OXFORDSHIRE COUNTY COUNCIL

Bicester Transport Modelling

London Road Level Crossing Options, Bicester

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1 Executive Summary

1.1 WYG were commissioned by Oxfordshire County Council (OCC) to complete a quantitative assessment of various scenarios for the future of the London Road level crossing in Bicester.

1.2 Reference case models have been constructed for 2021, 2026 and 2031 AM, inter and PM peak periods using the Bicester Transport Model. These included closure of the London Road level crossing for 34 minutes in every hour by 2021 and full closure of London Road from 2026 onwards.

1.3 Model results indicated that the PM peak shows the most congestion with the A41 Boundary Way and A41 east of A4421 Rodney House showing high volume over capacity ratios. By 2026, capacity issues are also seen at and approaching the A4421/Launton Road and A4421/Bicester Road junctions. This worsens in 2031 with the A4421/Buckingham Road also showing congestion on all approaches in the PM peak. The majority of the largest delays are seen in the eastern corridor and along the A41. Delays in the western corridor correspond to delays at traffic signal junctions as a direct result of the change in priority during different signal stages rather than due to capacity issues.

1.4 An assessment to understand the level of relief dualling of part of the eastern perimeter road would provide during closure of London Road for construction of a level crossing solution was tested in 2026 and 2031.

1.5 The models indicated that the A41 Boundary Way and A41 east of A4421 Rodney House still experience capacity issues for the AM and PM peak periods in both 2026 and 2031.

1.6 Inclusion of the dualling leads to a general shift in traffic from central and western areas of Bicester to the A4421 eastern corridor in the AM and PM peaks. This is not as prevalent in the Inter Peak as the lower levels of congestion make rerouting less likely to occur. The network statistics indicate overall improvement in network conditions with the inclusion of the dualling scheme.

1.7 Engineering feasibility has been carried out and a possible solution identified in delivery terms, providing a level crossing bypass via a similar alignment to the current alignment of London Road using either a bridge or a tunnel. A London Road option has been included in the 2021, 2026 and 2031 models.

1.8 The modelling indicates that inclusion of a bridge or tunnel on London Road leads to traffic re-routing from the A41 Boundary Way and Skimmingdish Lane to use London Road in all three peaks across each of the three modelled years. As would be expected, there is a large drop in delay on London Road at the site of the bypassed level crossing compared to the reference case in 2021. In 2026 and 2031, the travel time using London Road as a through route is less than alternative routes for some trips which caused a shift to London Road even when considering the (relatively minor) increase in delay at the Rodney House Roundabout compared to the Reference Case.

1.9 Although there is an increase in overall volume of traffic on London Road, this does not cause any of the links to experience high levels of congestion in either of the three peak periods modelled for any of the three years.

1.10 Economic assessments were carried out for each of the London Road options compared to the reference case using the WebTAG recommended Transport User Benefit Appraisal program (TUBA) version 1.9.7.

1.11 Construction cost estimates were supplied by Oxfordshire County Council in the form of an EWR2: London Road, Bicester Proposed Bridge Options Cost Comparison Study Estimate Report. Assessment was made for an online and offline underbridge and an offline overbridge.

1.12 Results indicate that in each case, although the inclusion of a London Road option shows a positive transport user benefit, the costs outweigh the benefits giving a negative Net Present Value i.e. the costs are higher than the benefits obtained over the 60 year assessment period. The lowest costs are for the offline bridge although this still does not give a positive benefit and as such gives a Benefit Cost Ratio of less than one. This indicates a poor Value for Money based on the Department for Transports Value for Money Framework (Box 5.1 Standard Categories).

1.13 The scheme costs provided are considered high and it is recommended that the options are progressed to a further level of design and a quantified risk workshop is held in order to provide further cost certainty.

1.14 This assessment has been carried out based on Value of Time and Vehicle Operating Costs basis only. Other quantifiable benefits e.g. safety, Air Quality and Green House Gases have not been assessed. Further non-monetised benefits such as severance and the Wider Economic Benefits have not been assessed and these should also be considered as part of any further work.

