM was developed from PRISM. PRISM is a travel demand model forecasting system developed on behalf of the seven metropolitan districts in the West Midlands Metropolitan Area, Highways England and Centro (an organisation responsible for the delivery of public transport in the West Midlands).

Details of CASM’s demand model can be found in Coventry Area Strategic Transport Appraisal Specification Report (WSP, Feb 15).

2.13.2 Realism and Sensitivity Tests

To validate the sensitivity of the CASM A46 Base Year TDM to changes in input values, a number of realism tests have been performed in line with TAG guidance at PCF Stage 1. This part of the process ensures the CASM TDM validates to TAG criteria in its responses to changes in generalised costs via the elasticity (realism) tests.

The realism tests performed are the following:

- Test 1: 10% increase in car fuel costs
- Test 2: 10% increase in public transport fares
- Test 3: 10% increase in car journey time

Full details of the realism tests are provided in A46 Traffic Forecasting Report (Mouchel, Oct 2016). The elasticity results indicated that acceptable levels of realism were achieved for each test.

2.13.3 Forecasting

The level of assurance for the Stage 1 model is appropriate for Stage 3 and therefore the CASM base year model developed in Stage 1 will be used as a starting point for the Stage 3 forecasting and appraisal. The forecasting differs from that undertaken at Stage 1 by incorporating the latest DfT WebTAG guidance for the following:

- Latest traffic growth forecasts using TEMPRO 7 (NTEM7)
- Latest WebTAG Databook, in particular updates to the values of time

2.13.4 Forecast Models

Do-Minimum and Do-Something highway model scenarios will be developed based on the PCF Stage 1 2013 base year model. The revised WebTAG guidance for NTEM7 and changes in the Databook, e.g. values of time, will be incorporated in the revised forecasts where it is agreed to be proportionate. The risk to assurance will need to enable the economic and environmental assessment for the scheme.

2.13.5 Reference Case Years

Based on the estimated opening year of 2021 for the A46 Coventry Junctions Upgrade scheme, two new reference case years will be required:

- 2021 Opening Year of A46 Coventry Junctions Upgrade Scheme
- 2036 Design Year of A46 Coventry Junctions Upgrade Scheme

These forecast years are consistent with those used in the Stage 1 modelling.

2.13.6 Network Development
The Do-Minimum network will be based on the Do-Minimum scenario for Stage 1 modelling. The Do-Something scenario network will be based on the network developed for Stage 1, with the 50mph zone of the A46 refined as per the latest proposals.

Both the Do-Minimum and Do-Something networks will include the improvement works at Tollbar End and the M6 Junction Junctions 2 – 4 SMP.

### 2.13.7 Forecast Matrix Development

New highway demand matrices for the three peak periods will be developed for the reference case years 2021 and 2036. An examination of CASM’s uncertainty log was previously undertaken at Stage 1. This exercise involved the development of uncertainty logs for 2021 and 2036, which were largely based on the 2019 and 2034 uncertainty logs.

At Stage 1 traffic growth factors for cars were derived using TEMPRO 6.2. For Stage 3 the growth will be updated to TEMPRO 7.

In summary, forecast year matrices will be developed for the following scenarios:

- 2021 Opening Year
- 2036 Design Year

### 2.13.8 Value of Time

At PCF Stage 3 the values of time will be updated to the latest DfT values as adopted in November 2016.

### 2.13.9 Uncertainty and Sensitivity Testing

The following sensitivity tests were conducted at PCF Stage 1:

- High growth.
- Low growth.

These were calculated using the following guidance from TAG Unit M4:

The high growth scenario consisted of forecasts that are based on a proportion of base year demand added to the demand from the core scenario. The proportion of base year demand to be added is based on a parameter \( p \) which varies by mode. The proportion is calculated as follows:

- for 1 year after the base year, proportion \( p \) of base year demand added to the core scenario;
- for 36 or more years after the base year, proportion \( 6p \) of base year demand added to the core scenario;
- between 1 and 36 years after the base year, the proportion of base year demand should rise from \( p \) to \( 6p \) in proportion with the square root of the years. (So, for example, 16 years after the base year the proportion is \( 4p \)).
- for highway demand at the national level, the value of \( p \) is 2.5%, reflecting uncertainty around annual forecasts from the National Transport Model (NTM), based on the macro-economic variables that influence the main drivers of travel demand.

The low growth scenario was based on the same ranges **below** the core scenario demand as the high growth scenario is above it.
High and low growth sensitivity tests, using the above methodology, will also be undertaken at PCF Stage 3.

2.13.10 Risk Log

Base model values of time not updated – The Base model will not be updated in PCF Stage 3 and will thus not include the latest values of time. These is a risk that base model validation could differ from the validation undertaken at PCF Stage 1.

TEMPRO growth factors – An update to the latest version of TEMPRO is expected in February 2017 after the PCF Stage 3 forecasting is likely to take place. There is a risk that TEMPRO growth factors will differ slightly after the release of the update.

Committed highway schemes – Both the Toll Bar End improvements and M6 Junction Junctions 2 – 4 SMP will be included in the forecast models. There is a risk that forecast changes in traffic flow as a result of these schemes will not reflect reality when these schemes open. In addition the schemes could change from what is currently coded in CASM.

2.13.11 Change Log

December 2016 – First version.
3 Economic Assessment

The Economic Assessment will be carried out using standard procedures and economic parameters as defined by WebTAG. The assessment at PCF Stage 3 will consider the preferred Binley 50 option only.

3.1 Traffic Model Data

The traffic data that will be used in the economic assessment of the A46 Coventry Junctions Upgrade scheme will be derived from the forecast highway model of the updated CASM. The model has been developed for the time periods:

- AM peak hour: 0800 – 0900
- Average interpeak hour: between 1100 and 1400
- PM peak hour: 1700 – 1800

Traffic forecasts of the following future modelled years will be used:

- 2021 Opening Year
- 2036 Design Year

The scenarios that will be modelled are shown in Table 3-1.

Table 3-1 ATC A46 Junction Upgrade Scheme Option Scenarios

<table>
<thead>
<tr>
<th>Scenario No.</th>
<th>Scheme Scenario</th>
<th>Traffic Model Network</th>
<th>Traffic Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Do Minimum, without scheme</td>
<td>No improvement works at Binley and Walsgrave roundabouts</td>
<td>Central</td>
</tr>
<tr>
<td>3</td>
<td>Binley 50</td>
<td>Grade separation of Binley Roundabout only with 50mph speed limit on A46</td>
<td>Central</td>
</tr>
</tbody>
</table>

3.2 Transport Economic Efficiency

An assessment of Transport Economic Efficiency benefits and costs will be conducted using the following computer software program:

- TUBA v1.9.8 for user benefits and vehicle operating cost benefits
- COBALT for accident benefits
- QUADRO delays for construction and maintenance

It was agreed with TAME that a MYRIAD reliability assessment is not appropriate for a single junction scheme, however a qualitative assessment based on WebTAG guidance will be undertaken. It is proposed that wider impacts will not be included for the same reason.

The assessment will produce monetised costs and benefits for the all the scheme options with the following outputs in 2010 prices, discounted to 2010:

- User Benefits
- Greenhouse Gas Benefits
- Accident Reduction Benefits
- Air Quality and Noise Benefits
- Indirect Tax Revenues
- Present Value of Benefits (PVB)
- Present Value of Costs (PVC)
- Net Present Value (NPV)
3.3 Annualisation and Treatment of Non-Modelled Periods

The modelled period benefits calculated will be converted into an estimate of annual benefits using a series of annualisation factors derived from long-term traffic counts data from TRADS. Factors were previously derived for the PCF Stage 1 appraisal. The same factors will be used at the Stage 3 appraisal. These will be used to develop an appropriate set of factors to approximate non-modelled periods such as weekday off-peak, weekend and bank holiday period.

3.4 Distributional Impact Appraisal

It is proposed that distributional impacts will be assessed in line with approaches recommended in TAG Unit A4.2. This process adopts a three-stage approach of screening, assessment and appraisal. It utilises demographic and geographic data to understand the impacts of a scheme on particular segments of the population.

Screening was carried out at PCF stage 1 (Appendix A). More detailed assessment and appraisal will be carried out at PCF stage 3.

The screening exercise identified the following impacts which will be assessed and appraised further:

- Severance
- Personal affordability
- Air quality
- Noise
- User benefits
- Accidents

The scheme would not have an impact on security, as detailed in Appendix A, and will therefore not be considered further.

The appraisal will be reported in an updated AST at the end of PCF stage 3. It was also agreed with TAME that a Regeneration Report will be undertaken.

3.5 Risk Log

Reliability and wider impacts benefits not included in BCR – No quantitative assessment of the reliability and wider impacts is to be undertaken. There will therefore be no adjustments to the initial BCR.

3.6 Change Log

December 2016 – First version.
4 Operational Assessment

Operational assessment will be undertaken to inform the evolving scheme design and to refine the design.

It is envisaged that the scheme would result in a change in traffic patterns on the local road network in the scheme area. Indeed findings from the A46 Coventry Eastern Bypass Operational Review Report (Amey, June 14) indicate that congestion occurs on local roads during the morning and evening peak hours at the following junctions in the Scheme area.

