



OXFORDSHIRE COUNTY COUNCIL

**Bicester Transport Modelling**  
London Road Options Assessment

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Draft  
Report No. RT-084107-14  
Version 2

## REPORT CONTROL

Document:

Project: Bicester Transport Modelling

Client: Oxfordshire County Council

Job Number: A084107

File Origin: N:\Projects\A084107 - Bicester Transport Modelling\reports\A084107-14  
London Road Option Assessment\A084107-14\_London Road Options  
Assessment\_Rev2.docx

## Document Checking:

|                |                |             |    |
|----------------|----------------|-------------|----|
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|-----------|---------------|-------------|----|

| Issue | Date     | Status                     | Checked for Issue |
|-------|----------|----------------------------|-------------------|
| 1     | 23.07.15 | Draft for Information      | CS                |
| 2     | 04.11.15 | Incorporating OCC Comments | CS                |
| 3     |          |                            |                   |

## Contents

|   |                               |    |
|---|-------------------------------|----|
| 1 | Introduction .....            | 1  |
| 2 | Reference Case Models .....   | 2  |
| 3 | London Road Options .....     | 7  |
| 4 | Option analysis.....          | 8  |
| 5 | Economic Assessment.....      | 10 |
| 6 | Summary and Conclusions ..... | 16 |

## Tables

|  |    |
|--|----|
| Table 1: Summary of Reference Case Infrastructure.....                             | 4  |
| Table 2: Summary of Peripheral Route Additional Reference Case Infrastructure..... | 5  |
| Table 3: Housing and Employment Figures: 2024 Trajectory.....                      | 5  |
| Table 4: Housing and Employment Figures: 2031 Trajectory.....                      | 6  |
| Table 5: Housing and Employment Figures: 2031 Trajectory.....                      | 12 |
| Table 6: Reference Case Comparison Economic Assessment Results.....                | 14 |
| Table 7: Reference Case incl. Route 2C Comparison Economic Assessment Results..... | 15 |

## Appendices

- Appendix A – Reference Case Infrastructure
- Appendix B – Reference Case Link Flows
- Appendix C – London Road Scheme Options
- Appendix D – Options Link Flows
- Appendix E – Link Flows Comparison Plots
- Appendix F – Node Volume Over Capacity Plots

# 1 Introduction

- 1.1 WYG were commissioned by Oxfordshire County Council (OCC) to assess the highway network impacts of mitigation options proposed in relation to the proposed closure of the London Road level crossing in Bicester.
- 1.2 This technical note outlines the procedure used to update the 2024 and 2031 Bicester Saturn models used at the Cherwell Local Plan Examination In Public in order to provide suitable reference case models for assessment of the options. It provides an overview of the options and details the economic assessments carried out.

## 2 Reference Case Models

2.1 In order to establish the relative benefits of the London Road Option, each option has been compared against a suitable reference case for the forecast years of 2024 and 2031.

2.2 Saturn networks were previously produced to test the Main Modifications to the Local Plan.

2.3 These networks were reviewed and the following infrastructure changes initially included to update the network from the 2012 base to both the 2024 and 2031 forecast years were retained:

- Vendee Drive (the south west link road);
- M40 Junction 9 phase 1;
- Town centre access improvements;
- Changes implemented as part of the town centre redevelopment;
- Traffic calming and 30mph speed limit on Middleton Stoney Road;
- A4095 / B4100 junction alterations (as part of NW Bicester exemplar site);
- Changes at the Pingle Drive junction, A41 / Oxford Road (ESSO) junction and along the A41 corridor (as part of the mitigation measures from Tesco's move and Bicester Village phase 4);
- Park & ride entrance / exit at the junction of Vendee Drive and the A41;
- M40 Junction 9 phase 2
- Inclusion of the M40 Junction 10 pinch point scheme; and
- Minor amendments to traffic signal timings at M40 Junction 9 and M40 Junction 10;
- Development access for Graven Hill (BICESTER 2) at A41/Pioneer Road and alterations to the A41 / London Road (Rodney House) junction (as part of Graven Hill mitigation); and
- Development access for the Upper Heyford committed development scheme.