2 Introduction

2.1 East West Rail Phase 1 has intensified use of London Road Level Crossing in Bicester, previously only occasionally used for rail freight services. The crossing was considered as part of the Transport & Works Act into East West Rail Phase 1 in 2011. The T&WA Inspector concluded that an at-grade level crossing – albeit one that has been upgraded to meet safety requirements - was acceptable for that level of train service (2 trains per hour in each direction, now operating) plus the additional East West Rail 'core' service envisaged to operate once Phase 2 was open (an additional 2 passenger trains per hour in each direction). As a result, the crossing is not within scope of Phase 2 of the East West Rail project, i.e. the proposals currently being consulted upon.

2.2 Following a re-planning of all rail enhancement projects in 2015, the Phase 2 is scheduled for completion before 2024. The East West Rail Consortium, Network Rail and the Department for Transport are working closely to identify how work may be accelerated so that trains can start operating at the earliest opportunity before then.

2.3 Typical current "barrier down" times at the crossing are around 14 minutes in each hour, although they vary according to train direction. These are projected to go up to between 30 and 34 minutes with the introduction of the 'core' EWR service. Network Rail are looking at how down times could be reduced in the short term, especially for trains coming from London.

2.4 Future phases of East West Rail are proposed, but not yet committed or funded – and are therefore very unlikely to come forward until the 2024-2029 rail investment period at the earliest. These include the extension of the scheme to Cambridge/the east (the Central and Eastern Sections of EWR) along with additional passenger and freight services to support planned development on this corridor, which could include national 'cross country' services.

2.5 It is acknowledged that as and when this happens, this would place significant additional pressure on the crossing, significantly extending the barrier down time and road user delay period to an unacceptable level, especially given the level of development planned for Bicester.

2.6 Work has therefore been undertaken to investigate potential bridge and tunnel options to determine their feasibility and impact for consideration as solutions, should there be a time when this becomes appropriate. This type of solution would be extremely costly and disruptive to build, and there is currently no technical justification or funding identified for any scheme. However, it

remains on the list of Oxfordshire Infrastructure requirements, supported by both Oxfordshire County Council and Cherwell District Council.

2.7 OCC are proposing that any further service upgrade for East West Rail over and above the core service specification proposed for Phase 2 would be contingent upon a solution for the London Road Level Crossing being approved and funded. Progress of a solution for the crossing is therefore closely linked to East West Rail Phase 2 being implemented, so that further phases can be taken forward.

2.8 The aim of current planning and transport planning policy in Bicester is to deliver jobs-led growth supported by housing, with approximately 10,000 new homes and employment increasing significantly by 2031. The transport network needs to play its part in making the town an attractive location for businesses by enabling access to the strategic transport system and to ease movements between homes and the main employment areas. The priority is to tackle the challenges identified in the movement study by:

- Delivering highway infrastructure which effectively reduces the predicted transport congestion in Bicester;
- Delivering highway capacity improvements to peripheral routes to make these attractive to employment and longer distance through traffic and thereby enabling the improvement of internal sustainable movements within the town;
- Proactively accommodating the proposed strategic rail initiatives; and
- Strengthening the town's sustainable transport network to ensure good links to local employment opportunities and amenities within the town.

2.9 Assessing the impact of increased closures of the level crossing to general road traffic is extremely important in informing future investment in the local highway system, to underpin Bicester's economic strategy.

2.10 This report outlines the modelling work carried out to illustrate the consequences of different strategies for the level crossing including closure, investment in eastern peripheral route capacity improvements and investment in an all mode level crossing bypass.

3 Reference Case Models

3.1 In order to establish the relative benefits of the proposed options and the relief effect of the proposed Eastern Dualling, each option has been compared against a suitable reference case for the forecast years of 2021, 2026 and 2031.

3.2 The Bicester Transport model was set up for future year forecasting of traffic conditions. This includes testing of proposed highways and development schemes in order to assess their comparative viability and to aid economic assessment. The model complies with modelling guidance and protocols outlined in the Design Manual for Roads and Bridges (DMRB) and with the Department for Transport (DfT) WebTAG guidance on modelling. For further details of the Transport Model, please refer to the relevant Local Model Validation Report (RT099211-001 LMVR) and Future Year Forecasting Report (RT099211-002 FYFR).