- B4082 Clifford Bridge Road / A46 Link
- B4082 Clifford Bridge Road / B4428 Brinklow Road
- B4082 Clifford Bridge Road / A428 Brandon Road / A428 Binley Road

It is therefore proposed that the operational assessment include these junctions, Binley and Walsgrave roundabouts as shown in Figure 4-1.

*Figure 4-1 A46 Junction Upgrade Operational Assessment*
4.1 Methodology

The assessment will be conducted using the modelled flows from the opening year (2021) and the design year (2036) morning and evening peak scenarios. It will involve using the following computer program:

- Junctions 8 for unsignalised junctions
- LinSig for signalised junctions including the proposed scheme at Binley

Link based merge and diverge layout analysis in accordance to TD 22/06 will also be undertaken at Binley for the opening and design years AM and PM peak hours.

During the design process for PCF Stage 1 it was noted that the location of the accesses to the petrol station and car showroom, approximately 800m south of Binley, could have the potential to impact the operation of the proposed south facing merge and diverge facilities. At Stage 3 it is proposed to build a microsimulation model of the A46 between Binley and the accesses on to the A46 to the south. The purpose of the model will be to assess the weaving between Binley and the petrol station and car showroom accesses, thus informing the design of the south facing merge and diverge facilities.

4.2 Change Log

December 2016 – First version.
5 Environmental Assessment

This chapter records how the methodologies for transport modelling and the relevant traffic related environmental assessment and appraisal (noise, air quality and road drainage and the water environment) interact and how these will be handled during PCF Stage 3. It provides a reference for undertaking the required environmental assessment and appraisal work, identifies any assumptions being made in deriving the required traffic data, the likely environmental impacts, timescales and risks of the detailed work.

The traffic data would be provided within a Traffic Reliability Area (TRA), an area considered to have the potential to be significantly and reliably influenced by the proposed scheme. The traffic related environmental assessments will take into account the predicted traffic flows in the TRA in all the assessment years. A plan showing the TRA is presented in Figure 4-1 below.
Figure 5-1 – Traffic Reliability Area
As a result of assessment work undertaken to date, the interactions between traffic modelling and noise / air quality / road drainage and the water environment have been identified as relevant for assessing the likelihood of significant environmental effects occurring as a result of the construction and operation of the proposed scheme. A detailed description of these interactions follows this introduction.

All other environmental aspects which do not require traffic data for their assessment or appraisal have not been considered within this ASR. At this stage, it has been established that for these non-traffic dependent environmental aspects, very limited further refinement of evidence using traffic data is required to progress the proposed scheme through the PCF stages.

5.1 Noise Assessment

5.1.1 Existing Knowledge and Data

An update of the Stage 1 assessment identified a number of sensitive receptors within 1km of the proposed scheme. Sensitive receptors around the proposed scheme consist of dwellings within the residential areas in closest proximity to the proposed scheme. These are located to the east of the junction on the A428 in Binley Woods; to the north of the junction/Warwick shopping centre and to the west of the A46, Kings Park Drive.

By definition, sensitive receptors also include, but are not limited to, facilities such as hospitals, schools, daycare centres, churches, residences, elderly homes and multi-purpose community centres, where the occupants are more susceptible to the adverse effects of exposure to pollutants. There are a number of non-dwelling sensitive receptors within 1km of the proposed scheme which include the following:

- Educational facilities – Clifford Bridge Primary School, Bambinos Day Nursery(Binley Business Park), St Bartholomew’s Church of England Academy, Blue Bell Woods Day Nursery (Monks Rd Binley).
- Health care facilities –Youell Court Care Home, Bradbury House Respite Unit, Abbeyfield (Bredon Ave), Phil Mead House (Bredon Ave).
- Other – Binley Woods Village Hall.

Information from the Department for Environment Food & Rural Affairs’ (Defra) strategic-level noise maps indicates that with respect to road traffic noise, night time levels ($L_{night}$) at approximately 50m from the A46 are in the range 60-65 A-weighted decibels dB(A), and the day / evening / night level ($L_{den}$) is in the range 65-70 dB(A). The maps are provided for strategic purposes only, and these estimates refer to the first round of maps produced in 2007.

5.1.2 Environmental Constraints Evaluation

There is a potential for road schemes to negatively or positively influence traffic noise on an existing road by changing the composition (percentage of heavy vehicles) of traffic or by introducing a new noise source. Factors such as traffic volume, speed, road gradient and surface characteristics also influence noise level close to a road with free flowing traffic. Traffic noise from individual vehicles can be perceptible if sensitive receptors are located in close proximity to the road. However, this influence of traffic noise from individual vehicles will become less noticeable when sensitive receptors are located further away from the road. The noise level may be reduced by a number of factors including distance from noise source, presence of barriers and characteristics of the road surface.
During the Stage 1 assessment, a proximity count exercise was undertaken using a geographic information system (GIS) software to give an indication of the potential number of receptors which may experience operational noise impacts as a result of the proposed scheme. The number of dwellings and non-dwelling sensitive receptors (e.g. hospitals, schools) within distance bands of the proposed scheme are presented in Tables 5-1 and 5-2 respectively.

Table 5-1: Dwelling Receptor Counts

<table>
<thead>
<tr>
<th>Banding Zone</th>
<th>0 – 50m</th>
<th>50 – 100m</th>
<th>100 – 200m</th>
<th>200 – 300m</th>
<th>300 – 600m</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>34</td>
<td>128</td>
<td>217</td>
<td>844</td>
<td></td>
</tr>
</tbody>
</table>

Table 5-2: Non-Dwelling Sensitive Receptor Counts

<table>
<thead>
<tr>
<th>Banding Zone</th>
<th>0 – 50m</th>
<th>50 – 100m</th>
<th>100 – 200m</th>
<th>200 – 300m</th>
<th>300 – 600m</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

Following a sifting process undertaken by Defra, some locations along the A46 and surrounding roads have been assigned the status of a Noise Important Area. Noise Important Areas (NIA) with respect to noise from major roads are where the 1% of the population that are affected by the highest noise levels from major roads are located, according to the results of the strategic noise mapping. There is one NIA within 1km of the proposed scheme, Identification Number (ID) 330 on the A428 Brandon Road, Binley. The noise making and noise receiving authority is Coventry City Council. The location of this NIA is shown on the Constraints Plan, Drawing HE551486-MOU-EGN-A46_A428-LE-0056 (Appendix B).

5.1.3 Likely Scale of Impacts

A key element of the proposed scheme is the grade separation of Binley junction by raising the A46 over the A428 Rugby Road with entry and exit slip roads to an at-grade signalised junction. The A46 mainline through the Binley junction would be designed with a speed limit of 50mph; a reduction of 20mph from the original speed limit of 70mph. Changes to the alignment of the carriageway may result in traffic being moved closer to the identified sensitive receptors. The potential impact the proposed scheme is likely to have on traffic characteristics would include a change in traffic flow, traffic speed and noise level. Evidence from the Stage 1 assessment shows that the changes in traffic volume for the proposed scheme is likely to cause an exceedance of the threshold value for noise of between 1-3dB.

Assuming all other factors do not change, a change in noise level of 1dB $L_{A10,18h}$ is equal to a 25% increase or 20% decrease in traffic flow and a change in noise level of 3dB $L$, represents a 100% increase or a 50% decrease in traffic flow. This is based on the scale of magnitude provided in HD213/11 for short and long-term changes in noise.

As a result of the proposed physical changes to the geometry of this junction, the residential areas to the east, west and northern extent of the Binley junction and the other sensitive receptors in closest proximity to the proposed scheme are likely to experience adverse noise effect during construction of the proposed scheme. With the expected changes to traffic characteristics, there is a high likelihood for adverse noise impacts to sensitive receptors within the noise study area.
The single NIA located within the study area exists within a 1km radius of the proposed scheme. Noise modelling at Stage 3 will enable the quantification of noise increases or decreases at the NIA location arising from the implementation of the proposed scheme. However, considering the distance of the A46 and the proposed scheme from the NIA, it is not anticipated that the noise environment within this NIA would be influenced by road traffic from the A46.

Any new development or works must also take into consideration the Government’s policy on noise. This is set out in the Noise Policy Statement for England (NPSE) which was published in March 2010. It contains the high level vision of promoting good health and good quality of life (wellbeing) through the effective management of noise. It is supported by three aims which are to be achieved through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development. These aims are:

- Avoid significant adverse impacts on health and quality of life;
- Mitigate and minimise adverse impacts on health and quality of life; and
- Where possible, contribute to the improvement of health and quality of life.

These aims would need to be considered when undertaking the impact assessment, especially the treatment of any adverse impacts, but also the possibility for enhancement.

In addition to the NPSE, in May 2013, Highways Agency (now Highways England) issued a Major Projects Instruction (Policy positions on noise and application to major improvement schemes) that is aimed at clarifying the position to take with regard to noise impacts during the assessments of Major Projects. This Instruction effectively imbeds the NPSE aims within current Highways England procedures.

