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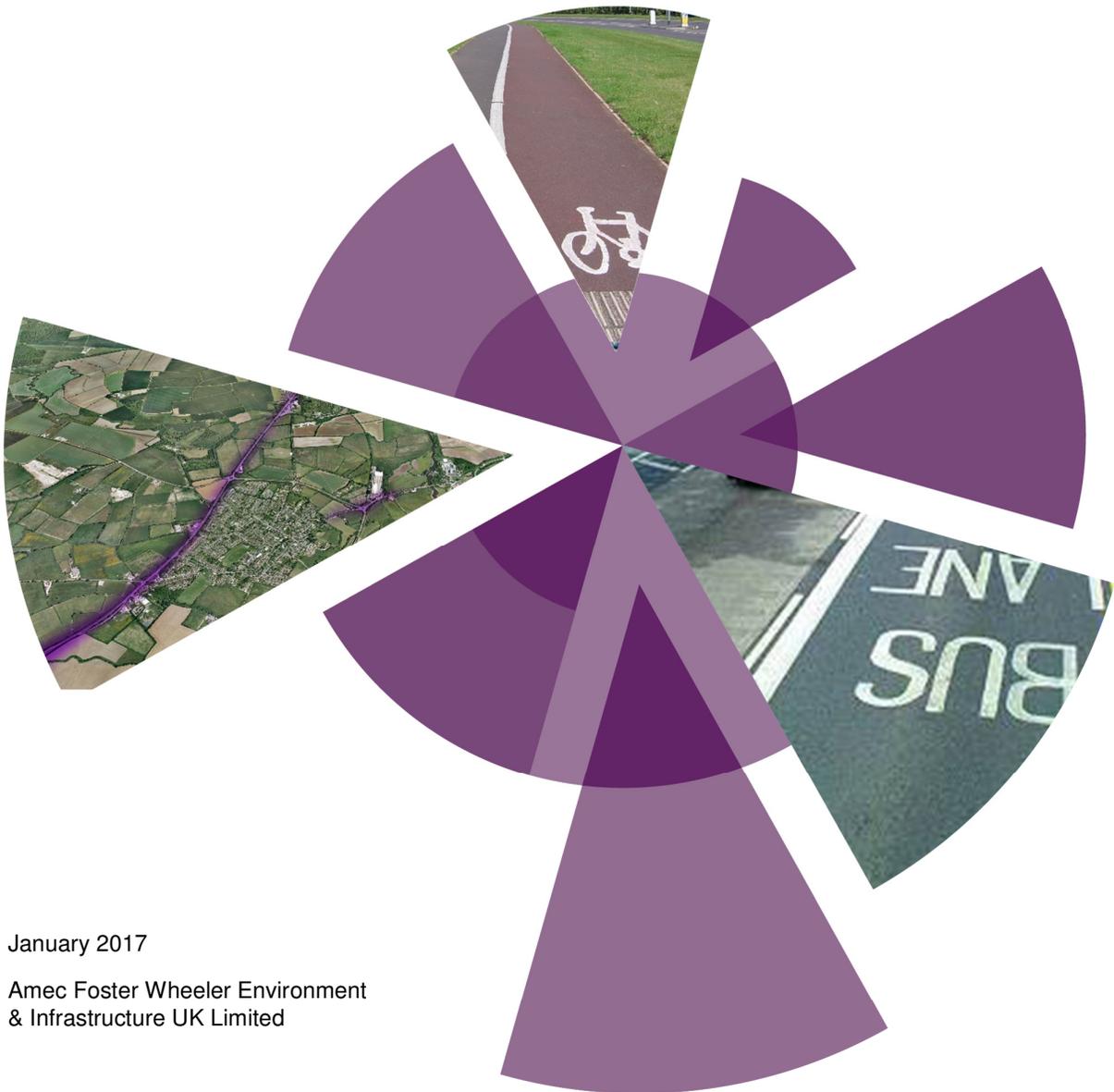


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Oxfordshire County Council

A40 Science Transit 2 Project

Baseline Study Findings Report



January 2017

Amec Foster Wheeler Environment
& Infrastructure UK Limited



Report for

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Doc Ref. 37816.R005 i2

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Document revisions

No.	Details	Date
1	Draft	February 2016
2	Final	January 2017



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1. Introduction

1.1 Project Brief

Amec Foster Wheeler Environment and Infrastructure UK Ltd (Amec Foster Wheeler) has been appointed by Oxfordshire County Council (OCC) to provide design and consultancy services for the development of bus priority and junction improvement schemes to feasibility design stage for a section of the A40 and the B4044.

The study area is illustrated within Figure 1.1:

Figure 1.1 Study area



The package of measures defined within the project brief are:

- ▶ Provision of an east bound bus lane, running along the A40 from Eynsham to Dukes Cut;
- ▶ Provision of bus priority areas at the major west bound junctions along the A40 between Dukes Cute and Eynsham;
- ▶ Junction improvements at accesses onto the A40 at Eynsham and Cassington; and
- ▶ Provision of a bus priority scheme on the approach to the Swinford Toll Bridge along the B4044.

The principal objective of the bus priority schemes outlined above is to improve the attractiveness and reliability of public transport services along the A40 and the B4044, which will support the delivery of a new Park and Ride in the Eynsham area, thus facilitating a reduction in car trips into Oxford.

1.2 Report considerations and structure

A key element of the project is to fully understand the baseline situation and the opportunity and constraints of the Study Corridor. A series of desktop studies have been undertaken, a summary of which is provided within this report, including methodology, key findings and recommendations, with a full copy of each study appended to the rear of this report.

With reference to the above, the report structure and study topics are set out below:

- ▶ Chapter 2: Project background – provides an overview of the project, including previous and ongoing work which will inform the approach, and highway infrastructure schemes;
- ▶ Chapter 3: Highways – provides an overview of existing features within the highway that may be affected by the proposed bus priority scheme, along with an analysis of current traffic flows, journey times, personal injury accident data and congestion issues at the Eynsham roundabout and Cassington signal controlled crossroads;
- ▶ Chapter 4: Structures – provides a review of the structures located within the study corridor, including details on structure type, load, condition and potential to accommodate a bus lane;
- ▶ Chapter 5: Utilities – provides an overview of the utilities within the study area that may require diversion/lowering to support the development of the bus lane;
- ▶ Chapter 6: Ecology – reviews all ecological features within the corridor and all designated and non-designated sites situated within the surrounding area that may be impacted by the proposed scheme;
- ▶ Chapter 7: Arboricultural – provides an overview of the types and quality of trees that are situated within the study area;
- ▶ Chapter 8: Heritage – provides a review of the historical and archaeological features located within and around the study area that may be affected by the scheme; and
- ▶ Chapter 9: Geo-environmental – provides an overview of the current ground conditions and the location of any contaminated land that would pose a risk to construction activities.

Based on the outcome of the study topics referenced above, a list of the most relevant considerations, constraints and recommendations have been compiled and presented within Chapter 10. The content of Chapter 10 will be used to inform the initial design options, which will later be discussed during the preliminary design workshop, due to take place on Friday 4th March 2016 with stakeholder officers from OCC.



2. Project background

2.1 Introduction

The Oxford Transport Strategy (OTS), part of the county council's fourth Local Transport Plan, includes proposals to help deal with existing and future growth across Oxfordshire. In order to reduce congestion within the city and on the approaches to it, the OTS proposes a major expansion and reconfiguration of the Park and Ride system to intercept more car trips earlier in their journeys and further away from the city. The A40 corridor is recognised as a key artery for the “knowledge spine” and essential to the gateway into Oxford. As part of the Local Growth Deal, Oxfordshire Local Enterprise Partnership (LEP) has been provisionally awarded £35 million, to be matched by a local contribution of at least £5 million, to deliver a Park and Ride site and bus priority measures along the A40 strategic route.

The following OCC studies and highway infrastructure schemes are being used to inform the project and will be considered as part of the feasibility design work.

- ▶ A40 Witney to Oxford Corridor Study, conducted by URS and published March 2015;
- ▶ A40 Park and Ride Options Study, conducted by Atkins, ongoing;
- ▶ A40/A44 Link Road; and
- ▶ Wolvercote Roundabout and Cutteslowe Roundabout improvements.

The following summarises the sections of the studies relevant to the project brief along with appropriate commentary on the methodologies and conclusions.

2.2 OCC Studies and Schemes

A40 Witney to Oxford Corridor Study (March 2015)

URS Infrastructure & Environment UK Limited (URS) was appointed by OCC to investigate the feasibility of implementing a range of options designed to improve transport conditions along the A40 corridor between Witney and Oxford and along a section of the B4044 between the outskirts of Eynsham and the Swinford Toll Bridge. This included a concept design of an A40 bus lane which outlined a horizontal design for the bus lane and identified, from a desktop study, where along the length of the A40 that there was sufficient width within the highway boundary to accommodate this design. This concept design has formed a basis for this baseline study, which has involved detailed site inspection.

The URS study makes reference to a number of national guidance documents concerned with defining and identifying the recommended provision for the following:

- ▶ Highway verge – defined in Design Manual for Roads and Bridges (DMRB) TD27/05 as being a minimum of 1.5m, or where footways and/or cycle ways are provided, a minimum width of 3.0m;
- ▶ Pedestrian/cycle routes – defined in DMRB TA90/05 as being 2.6m preferred width and 2.0m the accepted minimum for pedestrian only, [although where it is not possible to provide 2.0m, short sections with a width of 1.3m can be provided]¹. For off-carriageway cycle only routes, a 3.0m is recommended, with 2.0m width being the recommended minimum, although short sections measuring 1.5m wide are acceptable;

¹ Further guidance concerning widths inserted by Amec Foster Wheeler. Information obtained from DMRB TA90/05.