3.3 The modelled networks were reviewed prior to update to a suitable Reference Case. It was noted that the coding of the networks for the M40 southbound on slip at junction 9 was not accurately representing the clear exit behaviour. This was not due to a coding error but rather the Saturn transport modelling program was not accurately intercepting the input data when carrying out the transport model assignments. As such, the network was updated using an alternative style of coding in order to more realistically represent the behaviour at the junction and the signal timings adjusted at junction M40 J9 in response to this change. A test was carried out on the validated Base model to ensure that incorporating these changes did not detrimentally impact on the level of validation of the model. This found that the base model still achieved a similar level of validation within the WebTAG guidance and, as such, these changes to the network were considered suitable for use in the reference case modelling.

3.4 OCC advised that for the reference case, the London Road crossing should be assumed to be closed to through traffic for 34 minutes in every hour by 2021 and fully closed by 2026. This worst case scenario is based on interpretation of information provided by Network Rail relating to the expected increase in train frequency on this line.

3.5 Based on the above changes, minor amendments were also made to the signal timings at the A41/A4421/London Road Rodney House Roundabout in response to the traffic flow changes caused by the assumptions at the London Road Level Crossing.

3.6 In order to isolate the changes to traffic conditions due to the London Road Level Crossing proposals, it was agreed with OCC that the matrices derived for the 2021, 2026 and 2031 core (Do Minimum) models would be used directly for assignment and that the full variable demand modelling process would not be used. Please note that, as agreed with OCC, these reference case models do not include the proposed South East Perimeter Route or dualling of the Eastern Perimeter Road between Buckingham Road and Gavray Drive.

3.7 These matrices were assigned to the networks described above to provide reference case forecast flows for the following scenarios for the AM and PM peak periods:

- 2021 Reference Case;
- 2026 Reference Case; and
- 2031 Reference Case.

3.8 Reference case link flows in passenger car units (PCUs) are given in **Appendix A**.

3.9 Plots are also provided showing links where the volume over capacity (V/C) exceeds 85%. As can be seen from the plots, the PM shows the most links with V/C over 85% particularly along the A41 on Boundary Way and to the east of this. By 2026, links over 85% V/C are also seen at/approaching the A4421/Launton Road and A4421/Bicester Road junctions. This worsens in 2031 with the A4421/Buckingham Road also showing V/C over 85% on all approaches in the PM peak.

3.10 Plots showing delays of over 15 seconds on links are also provided in **Appendix A**. The largest delays correspond to the links with V/C over 85% as detailed in the paragraph above. The majority of the largest delays are seen in the Eastern corridor and along the A41. Delays in the western corridor correspond to delays at traffic signal junctions as a direct result of the change in priority during different signal stages rather than due to congestion. This is evidenced by the lack of links with V/C over 85% in this area.

4 Eastern Perimeter Road Dualling

4.1 Testing was carried out to determine the level of relief dualling of part of the eastern perimeter road would provide during closure of London Road for construction of a level crossing solution.

4.2 It was agreed that dualling would not be achieved by 2021 and as such, the 2026 and 2031 models would be updated.

4.3 The 2026 and 2031 modelled networks are the same as their respective Reference Case models but have dualling of the A4421 between Buckingham Road and Gavray Drive included. Details of the modelling assumptions for the dualling are given below:

4.4 A4421 links are assumed as two lanes in each direction with link capacity assumed twice that of the single lane modelled previously. The maximum free flow speed has been retained from the reference case. This represents the current 50mph speed limit along the route as included for the validated base model.

4.5 The existing roundabout junctions at the A4095/A4421/Buckingham Road, A4421 Skimmingdish Lane/Launton Road, A4421 Charbridge Lane/Bicester Road and A4421 Charbridge Lane/Gavray Drive were expanded to 2 lane entries plus a flare at the stop line for each of the A4421 approaches that have been dualled (i.e. not the A4421 Wretchwick Way approach to the Gavray Drive junction). These layouts are theoretical at this stage, have not undergone any significant design work and as such do not consider whether any third-party land would be required for construction.

4.6 The junctions for access to the proposed Bicester 11 development site and the existing Charbridge Way employment site are converted to roundabout junctions with the priority junction just to the south of Charbridge Way removed and any trips to/from this side road assumed to access the A4421 via the new Charbridge Lane/Charbridge Way roundabout.