### 5.1.4 Data Requirements and Survey Approach

The traffic data requirements for the noise assessment are as follows:

- Two Way, 18-hour Annual Average Weekday Traffic (AAWT). The time period being 0600 to 0000hrs.
- One way flows on any dual carriageway separated by a central reservation and on motorways and one-way roads (with a column of 0/1 flags to be able to ID them).
- % HGVs (greater than 3.5 tonne unladen) expressed as a percentage of the total flow for the same AAWT period.
- Average speed on the link in kph again over that AAWT period.
- Both DM and DS in the opening year and +15yr design year.

The above traffic data requirements for a detailed noise assessment are included in Appendix C. Traffic data must fulfil the requirements of IAN 185/15.

In addition to the traffic data, digital mapping of the proposed scheme will include:

- DTM (height contours).
- Ordinance Survey (OS) base raster/vector or similar for digitising buildings.
- Address point data to identify sensitive receptors (i.e. dwellings, hospitals, churches, schools etc).
- Scheme drawings.

A baseline noise survey will be required to quantify the noise climate in the vicinity of the scheme. Noise surveys are used to ascertain the influence of traffic and non-traffic noise sources. The noise surveys will be undertaken in accordance with the principles of British Standard (BS) 7445 and following guidance given in Calculation of Road Traffic Noise.
measured absolute noise levels is required for the construction noise assessment will be used as a sense check of the predicted operational noise levels. Locations for noise monitoring will be agreed with the local planning authority. A measure of noise level changes will be determined from the noise modelling exercise once a scheme alignment is confirmed and traffic data provided.

The proposed scheme will undergo a transport scheme appraisal as part of the business case to include the TAG Noise Workbook. This will then feed into the production of the Appraisal Summary Table (AST).

5.1.5 Study Area

A HD 213/11 assessment requires calculations of noise impacts at locations within 600m of both a scheme boundary, and within 600m of any other affected routes within 1km of a scheme boundary. In addition, this guidance requires consideration beyond the affected road network, to take into account the likely noise impacts on the wider road network. The wider road network being identified as 50m either side of the centreline of the identified affected routes.

5.1.6 Proposed Assessment Approach

A detailed quantitative assessment of the operational noise impacts will be undertaken in accordance with the DMRB Volume 11, Section 3, Part 7, HD 213/11. The aim of this DMRB detailed level assessment will be to determine baseline noise, operational noise and the significance of changes in noise for affected properties, leading to the design of appropriate mitigation (if required) in accordance with policy and guidance outlined in the following sections. The potential for vibration effects during operation will also be considered according to the guidance given in the DMRB.

A three-dimensional noise model of the study area will be constructed. The model will include terrain data, ground cover types, road links as well as buildings and other structures that might screen or reflect noise.

5.1.7 Forecasting Approach

Forecast traffic data for both the opening and design years will be required for a detailed noise DMRB assessment and WebTAG appraisal of the proposed scheme.

Highways England issued Interim Advice Note (IAN) 185/15 - updated traffic, air quality and noise advice on the assessment of links speeds and generation of vehicle data into ‘speed bands’ for users of DMRB Volume 11, Section 3, Part 1 ‘Air Quality and Volume 11, Section 3. Part 7 Noise with respect to the input data required for an assessment of noise impacts. This IAN will be applied to inform the production of traffic data for the proposed scheme.

5.1.8 Consideration of Cumulative Effects

Traffic data produced for the detailed noise assessment will include traffic flows associated with future committed developments, allowing cumulative effects to be considered. Committed developments being outlined in the uncertainty log produced at PCF Stage 1.

5.1.9 Determination of Significance

HD213/11 does not provide a method for determining significance. However the DMRB Volume 11 Section 2 Part 5 HA 205/08 provides guidance on determining significance of environmental effects and this will be adopted for the noise assessments.

The DMRB states “In terms of permanent impacts, a change of 1dB(A) in the short-term (e.g. when a project is opened) is the smallest that is considered perceptible. In the long term, a
3dB(A) change is considered perceptible. Such increases in noise should be mitigated if possible." In addition, it is necessary that in all cases where it is considered, mitigation should comply with acceptable standards in terms of traffic, safety, environmental and economic issues (DMRB Volume 11, Section 3, Part 7, Chapter 4 – Design and Mitigation, paragraph 4.10). Examples which could preclude the use of mitigation are disproportionate cost or have unacceptable visual impact.

5.1.10 Justification for the Chosen Approach
The chosen approach is in line with that recommended in HD213/11. No deviation from this is considered necessary.

5.1.11 Proposed Approach to Social and Distributional Impacts
Guidance provided within TAG unit A4.1-2, November 2014 and December 2015 will be the approach adopted for the Social and Distributional Impact (SDI) appraisal.

5.1.12 WebTAG
The TAG appraisal will utilise the noise model that is to be developed for the proposed scheme, and the procedures defined in TAG unit A3 environmental impact appraisal, December 2015.

5.1.13 Communication Strategy
Data from modelled outputs, when available, will inform Statutory Stakeholder engagement and Statutory Environmental Bodies (SEB) process and when finalised will be used to support the Public Information Exercise (PIE) and to prepare the Environmental Assessment Report (EAR)/Record of Determination (RoD). Liaison with the traffic team will be undertaken throughout the stage to ensure the traffic model serves the requirements of a noise assessment.

5.1.14 Work Programme
This assessment is dependent on traffic data which is anticipated for spring 2017 and the production of a fixed preliminary design in early autumn 2017.

Noise modelling for assessment and appraisal will follow in mid-late autumn 2017, and in agreement with Highways England.

5.1.15 Risks Summary
An Interim Advice Note for noise assessment is currently being drafted and may have implications for modelling and forecasting. If the IAN is released after the commencement of the proposed scheme, it may potentially not be possible to incorporate any changes in DMRB into the proposed scheme.

5.1.16 Noise Assessment – Change Log
December 2016 – First version.

5.2 Air Quality Assessment
5.2.1 Existing Knowledge and Data
This section outlines the methodology and traffic data requirements for a detailed air quality assessment of the proposed scheme and provides a brief evaluation of the identified air quality
constraints within the study area. There are a number of residential and non-residential sensitive receptors identified within 1 km of the proposed scheme. These include:

- Educational facilities – Clifford Bridge Primary School, Bambinos Day Nursery (Binley Business Park), St Bartholomew’s Church of England Academy, Blue Bell Woods Day Nursery (Monks Rd Binley).
- Health care facilities – Youell Court Care Home, Bradbury House Respite Unit, Abbeyfield (Bredon Ave), Phil Mead House (Bredon Ave).
- Numerous residential properties (>100).

The Coventry City Council (CCC) city-wide designated Air Quality Management Area (AQMA) borders the western edge of the A46 for the entire length of the proposed scheme and is declared for the exceedance of the annual mean nitrogen dioxide (NO₂) objective. There is currently no AQMA declaration within the study area for particulate matter, either PM₁₀ – assessed as the fraction of airborne particles of a mean aerodynamic diameter less than 10 micrometres – or PM₂.₅ – assessed as the fraction of airborne particles of mean aerodynamic diameter less than 2.5 micrometres – as indicated in the latest Local Air Quality Management (LAQM) report for CCC (2015).

Within the study area, there are seven air quality NO₂ monitoring sites operated by Rugby Borough Council and Highways England. These sites do not indicate any exceedance of the national objective/EU limit value for annual mean NO₂ (40 µg.m⁻³) for the most recently available year. See Table 5-3 below for details of the monitoring sites.

Table 5-3: NO₂ Diffusion Tube Monitoring within the Study Area.

<table>
<thead>
<tr>
<th>ID</th>
<th>Authority</th>
<th>Site Name</th>
<th>Site Type</th>
<th>Easting</th>
<th>Northing</th>
<th>Distance from Kerb (m)</th>
<th>NO₂ (µg.m⁻³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A46Cov_005_0116</td>
<td>Highways England</td>
<td>Valencia Road</td>
<td>Roadside</td>
<td>438410</td>
<td>278903</td>
<td>-</td>
<td>23.2ᵃ</td>
</tr>
<tr>
<td>A46Cov_006_0116</td>
<td>Highways England</td>
<td>The Stoop</td>
<td>Roadside</td>
<td>438758</td>
<td>278903</td>
<td>-</td>
<td>20.8ᵃ</td>
</tr>
<tr>
<td>A46Cov_009_0116</td>
<td>Highways England</td>
<td>Rugby Road</td>
<td>Roadside</td>
<td>438963</td>
<td>277640</td>
<td>-</td>
<td>27.3ᵃ</td>
</tr>
<tr>
<td>A46Cov_010_0116</td>
<td>Highways England</td>
<td>Grange Ave</td>
<td>Roadside</td>
<td>437916</td>
<td>277125</td>
<td>-</td>
<td>16.0ᵃ</td>
</tr>
<tr>
<td>A46Cov_011_0116</td>
<td>Highways England</td>
<td>Middle Ride</td>
<td>Roadside</td>
<td>437341</td>
<td>276436</td>
<td>-</td>
<td>19.0ᵃ</td>
</tr>
<tr>
<td>A46Cov_018_0116</td>
<td>Highways England</td>
<td>Bracadale Close</td>
<td>Background</td>
<td>438201</td>
<td>279004</td>
<td>-</td>
<td>21.1ᵃ</td>
</tr>
<tr>
<td>S14</td>
<td>Rugby</td>
<td>Binley Woods Village Hall</td>
<td>Urban Background</td>
<td>439450</td>
<td>277523</td>
<td>20</td>
<td>17.9ᵇ</td>
</tr>
</tbody>
</table>