- ▶ Shared pedestrian/cycle routes - defined in DMRB TA90/05 as being a suitable facility when either pedestrian or cyclist numbers are low. The recommended width is 3.0m, although 2.0m is considered acceptable when the combined pedestrian/cycle use is less than 200 per hour. Where a footway, cycleway or shared use facility is provided within the verge then an additional minimum width of 1.0m should be provided on the non-traffic side to accommodate street lighting or other highway/utility equipment. [The same guidance also recommends an area of segregation between the footway/cycleway and the carriageway of between 0.5m and 1.5m, with the higher of range recommended for roads with a speed limit exceeding 40mph]²; and
- ▶ Bus Lanes - LTN 1/96 [LTN 1/97]³ suggest that where roads are wide enough a bus lane should be 4.25metres wide, with the minimum preferred width recommended at 4.0m; this would allow buses to overtake cyclists safely and reduces the likelihood of interference from general traffic in the adjacent lane. The minimum recommended width is 3.0m.

Based on the guidance detailed above, a high level test of the various widening options was undertaken along the A40 corridor and as a result of the testing and through subsequent discussions between URS and OCC, it was identified that the most viable option would be the provision of a bus lane routing along the A40 between Eynsham and the Kingsbridge Brook (referred to as Dukes Cut within this study). The latter was selected as the proposed termination point due to engineering difficulties and the cost involved in widening the structure in order to accommodate a new bus lane.

It was also agreed that the most suitable width for the bus lane would be 4.0m, which consists of a 3.0m bus lane and a 1.0m margin of hatching to diagram 1041.1 situated between the bus lane and carriageway. In accordance with DMRB TA90/05 a 2.0m shared footway/cycleway would also be provided, along with a minimum 1.0m verge situated to the back of the shared footway/cycleway.

These design will need to be reaffirmed with officers and a discussion regarding the requirements for segregation between the bus lane and the shared footway/cycleway will also need to be discussed and agreed with OCC.

Following the identification of the preferred bus lane and footway/cycleway arrangement, a follow up assessment of the widening implications was undertaken by URS using OS master mapping and AutoCAD. The assessment considered widening along both sides of the carriageway for an eastbound and westbound bus lane to confirm the key points of constraint.

Given the context of this study, which comprises an eastbound bus lane only and westbound priority at key junctions, the results of the assessment are not entirely applicable, however, the following sets out a summary of the key constraints identified by URS:

- ▶ A40/ Eynsham Road/ Cassington Road staggered junction would require reconfiguration;
- ▶ Bridge structure spanning River Evenlode - West of Cassington, would require widening to support a continuous bus lane; and
- ▶ Bridge spanning route of former Witney - Oxford railway, would require widening to support a continuous bus lane.

B4044 Highway

The URS report provides an overview of the modelling undertaken in connection with the removal of the manual toll collection at the Swinford Toll Bridge and refers to work conducted by Atkins in 2014.

The study summarises traffic conditions extracted from Oxford's Strategic Model (OSM) which was used to assess the impacts of removing the manual toll collection and introducing automated toll collection. The Study indicates that the removal of the manual toll collection system would eliminate queueing on both the northbound and southbound approaches with the exception of the AM peak on the southbound approach, where there will be a reduction in queue length from 101 PCUs to 45 PCUs.

² Further guidance concerning widths inserted by Amec Foster Wheeler. Information obtained from DMRB TA90/05.

³ Correct reference is LTN 1/97

In spite of the above, URS concluded that while delays and congestion will be reduced in the base year there is no consideration of growth associated with significant local development pressures over the plan periods for West Oxfordshire and Oxford City. It is therefore likely that any benefits secured through automatic toll collection could be short term, with the present issues recurring in the medium to long term. Furthermore, the route along the B4044 incorporating Swinford Toll Bridge may not be suited to the additional traffic that will be attracted to it by reducing the existing level of delay.

URS identified the following constraints to bus priority provision on the B4044 corridor:

- ▶ Width restrictions on the bridge traversing Wharf Stream;
- ▶ A steep embankment immediately adjacent to the highway boundary along the northern side of carriageway, broadly situated between Wharf Stream and an existing car park located to the north-west of the Toll House (circa 200m in length);
- ▶ The existing car park; and
- ▶ The Toll House and Toll bridge itself.

Park and Ride Study

This study is investigating the options for new sites, enhancements to existing and identifying a preferred Park and Ride package and infrastructure and service requirements. One of the options for a new site is off the A40 corridor near Eynsham. The findings in relation to a Park and Ride site along the A40 corridor will be incorporated into this study, including the following:

- ▶ Park and Ride access location and design; and Park and Ride preferred location and indicative layout / access drawing; and
- ▶ Likely effects on traffic flow along the A40 and B4044. Consideration of infrastructure requirements for bus priority.

Wolvercote Roundabout Improvements

The following improvements are part of the ongoing works:

- ▶ Installation of traffic lights with controlled toucan crossings at A44 Woodstock Road, A40 North Way, A4144 Woodstock Road and A40 Northern Bypass junctions;
- ▶ Road widening along the A44 Woodstock Road southbound lane and A40 Northern Bypass eastbound lane will see the construction of three lanes on the approach to Wolvercote Roundabout;
- ▶ The existing junctions at the Five Mile Drive and Godstow Road will remain un-signalised with an uncontrolled pedestrian/cyclist crossing on the approach to Wolvercote Roundabout;
- ▶ Along the A40 North Way the existing signalised pedestrian crossing approximately 55m from its junction with Wolvercote Roundabout is to be removed; and
- ▶ Upon entering and exiting both BMW Garage access points along the A40 Northern Bypass, prohibition of right turns westbound onto the A40 will be implemented.

Cotteslowe Roundabout

The following improvements are part of the ongoing works:

- ▶ Installation of traffic lights with controlled toucan crossings at A4165 Banbury Road and A40 North Way junctions;
- ▶ Along the A4165 Banbury Road new keep clear markings will be provided at Harbord Road and Five Mile Drive junctions. New yellow box markings will be implemented at Harefields junction;

- ▶ Road widening along the A40 Northway eastbound lane will see the construction of three lanes on the approach to Cutteslowe Roundabout. Road widening will see the construction of four lanes on the A40 Elsfield Way westbound approach to Cutteslowe Roundabout;
- ▶ The existing signalised pedestrian crossing 85m from Cutteslowe Roundabout on the A40 North Way will be removed. The south side Banbury Road/Cutteslowe Roundabout junction is to remain un-signalised and an uncontrolled pedestrian/cyclist crossing is to remain in use; and
- ▶ A new cycleway linking Banbury Road to the A40 will route overbridge. The existing cycleway between Jackson Road and Cutteslowe Roundabout will be extended and a new giveaway arrangement is to be provided at Jackson Road junction.

A40/A44 Link Road

The county council has City Deal funding towards a link road between the A40 and A44 just outside of the study area. Planning and design work is currently underway to establish the preferred alignment and junction arrangements at either end of the link road. Once this work has been completed the county council will set a programme for consultation, further design work and construction, which will be linked to the A40 Science Transit 2 Programme.

2.3 Key Considerations

Based on the project background information provided by OCC, the following has been established.

Design

The URS report provides a basis for review. The following points will need to be confirmed with officers:

- ▶ The proposed corridor width to accommodate a bus lane and a footway/cycleway;
- ▶ The requirement for a verge between the bus lane and the footway/cycleway; and
- ▶ The assumptions regarding bus lane termination.

In addition to the constraints identified by URS, the following will need to be considered:

- ▶ The impact on Public Rights of Way (PRoW), which cross the A40;
- ▶ The impact on existing bus stops;
- ▶ Design considerations for existing access junctions off the A40;
- ▶ The location of the Eynsham Park and Ride and access design; and
- ▶ The eastern termination of the eastbound bus lane which need to safely merge buses with general traffic, taking into consideration the proposals for the A40/A44 Link Road as well as the improvements to the Wolvercote and Cutteslowe roundabouts.

Traffic Flow Modelling

The results of the modelling work for the Park and Ride Study will need to be incorporated into this study, as will assumptions for the A40/A44 Link Road.

Based on discussions with the Client Team to-date, it is assumed that this will be undertaken through the extension of the validated North Oxford VISSIM model that has been developed to look at the impact of development and infrastructure improvements in north Oxford. This would be the most comprehensive approach to assessment of the impacts and will enable all options to be tested in combination as well as enabling the impacts of the A40 – A44 strategic link to be quantified.

3. Highways

3.1 Introduction

A review of the highway network included within the study area has been undertaken to establish an existing baseline situation, the works have broadly comprised:

- ▶ Identification of existing features that may be impacted on by the proposed bus lane, including crossing facilities, Public Rights of Way (PRoW), bus stops and access and egress onto the A40 and the B4044;
- ▶ An overview of the current pedestrian, cyclist and public transport environment;
- ▶ A review of current traffic flows along the A40 and the B4044, and identification of key trends;
- ▶ A review of highway safety using Personal Injury Accident data;
- ▶ A review of the current journey time data for the A40 and the identification of key trends;
- ▶ A review of current queue length data and the identification of key trends; and
- ▶ An appraisal of the current link capacity.

A full copy of the study is included within Appendix A.

3.2 Assessment methodology

The assessment has comprised a desk based review of the study area using a mixture of online resources and data supplied by OCC as follows:

- ▶ OCC website – access to PRoW records, cycle route mapping and bus services utilising the local highway network;
- ▶ Aerial imagery and street view imagery from Google Earth Pro; and
- ▶ Records supplied by OCC, for the following:
 - ▶ Journey time data along the A40;
 - ▶ Traffic flow data collected from Automatic Traffic Counters on the A40 and the B4044; and
 - ▶ Personal Injury Accident data.