4.7 The proposed Bicester 8 development access onto the A4421 to the east of Buckingham Road is assumed as an all movements priority junction. This includes flared lanes to accommodate right turners both to and from the A4421 and the development.

4.8 Capacity by turn for each of the above junctions was updated in the model according to the number of lanes and using the standardized coding format used throughout the modelling.

4.9 Traffic signal timings at Rodney House Roundabout and the M40 J9 retain the same timings as the reference case.

4.10 Plots of traffic volumes (in demand PCUs), volume over capacity greater than 85% and links with delay over 15 seconds have been included in **Appendix B**. These models are referred to as EPDual for ease of referencing.

4.11 The plots show that the PM remains the most congested peak period. The A41 east of Oxford Road and east of Graven Hill see V/C of greater than 85% for the AM and PM peak periods in both 2026 and 2031.

4.12 Difference plots between the EPDual and Reference models for each of the three plot types given above are also included in **Appendix B**.

4.13 The demand flow plots show a general shift in traffic from central and western areas of Bicester to the A4421 eastern corridor in the AM and PM peaks. This is not as prevalent in the Inter Peak as the lower levels of congestion make rerouting less likely to occur.

4.14 The differences in V/C plots are not cut off at the 85% criteria but show any difference between two respective plots. These differences show that, although there are some small-scale shifts in V/C due to rerouting of traffic, the most significant change is a decrease in the V/C along the Eastern Perimeter Route with the introduction of the dualling.

4.15 The difference in delay plots show that there are some localised increases in delay notably Launton Road approach to the A4421 junction in the PM peak in 2031. Consideration could be given to whether this approach could be improved as part of roundabout design. Decreases in delay are seen on the other approaches to this junction in both the AM, inter and PM peaks. Additionally, significant delay decreases are seen on the A4421 approach to its junction with Buckingham Road in the PM peak.

4.16 The overall network statistics for the reference case and EPDual models are given in **Table 1**.

Table 1: Eastern Perimeter Dualling Network Statistics

Peak	Scenario	Over Capacity Queues (PCU Hrs)	Total Travel Time (PCU Hrs)	Travel Distance (PCU KMs)	Average Speed (KPH)
AM Peak	2026 Ref	102.2	4,694.0	390,825.9	83.3
	2026 EP Dual	94.2	4,678.0	390,805.7	83.5
	Difference	-8.0	-16.0	-20.2	0.2
	2031 Ref	163.1	5,136.1	421,036.3	82.0
	2031 EP Dual	146.8	5,115.3	420,891.6	82.3
	Difference	-16.3	-20.8	-144.7	0.3
Inter Peak	2026 Ref	16.2	2,916.4	262,002.8	89.8
	2026 EP Dual	16.1	2,915.5	262,021.4	89.9
	Difference	-0.1	-0.9	18.6	0.1
	2031 Ref	33.5	3,164.4	280,919.5	88.8
	2031 EP Dual	33.4	3,162.8	280,945.9	88.8
	Difference	-0.1	-1.6	26.4	0.0
PM Peak	2026 Ref	225.3	5,788.6	456,260.8	78.8
	2026 EP Dual	222.8	5,777.0	456,331.3	79.0
	Difference	-2.5	-11.6	70.5	0.2
	2031 Ref	321.4	6,426.3	497,359.5	77.4
	2031 EP Dual	316.4	6,413.7	497,399.9	77.6
	Difference	-5.0	-12.6	40.4	0.2

4.17 Based on **Table 1** above, the inclusion of the dualling shows a decrease in over capacity queues and total travel time across each peak period and both years with the AM and PM showing more significant changes than the inter peak as would be expected. Similarly, there is a corresponding increase in average speed in the AM and PM peaks with little or no change in the Inter Peak.

4.18 The total travel distance shows a decrease in the AM peak for both years. This indicates that overall, trips are routing back onto more direct paths through the network. However, an increase in travel distance is seen in both the inter and PM peaks. This indicates a move onto faster routes that might be longer in pure distance terms.