2.4 The London Road crossing is assumed to be closed to through traffic for 40 minutes in every hour in 2024 and fully closed by 2031. This is based on information provided by Network Rail relating to the expected increase in train frequency on this line.

2.5 The above network changes approximately equated to the 'committed' infrastructure proposals for the Bicester area.

- 2.6 It is best practice to model not just the committed development but to include those that are likely to come forward in a core modelling scenario using the WebTAG definitions of 'near certain' and 'more than likely'. This gives a more rounded view of what the future year scenario could be.
- 2.7 A review of potential large scale developments was therefore carried out. This resulted in the inclusion in the model of additional development accesses for South West Bicester phase 2 (BICESTER 3), Bicester Business Park (BICESTER 4), Town centre redevelopment phase 2 (BICESTER 6), RAF Bicester (BICESTER 8), Bicester Gateway (BICESTER 10), North East Bicester Business Park (BICESTER 11) including the care home and business park adjacent to this site with existing planning permission, North West Bicester (Bicester 1) and South East Bicester (BICESTER 12).
- 2.8 Although not all of the developments are sufficiently detailed at this time to include significant development related infrastructure proposals, this review highlighted a number of additional changes to the Bicester highway network that could come about as a results of the proposed developments or to mitigate the likely future traffic conditions in the area. These are summarised in **Table 1** and are in addition to the highway infrastructure outlined in paragraph 2.3 above. Please see **Appendix A** for details of the proposals:

**Table 1: Summary of Additional Reference Case Infrastructure**

| Network Modification                  | Description  | To be included? |      |
|---------------------------------------|--|-----------------|------|
|                                       |  | 2024            | 2031 |
| Development Assumption: NW Bicester   | Inclusion of North West Bicester Development infrastructure and associated improvements  | Yes             | Yes  |
| Development Assumption: SE Bicester   | South East Bicester Development Link Road between A41/Pioneer Road and A41/Gavray Drive  | Yes             | Yes  |
| Development Assumption: Upper Heyford | Inclusion of Upper Heyford Development infrastructure  | Yes             | Yes  |
| Mitigation Package A                  | Improvements to the A41/Vendee Drive junction  | No              | Yes  |
| Mitigation Package A                  | Improvements to the Vendee Drive/Wendlebury Road junction  | No              | Yes  |
| Mitigation Package A                  | Inclusion of a roundabout at the A41/ SE Bicester development link road junction.  | Yes             | Yes  |
| Mitigation Package B                  | Charbridge Lane level crossing replaced by an overbridge   | Yes             | Yes  |
| Mitigation Package B                  | Improvements to A4421 Skimmingdish Lane and Charbridge Lane Corridor consisting of dualling of the A4421   | No              | Yes  |
| Mitigation Package B                  | Signalisation of the A4421/A4095 (including conversion of the two existing accesses directly to the north of this junction to left in/left out priority junctions) | No              | Yes  |
| Mitigation Package B                  | Signalisation of the A4421/Bicester 8 proposed development access  | No              | Yes  |
| Mitigation Package B                  | Signalisation of the A4421/Bicester 11 proposed development access   | No              | Yes  |
| Mitigation Package B                  | Signalisation of the A4421/Launton Road/Charbridge Lane/ Bicester Road roundabouts   | Yes             | Yes  |
| Mitigation Package B                  | Signalisation of the A4421/Gavray Drive  | Yes             | Yes  |

2.9 Following investigation of the model assignments, results from an Arcady junction assessment for the A4095 Lord's Lane / B4100 Banbury Road roundabout junction were input into the SATURN network in order to accurately reflect traffic conditions at the junction.

