OXFORDSHIRE RAILFREIGHT INTERCHANGE LIMITED

TECHNICAL NOTE 8: M40 JUNCTION 10 OPTIONS 3A AND 3B

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APPENDICES

1.0 INTRODUCTION

1.1 ADC Infrastructure Ltd and BWB Consulting Ltd are appointed by Oxfordshire Railfreight Ltd (the Applicant) to assess and design the transport and infrastructure requirements of a Nationally Significant Infrastructure Project (NSIP), that being a proposed Strategic Rail Freight Interchange in Oxfordshire, to be known as Oxfordshire Strategic Rail Freight Interchange (OxSRFI).

1.2 Ensuring good access to the Strategic Road Network (SRN) is a prerequisite for the proposed OxSRFI development. Initial investigations into this, and consultation with Oxfordshire County Council (OCC) and National Highways (formerly Highways England), advanced the access strategy such that it is centred on provision of significant improvements to Junction 10 of the M40 motorway, in combination with a provision of a new bypass for the village of Ardley, a new relief road around the north-east quadrant of the village of Middleton Stoney and a Heyford Park link.

1.3 The objectives of this approach are to ensure adequate capacity at M40 Junction 10 to accommodate the required access to the SRN, whilst delivering appropriate new site access infrastructure, along with aiding the delivery of planned growth and development across the wider area. Technical Note 5[1] (TN5) identified and assessed a long list of potential interventions at M40 Junction 10 that could be implemented by the OxSRFI scheme to mitigate the impact of the OxSRFI development at the junction. A short list of options was identified to be taken forward for further consideration.

1.4 As part of the extensive option testing undertaken for TN5, the option for a large single grade-separated gyratory that would replace the separate Ardley, Cherwell and Padbury junctions was considered at a high-level, which was termed Option 3. TN5 concluded that such a junction would not have sufficient capacity to accommodate the 2031 background and development traffic flows and was therefore discounted as a viable option.

1.5 However, following a meeting on the 23 of July 2021, National Highways requested that the option for a large single grade-separated gyratory (Option 3) be given further consideration to examine whether the capacity constraints could be overcome, potentially through the use of multi-lane approaches and circulatory carriageway controlled via splitter islands.

1.6 National Highways provided initial feedback on TN5 via email on 21 September 2021, including audits of the LinSig modelling which supports TN5. A full response to the TN5 feedback will be provided by National Highways in due course. However, the relevant feedback on the LinSig modelling provided in the audits has been considered and incorporated into the modelling presented within this report.

1.7 This technical note has therefore been prepared by ADC Infrastructure Ltd working jointly with BWB Consulting Ltd to consider in greater detail the opportunity to provide a large single grade-separated gyratory at M40 Junction 10.

[1] Technical Note 5 – M40 Junction 10 Options Report, report reference ADC1794-RP-M -V3, ADC June 2021.

2.0 FUTURE BASELINE AT M40 JUNCTION 10

Introduction

2.1 As discussed in TN5, the closest point of access to the SRN from the OxSRFI site is at Junction 10 of the M40, approximately 1.6km to the north of the Main Site when accessed via the B430. At Junction 10 there is also direct access to the A43.

2.2 The existing M40 Junction 10 is a grade-separated 'dumb-bell' interchange with northern (Cherwell) and southern (Ardley) roundabouts connected by two bridges close together over the M40 motorway as shown at **Figure 1**.

2.3 M40 Junction 10 was improved in 2015 using Pinch Point funding, though this was not a long-term fix and assessment work undertaken by National Highways (Highways England, as was) has identified the 2021 to 2026 time period as the tipping point for the junction.