Following a review of the desk based resources a site inspection was undertaken on the 14th January 2016. The site visit included confirmation of features identified as part of the desktop analysis, a video survey, a photographic record and observations on the operation of the network during the morning peak period.

It was noted during the site inspection

3.3 Summary of findings

Link and Junction Highway Features Review

Table 3.1 summarises the outcome of the link and junction review for the A40 and the B4044. Figures 3.1 and 3.2 illustrate the location of the links and junctions referenced within the aforementioned table.

Figure 3.1 Link and Junction Locations

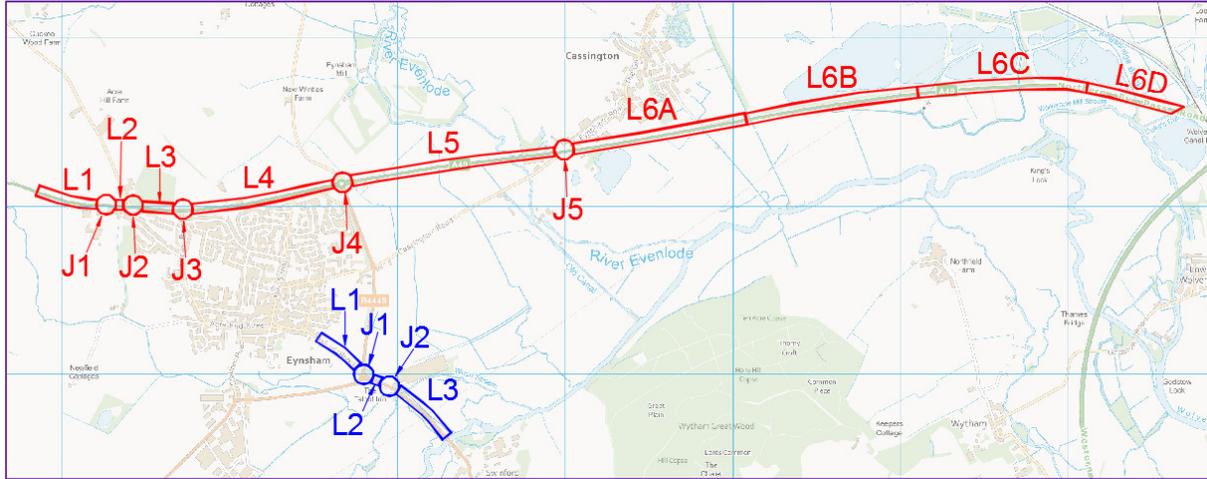


Table 3.1 Link and junction features review: summary

Summary of Features/Considerations	
Junction 1	No significant issues.
Junction 2	Re-configuration required, but dependent on the final location of the Park and Ride. Bus stop relocation and/or inclusion within the bus lane.
Junction 3	Re-configuration required, but dependent on the final location of the Park and Ride.
Link 4	Petrol station entry and exit requires reconfiguration and/or temporary termination of the bus lane. Existing pedestrian crossings will need to be reconfigured/relocated.
Junction 4	Continuous bus lane would need to be terminated prior to meeting Junction 4. Potential to convert the roundabout into a signal controlled cross roads. This would provide bus priority and may provide capacity benefits. Bus stop relocation and/or inclusion within the bus lane. Consultation with adjacent land owners concerning access rights/frequency into adjacent fields.
Junction 5	No significant issues, bus priority can be retrospectively introduced. Consideration of the toucan crossing and re-configuration of carriageway space required. Access from Horsmere Lane will need to be retained, but is unlikely to require termination of the bus lane. Consultation with adjacent land owners concerning access rights/frequency into adjacent fields.
Link 6B	Access into the quarry will need to be retained and compassed into the bus lane design. Potential for bus lane termination.
Link 6D	Consultation with adjacent land owners concerning access rights/frequency into adjacent fields.
B4044	

Summary of Features/Considerations

Link 1	Narrow verges towards the north-west of the link. Wider verges towards the east, but presence of Junction 1 will need to be considered.
Junction 1	Current radius between the Oxford Road and B449 arm is substandard, therefore widening for a bus lane on Oxford Road would require a re-siting of the roundabout.
Link 2	Widening of the carriageway is possible, however the link is exceptionally short and would need to consider the junctions situated either side.
Junction 2	Junction could be set back but thus may present visibility issues. Bus lane could commence east of the junction, however the presence of the adjacent public house may cause additional issues.
Link 3	Very narrow footway present along much of link 3, widening would require third part land and would impact upon the public house, a field access and the car park situated adjacent to the Toll Bridge.

Accident data results

Accident data for each of the highway links and junctions situated within the study corridor have been undertaken.

With regards to highway link accidents, the underlying cause of the accidents is driver error, such as failing to judge path/speed of other vehicles, distractions within vehicle, following too close, and sudden braking and failing to look properly. In some instances, icy or slippery road surface conditions were attributed.

With regards to the junction accidents, the majority of the accidents were caused by driver error, including travelling too fast for conditions, failing to look properly, and poor turning manoeuvres. In some cases, slippery road surface (due to weather conditions) was attributed.

There is a notable recurring trend of accidents at Junction 5 (A40/Cassington Road/Eynsham Road) involving vehicles making U-turn manoeuvres in both directions, and colliding with oncoming or overtaking motorcycles. The accidents occurring in this was were all attributed to driver error, and involved failing to look properly and undertaking a poor turning manoeuvre. This will need to be considered within the scheme considerations.

Traffic flows

Based on information supplied by OCC and through on-site observation it is noted that major junction improvement works are ongoing at the Wolvercote and Cuttelowe roundabouts located immediately east of the study area, which commenced in July 2015 and are due to be completed in autumn 2016.

Analysis of both recent and past data has been used to identify any effect that the road works may have on current traffic flow conditions, in order that a reasonably accurate representation of the baseline is presented.

Traffic flow data for the A40 and B4044 was obtained from OCC for the period 30th December 2013 to 27th December 2015. A review of the data was undertaken for neutral months within each respective year, before and the after the aforementioned road works commenced. The analysis indicated that the works have had an effect on traffic flows, where peak hour and 24 hour data was recorded as being significantly lower in 2015 than in 2014 and in the interests of presenting robust assessment, data recorded in 2014 has been considered.

A review of link capacity has also been undertaken using the Congestion Reference Flow calculation contained within DMRB TA46/97. The highest AADT flow on the A40 is recorded as 21,740 and on the B4044 as 10,533, both of which are from the October 2014 data sets. The corresponding CRF values are 38,031 and 11,337. Whilst the CRF is only indicative of link capacity, the results indicate that the A40 currently has sufficient capacity but that the B4044 is currently operating close to capacity.

Journey time

Journey time data, supplied by OCC, has been reviewed for two sections of the A40. The first section is between Eynsham to Cassington and the second section is between Cassington to Wolvercote, both of which are inbound only towards Oxford.

In general, journey times are far higher during the AM peak period, which is to be expected and relatively consistent throughout the rest of the day. In comparing the 2014 and 2015 data, there are apparent discrepancies between the expected outcome and the actual outcome, where the presence of road works would be expected to increase journey times. The analysis indicated that journey times were significantly lower during the AM peak in 2015 and because of this it is considered that the 2015 data is not entirely reliable as it contradicts the most likely outcome. As a result, the journey time data from 2014 is considered to be a more reliable baseline and will be taken forward as part of the bus priority scheme assessment work.

Traffic congestion

Information on current congestion has been obtained from the video survey conducted during the site inspection (14/01/16) and Google maps traffic data. The latter provides a visual representation of traffic conditions overlaid on a google mapping base.

Traffic congestion has been considered at the three main junction within the study area:

- ▶ A40 / B4449 roundabout (A40 - Junction 4);
- ▶ A40 / Eynsham Road / Cassington Road (A40 – Junction 5); and
- ▶ B4449 / B4044 / Oxford Road (B4044 – Junction 1).

In summary, the following observations were made for traffic congestion on the A40:

- ▶ In the morning peak period, there is some congestion on the eastbound lane towards Oxford which stems from Wolvercote Roundabout; and
- ▶ In the evening peak, there is significant traffic congestion at most junctions for westbound traffic.

In summary, the following observations were made for traffic congestion on the B4044:

- ▶ There is congestion at the B4449/B4044/ Oxford Road roundabout largely due to queuing at the Swinford Bridge toll collection point, as well as volume of traffic.

3.4 Recommendations

Based on the baseline review there are two recommendation, which require further consultation:

- ▶ Consultation with adjacent land owners afforded field access points to establish current level of use; and
- ▶ Confirm location and access arrangements for Eynsham Park and Ride site to determine extent of accommodation works required.

3.5 Key Considerations

Table 3.2 sets out the key considerations for progressing the bus priority scheme along the A40 and B4044.