2.10 An additional reference case has been constructed which includes a potential new link road in South East Bicester (as identified through the February 2013 Movement Study). For the purpose of this modelling report, the route based on Route 2C. The junctions on the route are given in **Table 2** below and included diagrammatically in **Appendix A**:



**Table 2: Summary of Peripheral Route Additional Reference Case Infrastructure**

| Network Modification | Description                               | To be included? |      |
|----------------------|---|-----------------|------|
|                      |   | 2024            | 2031 |
| Peripheral Route 2C  | Proposed Link Road/Graven Hill access     | Yes             | Yes  |
|                      | Proposed Link Road/Bicester 10 access     | Yes             | Yes  |
|                      | Proposed Link Road/Wendlebury Road        | Yes             | Yes  |
|                      | Proposed Link Road/A41/B4030 Vendee Drive | Yes             | Yes  |

2.11 Development forecasts previously compiled for the Cherwell Local Plan Examination In Public were reviewed by OCC and updated where appropriate. Details of the housing and employment sites trajectory for the 2024 and 2031 forecast years are given in **Tables 3 & 4** below:

**Table 3: Housing and Employment Figures: 2024 Trajectory**

| Plan Period Total Supply 2011 – 2024     | Housing     | Employment   |
|--|-------------|--------------|
|  | Dwellings   | Hectares     |
| North West Bicester (Bicester 1)         | 1863        | 10           |
| Graven Hill (Bicester 2)                 | 1400        | 26           |
| South West Bicester Phase 1              | 1542        |              |
| South West Bicester Phase 2 (Bicester 3) | 726         |              |
| South East Bicester (Bicester 12)        | 1100        |              |
| Gavray Drive (Bicester 13)               | 300         |              |
| Talisman Road (approved site)            | 125         |              |
| Upper Heyford                            | 1350        |              |
| Bicester Business Park (Bicester 4)      |             | 29.5         |
| Bicester Gateway (Bicester 10)           |             | 18           |
| Land at NE Bicester (Bicester 11)        |             | 15           |
| SE Bicester (Bicester 12)                |             | 28.8         |
| <b>Total</b>                             | <b>8406</b> | <b>127.3</b> |

**Table 4: Housing and Employment Figures: 2031 Trajectory**

| Plan Period Total Supply 2011 – 2031     | Housing     | Employment   |
|--|-------------|--------------|
|  | Dwellings   | Hectares     |
| North West Bicester (Bicester 1)         | 3293        |              |
| Graven Hill (Bicester 2)                 | 2100        |              |
| South West Bicester Phase 1              | 1742        |              |
| South West Bicester Phase 2 (Bicester 3) | 726         |              |
| South East Bicester (Bicester 12)        | 1500        |              |
| Gavray Drive (Bicester 13)               | 300         |              |
| Talisman Road (approved site)            | 125         |              |
| Upper Heyford                            | 2361        |              |
| Bicester Business Park (Bicester 4)      |             | 29.5         |
| Bicester Gateway (Bicester 10)           |             | 18           |
| Land at NE Bicester (Bicester 11)        |             | 15           |
| SE Bicester (Bicester 12)                |             | 40           |
| <b>Total</b>                             | <b>9377</b> | <b>127.3</b> |

2.12 The matrices produced for the Main Modification to the Local Plan were updated to the revised development trajectory detailed in **Tables 3 & 4**. These matrices were then assigned to the networks described above to provide reference case forecast flows for the following scenarios for the AM and PM peak periods:

- 2024 Reference Case;
- 2031 Reference Case;
- 2024 Reference Case with Route 2C; and
- 2031 Reference Case with Route 2C.