ᵃ – 2016 bias adjusted annual mean;ᵇ – 2014 bias adjusted and annualised annual mean
5.2.2 Environmental Constraints Evaluation

The environmental constraints plan (Appendix B) outlines the following air quality related constraints used to identify locations where there is potential for local air quality to be adversely affected by the proposed scheme:

- Air Quality Management Areas (AQMAs) within the study area where air quality objectives are unlikely to be met. These have been identified from Defra ([http://uk-air.defra.gov.uk/aqma/](http://uk-air.defra.gov.uk/aqma/)).
- Location of Local Authority air quality monitoring sites in the study area.
- Location of Defra Pollution Climate Mapping (PCM) model links. The PCM model is a set of models developed to achieve the UK's EU Directive (2008/50/EC) requirements on the reporting of concentrations of particular pollutants in the atmosphere. It will be used in this context to give an indication of local air quality in the scheme area.

The environmental constraints map provides an initial indication of the likely study area which is defined by a 1 km buffer zone of the A46 corridor. The study area overlaps with the Coventry city-wide AQMA declared by CCC for NO₂. The AQMA encompasses all land within the administrative boundaries of the city of Coventry and runs adjacent to the A46 north bound links.

Defra’s 2016 NO₂ 1x1 grid square background concentrations along the proposed scheme corridor presented in Table 5-4 below, indicate that the highest NO₂ concentration of 20.5 µg.m⁻³ occurs in the grid square incorporating the Binley junction of the A46 and the A428. Background concentrations of PM₁₀ and PM₂.₅ within the study area are below the national objective/EU limit value of an annual mean concentration of 50 µg.m⁻³ and 25 µg.m⁻³ respectively.

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Maximum Concentration (µg.m⁻³)</th>
<th>Easting, Northing</th>
<th>Minimum Concentration (µg.m⁻³)</th>
<th>Easting, Northing</th>
<th>Average Concentration (µg.m⁻³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOₓ</td>
<td>30.4</td>
<td>438500,277500</td>
<td>24.8</td>
<td>437500,277500</td>
<td>27.3</td>
</tr>
<tr>
<td>NO₂</td>
<td>20.5</td>
<td>438500,277500</td>
<td>17.2</td>
<td>437500,277500</td>
<td>18.7</td>
</tr>
<tr>
<td>PM₁₀</td>
<td>17.1</td>
<td>438500,277500</td>
<td>15.0</td>
<td>437500,277500</td>
<td>16.1</td>
</tr>
<tr>
<td>PM₂.₅</td>
<td>12.0</td>
<td>438500,277500</td>
<td>10.9</td>
<td>437500,277500</td>
<td>11.5</td>
</tr>
</tbody>
</table>

Preliminary traffic data were screened against the scoping criteria provided in HA207/07 as to determine the affected road network which includes roads that meet any of the following criteria:

- Road alignment will change by 5 m or more; or
- Daily traffic flows will change by 1,000 AADT or more; or
- Heavy Duty Vehicle (HDV) flows will change by 200 AADT or more; or
- Daily average speed will change by 10 km/hr or more; or
- Peak hour speed will change by 20 km/hr or more.

The scoping exercise shows that there are 85 affected road links within the preliminary traffic dataset.

There are three roads with PCM model links identified in the study area intersecting the affected road network. The sections cover the M6 Junction 2 with the A46, the A428 through...
the Binley junction with the A46 and the A45 junction with the A44. The highest predicted roadside NO$_2$ concentration for a PCM link within the study area in the model base year (2013) is 52 µg.m$^{-3}$ on the M6 that intersects the affected road network, reducing to 33 µg.m$^{-3}$ in the future year model (2020).

DMRB, Volume 11, Section 3, Part 1 HA 207/07 Air Quality guidance identifies that statutory designated conservation sites may be sensitive to Nitrogen Oxides and Nitrogen deposition, which can have direct and indirect impacts upon vegetation, affecting species composition and ecosystem health require consideration for assessment.

There are two designated sites that could be affected by Nitrogen Oxides (NO$_x$) within the study area. They are Combe Pool Site of Special Scientific Interest (SSSI) located near A46/B4082 roundabout and Herald Way Marsh SSSI adjacent to the A46 northbound and just south of Binley Industrial Estate.

Table 5-5: Designated sites within the study area

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coombe Pool</td>
<td>SSSI</td>
<td>Near A46/B4082 roundabout of an area 50.97ha and is centred on 439063, 279341. Coombe Pool is one of the most important ornithological sites in Warwickshire for its herons Ardea cinerea, other breeding birds, and for its wintering wildfowl.</td>
</tr>
<tr>
<td>Herald Way Marsh</td>
<td>SSSI</td>
<td>Designated in 1988. The site ranges from open water through swamp and fen to marsh, as well as areas of grassland, scrub and woodland.</td>
</tr>
</tbody>
</table>

5.2.3 Likely Scale of Impacts

Receptors more likely to receive a higher order of impact are anticipated to be those in closest proximity to motorways and any major roads in the affected road network including the A46. Some of the identified sensitive receptors are located within the Coventry City Council city-wide AQMA and therefore, there is potential for an adverse local air quality impact within the existing AQMA.

Air quality impacts are more likely to be significant where there are receptors that are sensitive to changes in pollutant concentrations, such as residential properties and locations of the young, elderly and those with health conditions, or where receptors are located in areas of non-compliance with air quality objectives.

5.2.4 Data Requirements and Survey Approach

Local authority air quality monitoring data is available in the study area but there are a limited number of monitoring sites adjacent to the A46. Highways England conducted an NO$_2$ monitoring programme along the A46 for a six month period from January 2016 to June 2016. There are sites within the dataset which are suitable for verification, therefore no further monitoring will be required. It should be noted that future traffic forecasts may change the study area, and include areas where monitoring data is currently not available.

Relevant traffic data for the proposed scheme will be supplied in accordance with the requirements set out in MPI 28-082014 and MPI 29-082014. Speed band categories will be provided for each traffic link (based on pivoted speeds), as described in Highways England Interim Advice Note 185/15. The traffic data should fulfil the requirements of the template given in Appendix C.

The assessment will utilise Defra PCM model outputs in order to report compliance against the EU Directive on Ambient Air Quality. The IAN 175/13 prescribing the compliance risk
assessment methodology has been withdrawn and is currently under review. Highways England is being consulted on an appropriate methodology for assessing compliance in the interim period.

The proposed scheme will undergo a transport scheme appraisal as part of the business case to include the Air Quality Valuation Workbook and Local Air Quality Workbook.

5.2.5 Study Area

The study area for the air quality assessment will encompass receptors within 200 m of the identified ‘affected road network’, as defined with reference to DMRB HA 207/07, which is also adopted in the TAG Unit A3 Air Quality guidance. Preliminary traffic data were screened to determine the likely extent of the affected road network in relation to local air quality assessment, as presented on the Constraints Plan, (Appendix B).

Similarly, preliminary traffic data were screened to identify the regional affected road network according to the following DMRB HA207/07 criteria, including links that experience:

- A change of more than 10% in AADT; or
- A change of more than 10% to the number of heavy duty vehicles; or
- A change in daily average speed of more than 20 km/hr.

The regional affected road network includes 48 road links as shown on the Constraints Plan (Appendix B).

5.2.6 Proposed Assessment Approach

The air quality assessment will be undertaken following DMRB HA207/07 and TAG Unit A3, with reference to Defra’s technical air quality guidance where applicable.

Detailed traffic data screening has been undertaken to establish the affected road network (and study area) for both the local and regional assessment. Given the location and extent of the affected road network that satisfies the respective DMRB criteria, a detailed local air quality assessment in accordance with DMRB HA207/07 will be required.

An atmospheric dispersion model will be developed to inform a detailed assessment and define the magnitude of potential local air quality impacts.

Highways England has issued the following Interim Advice Notes on the assessment of air quality which will also be used to inform the assessment:

- IAN 170/12, Updated air quality advice on the assessment of Future NOx and NO2 projections for users of DMRB Volume 11, Section 3, Part 1, Air Quality.
- IAN 174/13, Updated advice for evaluating significant local air quality effects for users of DMRB Volume 11, Section 3, Part 1 Air Quality.