Figure 1: M40 Junction 10

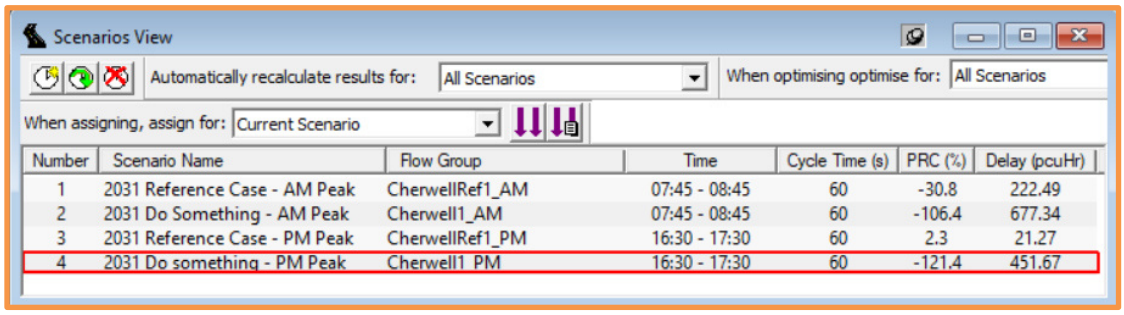
2.4 Assessment work undertaken by National Highways shows that by 2031 both the Cherwell and Ardley roundabouts will operate overcapacity. The M40 southbound on-slip at the Cherwell Roundabout breaks down due to the merge type, whereas the Ardley Roundabout breaks down because of the demand for right-turners from the M40 northbound off-slip.

2.5 TN5 presents a detailed assessment of the existing and future baseline performance of M40 Junction 10. The assessment work detailed in TN5 used 2031 forecast traffic flows for the 'reference case' (i.e. no development) and the 'do something' (i.e. with development) scenarios. The derivation of the traffic flows is detailed in Technical Note 6 (TN6).

Cherwell Roundabout

2.6 The northern section of the M40 J10 dumbbell is known as the Cherwell Roundabout. Cherwell Roundabout provides southbound access to the M40 southbound and also serves the Cherwell Valley motorway service area (MSA).

2.7 Initial feedback on TN5 was provided via email on 21 September 2021, including an audit of the LinSig modelling of the existing Cherwell roundabout. Therefore, the LinSig baseline modelling at the Cherwell roundabout has been updated to include the relevant feedback provided in the HE/Aecom audit. The results of the revised modelling are summarised below and the full model report is contained in **Appendix A**.



Number	Scenario Name	Flow Group	Time	Cycle Time (s)	PRC (%)	Delay (pcuHr)
1	2031 Reference Case - AM Peak	CherwellRef1_AM	07:45 - 08:45	60	-30.8	222.49
2	2031 Do Something - AM Peak	Cherwell1_AM	07:45 - 08:45	60	-106.4	677.34
3	2031 Reference Case - PM Peak	CherwellRef1_PM	16:30 - 17:30	60	2.3	21.27
4	2031 Do something - PM Peak	Cherwell1_PM	16:30 - 17:30	60	-121.4	451.67

2.8 As shown, in the 2031 morning peak hour the junction is forecast to operate over capacity in the Reference Case scenario, with a negative PRC of -30.8%. The A43 southbound approach is significantly saturated, with a mean maximum queue of 184.6 pcus. Once the development traffic is added, the model results show that the junction performance would deteriorate significantly as more traffic is added to the A43 southbound lane, and the demand for the right-turn to the M40 southbound on-slip is increased. In the 2031 Reference Case evening peak hour, the modelling suggest that the junction would operate acceptably with a PRC of 2.3%. However, there would be no material headroom and hence, once the development traffic is added the performance of the junction deteriorates significantly, as per the morning peak hour.

2.9 Therefore, the existing Cherwell Roundabout junction would not have the capacity to accommodate the background and development traffic in 2031.

Ardley Roundabout

2.10 The southern section of the M40J10 dumbbell is known as the Ardley Roundabout. The Ardley Roundabout is a three-arm priority controlled roundabout with the M40 Junction 10 northbound off-slip and on-slip forming the south-eastern arm. The A43 is the northern arm, bridging over the M40, and the B430 is the western arm routing through Ardley.