2.13 Reference case link flow plots are given in **Appendix B**.

## 3 London Road Options

- 3.1 Draft scheme drawings of four options to mitigate the closure of the London Road level crossing were provided by OCC. These are included in **Appendix C**.
- 3.2 The four options can be grouped into pairs based on their configuration.
- 3.3 The first pair consists of the construction of an underpass at or near to the existing level crossing (Options A1 and C). Although the options vary in the position of the underpass and the treatment of the local roads and station forecourt, in purely modelling terms, the options can be considered identical for this assessment.
- 3.4 The second pair of options consists of a new link road from London Road, north of the level crossing, to a new junction with the A41 Boundary Way to the south (Options D1 and D2). The junction of the new link with the A41 is proposed as a three arm signalised junction with a single lane from the west, a flare to two lanes from the north and a flare to two lanes to accommodate a right turn lane from the east. Again, although the options differ in their alignments and the location of the A41 junction, they can be considered identical for assessment in the model.
- 3.5 A preliminary Linsig traffic signal assessment was carried out using the 2024 (no Route 2C) traffic flows. This indicated that the small signalised junction proposed on the A41 for Options D1&2 would be unlikely to be able to accommodate the traffic flows predicted. Therefore a further option which allowed for a flare to an additional ahead lane both east and westbound on the A41 approaches with exit merges was included (Option D3&4).
- 3.6 The options A1/C, D1&2 and D3&4 were each modelled for the AM and PM peak periods in the 2024 and 2031 forecast years both with and without the proposed Route 2C.
- 3.7 The matrices produced for the reference case were assigned to the option models to produce forecast option traffic flows. These are shown in **Appendix D**.

## 4 Option analysis

- 4.1 Comparisons of forecast traffic flows were carried out between each option and its equivalent reference case. These difference plots are presented in **Appendix E**.
- 4.2 It can be seen that for Option A1/C, the most significant impact in both 2024 and 2031 for both peaks is a shift of traffic from the A4421 Charbridge Lane to London Road. There is also a decrease on the A41 between Oxford Road and London Road in 2031. No significant change is seen on Route 2C.
- 4.3 Where Option D1&2 is introduced, a decrease in traffic is seen on London Road to the south east of the new link as would be expected. This is balanced by an increase in traffic to the east of the new junction on the A41 and a corresponding decrease to the west of the junction. Where Route 2C is provided, this sees an increase in traffic as A41 Boundary way traffic is reassigned to this route. Where Route 2C is not available, the A41 traffic reroutes through Bicester and uses the new link.
- 4.4 Option D3&4 provides similar results to D1&2 but with less significant reductions in traffic on the A41 west of the new junction. In fact, in 2024 with Route 2C in place, this link sees an increase in traffic.
- 4.5 In both D1&2 and D3&4, a reduction is seen on the A4421 Charbridge Lane with the exceptions of in 2024 without Route 2C where an increase is seen on this route.
- 4.6 Network plots in **Appendix F** show in red where the Volume over Capacity ratio (V/C) exceeds 85% at nodes (i.e. junctions). It can be seen that in the reference case with no Route 2C scenarios the intermediate nodes along the A41 Boundary Way show up as over 85%. These nodes are 'dummy' nodes that allow direct comparison to be made between the scenarios both with and without the A41/new link junction. These nodes have a relatively high capacity and have no loss of priority to the main line flow and as such illustrate that the A41 is operating over capacity in the forecast scenarios. This is not prevalent in the with Route 2C reference case scenarios as the link road allows a decrease in traffic on this route.
- 4.7 In the Option A1/C scenarios, some additional over capacity nodes are seen in central Bicester. This is due to rerouting of traffic onto London Road which no longer has delay caused by the level crossing.

- 4.8 In Option D1&2, some shifting of over capacity nodes is seen as traffic uses the new route rather than the A41 between Oxford Road and the new junction. Overall, as the new junction is also over capacity and more central Bicester junction become over capacity, this option could be considered not to perform well.
- 4.9 Overall, Option D3 reduces the number of over capacity nodes in central Bicester with the exception of the 2031 no Route 2C comparisons. This is offset in the 2031 AM scenarios by a reduction in the number of junction over 85% around outer Bicester.

## 5 Economic Assessment

5.1 In accordance with WebTAG guidance on the Transport Economic Efficiency Sub-Objectives (TAG Unit 3.5.2), the Transport User Benefit Appraisal program, TUBA, (version 1.9.5) has been used to estimate the benefits derived from a scheme in terms of time and vehicle operating cost savings. TUBA assesses the whole life costs and benefits of transport schemes using matrices of costs, in terms of distance and time, and trips from the transport model. The program calculates user benefits and changes in revenues and produces indicators of a project worth.