4.19 It is difficult to isolate the individual trips that reroute using the difference plots from Saturn due to the knock on effect the direct rerouting has on the other network trips. For example, a trip rerouting from a direct route through Bicester to the eastern corridor would increase in trip distance but could then have the knock on effect freeing up capacity through central Bicester allowing other trips previously using a peripheral route such as Lords Lane to use a more direct route decreasing the overall network trip distance. This knock on effect is illustrated in the AM peak by an increase on Buckingham Road southbound towards Bicester compared to a decrease

on the M40 southbound which is indicative of a move to shorter distance routes for longer distance trips.

4.20 Overall, the network statistics support the plots in **Appendix B** indicating overall improvement in network conditions with the inclusion of the dualling scheme.

5 London Road Options

5.1 Engineering feasibility has been carried out and a possible solution identified in delivery terms, providing a level crossing bypass via a similar alignment to the current alignment of London Road using either a bridge or a tunnel.

5.2 In modelling terms, the inclusion of either a tunnel or a bridge is modelled in exactly the same way within the model as both lie along the same route and constitute a link which does not lose priority along the line of the existing road. Small variations of alignment would not be significant enough to alter the results within the model. As such, only one scenario (called Tunnel in the models for ease of referencing) was set up for each peak period and modelled year.

5.3 OCC required a solution at London Road to be included in each of the three modelled years to fully understand the potential benefits of a scheme. Each peak hour model is based on the reference case but with the traffic signals representing the closed to traffic period of the level crossing removed. No other changes are made to the networks and the matrices used in the previous models were reassigned to provide model the outputs.

5.4 Plots of traffic volumes (in demand PCUs), volume over capacity greater than 85% and links with delay over 15 seconds have been included in **Appendix C**. Difference plots between the Tunnel and Reference models for each of the three plot types are also included.

5.5 The inclusion of a bridge or tunnel on London Road leads to traffic re-routing from the A41 Boundary Way and Skimmingdish Lane to use London Road in all three peaks across each of the three modelled years.

5.6 As would be expected, there is a large drop in delay on London Road in 2021 at the site of the bypassed level crossing compared to the reference case. In 2026 and 2031, the travel time using London Road as a through route is less than alternative routes for some trips which cause a shift to London Road even when considering the (relatively minor) increase in delay at the Rodney House Roundabout compared to the Reference Case.

5.7 An increase in V/C is seen on London Road with a corresponding decrease on the Eastern perimeter and A41 links. Although there is an increase in overall V/C on London Road links, this does not put any of the links over 85% V/C in either of the three peak periods modelled for any of the three years.

5.8 The overall network statistics for the reference case and with tunnel/bridge models are given in **Table 2**.

Table 2: London Road Option Network Statistics

Peak	Scenario	Over Capacity Queues (PCU Hrs)	Total Travel Time (PCU Hrs)	Travel Distance (PCU KMs)	Average Speed (KPH)
AM Peak	2021 Ref	48.8	4,132.0	354,077.7	85.7
	2021 Tunnel	48.3	4,128.1	354,045.3	85.8
	Difference	-0.5	-3.9	-32.4	0.1
	2026 Ref	102.2	4,694.0	390,825.9	83.3
	2026 Tunnel	101.0	4,677.3	390,368.9	83.5
	Difference	-1.2	-16.7	-457	0.2
	2031 Ref	163.1	5,136.1	421,036.3	82.0
	2031 Tunnel	156.9	5,116.7	420,517.5	82.2
	Difference	-6.2	-19.4	-518.8	0.2
Inter Peak	2021 Ref	0.6	2,624.8	240,153.2	91.5
	2021 Tunnel	0.5	2,622.1	240,124.0	91.6
	Difference	-0.1	-2.7	-29.2	0.1
	2026 Ref	16.2	2,916.4	262,002.8	89.8
	2026 Tunnel	15.5	2,910.2	261,790.9	90.0
	Difference	-0.7	-6.2	-211.9	0.2
	2031 Ref	33.5	3,164.4	280,919.5	88.8
	2031 Tunnel	32.8	3,157.1	280,664.7	88.9
	Difference	-0.7	-7.3	-254.8	0.1
PM Peak	2021 Ref	142.5	5,027.7	407,914.5	81.1
	2021 Tunnel	142.6	5,021.1	407,842.3	81.2
	Difference	0.1	-6.6	-72.2	0.1
	2026 Ref	225.3	5,788.6	456,260.8	78.8
	2026 Tunnel	224.8	5,771.4	455,839.1	79.0
	Difference	-0.5	-17.2	-421.7	0.2
	2031 Ref	321.4	6,426.3	497,359.5	77.4
	2031 Tunnel	312.4	6,402.1	496,811.8	77.6
	Difference	-9.0	-24.2	-547.7	0.2