5.2.7 Forecasting Approach

Preliminary traffic data that fulfils the requirements for screening against the DMRB (HA207/07) criteria and IAN 185/15 has been used to identify the affected roads to be included in a detailed assessment of changes in local and regional air quality through atmospheric dispersion modelling. The scenarios to be considered comprise:
• Base Year (2013)
• Opening Year without the proposed scheme (Do Minimum) (2021)
• Opening Year with the proposed scheme (Do Something) (2021)
• Design Year Do Minimum (2036)
• Design Year Do Something (2036)

The dispersion model (ADMS-Roads) will be utilised to predict concentrations of the aforementioned air pollutants at the identified sensitive receptors. This will facilitate model verification of the base year model outputs versus monitoring data, in addition to an assessment of predicted local air quality impacts and associated significance in relation to the proposed scheme.

In terms of regional emissions, total annual mass emissions of the respective pollutants and carbon dioxide (CO₂) will be predicted for each model scenario. This will enable the impact of the proposed scheme to be predicted and assessment within the context of total regional road emissions data published by the National Atmospheric Emissions Inventory (NAEI).

5.2.8 Consideration of Cumulative Effects

Finalised traffic data produced for the air quality assessment will include traffic flows associated with future committed developments, allowing cumulative effects to be considered. Committed developments being outlined in the uncertainty log produced at PCF Stage 1.

5.2.9 Determination of Significance

A determination of potential significant effects will be reported for the proposed scheme with reference to IAN 174/13 Evaluation of Significant Local Air Quality Effects. IAN 174/13 provides supplementary guidance on how to apply the significance criteria in relation to Air Quality.

5.2.10 Justification for the Chosen Approach

The approach will follow current Highways England TAG / DMRB guidance and will also include emerging updates to policy and guidance where the programme permits. From screening of preliminary traffic data and given the location of the scheme within an urban area and adjacent to an AQMA, a detailed air quality assessment is the most appropriate level of assessment.

5.2.11 Proposed Approach to Social and Distributional Impact

The approach for the SDI will be to follow the guidance within TAG unit A4.1-2, November 2014 and December 2015 respectively.

5.2.12 WebTAG

The proposed scheme will undergo a transport scheme appraisal as part of the business case to include the TAG Local Air Quality Workbook. This will then feed into the production of the Appraisal Summary Table (AST). The TAG appraisal will utilise the Air Quality model that is to be developed for the proposed scheme, and the procedures defined in TAG unit A3 environmental impact appraisal, December 2015.

5.2.13 Communications Strategy

Data from modelled outputs, when available, will inform Statutory Stakeholder engagement and Statutory Environmental Bodies (SEB) process and when finalised will be used to support the Public Information Exercise (PIE) and to prepare the Stage 3 Environmental Assessment Report (EAR).
5.2.14 Work Programme

This assessment is dependent on traffic data which is anticipated for spring 2017 and the production of a fixed preliminary design in early autumn 2017.

Air Quality modelling for assessment and appraisal will follow in mid-late autumn 2017, and in agreement with Highways England.

5.2.15 Risk Summary

The proposed A46 scheme study area incorporates road links included in Defra’s Pollution Climate Mapping (PCM) model, which is a national-scale model designed to fulfil part of the UK’s EU Directive (2008/50/EC) requirements to report on the concentrations of particular pollutants in the atmosphere, including annual mean NO₂. A High Court ruling in November 2016 on Defra’s national air quality plan – targeted at reducing concentrations of NO₂ within towns and cities concluded that the current PCM model produced by Defra is over optimistic, requiring a revision to both the model and the timetable for achieving compliance with the EU annual mean limit value for NO₂.

The revised Defra PCM model could potentially predict higher NO₂ concentrations adjacent to PCM links and the updated national air quality plan is likely to shorten the timetable to achieve compliance with the EU limit value. This presents a potential risk to the proposed scheme, particularly if the predicted baseline NO₂ values adjacent to the respective PCM links increase, resulting in either an exceedance of the annual mean NO₂ limit value or reduced ‘headroom’ between the predicted value and the limit value. If the introduction of the proposed scheme is predicted to increase local NO₂ concentrations, this could lead to a worsening of an existing exceedance or result in a new exceedance of the limit value. This could subsequently impact the timetable for compliance and thus the potential significance of the proposed scheme with respect to air quality.

To mitigate this risk, an initial air quality screening exercise will be undertaken to predict NO₂ concentrations at selected ‘worst case’ sensitive receptors, i.e. those closest to affected road links within the proposed scheme study area. The screening exercise will utilise Highways England’s latest DMRB local air quality model and the latest scheme traffic data, including base year and future opening year ‘without’ and ‘with’ scheme scenarios. This exercise will provide an indication of the potential magnitude of change to NO₂ levels associated with the scheme and thus the potential significance with respect to air quality, in advance of Defra’s revised PCM model and timetable release.

The aforementioned screening exercise will provide an indication of the potential for the scheme to cause exceedances of the national air quality limit value, which could result in a risk to the scheme programme (delays) and significance (adverse impacts). The outcomes of the screening will identify, at an early stage, the need for further baseline air quality monitoring, detailed modelling at specific locations and consideration of potential mitigation.

5.2.16 Change Log

December 2016 – Stage 3 version 1.

5.3 Water Environment Assessment

5.3.1 Existing Knowledge and Data

At this stage no water environment assessments or surveys have been undertaken for the proposed scheme. This section therefore highlights the traffic data requirements, the
methodology that will be adopted and provides a brief evaluation of constraints identified through a desk study.

5.3.2 Environmental Constraints Evaluation

There are four rivers classified under the Water Framework Directive (WFD) within 50m of the scheme:

- The River Sowe from its confluence with Withy Brook to the confluence with the River Avon.
- The River Sowe from the confluence with Breach Brook to the confluence with Withy Brook.
- Withy Brook from its source to the confluence with the River Sowe.
- Smite Brook from its source to its confluence with the River Sowe.

There are Lowland Fens which are considered standing waters at the following five locations:

- SP375787 (Stoke Floods).
- SP391789 (Marsh in Coombe Abbey West Deer Park).
- SP393795 (Coombe Pool).
- SP391795 (Not named).
- SP381769 (Herald Way Marsh / Claybrookes Marsh).

Coombe Pool is a lake which is designated as a Site of Special Scientific Interest, in close proximity to the proposed scheme.

There are category 2 and 3 flood zones associated with the Withy Brook, Smite Brook and River Sowe within 100m of the existing highway boundary.

The underlying groundwater body classified under the WFD is the Warwickshire Avon-Secondary Mudrocks. Limited groundwater resources are available due to local conditions and no sources of drinking water have been identified in the study area.

5.3.3 Likely Scale of Impacts

There are surface water and groundwater bodies that could potentially be impacted through the deterioration of water quality and changes to flow. The proposed scheme is expected to involve an increase in impermeable area, which would increase the highway drainage discharge volumes and rates. Engineering solutions can be included to attenuate changes in discharge and mitigate any deterioration of water quality. There is an opportunity to address any existing water quality or flooding issues for this section of the strategic road network or bring it to a higher standard.

5.3.4 Data Requirements and Survey Approach

A detailed desk study and review will be undertaken to identify relevant water environment receptors and collate any information on their status. A site visit may be required dependent on the results of the detailed desk study and production of a detailed drainage design.

Traffic data (AADT) will be required to complete the Highways Agency Water Risk Assessment Tool (HAWRAT), Accidental Spillage Assessment (Method D) and Environmental Quality Standards (EQS) Assessment. The traffic data requirements as set out in Appendix C are appropriate for this assessment.

5.3.5 Study Area
The study area has been defined as the physical area of the proposed scheme under consideration and a buffer of 1km either side of the route alignment and any surface or groundwater bodies or water dependent conservation sites located up to 1km downstream of any potential future outfalls that will discharge highway drainage.

5.3.6 Proposed Assessment Approach

The proposed options will be assessed with reference to the methodologies and criteria within DMRB Volume 11, Section 3, Part 10 - Road Drainage and the Water Environment (HD 45/09).

A qualitative assessment to identify potential effects of the proposed scheme on hydrological and hydrogeological features will be undertaken comprising an assessment of the potential effects of construction works, changes in the rate and quality of operational surface water run-off and any changes to flood risk.

A TAG appraisal, with reference to TAG Unit A3: Environmental Impact Appraisal, December 2015 (unless updated), will also be undertaken.

5.3.7 Forecasting Approach

Traffic forecasts are required for a quantitative DMRB assessment of the detailed drainage design of the proposed scheme. This will comprise of a DMRB HD 45/09 ‘Method A’ (Highways Agency Water Risk Assessment Tool & Environmental Quality Standards) assessment to assess the impact of routine runoff on local watercourses, and a DMRB HD 45/09 ‘Method C’ groundwater assessment for any potential groundwater discharges. The potential for accidental spillages within drainage networks to cause an impact on receiving waterbodies will be assessed following DMRB HD 45/09 ‘Method D’.

5.3.8 Consideration of Cumulative Effects

A qualitative assessment of potential interactions with other schemes or developments will be undertaken at Stage 3 with reference to DMRB Volume 11, Section 2, Part 5.

5.3.9 Determination of Significance

A quantitative indication of potential significant effects will be produced for the proposed scheme with reference to DMRB Volume 11, Section 2, Part 5 (HA 205/08). This guidance provides a framework for the development of significance criteria based around consideration of resource value, magnitude of impact and the significance of effects. DMRB Volume 11, Section 3, Part 10 (HD 45/09) provides guidance on the application of such significance criteria in the assessment of impacts on the water environment which will be followed for this assessment.