### **TUBA Inputs**

5.2 There are three main inputs to the TUBA process:

- Economic parameters
- Scheme specific control data
- Matrix data from the traffic model

### **Economic Parameters**

5.3 In accordance with WebTAG guidance, the standard TUBA economics file has been used. This file provides details of tax rates, Values Of Time (VOT) and Vehicle Operating Cost (VOC) parameters and growth forecasts for VOT and VOC.

### **Scheme Specific Control Data**

5.4 The control data file used by TUBA is scheme specific and defines the appraisal period, sets out the scheme costs, provides details of model specific data (e.g. time slices and user classes) and defines the annualisation factors (i.e. to convert model time periods to their annual equivalent).

5.5 For the purposes of the TUBA assessment the current year has been taken as 2015 and an opening year of 2024 has been assumed. This gives the horizon year as 2083, thus providing a 60 year assessment period in accordance with WebTAG guidance (TAG Unit 3.5.2). A second intermediate year of 2031 is also defined within TUBA for assessment.

5.6 The time periods from the transport model were:

- 0800 – 0900 (AM peak); and
- 1700 – 1800 (PM peak).

- 5.7 A simplistic approach for the calculation of annualisation factors has been taken where the factors are assumed to be the number of weekdays in a year (253) for each peak period.
- 5.8 The total annual hours assessed therefore are 506 (out of an annual total of 8760 hours). This is not considered to be a robust assessment but allows for initial relative assessment of the options to be carried out.
- 5.9 The following vehicle mode types have been used in the TUBA assessment:
- Cars
  - Light Goods Vehicles (LGV)
  - Medium Goods Vehicles (OGV1); and
  - Heavy Goods (OGV2)
- 5.10 Although only 2 vehicle classes were available from the model (Lights and Heavies), it was deemed appropriate to split the model outputs into the four classes for assessment with TUBA. As such the Lights vehicle class is assumed to consist of 90% car and 10% light goods vehicles and the heavies vehicle class is assumed to consist of 60% OGV1 and 40% OGV2. This allows TUBA to take account of different vehicle type impacts in the assessment.
- 5.11 All scheme costs have been entered as Factor Costs to allow TUBA to convert to Market Prices.
- 5.12 All scheme costs have been assumed to occur in 2023.
- 5.13 The Retail Price Index (RPI) value of 258.9 has been used in all assessments. This is equivalent to the July 2015 figure which was the latest available at the time of carrying out the assessments.
- 5.14 All costs have been assumed to be attributable to TUBA Mode 1 (i.e. Private Mode).
- 5.15 Costs for construction were provided by OCC for Options A1, C, D1, D2 and for Option C with a non compliant headroom design (referred to as CNC). These are given in **Table 5** below:

**Table 5: Housing and Employment Figures: 2031 Trajectory**

| Option | Route                                 | Cost in £m      |                 |
|--------|---------------------------------------|-----------------|-----------------|
|        |                                       | Cost excl. risk | Cost incl. risk |
| A1     | Off line tunnel through business park | 26.8            | 37.6            |
| C      | Tunnel on existing alignment          | 16.4            | 23.0            |
| C (NC) | As above with non-compliant headroom  | 15.1            | 21.2            |
| D1     | A41 Connection                        | 21.3            | 29.8            |
| D2     | A41 (variant)                         | 27.4            | 38.4            |

5.16 The cost including risk has been used. Although it is best practice to split the costs into subsections within TUBA (e.g. construction, land, preparation etc), the whole cost has been attributed to construction for this assessment due to lack of detailed information. This is considered reasonable as all costs have been considered in a consistent manner.