Table 3.2 Summary of key considerations

Section	Key considerations
A40	
Overview	<p>In the morning peak period, there is some congestion on the eastbound lane towards Oxford which stems from Wolvercote Roundabout. In the evening peak, there is traffic congestion at most junctions for westbound traffic.</p> <p>An assessment of A40 link capacity has been undertaken which indicates that the A40 has sufficient capacity.</p> <p>Given carriageway width is an important component of link capacity it is considered that the A40 carriageway could be narrowed in order to reduce the amount land required to construct the bus lane. This could prove significantly advantageous where localised narrowing the grassed verge occurs.</p>
Link 1	<ul style="list-style-type: none"> No significant issues. No significant issues.
Link 2	<ul style="list-style-type: none"> No significant issues.
Junction 2	<ul style="list-style-type: none"> Re-configuration required, but dependent on the final location of the Park and Ride.
Link 3	<ul style="list-style-type: none"> Bus stop relocation and/or inclusion within the bus lane.
Junction 3	<ul style="list-style-type: none"> Re-configuration required, but dependent on the final location of the Park and Ride.
Link 4	<ul style="list-style-type: none"> Petrol station entry and exit requires reconfiguration and/or temporary termination of the bus lane. Existing pedestrian crossings will need to be reconfigured/relocated.
Junction 4	<ul style="list-style-type: none"> Continuous bus lane would need to be terminated prior to meeting Junction 4. Potential to convert the roundabout into a signal controlled cross roads. This would provide bus priority and may provide capacity benefits. Peak AM period from 07:00 - 08:00 with 07:00 being the most congested. The A40 eastbound arms show slow traffic throughout the AM, the worst being between 07:00-08:00, with minor congestion back to Cuckoo Lane (west) and Junction 5 (east). Peak PM period is between 17:00-18:00, with 17:00-17:30 being the most congested mainly limited to the A40 westbound arms which in addition block the gyratory. Congestion is also experienced on the northbound B4449. The southbound B4449 arm only experiences congestion at the junction only.
Link 5	<ul style="list-style-type: none"> Bus stop relocation and/or inclusion within the bus lane. Consultation with adjacent land owners concerning access rights/frequency into adjacent fields.
Junction 5	<ul style="list-style-type: none"> No significant issues, bus priority can be retrospectively introduced. Consideration of the toucan crossing and re-configuration of carriageway space required. Peak AM period from 07:30 – 08:00 as the slow moving queue from Wolvercote roundabout starts to affect Junction 5. Data indicates that traffic never slows to a complete halt on A40 eastbound and keeps moving slowly through junction throughout the AM period; The A40 westbound experiences congestion in the PM with a peak between 17:00-18:00 with significant congestion is experienced as far back as 1km east from junction; eastbound remains largely free flowing. There is a notable recurring trend of accidents involving vehicles making U-turn manoeuvres in both directions.
Link 6A	<ul style="list-style-type: none"> Access from Horsemere Lane will need to be retained, but is unlikely to require termination of the bus lane. Consultation with adjacent land owners concerning access rights/frequency into adjacent fields.
Link 6B	<ul style="list-style-type: none"> Access into the quarry will need to be retained and compassed into the bus lane design. Potential for bus lane termination.
Link 6C	<ul style="list-style-type: none"> Need to confirm that field access points to the north are redundant.
Link 6D	<ul style="list-style-type: none"> Consultation with adjacent land owners concerning access rights/frequency into adjacent fields.
B4044	
Overview	<p>An assessment of the B4044 link capacity has been undertaken and it has been established that the B4044 is approaching capacity.</p> <p>There is congestion at the B4449/B4044/ Oxford Road roundabout largely due to queuing at the Swinford Bridge toll collection point, as well as volume of traffic.</p>

Section	Key considerations
Link 1	<ul style="list-style-type: none">Narrow verges towards the north-west of the link. Wider verges towards the east, but presence of Junction 1 will need to be considered.
Junction 1	<ul style="list-style-type: none">Current radius between the Oxford Road and B449 arm is substandard, therefore widening for a bus lane on Oxford Road would require a re-siting of the roundabout.The AM peak period is between 08:00-09:00 when all arms experience significant congestion, with congestion on all entry arms (apart from B4044) extending back from junction 6. Congestion begins at this junction just before 07:00 with the B4044 experiencing congestion as a result of the Toll Bridge. The traffic profile indicates a tidal effect where traffic moves north-south during the AM, using the Toll Bridge to the south and returns during the PM via the Bridge and the B4044
Link 2	<ul style="list-style-type: none">Widening of the carriageway is possible, however the link is exceptionally short and would need to consider the junctions situated either side.
Junction 2	<ul style="list-style-type: none">Junction could be set back but thus may present visibility issues. Bus lane could commence east of the junction, however the presence of the adjacent public house may cause additional issues.
Link 3	<ul style="list-style-type: none">Very narrow footway present along much of link 3, widening would require third party land and would impact upon the public house, a field access and the car park situated adjacent to the Toll Bridge.

4. Structures

4.1 Introduction

The structures report has reviewed the status of all bridges and culverts situated along the A40 and B4044. A full copy of the study is included within Appendix B.

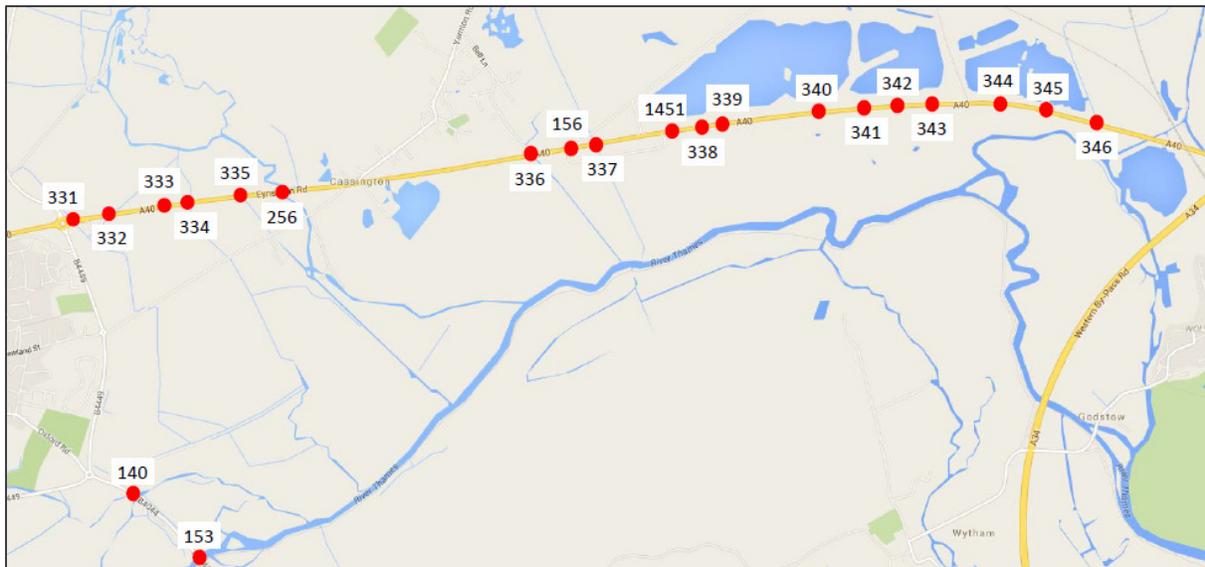
4.2 Assessment methodology

Data on the bridges and structures in the area of interest was requested from OCC's Highways and Transport department. The bridge team at OCC identified the bridges that are located within the study area (a total of 21) and collated the information. Amec Foster Wheeler received a CD containing the data on 5th February 2016 which comprised:

- ▶ Drawings;
- ▶ Reports; and
- ▶ Photographs.

This CD did not include the information for the bridges on the B4044, and this additional data was received on 24th February 2016. The location of the bridges are illustrated within Figure 4.2.

Figure 4.1 Bridge location plan – A40 and B4044 structures



For each bridge the data has been reviewed to understand the structural form, load capacity, history, condition and any potential issues. Where available the data on utilities has been extracted. The review has comprised a desk study only, and use has been made of mapping tools to identify the locations and potential issues relating to the surrounding area, including proximity to junctions or embankments.

Site visits and inspections have not been carried out at this stage. The quality of the historical data received is generally good and comprehensive, with evidence of recent inspections, and this data is considered sufficient for the purposes of this review. Although there were recent inspection photographs (dated 2014), there were no inspection records from these inspections so it is not possible to comment on the current condition. Full details of any assessments were generally not available, but the summary findings were.

4.3 Summary of findings

Condition

Along the A40, the bridges generally date from the early 1930s, and the majority are short span culverts (one, two or three spans) for watercourses. The exception is the old railway arch at Cassington Halt (bridge 156). There has been an extensive programme of strengthening works carried out to all of the bridges in the study area on the A40.

- ▶ Bridges 331-335 and 342-346 all had the decks replaced in 1995;
- ▶ Bridge 246 had the central pier removed and a longer span deck installed in 1995;
- ▶ Bridges 336-341 had repair / strengthening works to the bridge soffits and abutments at some point between 1997 and 2014; and
- ▶ Bridge 156 was strengthened in 2004.

There is limited recent information on the condition of these structures, but as the works are relatively recent the condition is expected to be good.

The only structures that do not appear to have had major maintenance carried out are 1451 which is a concrete pipe culvert and bridge 140 on the B4044 at Eynsham.

Load Capacity

All bridges have been designed or assessed to be capable of carrying HA loading and 45 units HB loading, with the exception of the pipe culvert, where no data was available, but this is not anticipated to be a problem. This is the normal design loading for bridges in accordance with the DMRB⁴. The structural form of most of the bridges is reinforced concrete (RC) flat slab supported on mass concrete or piled abutments. It is anticipated that the additional loading from an extra lane would not be a problem as there does not appear to be any variation in strength across the cross-section, but this should be verified. The bridges that have different structural forms are:

- ▶ Bridge 156 – Cassington Halt railway arch: the maintenance manual for this bridge states that the 'strengthening design has allowed for proposals to install a bus lane along the north side of the carriageway and remove the north foot/cycleway'; and
- ▶ Bridge 140 – Eynsham: the assessment should be reviewed to determine if there is capacity for the additional loading from the proposed bus lane.