5.3.10 Justification for the Chosen Approach

The assessment and appraisal will be in accordance with published DMRB and WebTAG guidelines.

5.3.11 Proposed Approach to Social and Distributional Impacts

Not applicable for this topic.

5.3.12 WebTAG

The proposed scheme will undergo a transport scheme appraisal as part of the business case to include the TAG Water Environment Worksheet. This will then feed into the production of the Appraisal Summary Table (AST). The TAG appraisal will adopt the procedures defined in TAG unit A3 environmental impact appraisal, December 2015.
5.3.13 Communication Strategy

The output from this assessment, when available, will inform Statutory Stakeholder and Statutory Environmental Bodies (SEB) engagement and when finalised will be used to support the Public Information Exercise (PIE) and to prepare the Environmental Assessment Report (EAR). Liaison with the design team will be undertaken.

5.3.14 Work Programme

This assessment is dependent on traffic data which is anticipated for spring 2017, a detailed drainage design expected in late spring-early summer 2017 and the production of a fixed preliminary design in early autumn 2017. This will enable assessments for both routine runoff and accidental spillage of contaminants in mid-late autumn 2017, and in agreement with Highways England.

5.3.15 Risks Summary

The current risks associated with the water environment assessment relate to the drainage design for the proposed scheme. These risks include the potential for proposed road drainage networks to fail the assessments detailed in section 5.3.7, and therefore not meet Environment Agency requirements for discharges to the water environment (both surface water and groundwater receptors), particularly with designated receptors located downstream.

To manage this risk, early liaison between the drainage design and water environment assessment teams is required. An iterative design-assessment process will be established, to ensure the drainage design incorporates sufficient SuDS to meet the water quality assessment requirements. The potential need for multiple stage SuDs also has some land take implications, which would be considered at an early stage.

Additionally, the need for land to be made available for construction SuDs to manage potential construction sediment pollution would be considered as early as possible. Construction SuDS typically require considerably more land than the operational SuDS and this will be taken into consideration when defining land-take requirements.

5.3.16 Change Log

December 2016 – First version.
### Glossary

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AADT</td>
<td>Annual Average Daily Traffic</td>
</tr>
<tr>
<td>AAWT</td>
<td>Annual Average Weekday Traffic</td>
</tr>
<tr>
<td>ASR</td>
<td>Appraisal Specification Report</td>
</tr>
<tr>
<td>AQMA</td>
<td>Air Quality Management Areas</td>
</tr>
<tr>
<td>AQSS</td>
<td>Air Quality Strategy</td>
</tr>
<tr>
<td>ATC</td>
<td>Automatic Traffic Count</td>
</tr>
<tr>
<td>BCR</td>
<td>Benefit Cost Ratio</td>
</tr>
<tr>
<td>CASM</td>
<td>Coventry Area Strategic Model</td>
</tr>
<tr>
<td>CSR</td>
<td>Client Scheme Requirements</td>
</tr>
<tr>
<td>dB(A)</td>
<td>Decibels (A-weighted)</td>
</tr>
<tr>
<td>DCO</td>
<td>Development Consent Order</td>
</tr>
<tr>
<td>DMRB</td>
<td>Design Manual for Roads and Bridges</td>
</tr>
<tr>
<td>DfT</td>
<td>Department for Transport</td>
</tr>
<tr>
<td>EAR</td>
<td>Environmental Assessment Report</td>
</tr>
<tr>
<td>EQS</td>
<td>Environmental Quality Standard</td>
</tr>
<tr>
<td>HA</td>
<td>Highways Agency (replaced by Highways England on 1 April 2015)</td>
</tr>
<tr>
<td>HAWRAT</td>
<td>Highways Agency Water Risk Assessment Tool</td>
</tr>
<tr>
<td>HE</td>
<td>Highways England</td>
</tr>
<tr>
<td>LAQM</td>
<td>Local Air Quality Management</td>
</tr>
<tr>
<td>LDEN</td>
<td>Day Evening Night Sound Level</td>
</tr>
<tr>
<td>LMVR</td>
<td>Local Model Validation Report</td>
</tr>
<tr>
<td>(Lnight)</td>
<td>Night Time Levels (Road Traffic Noise)</td>
</tr>
<tr>
<td>LNR</td>
<td>Local Nature Reserve</td>
</tr>
<tr>
<td>IA (Noise)</td>
<td>Important Areas</td>
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<tr>
<td>IAN</td>
<td>Interim Advice Note</td>
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<tr>
<td>M6 J2-J4 SMP</td>
<td>M6 Junction 2 – Junction 4 Smart Motorway Programme</td>
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<td>MCTC</td>
<td>Manual Classified Traffic Count</td>
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<tr>
<td>NIA</td>
<td>Noise Important Area</td>
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<tr>
<td>NTEM</td>
<td>National Trip End Model</td>
</tr>
<tr>
<td>Acronym</td>
<td>Definition</td>
</tr>
<tr>
<td>---------</td>
<td>------------------------------------------------</td>
</tr>
<tr>
<td>NOx</td>
<td>Oxides of Nitrogen</td>
</tr>
<tr>
<td>NO₂</td>
<td>Nitrogen Dioxide</td>
</tr>
<tr>
<td>NPSE</td>
<td>Noise Policy Statement for England</td>
</tr>
<tr>
<td>NPV</td>
<td>Net Present Value</td>
</tr>
<tr>
<td>OAR</td>
<td>Options Assessment Report</td>
</tr>
<tr>
<td>OS</td>
<td>Ordnance Survey</td>
</tr>
<tr>
<td>PCF</td>
<td>Project Control Framework</td>
</tr>
<tr>
<td>PCM</td>
<td>Pollution Climate Mapping</td>
</tr>
<tr>
<td>PERA</td>
<td>Preliminary Environmental Risk Assessment</td>
</tr>
<tr>
<td>PIE</td>
<td>Public Information Exercise</td>
</tr>
<tr>
<td>PM₁₀</td>
<td>Particulate Matter (less or equal to 10micron)</td>
</tr>
<tr>
<td>PVB</td>
<td>Present Value Benefit</td>
</tr>
<tr>
<td>PVC</td>
<td>Present Value Cost</td>
</tr>
<tr>
<td>RIS</td>
<td>Roads Investment Strategy</td>
</tr>
<tr>
<td>RoD</td>
<td>Record of Determination</td>
</tr>
<tr>
<td>SEB</td>
<td>Statutory Environmental Body</td>
</tr>
<tr>
<td>SOBC</td>
<td>Strategic Outline Business Case</td>
</tr>
<tr>
<td>SPA</td>
<td>Spatial Planning Arrangement</td>
</tr>
<tr>
<td>TRADS</td>
<td>Traffic Flow Data System</td>
</tr>
<tr>
<td>WFD</td>
<td>Water Framework Directive</td>
</tr>
<tr>
<td>WebTAG</td>
<td>Web Transport Appraisal Guidance</td>
</tr>
</tbody>
</table>
## 7 Appendix A – Distributional Impacts: Screening Proforma

Scheme description: Binley 50. Grade separation of Binley roundabout by raising the A46 over the A428 Rugby Road with entry and exit slip roads to an at-grade signalised junction. The speed limit on the A46 mainline through the junction would be 50mph.

<table>
<thead>
<tr>
<th>Indicator</th>
<th>(a) Appraisal output criteria</th>
<th>(b) Potential impact (yes / no, positive / negative if known)</th>
<th>(c) Qualitative Comments</th>
<th>(d) Proceed to Step 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>User benefits</td>
<td>The TUBA user benefit analysis software or an equivalent process has been used in the appraisal; and/or the value of user benefits Transport Economic Efficiency (TEE) table is non-zero.</td>
<td>Yes. Positive.</td>
<td>The TUBA analyses indicate that there are user benefits with respect to journey time.</td>
<td>Yes</td>
</tr>
<tr>
<td>Noise</td>
<td>Any change in alignment of transport corridor or any links with significant changes (&gt;25% or &lt; -20%) in vehicle flow, speed or %HDV content. Also note comment in TAG Unit A3.</td>
<td>Yes. Neutral to slightly negative.</td>
<td>There will be potentially be a change in road traffic generated noise levels as the scheme is forecast to attract more traffic to the A46 corridor, however it is anticipated that traffic will be travelling at a lower speed. There are numerous properties and other noise sensitive receptors within 600 m of the existing Binley junction. This indicates that there is the potential for adverse impacts during construction and operation of either option. Within 1km of the Binley junction there are two Defra Noise Important Areas (NIAs); reference numbers 325</td>
<td>Yes</td>
</tr>
</tbody>
</table>
### Indicator: Air quality