5.17 A cost for Options D3&4 were not supplied as this option was developed during the modelling work. Based on discussions within WYG a cost of £9.5m additional to the costs of D1&2 has been assumed based on the following:

- £5m for widening of the existing A41 bridge over the railway line;
- £1m for additional stats works;
- £0.1m for additional Highways works;
- £.5m for additional signal installation; and
- 44% optimism bias.

5.18 This is considered to be robust and allows for the high level of uncertainty implicit in a design that is only a concept at this stage. Therefore, the costs assumed for D3 and D4 are D1+£9.5m = £39.3m and D2+£9.5m = £47.9 respectively.

#### **Matrix Data from the Transport Model**

5.19 Forecast flows from the Bicester reference case and options models, as detailed in the previous sections have been used in the economic assessments.



5.20 Trip Matrices have been skimmed from the SATURN assignments for each vehicle type (Lights and Heavies) for both 2024 and 2031 Matrices.

5.21 Each scenario has then been skimmed to produce time and distance matrices by origin destination pair. In accordance with TUBA guidance, a factor of 0.00028 has been used to convert the time matrices from seconds to hours and a factor of 0.001 has been used to convert the distance matrices from metres to kilometres.

5.22 The following TUBA assessments have been carried out:

- Reference versus Option A1
- Reference versus Option C
- Reference versus Option CNC
- Reference versus Option D1
- Reference versus Option D2
- Reference versus Option D3
- Reference versus Option D4
- Reference incl. R2C versus Option A1
- Reference incl. R2C versus Option C
- Reference incl. R2C versus Option CNC
- Reference incl. R2C versus Option D1
- Reference incl. R2C versus Option D2
- Reference incl. R2C versus Option D3
- Reference incl. R2C versus Option D4

5.23 Checks have been carried out to ensure the correct matrices have been input into the TUBA assessment process.

### TUBA Error / Warning Message Analysis

5.24 TUBA outputs error and warning messages generated during the assessment were checked and are summarised below.

5.25 Errors: No scheme related errors have been recorded. The "Table VALUE\_OF\_TIME\_GROWTH" and "Table FUEL\_COST\_CHANGES" errors were present but this relates to data being specified in the economics parameters file for horizon years post 2083 and can therefore be ignored.

5.26 Warnings: A large number of warnings were generated for each of the TUBA assessments. This is expected in TUBA and is not a cause for concern as long as they can be justified. The warnings were checked and summarised below:

- Ratio of travel times higher than the limit
- Speeds less than limit
- Speeds greater than limit

5.27 The warnings have been analysed and are not considered a cause for concern.

### TUBA Results

5.28 The Present Value Costs (PVC), Present Value Benefits (PVB), Net Present Value (NPV) and Benefit Cost Ratio (BCR) for each option assessment are summarised in **Tables 6 and 7** below. All costs are in £000's and 2010 prices.

**Table 6: Reference Case Comparison Economic Assessment Results**

| <b>Option</b> | <b>PVB</b> | <b>PVC</b> | <b>NPV</b> | <b>BCR</b> |
|---------------|------------|------------|------------|------------|
| <b>A1</b>     | 32766      | 11050      | 21716      | 2.97       |
| <b>C</b>      | 32766      | 6760       | 26006      | 4.85       |
| <b>C(NC)</b>  | 32766      | 6231       | 26535      | 5.26       |
| <b>D1</b>     | -22510     | 8758       | -31268     | -2.57      |
| <b>D2</b>     | -22510     | 11286      | -33796     | -1.99      |
| <b>D3</b>     | -2366      | 11550      | -13916     | -0.20      |
| <b>D4</b>     | -2366      | 14078      | -16444     | -0.17      |

**Table 7: Reference Case incl. Route 2C Comparison Economic Assessment Results**

| <b>Option</b> | <b>PVB</b> | <b>PVC</b> | <b>NPV</b> | <b>BCR</b> |
|---------------|------------|------------|------------|------------|
| <b>A1</b>     | 26860      | 11050      | 15810      | 2.43       |
| <b>C</b>      | 26860      | 6760       | 20100      | 3.97       |
| <b>C(NC)</b>  | 26860      | 5231       | 21629      | 5.13       |
| <b>D1</b>     | 1986       | 8758       | -6772      | 0.23       |
| <b>D2</b>     | 1986       | 11286      | -9300      | 0.18       |
| <b>D3</b>     | 13941      | 11550      | 2391       | 1.21       |
| <b>D4</b>     | 13941      | 14078      | -137       | 0.99       |