2.11 The existing Ardley Roundabout was modelled using the Arcady module of Junctions 9 with the 2031 Reference Case traffic flows. The results of the Reference Case assessment are summarised below (the full model report is contained in **Appendix 7** of TN5).

	AM1				AM2				PM			
	Set ID	Queue (PCU)	Delay (s)	RFC	Set ID	Queue (PCU)	Delay (s)	RFC	Set ID	Queue (PCU)	Delay (s)	RFC
	2031 Ref Case - 2031 Ref											
Arm 1	D1	1.0	5.39	0.49	D2	1.2	6.23	0.53	D3	2.3	11.69	0.69
Arm 2		1.9	4.92	0.65		2.0	4.94	0.66		0.9	3.14	0.47
Arm 3		3.6	9.99	0.76		4.8	12.08	0.81		27.5	49.53	0.99

where Arm 1 is B430, Arm 2 is A43 Bridge and Arm 3 is the M40 slips (AM2 is the relevant AM peak hour)

2.12 As shown, the roundabout is forecast to operate acceptably in the morning peak hour 2031 Reference Case scenario. However, in the 2031 Reference Case evening peak hour scenario the roundabout is forecast to operate over the design threshold of 0.85 RFC, with the M40

northbound off-slip arm of the roundabout operating with a RFC of 0.99, and a queue of 28 pcus and delay of around 50 seconds per pcu.

2.13 As the layout of the existing junction would need to be amended to accommodate the Ardley Bypass that is proposed as part of the OxSRFI highway access strategy, the operation of the existing junction has not been assessed with the Do Something traffic flows.

Summary

2.14 The above analysis demonstrates that the future baseline highway conditions at M40 Junction 10 would be such that the junctions would already be operating over capacity with the Reference Case traffic flows in 2031. Once the development traffic from the proposed OxSRFI scheme is added in the 'Do Something' scenarios, the analysis shows that these existing issues would be further exacerbated and there would be significant congestion at M40 Junction 10.

2.15 Hence, TN5 concluded that a step change in the scale and type of mitigation at the junction is required so that the background and development traffic can be accommodated satisfactorily.

3.0 M40 JUNCTIO0N 10 OPTION DEVELOPMENT AND CAPACITY TESTING

Introduction

3.1 As part of the extensive option testing undertaken for TN5, the option for a large single grade-separated gyratory that would replace the separate Ardley, Cherwell and Padbury junctions was considered at a high-level , termed Option 3. Section 6 of TN5 presents the findings of a LinSig model developed to test this option. No preliminary design work was undertaken and the LinSig model was based upon typical geometry found at such junctions, using the current junction geometries as a proxy.

3.2 TN5 concluded that such a junction would not have sufficient capacity to accommodate the 2031 background and development traffic flows and was therefore discounted.

3.3 However, following a meeting on the 23 of July 2021, National Highways requested that the option for a large single grade-separated gyratory be given further consideration, to examine whether the capacity constraint could be overcome.

3.4 To undertake a more detailed appraisal of a large single grade-separated gyratory and establish its ability to accommodate both the forecast background traffic flows and the proposed development traffic flows, a two-stage approach has been followed.

3.5 Firstly, an option has been considered which seeks to maximise the capacity of the gyratory. The development of this option was undertaken to establish the parameters (number of lanes on each approach, storage capacity of circulating links, flared lane lengths etc) required to achieve a junction that would operate within capacity. This option is referred to as Option 3A.

3.6 Once Option 3A had been satisfactorily developed, the geometric requirements of DMRB CD 116 were applied to the design with the necessary amendments made to demonstrate a geometrically compliant junction. This option is referred to as Option 3B.

3.7 The geometric compliance of Options 3A and 3B are discussed in detail in Section 5 of this Technical Note. The results of the capacity assessments for both options are discussed in this section.

Option 3A

Design considerations – existing bridges

3.8 An early consideration in the development of Option 3A was whether the existing bridges at M40 Junction 10 could be reused. An option to link the existing bridges was dismissed as they are both very different types of construction and it is not considered feasible to link them due to their differing material types, and age, as shown on **Figure 2**.