5.9 As can be seen from **Table 2** above, a reduction in over capacity queue, total travel time and travel distance and an increase in average speed is seen in all periods and in each year with the inclusion of an option at London Road. The exception is the Over Capacity Queue in the 2021 PM Peak period which sees a small increase in over capacity queue. This increase is likely due to a shift in traffic to a route which already experiences queuing at specific local points as part of a route which is otherwise improved by the proposals making it a more desirable route.

5.10 As such, it can be concluded that inclusion of a London Road option improves overall network conditions.

6 Economic Assessment

6.1 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 1.9.7) has been used to estimate the benefits derived from a London Road 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

6.2 There are three main inputs to the TUBA process:

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

Economic Parameters

6.3 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

6.4 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).

6.5 For the purposes of the TUBA assessment the current year has been taken as 2017 and an opening year of 2021 has been assumed. This gives the horizon year as 2080, thus providing a 60 year assessment period in accordance with WebTAG guidance (TAG Unit 3.5.2). The modelled intermediate years of 2026 and 2031 are also defined within TUBA for assessment.

6.6 The time periods from the transport model were:

- 0800 – 0900 (AM peak);

- An average hour 1000 – 1600 (Inter peak); and
- 1700 – 1800 (PM peak).

6.7 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 peak period and 1518 (i.e. 6 x 253) for the inter peak.

6.8 The total annual hours assessed therefore are 2024 (out of an annual total of 8760 hours). Although the off peaks and weekend hours are not modelled, these assumptions allow for initial relative assessment of the options to be carried out. The impact of not modelling the weekend/off peak hours is often to underestimate the present value benefit if a positive impact is seen and conversely, underestimate the disbenefit if a scheme has a negative impact on the network. The impact of the non-peak hours is generally less marked that the peak hours due to lower levels of traffic but have a cumulative effect due to the number of hour within the non-peak periods.

6.9 The following vehicle mode types have been used in the TUBA assessment:

- Cars (Commute);
- Cars (Employers Business);
- Cars (Other);
- Cars (External-External movements);
- Light Goods Vehicles (LGV)
- Medium Goods Vehicles (OGV1); and
- Heavy Goods (OGV2)

6.10 Although 6 user classes were available from the model, the heavy vehicles user class is split into OGV1 and OGV2 using factors from traffic surveys to provide the 7 classes specified above. This allows TUBA to take account of different vehicle type impacts in the assessment.

Scheme Costs

6.11 Scheme costs were supplied by OCC in the form of an EWR2: London Road, Bicester Proposed Bridge Options Cost Comparison Study Estimate Report (**Appendix D**). Costs were estimated in Quarter 2 2016 prices.

6.12 All scheme costs have been entered as Factor Costs to allow TUBA to convert to Market Prices.

6.13 Scheme costs have been assumed to occur in 2019 and 2020 split 50/50 between the two years based on a 2 year construction programme in line with details contained in the Estimate Report.

6.14 Please note, changes to the date of delivery of the scheme would change the cost estimates (due to factors such as inflation and discounting) and the scheme would likely cost more (in 2010 prices) if built at a later date. This can be offset by an increase in scheme benefits caused by the 60 year assessment period starting at a later and hence likely more congested period but does not take into account any disbenefit of congestion that occurs between the current year and the later opening year. Due to lack of information over the scheme delivery timetable and based on the availability of the three model forecast years, the 2019/2020 construction assumption is considered reasonable for this early stage of assessment.

6.15 The GDP value of 116.42 has been used in all assessments. This is the average 2019 and 2020 value taken from the WebTAG Databook July 2017 version available at the time of carrying out the assessments. An average has been used based on a 2 year construction programme.