- 5.29 As can be seen from **Tables 6 and 7** above, Options C and C(NC) offer the highest BCR both with or without Route 2C.
- 5.30 Analysis of Option A1 indicates a positive BCR offering a good value for money.
- 5.31 In the No Route 2C case, each of the Options D gives negative benefits. Leading to a negative BCR. This is likely due to the delay caused to the A41 traffic from introduction of the signalised junction. It can be seen that Options D3&4 have a less negative impact than D1&2 but this does not offset the cost of the scheme.
- 5.32 In the with Route 2C case, the same pattern is observed although each of the Options D now provides a positive PVB. In all of the Options D except D3 however, the costs of the scheme outweighs the benefits giving a negative NPV and a BCR of less than 1. For D1&2 this is due to a low PVB and for D4, a high PVC. For D3, although the NPV is positive, a BCR of less than 2 indicates that the scheme does not offer a high value of return on the costs invested.
- 5.33 In summary, Options C and C(NC) are considered to offer the most benefit both with or without the Route 2C in place.

## 6 Summary and Conclusions

- 6.1 Reference case models have been constructed for 2024 and 2031 AM and PM peak periods both with and without the Route 2C proposed link to the south east of the town using the existing SATURN Bicester Transport Model.
- 6.2 Three London Road options have been tested in the model namely:
- Options A1/C/C(N): An online or offline underpass at or near the existing level crossing;
  - Options D1/2: A new link road from northeast of the existing level crossing to a new small scale signal junction on the A41 Boundary Way; and
  - Options D3/4: Is similar to Options D1/2 but with a larger scale signalised junction of the new link with the A41 Boundary way.
- 6.3 For Options A1, C and C(N), the most significant impact in both 2024 and 2031 for both peaks is a shift of traffic from the A4421 Charbridge Lane to London Road.
- 6.4 Where Option D1&2 is introduced, a decrease in traffic is seen on London Road to the south east of the new link as would be expected. This is balanced by an increase in traffic to the east of the new junction on the A41 and also a decrease to the west of the junction.
- 6.5 Option D3&4 provides similar results to D1&2 but with less significant reductions in traffic on the A41 west of the new junction.
- 6.6 In both D1&2 and D3&4, a reduction is seen on the A4421 Charbridge Lane with the exceptions of in 2024 without Route 2C where an increase is seen on this route.
- 6.7 Junctions with Volume over Capacity ratios (V/C) which exceed 85% are seen in all scenarios. In general, Options A1/C/C(NC) and D1/2 increase the number of central Bicester nodes with V/C over 85% and Option D3/4 decrease this number.
- 6.8 Economic assessments were carried out for each of the options compared to the relevant reference case using the WebTAG recommended Transport User Benefit Appraisal program (TUBA) version 1.9.5.

- 6.9 Construction cost estimates were provided by Oxfordshire County Council separately for Options A1, C, C(NC), D1 and D2. An additional cost estimate for D3 and D4 was calculated by WYG for testing in the TUBA program.
- 6.10 Results indicate that for Options D1/2/3/4, the inclusion of a signalised junction onto the A41 does not provide sufficient benefits to offset the cost of construction.
- 6.11 Option A1 analysis indicated a positive BCR offering a good value for money
- 6.12 Options C and C(NC) are considered to offer the most benefit both with or without the Route 2C.



# Appendices

## Appendix A – Reference Case Infrastructure

## Appendix B – Reference Case Link Flows



## Appendix C – London Road Scheme Options

## Appendix D – Options Link Flows

## Appendix E – Link Flows Comparison Plots

## Appendix F – Node Volume Over Capacity Plots