<table>
<thead>
<tr>
<th>(a) Appraisal output criteria</th>
<th>(b) Potential impact (yes / no, positive / negative if known)</th>
<th>(c) Qualitative Comments</th>
<th>(d) Proceed to Step 2</th>
</tr>
</thead>
</table>
| Any change in alignment of transport corridor or any links with significant changes in vehicle flow, speed or %HDV content:  
  • Change in 24 hour AADT of 1000 vehicles or more  
  • Change in 24 hour AADT of HDV of 200 HDV vehicles or more  
  • Change in daily average speed of 10kph or more  
  • Change in peak hour speed of 20kph or more | Yes. Neutral to slightly negative. | There are numerous dwellings and other sensitive receptors within 200m of the proposed option. This indicates that there is the potential for adverse impacts during construction and operation of the scheme. The traffic changes and affected road network, associated with the proposed option, will be within 200 m of the Coombe Pool Site of Specific Scientific Interest (SSSI). The Coventry City AQMA which is designated citywide for the exceedance of the annual mean nitrogen dioxide objective borders the A46 and part of the proposed option. | Yes |

and 330. Consideration should be given to improving the noise environment in NIA locations where possible.
<table>
<thead>
<tr>
<th>Indicator</th>
<th>(a) Appraisal output criteria</th>
<th>(b) Potential impact (yes / no, positive / negative if known)</th>
<th>(c) Qualitative Comments</th>
<th>(d) Proceed to Step 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accidents</td>
<td>Any change in alignment of transport corridor (or road layout) that may have positive or negative safety impacts, or any links with significant changes in vehicle flow, speed, %HGV content or any significant change (&gt;10%) in the number of pedestrians, cyclists or</td>
<td>Yes. Positive.</td>
<td>The COBALT analysis indicates that accident benefits are forecast as a result of the grade separation of Binley Roundabout and the resultant removal of A46 mainline traffic.</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>• Change in road alignment of 5m or more</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indicator</td>
<td>(a) Appraisal output criteria</td>
<td>(b) Potential impact (yes / no, positive / negative if known)</td>
<td>(c) Qualitative Comments</td>
<td>(d) Proceed to Step 2</td>
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<tr>
<td>-----------</td>
<td>-----------------------------</td>
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</tr>
<tr>
<td>Motorcyclists using road network.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Security</td>
<td>Any change in public transport waiting/interchange facilities including pedestrian access expected to affect user perceptions of personal security.</td>
<td>No impact.</td>
<td>No changes to the provision of lighting and visibility are expected as a result of the scheme. The scheme is not located on a route currently served by public transport and therefore no changes are expected in relation to public transport facilities. Pedestrian access is expected to be retained. The scheme does not include changes to formal surveillance, and changes to traffic flows on the wider network are not expected to be significant enough to change the levels of informal surveillance.</td>
<td>No</td>
</tr>
</tbody>
</table>

Page 43
<table>
<thead>
<tr>
<th>Indicator</th>
<th>(a) Appraisal output criteria</th>
<th>(b) Potential impact (yes / no, positive / negative if known)</th>
<th>(c) Qualitative Comments</th>
<th>(d) Proceed to Step 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Severance</td>
<td>Introduction or removal of barriers to pedestrian movement, either through changes to road crossing provision, or through introduction of new public transport or road corridors. Any areas with significant changes (&gt;10%) in vehicle flow, speed, %HGV content.</td>
<td>Yes. Positive.</td>
<td>The scheme does not introduce any new infrastructure routes that could reduce severance. Nor does the scheme include the introduction or removal of public transport services. As a result of the scheme there will be changes to the routeing of vehicles, which may lead to some links exceeding the 10% change in vehicle flow threshold, which then determines that an assessment of severance is needed. The grade separation of Binley roundabout will result in improved crossing facilities, reduced crossing times for pedestrians and cyclists and a reduction in existing severance caused by the at-grade A46. Whilst the expected increase in vehicles on the A46 will not change the degree of severance at this location, the rerouting of vehicles away from some local routes should reduce traffic flow, and may improve severance conditions in these localities.</td>
<td>Yes</td>
</tr>
<tr>
<td>Accessibility</td>
<td>Changes in routings or timings of current public transport services, any changes to public transport provision, including routing, frequencies, waiting facilities (bus stops / rail stations) and rolling stock, or any indirect impacts on accessibility to</td>
<td>No impact.</td>
<td>The scheme does not require the relocation of any amenities. The scheme is not on a public transport route. Changes to traffic flows on the wider network are not expected to be significant enough to affect access to amenities or public transport facilities located on the surrounding network.</td>
<td>No</td>
</tr>
<tr>
<td>Indicator</td>
<td>(a) Appraisal output criteria</td>
<td>(b) Potential impact (yes / no, positive / negative if known)</td>
<td>(c) Qualitative Comments</td>
<td>(d) Proceed to Step 2</td>
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<tr>
<td>Services (e.g. demolition &amp; re-location of a school).</td>
<td></td>
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<tr>
<td>Affordability</td>
<td>In cases where the following charges would occur; Parking charges (including where changes in the allocation of free or reduced free spaces may occur); Car fuel and non-fuel operating costs (where, for example, rerouting or changes in journey speeds and congestion occur resulting in changes in costs); Road user charges (including discounts and exemptions for different groups of travellers); Public transport fare changes (where, for example premium fares are set on new or existing modes or where</td>
<td>Yes. Negative.</td>
<td>The scheme will have an impact on car fuel and non-fuel operating costs, only. As a result of rerouting it is expected that there will be changes to these costs. For car fuel and non-fuel operating costs, the outputs from TUBA can be used, and indicate negative benefits. The remaining areas of affordability (parking charges, road user charges, public transport fares and concession availability) are not affected by the scheme.</td>
<td>Yes</td>
</tr>
<tr>
<td>Indicator</td>
<td>(a) Appraisal output criteria</td>
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<td></td>
<td>multi-modal discounted travel tickets become available due to new ticketing technologies; or Public transport concession availability (where, for example concession arrangements vary as a result of a move in service provision from bus to light rail or heavy rail, where such concession entitlement is not maintained by the local authority[1]).</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
8 Appendix B - Environmental Constraints Plan
9 Appendix C - Air Quality and Noise Traffic Data template
Appendix 1 C.06: A46 CLIENT SCHEME REQUIREMENTS (CSR)
Client Scheme Requirements

The Client Scheme Requirements is produced in SIP and reviewed at each subsequent Stage. The information given here is updated accordingly as the design evolves. Therefore certain sections below can only be completed / updated once a preferred option is selected. Where this applies to a section this will be indicated in the guidance notes below.

PROJECT DEFINITION

PROJECT TITLE

As defined in the Highways England Delivery Plan. The title provided here will be used by the MP Programme Hub for establishing the set-up documentation and populating other databases.

PIN NUMBER

The PIN number is assigned by MP Programme Hub when it is entered onto the ORACLE cost system.

MAJOR SCHEME MS NUMBER

The MS number is assigned by the MP Programme Hub when it is entered onto the PowerSteering system.

SCHEME CONTACT INFORMATION

Project Sponsor:
Martin Potts

MP Project Manager:
Steve Wrenn Walsgrave
Steve Davies Binley

SRO:
David Haimes

OD Senior User:
Isabele Maxwell

Other Key Consultees:
Anita Prashar (Programme Leader)

SCHEME TYPE

Junction improvements

ROAD AND/OR GEOGRAPHIC LOCATON

The A46 south and east of Coventry

The A46 is a strategic link between the East and West Midlands, and beyond, linking the M1 J21 and M40 J15, connecting Coventry and Warwickshire to the motorway system and providing connections to the SVN and the rest of the country.

The A46 is included in Highways England’s South Midlands Route Strategy which covers 440 carriageway miles (both directions) running from M5 J9, in the west, to the M69 at the M42 interchange which links to the M4, in the east.

The South Midlands Route provides access to a number of significant traffic generators, including the National Exhibition Centre, Birmingham and the Donnington Park Motor Racing Circuit. Coventry and East Midlands airports are within the route and it links these major international hubs with the M1 and M6. The A46 corridor links the M1 with the M40, thus providing an alternative route to the M42 for longer distance NE-SW travel.

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The route section is 6.6 km in length located between A46/A45 Tollbar End Junction to the South and M6 Junction 2 to the North and consists of a dual carriageway with two at-grade junctions. Two junctions connect the A46 to the A468 Binley roundabout (known locally as TGI junction) and the B4082 at Walsgrave roundabout. The Binley junction is signalised and incorporates a controlled NMU crossing.

Major improvement was carried out recently to grade separate the A46/A45 Tollbar End junction on the South and N4 Junction 2 to the North and consists of a dual carriageway with two at-grade junctions. Two junctions connect the A46 to the A468 Binley roundabout (known locally as TGI junction) and the B4082 at Walsgrave roundabout. The Binley junction is signalised and incorporates a controlled NMU crossing.

Major improvement was carried out recently to grade separate the A46/A45 Tollbar End junction this was Open for Traffic in December 2016. Works to convert the M6 between Junctions 2 and 4 to Smart Motorways began in Winter 2017 and are expected to be completed in March 2020.

PROJECT DESCRIPTION

A high level statement of the scope is required, including how the improved customer outcome will be delivered.