3.9 The remaining options that could be considered for the existing bridges were as follows:

- Utilise both existing bridges in the southbound circulating carriageway; and
- Widen the south bridge to the south to the add extra lanes by adding additional beams and widening the deck for the southbound circulating carriageway.

3.10 Both options would require a new bridge for the northbound circulating carriageway.

Figure 2: photo showing construction of existing bridge decks

3.11 To utilise both existing bridges in the circulating carriageway, a large number of splitter islands would be required, resulting in a very complex and potentially confusing layout at the MSA node, as shown on the screenshot at **Figure 3**. The number of islands would likely create maintenance issues and the layout would also lead to difficulties when considering walking and cycling connection to the MSA. Hence, this configuration for reusing the existing bridges was dismissed in favour of reusing only the southern bridge, which would need to be widened.

Figure 3: sketch layout utilising both existing bridge decks for southbound circulatory carriageway

Design considerations – A43 southbound entry

3.12 Whilst strictly adhering to the requirements of DMRB was not the priority when developing Option 3A, some consideration of entry path curvature was made. Hence, it was evident early in the process that the alignment of the A43 would be a major constraint in this regard. To the northeast of the M40 Junction 10, the A43 runs almost perpendicular to the motorway and with

little separation, such that it becomes very difficult to develop a suitable entry path whilst also developing the large number of entry and exit lanes required on this approach.

3.13 The high-level assessment work undertaken for the large single grade-separated gyratory option 3 in TN5 assumed that the separation between the A43 southbound approach and the MSA entry would be similar to the existing Cherwell roundabout geometry. Therefore, the circulating link lengths between these nodes in the TN5 modelling were relatively short, with very little storage capacity which meant A43 entry green times had to be limited to prevent excess queuing. Therefore, the Option 3A design work sought to maximise the storage capacity between these nodes, and also between the M40 southbound off-slip and the A43 approach.

Option 3A capacity assessment

3.14 The iterative capacity assessment and design work for Option 3A was concluded and the layout is shown at **drawing number OxSRFI-ADC-GEN-XX-SK-CH-SK06-S1-P1**. The assessment work concluded that all arms of the junctions would require signalisation and both the M40 northbound and southbound off-slips would require four lanes, with the A43 and Ardley Bypass Road approaches requiring five lanes.

3.15 The circulating carriageway would have a minimum of three lanes across both bridge decks, with four-lane sections at the A43 and Ardley Bypass nodes and a five-lane section between the A43 and MSA nodes.