Space requirements

Most bridges appear to have sufficient space for widening to the north of the existing carriageway, with the exception of:

- ▶ Bridge 246 (15.8m overall width);
- ▶ Bridge 156 (15m overall width); and
- ▶ Bridge 140 (on B4044) (12m overall width).

Widening of these bridges would be problematic and very costly, particularly for bridges 156 and 140. However it may be possible to consider separate foot/cycle bridge adjacent to the main structure.

⁴ BD 37/01 Appendix A of DMRB - Type HA loading is the normal design loading and adequately covers the effects of all permitted normal vehicles (up to 44 tonne gross vehicle weight) other than those used for abnormal indivisible loads. Type HB loading requirements derive from the nature of exceptional industrial loads likely to use the roads in the area. The vehicle load is represented by a four axled vehicle with four wheels equally spaced on each axle. The load on each axle is defined by a number of units which is dependent on the class of road - motorways and trunk roads require 45 units, principal roads require 37.5 units and other public roads require 30 units.

Other bridges that need further consideration are:

- ▶ Bridge 331 – the road alignment at the junction must take the existing bridge constraints into account;
- ▶ Bridge 332 – minor road realignment may be required;
- ▶ Bridge 337 – 15m available at top of embankment – embankment strengthening / retaining structures may be required if road widened; and
- ▶ Bridge 346 – minor road realignment may be required.

Utilities

All of the bridges have utilities in the verges. Generally there is a gas main in the north verge where the widening is proposed. There may also be other services and a full review will be required. Protection measures will need to be considered for any services that will be within a trafficked lane.

Parapets

Most of the bridges have parapets that do not appear to be in accordance with current standards. In some cases there are open box beam (OBB) barriers in front of the parapets, which restrict the available width for widening. It may be that the other bridges will also require additional protection in front of the parapets so this may reduce the width that is currently thought to be available. The only bridges with parapets or edge protection that is in accordance with DMRB are those with limited overall width that have been recently strengthened (bridges 246, 156 and 337). Bridge 140 in Eynsham is of particular concern as the parapets are traditional masonry balustrades and the bridge has extremely limited width.

Summary

Table 4.1 provides a summary of the key findings of the bridge data review with the following colour codings:

- ▶ **Green** represents no concerns;
- ▶ **Amber** represents potential issues; and
- ▶ **Red** represents a significant issues that are unlikely to be overcome.

Table 4.1 Summary of Bridge Review

Bridge	Load Capacity	Sufficient width for bus lane to north	Utilities in north verge	Utilities in south verge	Parapets
331	Designed HA + 45 units HB	Limited due to road alignment on approach and exit from roundabout	Gas BT? Electric?	BT Gas? Electric?	Currently protected by OBB – strength and suitability to be reviewed
332	Designed HA + 45 units HB	6.2m available. Overall width adequate, but may require road realignment towards south, or parapet strengthening to remove OBB.	Gas	Gas BT Electric	Currently protected by OBB – strength and suitability to be reviewed
333	Assumed HA + 45 units HB	>8m available	Unknown	BT Unknown	Strength and suitability to be reviewed
334	Designed HA + 45 units HB	>8m available	Gas	Gas BT	Strength and suitability to be reviewed
335	Designed HA + 45 units HB	>8m available	Gas	Gas BT	Strength and suitability to be reviewed

Bridge	Load Capacity	Sufficient width for bus lane to north	Utilities in north verge	Utilities in south verge	Parapets
246	Designed HA + 45 units HB	3.2m available to north of existing 9.3m carriageway. Overall width 15.8m – may require road realignment towards south. Alternatively, new foot/cyclebridge or widened bridge	Gas	Gas BT	Replaced 1995 so assumed adequate strength
336	Assessed HA + 45 units HB	To be verified but appears adequate		BT	Strength and suitability to be reviewed
156	Designed HA + 45 units HB	3.0m available to north of existing ~9m carriageway. Overall width 15m – may require road realignment towards south. Alternatively, new foot/cyclebridge	Gas under bridge	BT	Replaced as part of strengthening in 2004 – adequate strength.
337	Assessed HA + 45 units HB	Similar to bridge 156, but no cross section info available. If widening required, embankment would need to be strengthened and steepened.	Gas in embankment to north Sewerage?	BT Sewerage?	OBB barrier – adequate strength
1451	Unknown	To be verified but appears adequate	Unknown	Unknown	Strength and suitability to be reviewed
338	Assessed HA + 45 units HB	>8m available	Gas	BT	Strength and suitability to be reviewed
339	Assessed HA + 45 units HB	>8m available	Gas	BT	Strength and suitability to be reviewed
340	Assessed HA + 45 units HB	>8m available	Gas	BT	Strength and suitability to be reviewed
341	Assessed HA + 45 units HB	>8m available	Gas	BT Electric	Strength and suitability to be reviewed
342	Designed HA + 45 units HB	>8m available	Gas	BT	Strength and suitability to be reviewed
343	Designed HA + 45 units HB	>8m available	Gas	BT	Strength and suitability to be reviewed
344	Designed HA + 45 units HB	>8m available	Gas	BT	Strength and suitability to be reviewed
345	Designed HA + 45 units HB	>8m available	Gas	BT	Strength and suitability to be reviewed
346	Designed HA + 45 units HB	6.2m available. Overall width adequate, but may require road realignment towards south, or parapet strengthening to remove OBB.	Gas	BT	Currently protected by OBB – strength and suitability to be reviewed
140	Assessed HA + 45 units HB Not known if could support additional lane – further review required	Very limited – overall width ~12m. New foot/cyclebridge may be required	Gas, BT, Water, Electric all present	Strength and suitability to be reviewed	

4.4 Recommendations

It is recommended that further work is carried out to review the strength and suitability of the parapets in accordance with the DMRB standard TD19 'Requirement for Road Restraint Systems'. This is a risk based approach to the provision of parapets and barriers and will need to be carried out when the proposals for bus priority schemes are understood in more detail.

If it is proposed to install a bus lane on the B4044 at Eynsham, the structural assessment for bridge 140 should be reviewed to ensure the load capacity is adequate.

A full utilities review should be carried out to confirm the services in the verges. These may need protection measures if they will lie within the trafficked lane, or minor diversions to place them in the new footways.

4.5 Key Considerations

The key constraints identified are:

- ▶ Bridge 246 - 15.8m overall width, but with parapets to modern standards so can be widened across all available width;
- ▶ Bridge 156 - 15m overall width, but with parapets to modern standards so can be widened across all available width; and
- ▶ Bridge 140 (on B4044) - 12m overall width with parapets unlikely to meet modern standards so may not be able to make use of full bridge width.



5. Utilities

5.1 Introduction

A public records search was undertaken in January 2016 to understand the extent of existing public utilities in the area. A full copy of the study is included within Appendix C.

5.2 Assessment methodology

Desktop survey

Utilities providers were contacted in order to obtain electronic utilities records which have been combined within a fusion plan for analysis.

Site Inspection

A Ground Penetrating Radar (GPR) survey was commissioned to identify utility depths and alignments at 10 key locations within the study corridor. Details of which are appended to the full report.

5.3 Key Considerations

Table 5.1 provides a summary of the key considerations identified in this assessment.

Table 5.1 Summary of key considerations

Utility	Key considerations
Electricity	<ul style="list-style-type: none"> 11kV cables shown underground within ducts in Junction 2/Link 4 are assumed to need further protection underneath the proposed carriageway. It is assumed that additional ducting would be acceptable to protect the existing cables, however this would need to be agreed by Scottish and Southern Energy. LV cables serving commercial buildings within Link 4 would potentially need to be diverted lower or further northwards as it is assumed that they are not currently laid at sufficient depth to accommodate the carriageway. It is recommended that a further GPR survey is conducted to identify the depths of the cables once a design has been completed to assess the impact of the proposed widening works. An overhead LV cable network, transported on poles, is assumed to be affected by the proposed works as one pole is located within the proposed alignment at Link 6A and will therefore need to be diverted. It is assumed that at all cables which cross the A40 overhead (with the exception of the aforementioned overhead pole within Link 6A) will not be affected by the proposed works. However this should be clarified by Scottish and Southern Energy. <p>Scottish and Southern Energy should be contacted before any works are started to confirm proposed protection or diversion works to their assets.</p>
Gas	<ul style="list-style-type: none"> The 180mm PE MP gas main within Link 4 and Junction 5 will be partially affected by the proposed widening works to the north as it is likely that it is not laid at a sufficient depth. It is anticipated that this main will need to be diverted northwards with an easement of at least 3m from the edge of the carriageway. A 10" Spun Iron (SI) MP gas main within Link 5 and Junction 5 is assumed to be affected by the proposed works as the specified easement to protect the gas main is likely to be reduced below acceptance. 200mm DI LP and 300mm DI MP gas mains which cross the A40 within Junction 5 are assumed to be affected by the proposed works as it is anticipated that they are not laid at sufficient depths. From records received a 12" steel IP gas main is located within the northern verge of the A40 from Link 6A to Link 6D. It is anticipated that the gas main may be affected by the proposed works, as there may not be a sufficient easement between the new alignment of the carriageway and footpath and the gas main, and therefore it may need to be diverted or protected. <p>Southern Gas Networks should be contacted before any works are started to confirm proposed protection or diversion works to their assets.</p>