6.16 All costs have been assumed to be attributable to TUBA Mode 1 (i.e. Private Mode).

6.17 Costs for construction contained in the Estimate Report were available for 5 options: Offline Underbridge (Caisson footings), offline underbridge (spread footings), online underbridge (Caisson footings), online underbridge (spread footings) and offline bridge. For this assessment, the two Caisson foundations options have been used as these are more costly than the spread footings equivalent to provide a worst case assessment. The offline bridge was also assessed.

6.18 Breakdown of the costs are required for entry to the TUBA assessment. TUBA guidance indicates that at this stage of scheme cost estimate, costs in TUBA should exclude risk but include Optimism Bias at 64%. Land and preparation/supervision costs are entered separately to construction costs. Costs are then deflated to 2010 and discounted to 2010 prices for entry into TUBA.

6.19 Therefore, the costs, for entry into TUBA are given in **Table 3** below:

Table 3: London Road Scheme Costs (£000's)

	Option FS4 Offline Underbridge Caisson foundations	Option CS4 Online Underbridge Caisson foundations	Option F Offline Bridge
Land	22,631	15,263	22,631
Preparation	11,642	11,577	7,390
Construction	53,995	58,186	28,591
Total	**88,268**	**85,026**	**58,612**

Matrix Data from the Transport Model

6.20 Please note: the land costs were extracted from the cost breakdown appendices of the EWR2: London Road, Bicester Proposed Bridge Options Cost Comparison Study Estimate Report. The land costs were deducted for the total costs presented in the appendices as TUBA guidance requires land to be estimated separately where possible.

6.21 Forecast flows from the Bicester reference case and London Road option models, as detailed in the previous sections have been used in the economic assessments.

6.22 Trip Matrices have been output from the SATURN assignments for each user class for each modelled year.

6.23 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.

6.24 The TUBA assessments are identical between the three options to be assessed with the exception of the scheme costs assumed.

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

TUBA Error / Warning Message Analysis

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

6.27 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 2080 and can therefore be ignored.

6.28 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/lower than the limit
- Ratio of travel distances higher/lower than the limit
- Speeds less than limit
- Speeds greater than limit

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

TUBA Results

6.30 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 **Table 4** below. All costs are in £000's and 2010 prices.

Table 4: Economic Assessment Results (£000s)

Option	PVB	PVC	NPV	BCR
FS4	36,107	65,081	-28,974	0.555
CS4	36,107	62,691	-26,584	0.576
F	36,107	43,215	-7,108	0.836

6.31 As can be seen from **Table 4** above, all of the PVB values are the same. This is as each option uses the same set of model results.

6.32 Introduction of the scheme at a later date could increase the PVB as the 60 year assessment period would be over a later, more congested, time frame. However, the PVC would also increase if incurred later and would not take into account any disbenefits due to congestion between the current date and the revised forecast opening year. As such, the above results assume a 2021

opening year due to lack of further information and any revision to the assumed scheme opening date should be assessed separately.

6.33 In each case, although the inclusion of the London Road option indicates a positive benefit to the network, the PVC outweighs the PVB giving a negative NPV i.e. the costs are higher than the benefits obtained. The lowest costs are for the offline bridge giving the least negative NPV although this still does not give a positive benefit and as such gives a BCR of less than one.

6.34 In summary, although the options are beneficial in terms of transport user benefit, the costs outweigh the benefits achieved over the 60 year assessment period with a Benefit Cost Ratio of less than one. This indicates a poor Value for Money based on the Department for Transports Value for Money Framework (Box 5.1 Standard Categories).

6.35 However, based on professional experience, the scheme costs above are considered high for the tabled scheme designs. It is therefore recommended that the options are progressed to a further level of design and a quantified risk workshop is held in order to provide further cost certainty. This will also change the level of Optimism Bias to be assumed which may allow the costs to be reduced providing an improved Benefit to Cost Ratio.

6.36 It should also be noted that this assessment has been carried out based on Value of Time and Vehicle Operating Costs basis only. Other quantifiable benefits e.g. safety, Air Quality and Green House Gases have not been assessed. Further non-monetised benefits such as severance and the Wider Economic Benefits have not been assessed and these should also be considered as part of any further work.

Appendices

Appendix A – Reference Case Model Results

Appendix B – EPDual Model Outputs

Appendix C – London Road Options Model Outputs

Appendix D – Scheme Costs Estimate Report