Road Investment Strategy Statement - Grade separation of the Binley and Walsgrave roundabouts on the A46 near Coventry, upgrading the trunk road sections of the A45 and A46 between the M6 and M40 to full Expressway standard.

Highways England Delivery Plan - Provide access along the A46 to further residential developments and key employment sites near Binley and Walsgrave.

A phased delivery approach is being taken: Binley junction first followed later by Walsgrave junction.

Binley junction The preferred route for Binley junction was announced in March 2018. The A46 dual carriageway will be carried over the junction with the A468 on a flyover, separating local traffic using the A468 from through traffic using the A46. Drivers staying on the A46 will not need to pass through the roundabout, improving traffic flows and reducing journey times. Local road users will benefit from reduced flows on the roundabout. The design will provide improvements to the existing footways and cycle paths for non-motorised users. See proposed layout below:

Walsgrave junction Highways England is developing options which the public will be invited to comment on. No proposals have been published yet. Public consultation is planned in 2020.

Expressway Within the extents of the two junction improvements, the project will provide geometric layout to permit operation of A46 at the national speed limit and a rigid central reserve barrier. The upgrading of the remainder of the trunk road sections of the A45 and A46 between the M6 and M40 to expressway is not part of this project.

STATUS

Indicate the current Stage that the project is in. Note that this document is reviewed at every stage.

The Binley Junction scheme is currently in Project Control Framework (PCF) Stage 4. Walsgrave Junction is in PCF Stage 1.

CHALLENGES AND ISSUES

[Graph or image of project layout]
National Objectives
• Lane provision at Binley Junction will increase, at the junction, from 2 to 3 lanes (as it has been assessed at completion of the Option Phase and set as the preferred option is selected). These detailed objectives, comprised of the high-level outcomes that the scheme is intended to contribute to are as follows:
- Providing capacity and connectivity to support national and local economic activity
- Supporting and improving journey quality, reliability and safety
- Encouraging Economic Growth
- Supporting the smooth flow of traffic
- Keeping the network in good condition
- Improving user satisfaction
- Making the network safer
- Encouraging Economic Growth
- Supporting the smooth flow of traffic
- Keeping the network in good condition
- Improving user satisfaction
- Making the network safer

Transport Objectives
Define the high level objectives of the scheme, in terms of desired outcomes, such as improvement in journey times, reliability, safety, or catering for economic and housing growth. Where applicable, reference the objectives identified in the high level business case prepared through route strategies.
More detailed objectives (flowing from the high level objectives) should be developed as the design evolves and particularly once the preferred option is selected. These detailed objectives, comprised of specific, targets and measures should reflect the guidance given in WebTAG and be consistent with the Appraisal Summary Table (AST).
There should also be an objective to deliver a scheme which matches or improves on the value for money of the selected option, as it has been assessed at completion of the Option Phase and set out in the AST and Value for Money (VFM) assessment. This should be consistent with objectives provided in the RIS Investment Plan and for Highways England Delivery Plan or any changes to that during construction.

Performance Specification
Provide details of the performance specification that will be delivered by the RIS Performance Specification together with an indication of how they support delivery of the Key Performance Indicators (KPIs).

Route Performance Data collected between 2005 and 2015 demonstrated that:
- The A46 south of Coventry (between A426 and M45) is the busiest section on the south midlands route.
- 84% of average annual daily traffic (AADT) is concentrated between 2006 and 2010 on approaches to A46 junctions.
- It is the top 1% for vehicle hours delay.
- The A46 Binley/2TG junction is experiencing flow in excess of capacity on the approach from A42-Broadlands Road (west) during the PM peak.
- The A446/A4200 Binley Road/Broadlands Road junction is experiencing flow approaching capacity in the AM peak and flow exceeding capacity in the PM peak.
- The A4401/A420 Walsgrave/Broadlands Road junction is experiencing flow exceeding capacity in the PM peak.
- The proposed scheme at Binley Junction is forecast to generate time savings of approximately 350,000 person hours in the opening year for all users. The value of journey time savings is £178m over the 60 year appraisal period. Data for Walgrove junction will be available at end of Walgrove PCF Stage 1.

Overall Objectives
The high level objectives of the scheme include to:
- To reduce the length of the traffic queue on the A46 north of Coventry.
- To deliver a scheme which improves journey times, reliability and safety.
- To improve the network's performance.
- To reduce vehicle emissions and improve the environment.
- To reduce the number of accidents and improve the safety of the road.
- To improve the accessibility of the area.
- To provide capacity and connectivity to support national and local economic activity.
- To support and improve journey quality, reliability and safety.
### OPTIONS AND OUTPUTS

#### OPTIONS

At the start of the Options phase provide a list of the principal options which have been identified as meriting further investigation from the pre-options feasibility work, eg route strategies options assessment report, including details of any complementary measures.

<table>
<thead>
<tr>
<th>Option Phase</th>
<th>Development Phase</th>
<th>Construction Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Binley</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Walsgrave</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### TRANSPORT AND ROAD INFRASTRUCTURE DELIVERABLES

List the principal elements of the scheme when they have been defined in the Development Phase. This should be consistent with the Roads Investment Strategy (RIS) Investment Plan and/or Highways England Delivery Plan or any changes to that clearly identified.

#### TIME FRAMES

Include the planned Phase and Stage dates, as given in the Project Schedule.

### CONSTRAINTS

Special conditions that impact on the delivery should be noted; for example, particular environmental considerations, factors influencing the required time table; for example, the timing of planned housing developments should be noted. Details should be provided of any other bodies involved in the delivery of the scheme or of complementary measures.

#### COSTS AND FUNDING

Give the three point estimate for the Project. This should show separately the estimated capital project cost, the programme risk and total cost.

In the Options phase give these estimates for each option listed above under Outputs and Outputs.

<table>
<thead>
<tr>
<th>Option</th>
<th>Range Min (£m)</th>
<th>Central/most likely estimate (£m)</th>
<th>Range Max (£m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nov 19</td>
<td>£67.8m</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
If costs for some options are not available at the start of the options phase include them as they become available.

In the Development phase give the estimate for the preferred option. 
The central / most likely outcome project cost estimate plus the most likely programme risk figure = the expected outcome cost.
In the Options phase there will be a separate expected outcome cost for each option.
Include the assumed construction date used to calculate the Indicative Funding Assumption.

### Jan 2018
(Walsgrave MPDS comments Dec 19)

| Total                        | £139.2m |

#### Notes:
1. The central / most likely estimate is in excess of national DfT funding allocation. HE Operating Plan v1.7 has allowed £131.7m.
2. Project team are unsure if the Dec £71.4m figure from MPDS relates to a particular option.
3. Affordable options for Walsgrave will not achieve full scope of RIS brief.
4. HE Business will need to weigh scope against affordability and provide direction on completion of Walsgrave PCF Stage 1.

### SOURCE OF FUNDS
Indicate the assumed source of funding for the project.

<table>
<thead>
<tr>
<th>Department for Transport</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>100%</td>
</tr>
</tbody>
</table>

### AUTHORISED PHASE BUDGET

<table>
<thead>
<tr>
<th>Amount</th>
<th>Phase/Stage</th>
</tr>
</thead>
<tbody>
<tr>
<td>£0.175m</td>
<td>Pre-options (stage 0)</td>
</tr>
<tr>
<td>£3.724m</td>
<td>Options (Stages 1 &amp; 2)</td>
</tr>
<tr>
<td>£7.6m</td>
<td>Development (Stage 3)</td>
</tr>
<tr>
<td>£2.6m</td>
<td>Development (Stage 4 and 5)</td>
</tr>
<tr>
<td>2.71m</td>
<td>Construction (Advance works)</td>
</tr>
</tbody>
</table>

### APPROVAL

**AUTHOR**
Anita Prashar
Programme Leader
Major Projects RIP Midlands

**APPROVER**
Martin Potts

The form should either be completed by the Highways England SRO for Tier 1, novel or contentious projects by the DfT Sponsor, working with the MP Project Manager.
The MP Programme Hub and Strategy and Planning may also need to be consulted as appropriate.

The form should be signed off by the following:
1) Programme Internal Sponsor or 2) For Tier 1 projects only - DfT Sponsor

### RECORD OF REQUIREMENTS CHANGES

<table>
<thead>
<tr>
<th>Milestone or Change Event</th>
<th>Date</th>
<th>Version No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change of HE internal staff (SRO)</td>
<td>02-Dec-16</td>
<td>V0.1</td>
</tr>
<tr>
<td>Change of project scope: Delivery of grade seperated Binley Junction only</td>
<td>06-Apr-17</td>
<td>V0.2</td>
</tr>
<tr>
<td>PCF stage 3 SGAR: Clarification [ex HE IDC Feb 18] project is delivery of two junctions.</td>
<td>xx/xx/2019</td>
<td>V0.3</td>
</tr>
<tr>
<td>Change of HE internal staff (Sponsor)</td>
<td>16-Jun-19</td>
<td>V0.4</td>
</tr>
<tr>
<td>CSR Update Phase Budget and Timeframes Amended</td>
<td>18-Sep-19</td>
<td>V0.5</td>
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</tbody>
</table>