Utility	Key considerations
Telecommunications	<ul style="list-style-type: none"> • Virgin Media cables are located within the northern footway of the existing road alignment for most of the proposed widening works and are therefore assumed to be affected by the proposed works. It is assumed that the cables can be diverted either within the proposed footway or lowered along their existing alignment. It is recommended that a further GPR survey is conducted to identify the depths of the cables to assess the need for diversions. • BT Openreach cables cross the A40 within L2, L4 and Junction 5; however it is assumed that the cable can remain in-situ either within additional ducts or at a lower alignment. • BT Openreach cables which serve commercial properties to the north of Link 4 are assumed to be affected by the proposed works as approximately 20m of cables is shown to lie under the proposed footpath of the widened A40. It is assumed that the cables will be diverted or lowered. <p>BT Openreach and Virgin Media should be contacted before any works are started to confirm proposed protection or diversion works to their assets.</p>
Water	<ul style="list-style-type: none"> • A 6" AC water main located under the northern footpath within Links 3 and 4 and Junctions 2 and 3. It is anticipated that the water mains will have to be lowered or diverted as part of the widening works to the north of the A40; as it is likely that the water main are not laid at a sufficient depth to accommodate a carriageway. • It is not anticipated that the 24" and 900mm strategic water main which cross the A40 within Link 5 or the 6" water main which crosses the A40 within Junction 5 will be affected by the proposed widening works as it is assumed that they are laid with sufficient cover. However this should be confirmed by Thames Water. <p>Thames Water should be contacted before any works are started to confirm proposed protection or diversion works to their assets.</p>
Foul Water	<ul style="list-style-type: none"> • It is not anticipated that the 350mm rising main located within Junction 5 will be affected by the proposed widening works, however this should be confirmed by Thames Water. <p>Thames Water should be contacted before any works are started to confirm proposed protection or diversion works to their assets.</p>
Surface Water	<ul style="list-style-type: none"> • No public surface water sewers are shown to be present within or near to the A40. It is assumed that the highway drainage design will be remodelled to accommodate the proposed widening works.

5.4 Recommendations

It is recommended that a further GPR survey is conducted over the extent of the proposed works to confirm that locations of the anticipated affected utilities. It is also recommended that once the affected utility is confirmed that the relevant statutory undertaker is notified and accepts any proposed diversion or protection work specified.

6. Ecology

6.1 Introduction

The ecology study has been undertaken in accordance with industry standard practice^{5,6} which encompasses an extended Phase 1 habitat survey of the route and immediate surrounds. This approach combines a desk-based study and a Phase 1 habitat survey, extended to identify the presence, or potential presence, of legally protected/Priority Species. The report presents information on designated biodiversity sites, legally-protected and/or otherwise Priority Species and habitats that could be affected by the proposed scheme.

A full copy of the study is included within Appendix D.

6.2 Assessment methodology

Desktop survey

Information about statutory biodiversity sites of international and national/local importance, located within 10km and 5km (respectively) of the route, was obtained from the Magic website⁷ in January 2016. Information relating to areas afforded non-statutory protection, to a distance of 1km from the route, together with records of priority and/or legally protected species within 500m of the route, was requested from the Thames Valley Environmental Records Centre (TVERC). Information relating to badger setts within 1km of the route was requested from Oxon Badger Group. Information relating to records of bats within 500m of the route was requested from Oxfordshire Bat Group, along with records of confirmed bat roosts within 5km of the route, and the same search for bat roost records was also made by TVERC.

Any water bodies located on the route or to a distance of 500m from it were identified by reference to the 1:25,000 scale Ordnance Survey map and aerial photographs of the area. In the absence of significant barriers to movement, 500m is the maximum distance that great crested newts (GCNs) generally move from their breeding ponds to occupy surrounding areas of suitable terrestrial habitats. Natural England (NE) therefore recommends that, where a proposed development is located within 500m of a waterbody, consideration be given to the potential for the waterbody to support breeding GCN⁸.

In addition to the above, the Magic website was checked for European Protected Species Mitigation Licences (EPSMLs) that have been granted within the vicinity of the route between late-2008 to 2013⁹.

Site inspection

An extended Phase 1 habitat survey¹⁰ was undertaken in January 2016 by an ecologist from Amec Foster Wheeler. The survey combined the Phase 1 habitat survey methodology, which is a standardised system for classifying and mapping British habitats, with a survey to identify the presence or potential presence of species of importance for biodiversity conservation and/or species that are afforded legal protection. The output of this survey is a map with 'target notes' that includes information about specific habitat features/species.

The survey area covered the entirety of the route and adjoining areas of land up to 30m from the route (where these were visually or physically accessible). Information relating to the following was collected.

⁵ IEA (1995). *Guidelines for Baseline Ecological Assessment*. E & F Spon, London.

⁶ CIEEM (2016). *Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal*. Available at www.cieem.net.

⁷ <http://www.magic.gov.uk/>

⁸ English Nature (2001). *Great Crested Newt Mitigation Guidelines*.

⁹ The Magic website currently lists licences granted between 2008 and 2013.

¹⁰ JNCC (2010). *Handbook for Phase 1 Habitat Survey: A Technique for Environmental Audit*. JNCC, Peterborough.

-
- ▶ Habitats and notable plant species
 - ▶ Legally controlled species
 - ▶ Badger
 - ▶ Bats (all species)
 - ▶ Dormouse
 - ▶ Otters
 - ▶ Water Voles
 - ▶ Great crested newts
 - ▶ Reptiles
 - ▶ Birds
 - ▶ White-clawed crayfish
 - ▶ Terrestrial invertebrates
 - ▶ Other priority faunal species
-

6.3 Summary of findings

Biodiversity sites

The desk study identified two designated sites of European importance within 10km of the route, namely Cothill Fen SAC and Oxford Meadows SAC, the latter being located immediately adjacent to the route. Both of these sites are designated as a result of the internationally important vegetation communities that they support. Any proposed development would therefore need to be screened for its potential to result in a Likely Significant Effect on these sites, alone or 'in combination' with other plans and projects, in line with current legislation, i.e. Regulation 61 of the Conservation of Habitats and Species Regulations 2010 (as amended) (the 'Habitats Regulations'). The measures required to avoid impacts, such as any physical impact on the designated area, and/or any airborne emissions from the highway, and/or groundwater or run-off impacts, will need to be considered further within a Habitat Regulations Assessment screening report.

The desk study identified that Pixey and Yarnton Meads SSSI (also designated as part of Oxford Meadows SAC and part of which is also a Wildlife Trust reserve) is located immediately adjacent to the route. As the proposed development of the route does not entail any substantial additional land-take the scheme would not be expected to impinge upon this site, through direct loss of area or any indirect adverse impacts on the valued habitat and/or species that it supports, provided that standard dust and pollution prevention measures¹¹ are incorporated within the scheme design. Nevertheless, as the route falls within the Impact Risk Zone¹² for this and several other SSSIs (namely Cassington Meadows, Wytham Ditches and Flushes, Wolvercote Meadows, Hook Meadow and the Trap Grounds, and Port Meadow with Wolvercote Common & Green), consultation with Natural England (NE) will be required.

There are a number of non-statutory biodiversity sites within 1km of the route, with Oxey Mead Wildlife Trust reserve, Eynsham Wood Woodland Trust reserve, Cassington to Yarnton Gravel Pits LWS and Long Mead LWS all being located immediately adjacent to the route, The majority of the route is encompassed within the Oxford Meadows and Farmoor CTA. As the proposed development of the route does not entail any substantial additional land-take, the scheme would not be expected to impinge upon these sites provided that standard dust and pollution prevention measures are incorporated within the scheme design. However, consultation with the organisations responsible for the management of these sites is recommended.

All of the other national and local, statutory and non-statutory, designated sites identified by the desk study are separated from the route by large swathes of urban development, roads, open farmland etc. Taken with the fact that the scheme does not entail any substantial additional land-take, no adverse effects on these sites are expected and no further work is required.

¹¹ The Environment Agency and SEPA (Scottish Environment Protection Agency) Pollution Prevention Guidelines (PPG) can be downloaded from http://www.netregs.org.uk/library_of_topics/pollution_prevention_guides.aspx. Guidelines relevant to this work would include, PPG1 (general), PPG2 (on-site oil storage), PPG5 (in or near water) and PPG6 (construction activities).

¹² The Impact Risk Zones (IRZs) are a GIS tool developed by Natural England to make a rapid initial assessment of the potential risks posed by development proposals to: Sites of Special Scientific Interest (SSSIs), Special Areas of Conservation (SACs), Special Protection Areas (SPAs) and Ramsar sites. They define zones around each site which reflect the particular sensitivities of the features for which it is notified and indicate the types of development proposal which could potentially have adverse impacts

Habitats

The areas of habitat to be lost as a result of the proposed scheme largely comprise hardstanding, amenity grassland and some areas of semi-mature plantation woodland and trees. These habitats are common and widespread and are of limited value for biodiversity, such that their loss would pose few constraints to the proposed development. However, the following national/Oxfordshire Priority Habitats are present on or immediately adjacent to the route, such that further survey work will be required to assess the potential for direct loss/adverse impacts on these areas of habitat as a result of the proposed scheme, and what measures may be required to avoid, mitigate or compensate for such impacts:

Hedgerows

There are hedgerows along much of the A40 section of the route. In addition to constituting a Priority Habitat, some of the on-route sections of hedgerow may further meet the biological criteria to be classified as “important” under *The Hedgerows Regulations 1997*. It is intended that hedgerows will be retained as part of the proposals, in which case no adverse effects on hedgerows would be expected to arise, provided the hedges are protected from damage throughout the duration of the construction work and, where possible, enhanced through additional planting and sensitive management.

However, should the removal of any lengths of hedgerow be unavoidable, then further survey work is recommended, as set out in Section 4.2 of the main report (Appendix D).

Mature trees

The cumulative cover of mature trees along the route has value for biodiversity, and veteran trees are regarded as an “irreplaceable” habitat in Oxfordshire¹³. Some of the trees may qualify as being of ancient and/or veteran status and/or be covered by Tree Preservation Orders. Should any mature trees be affected by the scheme, then further survey work is recommended as set out in Section 4.2 of the main report (Appendix D).

Semi-improved neutral grassland

Some wider stretches of verge along the A40 section of the route contain semi-improved neutral grassland that may represent a Priority Habitat and/or be suitable to support notable plant species, such as stinking hellebore, which was recorded during the Phase 1 survey, and species including those that have been recorded from within 500m of the route, and/or from the adjacent SAC/SSSI in particular. Further survey work is recommended as set out in Section 4.2 of the main report (Appendix D).

Running water

The route crosses a number of watercourses, and rivers are a Priority Habitat. Further survey work will be required in respect of watercourses where there is potential for effects on the river channel and consideration for certain legally protected species that may be present on the watercourses is also recommended as set out in Section 4.2 of the main report (Appendix D). Additionally, standard dust and pollution prevention measures²¹ should be incorporated within the scheme design.

Species

The presence, or potential for presence, of a number of protected and Priority Species has been identified during the desk study and extended Phase 1 habitat survey. Recommendations regarding the requirement for species oriented surveys are made in Section 4.2 of the main report (Appendix D).

¹³ BBOWT, OCC and TVERC (2014). Biodiversity and Planning in Oxfordshire.

6.4 Recommendations

Based on the outcome of the assessment, licensed and/or statutory obligations require the following:

- ▶ A Habitat Regulations Assessment screening report is required due to the presence of a SAC;
- ▶ Consultation with Natural England (NE) is required in connection with the SSSIs; and
- ▶ Non-statutory biodiversity sites consultation with the organisations responsible for the management of these sites is recommended

The extent of follow on survey work is dependent on the scale of the proposed widening scheme. Where the widening is expected to occur within the highway (without significantly impacting adjacent hedgerow/trees), the extent of any further survey work will be relatively modest. Where the widening is expected to require hedgerow/tree removal, widening of structures, removal and/or strengthening of embankments or extensive use of land outside of the public highway, then a significant amount of additional survey work may be required, as indicated in Table 5.1 and detailed in Section 4.2 of the main report (Appendix D).

Table 6.1 Ecological constraints and further survey work that will be required depending on the final scheme design

Follow up survey work	Further survey work/consultation requirement	
	Scheme within existing route corridor	Scheme extends beyond existing route corridor*
Hedgerows	No	Yes
Mature trees	No	Yes
Semi-improved neutral grassland and notable plants	Yes	Yes
Legally controlled (invasive) plants	Yes	Yes
Running water	No	Yes
Badger	Yes	Yes
Bats (roosting)	Yes	Yes
Dormouse	No	Yes
Otter	No	Yes
Water vole	No	Yes
Breeding kingfisher and Cetti's warbler (birds)	Yes	Yes
Great crested newt	Yes	Yes
Reptiles	No	Yes
White-clawed crayfish	No	Yes

*The extent of the additional work is still dependent on the scope of works.

6.5 Key Considerations

Based on the outcome of the ecology assessment, there will be no significant impact if all works remain within the highway boundary and there is avoidance of effects to mature trees, hedgerows and structures/watercourses.

7. Arboricultural Assessment

7.1 Introduction

A tree survey was carried out compliant with BS5837. A full copy of the study is included within Appendix E.

7.2 Assessment methodology

Site Inspection

Trees are categorised in accordance with the cascade chart in Table 1 of BS5837:2012. The purpose of the categorisation process is to differentiate the quality and value of the existing tree stock so that informed decisions can be made on the retention or removal of trees.

The tree categories are summarised thus:

- ▶ Category U: Trees lost within the short term for reasons of physiology or poor structural integrity.
- ▶ Category A: Trees of particularly high quality in arboricultural, landscape or cultural/conservation terms
- ▶ Category B: Moderate quality trees downgraded from the high category because of significant defects, groups with a collective value through numbers rather than individual tree quality or trees with identifiable cultural or conservation values.
- ▶ Category C: Trees with low value in arboricultural, landscape or cultural/ conservation terms. Also includes young trees with a stem diameter of less than 150mm.

For trees in categories A – C subcategories 1, 2 & 3 are given to reflect arboricultural, landscape and cultural values respectively.

7.3 Summary of Findings

In the course of the tree survey the following was identified; 256 individual trees, 137 tree groups and 48 hedges. Of these it was found that they fell into the following quality and value grades:

Table 7.1 Tree Survey Summary

QV Category	Description	No. of Trees	%	No. of Groups	%	No. of Hedges	%
		32	12.5	9	7	0	0
	Trees of moderate quality	97	38	76	55	25	52
C	Trees of low quality	59	23	43	31	19	40

7.4 Recommendations

In critically grading the trees to make informed decisions on the retention and removal decisions the emphasis is on the loss of lower quality trees to enable the retention of better quality trees. Trees with a retention span of less than 10 years for reasons connected with their physiological or structural condition are not a consideration in the planning process. These trees are graded Category U in the BS 5837 categorisation method. Low quality trees are graded Category C and can generally be considered for removal to facilitate development, though consideration may need to be given to the mitigation for losses in the landscaping scheme.

Trees in higher categories that are considered to impose such a constraint on development that their retention would be disproportionate to their existing value are also sometimes identified for removal. This only rarely applies to Category A trees, being those of 'high quality and value', but can more defensibly apply to B grade trees, i.e. those of 'moderate quality and value'. The importance of mitigation for losses in the landscaping scheme increases substantially as the quality of trees to be removed increases.

7.5 Key Considerations

Category A and B trees to be retained as far as practically possible. Category U and C trees can be removed, though some offsetting for the loss of the latter may be required.

8. Heritage

8.1 Introduction

The heritage study has assessed the potential for historic environment features to be present within the site and the potential for any such features to be adversely affected by the proposal. A full copy of the study is included within Appendix F.

8.2 Assessment methodology

Desktop survey

A desk-based study has been undertaken, where existing information pertinent to the assessment of the potential impact of the development has been collected. The following baseline data sources have been investigated:

- ▶ Historic England Registers of designated features (Scheduled Monuments, Listed Buildings, Registered Historic Parks and Gardens, Registered Battlefields and World Heritage Sites);
- ▶ Oxfordshire Historic Environment Record (HER);
- ▶ Cartographic and historic documents;
- ▶ Aerial photographs;
- ▶ Place and field-name evidence; and
- ▶ Published sources.

These were obtained from the following organisations:

- ▶ Historic England (HE)¹⁴ - the National Monuments Record (NMR) including the National Heritage list For England;
- ▶ Envirocheck historic mapping; and
- ▶ Amec Foster Wheeler library and other, web-based published material.

In addition to the above and in order to place the site within its context and assist in identifying the potential for the presence of further remains of archaeological interest, data relating to non-designated heritage assets was collected for an area within 500m of the site.

Amec Foster Wheeler maintains a current dataset of designated heritage assets from HE. The 500m study area was reviewed for any World Heritage Sites, Scheduled Ancient Monuments, Listed Buildings and Registered Parks and Gardens.

A remote search of the Oxfordshire HER was conducted by Amec Foster Wheeler and data supplied electronically, via email, on the 21st January 2016.

Site Inspection

A site inspection was carried out on 9th February 2016 by an Amec Foster Wheeler Historic Environment Specialist, in order to view known and potential features of interest.

¹⁴ Formerly English Heritage

8.3 Summary of Findings

No designated heritage assets are recorded within the A40 corridor.

One Scheduled Monument, and three Listed Buildings have been identified within the B4044/Oxford Road area. However, given the proximity of the road corridor to these, current it is unlikely that the proposed works will harm the heritage significance of these assets through change to their setting. If works are planned in the area of the Scheduled Monument, Historic England should be consulted regarding Scheduled Monument Consent.

The remaining designated assets are centred on the medieval villages of Eynsham, Cassington and the Oxford canal, but these are unlikely to be impacted directly or indirectly by the scheme.

In the modern period the A40 site and study area have been heavily disturbed by ground works associated with gravel extraction, and the construction of the A40. These works are likely to have removed or heavily disturbed any archaeological remains within the road corridor and surrounding gravel extraction areas. The areas which surround the road and gravel extraction sites, consist of largely undisturbed agricultural land, if present archaeological remains in these areas can be expected to be well preserved.

With regards to the B4044/Oxford Road area, again, ground works associated with construction of the existing road are likely to have destroyed any below ground archaeological remains beneath the road. The area surrounding the road has been utilised as agricultural land or recreation grounds since at least the 19th century, and as such any archaeological remains can be expected to survive in these areas.

8.4 Recommendations

Based on the outcome of the assessment, it is considered that where groundworks are proposed in less disturbed parts of the site (i.e. outside former aggregate areas, and outside the area of the existing road) then it is likely that further archaeological investigation will be required to establish the extent, nature and survival of any archaeological remains.

8.5 Key Considerations

If the works are contained within the highway boundary i.e. where the ground has been disturbed, then no further survey work is required. However, Historic England should be consulted regarding Scheduled Monument Consent in relation to any works along the B404.

9. Geo-environmental

9.1 Introduction

The purpose of the geo-environmental study is to identify potential geotechnical and contaminated land risks and constraints. A full copy of the study is included within Appendix G.

9.2 Assessment methodology

Desktop survey

A desk-based study has been undertaken, where existing information pertinent to the assessment of the potential impact of the development has been collected, with the following aspects considered:

- ▶ Identification and review of selected contemporary information, where available, for the site and surrounds;
- ▶ Review of historical mapping for the site and surrounds to determine historical land uses;
- ▶ Development of a Conceptual Model (CM) and Preliminary Environmental Risk Assessment, in line with CLR 11 to provide an assessment of the sites potential contamination status and identify the presence of potentially significant contaminant linkages that require further consideration;
- ▶ Assessment of potential geotechnical development constraints, including development of a Geotechnical Risk Register to provide information and ensure the safe and economic design of the development; and
- ▶ Identification of information gaps, geo-environmental development abnormalities and any requirements for further assessment.

To inform the above, the following sources of data have been consulted:

- ▶ Envirocheck Reports (Reference: 78294976_1 and 78295171_1);
- ▶ Current OS Plans;
- ▶ Topographical plans for the site;
- ▶ BGS geological maps;
- ▶ Environment Agency (Water Framework Directive, Rivers, Aquifer Classification – <http://maps.environment-agency.gov.uk>);
- ▶ The Environment Agency hydrogeological and groundwater vulnerability maps and plans (<http://maps.environment-agency.gov.uk>);
- ▶ Zetica UXB Risk Maps (http://www.zetica.com/uxb_downloads.htm); and
- ▶ Current site condition data gathered during the January 2016 site walkover.

Site Inspection

A site inspection was undertaken by an experienced Amec Foster Wheeler geo-environmental engineer on 21st January 2016 to gain an understanding of current site conditions.

9.3 Summary of findings

The preliminary geotechnical assessment indicates that the ground conditions potentially pose constraints, to include compressible ground stability issues and shrink swell clays. Shrink swell clays can cause sinking or heaving of pavements, resulting in cracking or an uneven pavement. The geotechnical constraints are considered to be manageable through appropriate design, consideration of groundwater conditions and consideration of advice published by the Building Research Establishment (BRE).

A number of mature trees are present along the A40 and B4044 routes, which may require careful consideration in the scheme designs. Trees can affect the drying and wetting of soil and may exacerbate any shrink swell clay issues. Superficial deposits underlying the A40 (Summertown-Radley Sand and Gravel Member, Upper Facet and alluvium) and the B4044 (Alluvium Deposits) are expected to have a granular nature and can have an effect on drainage and may alleviate shrink swell clay issues.

In addition, existing services may pose constraints, with a requirement for measures to be taken to avoid or protect them.

9.4 Recommendations

Contamination is not considered to pose a constraint to the proposed bus route development of the site. Two potentially significant contaminant linkage has been identified in relation to Made Ground associated with the development of the existing road for the A40 and one potentially significant contaminant linkage has been identified in relation to Made Ground associated with the B4044.

For both the A40 and the B4044, the identified receptor is future site users (construction workers). It is anticipated that the potential pollutant linkage will only be a factor if the Made Ground is exposed by the removal of the existing tarmacadam present on the site.

The second potentially significant contaminant linkage concerns the A40 only and is from the two petrol stations located immediately north and south of the site boundary in the centre of the A40.

The preliminary geotechnical assessment has identified potential issues relating to compressible ground stability and shrink swell clays. To confirm the near surface ground conditions an intrusive ground investigation is recommended. The data obtained will inform detailed design for the proposed bus lane development.

It is recommended that during the intrusive investigation that limited chemical testing is undertaken to confirm the CM and ensure any topsoil and subsoil to be retained and incorporated into the development is suitable for use. In addition this opportunity should be taken to obtain chemical data to support disposal of any waste materials that may be generated during the proposed works.

9.5 Key Considerations

Based on the outcome of the geo-environmental assessment, there will be no significant impact if all works remain within the highway boundary and all mature trees are avoided.

10. Key Constraints and Design Considerations

A key element of the study is to fully understand the opportunity and constraints of the A40 and B4044 study corridors. The findings from the desktop studies provide the basis for constraints and opportunities plans, which will inform the design considerations and are summarised in this section.

10.1 Key Constraints and Opportunities

The key constraints and opportunities considerations based on the findings are summarised in Table 10.1 and are illustrated within Figures 1 -14 contained within Appendix H.

Table 10.1 Key Considerations from Baseline Surveys

Topic Area	Key Consideration
Highways	<p>Based on its current design, the A40 has capacity, however, in the peak periods, there is congestion for eastbound traffic which stems from Wolvercote Roundabout in the AM peak and in the PM peak there is significant traffic congestion at most junctions for westbound traffic. The following are key design considerations:</p> <ul style="list-style-type: none"> • Provision of adequate bus priority at junctions on the south side of the corridor for westbound traffic to address the PM peak congestion. • Given carriageway width is an important component of link capacity it is considered that the A40 carriageway could be narrowed in order to reduce the amount land required to construct the bus lane. This could prove significantly advantageous where localised narrowing of the grassed verge occurs and around key structures. • VISSIM modelling will be enable an understanding of the effectiveness of bus priority in bypassing the traffic queues. <p>An assessment of the B4044 link capacity has been undertaken and it has been established that the B4044 is approaching capacity. There is congestion at the B4449/B4044/ Oxford Road roundabout largely due to queuing at the Swinford Bridge toll collection point, as well as volume of traffic. Bus priority provision is constrained by the following:</p> <ul style="list-style-type: none"> • Limited verge availability on the B4044 on the approach to the B4449/B4044/ Oxford Road roundabout • South of the junction widening of the carriageway is possible, however the link is exceptionally short and would need to consider the junctions situated either side. • On the approach to the Swinford Toll Bridge, widening would require third party land and would impact upon the public house, a field access and the car park situated adjacent to the Toll Bridge.
Structures	<p>The key constraints identified are:</p> <ul style="list-style-type: none"> • Suitability of parapets. • Bridge 246 - 15.8m overall width, but with parapets to modern standards so can be widened across all available width; • Bridge 156 - 15m overall width, but with parapets to modern standards so can be widened across all available width; and • Bridge 140 (on B4044) - 12m overall width with parapets unlikely to meet modern standards so may not be able to make use of full bridge width.
Utilities	To be completed
Ecology	Based on the outcome of the ecology assessment, there will be no significant impact if all works remain within the highway boundary and there is avoidance of effects to mature trees, hedgerows and structures/ watercourses. Additional surveys will be required to identify any potential mitigation needs.
Aboricultural	To be completed
Heritage	If the works are contained within the highway boundary i.e. where the ground has been disturbed, then no further survey work is required. However, Historic England should be consulted regarding Scheduled Monument Consent in relation to any works along the B4044.
Geo-Environmental	Based on the outcome of the geo-environmental assessment, there will be no significant impact if all works remain within the highway boundary and there is avoidance of effects to mature trees.

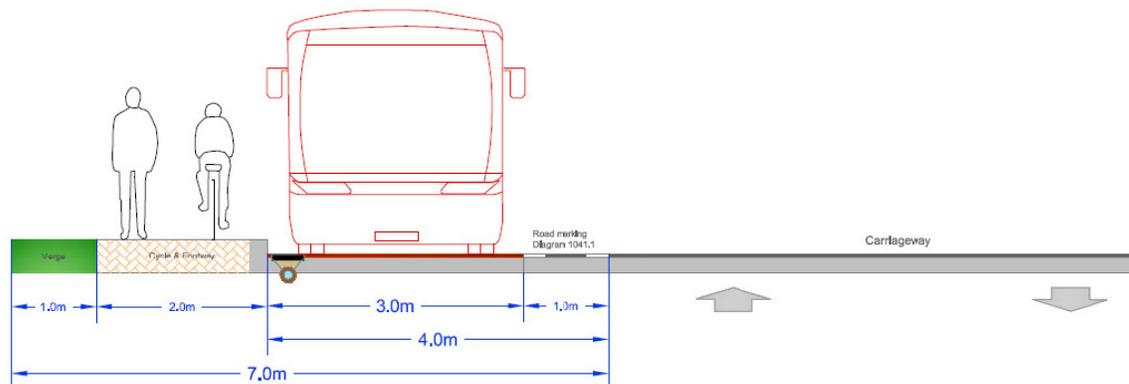
10.2 Design Considerations

Based on the brief, key design considerations are as follows:

- ▶ The minimum required to accommodate the bus lane;
- ▶ Buses should be able to travel safely and freely alongside queues on the corridor;
- ▶ The cycle track along both the north and south verges of the A40 should be retained and improved, where possible, in the improvement design; and
- ▶ Where there is insufficient space to accommodate the design within the highway boundary, this should be overcome either by:
 - ▶ widening the highway (and identifying the consequences of this); or
 - ▶ reducing the standard of construction, which could include.

The concept design for the A40 bus lane identified by URS provides a starting point for scheme options, as illustrated in Figure 10.1 (extracted from the URS report, Pg 19, Figure 3.5). This has been based on a review of design standards undertaken as part of the URS study which was discussed and agreed with OCC highways officers during the course of the study.

Figure 10.1 Minimum width on-carriageway busway with minimum width shared foot/cycleway (URS)



The design standards specified above will need to be discussed with OCC officers as part of the optioneering workshop to identify the design principles, from which the scheme options will be derived.

10.3 Next steps

The next steps will be to identify design options based on the topographical survey which has been undertaken as part of the baseline study and the findings of the topic areas. These will be presented and discussed at the optioneering workshop, from which it is anticipated that the following will be identified:

- ▶ a set of design principles in terms of standard of provision (carriageway, bus lane, cycleway/footway and verge widths);
- ▶ preferred treatment of pinchpoint locations – widening or interruption of bus lane with appropriate means of traffic management; and
- ▶ preferred treatment of junctions, including maximising the bus priority opportunities on the southern side to facilitate westbound bus services, and also improving junction capacity to alleviate overall traffic congestion, particularly in the PM peak period.