3.16 A screen shot of the LinSig model structure is provided at **Figure 4**.

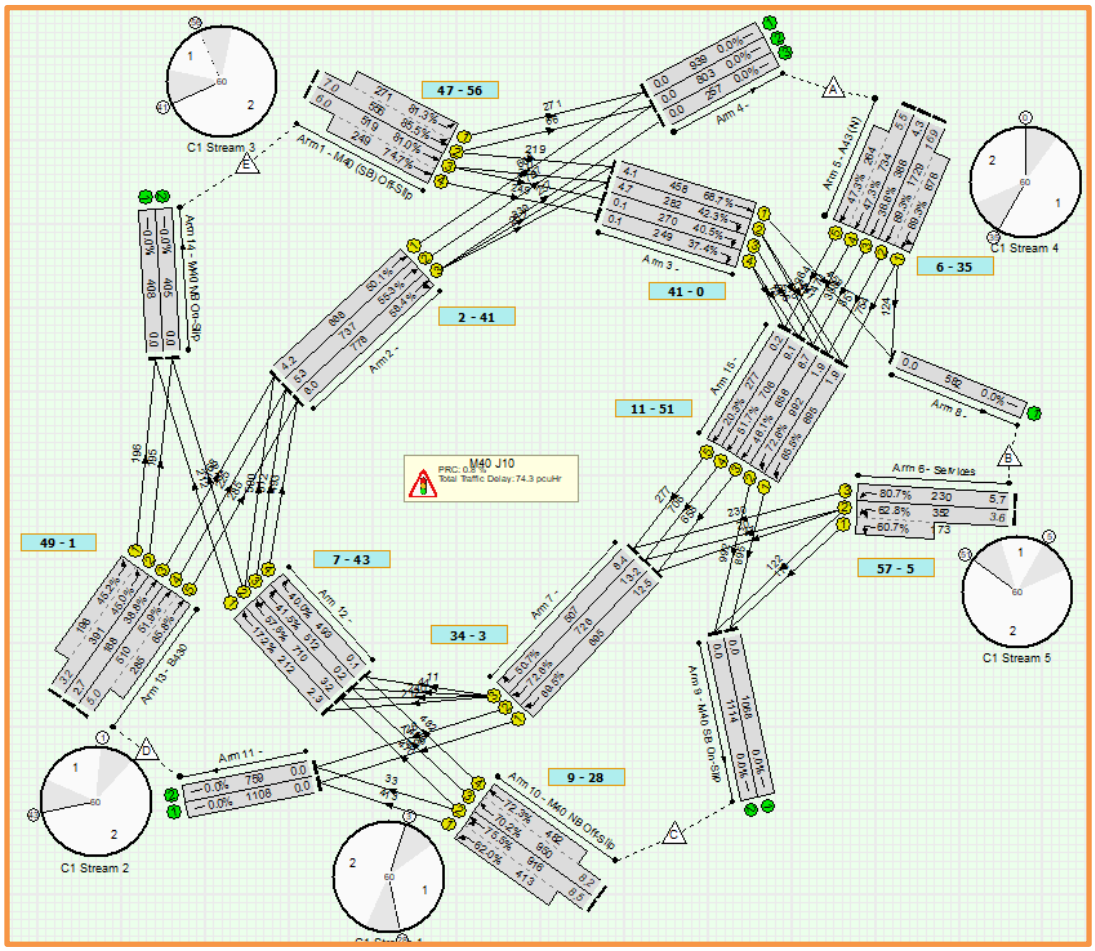


Figure 4: lane/link structure of Option 3A

3.17 Option 3A has been modelled using LinSig and the 2031 Do Something morning and evening peak hour traffic flows (Diagrams 63 and 64 at Appendix D of TN6). To reflect the early optioneering stage of the process, 'directly entered' saturation flows of 2,000 pcus/hour have been used for all entry lanes. Further, based on the advice provided in the feedback on the TN5 modelling, the saturation flows for all circulating lanes have also been set to 2,000 pcus/hour. The results are summarised below and the full model report is contained in **Appendix B**.

Scenarios View

Automatically recalculate results for: All Scenarios | When optimising optimise for: All Scenario

When assigning, assign for: Current Scenario

Number	Scenario Name	Flow Group	Time	Cycle Time (s)	PRC (%)	Delay (pcuHr)
1	2031 do something AM	2031 do some AM	07:45 - 08:45	60	0.8	74.27
2	2031 do something PM	2031 do some PM	16:30 - 17:30	60	3.1	78.02

3.18 The results show that, in principle, the Option 3A junction arrangement would operate acceptably in the morning and evening peak hours for 2031 Do Something scenario. In the morning peak hour the PRC would be 0.8%, with the A43 southbound approach operating at 89.3% saturated and the M40 southbound off-slip at 85.5% saturated. The other approaches to the junction are shown to operate comfortably. All internal queueing could be acceptably accommodated, though queuing on the A43 circulatory is at the limit of what could be accommodated before exit blocking occurs. This particular internal queue does create an issue from a geometrical standpoint, and this is discussed in more detail later in this Technical Note.

3.19 In the evening peak hour, the PRC would be 3.1%, with the A43 southbound approach operating at 87.3% saturated and the M40 southbound off-slip at 84.3% saturated. The other approaches to the junction are shown to operate comfortably. As per the morning peak hour, all internal queueing could be acceptably accommodated, though queuing on the A43 circulatory is again at the limit of what could be accommodated before exit blocking occurs.

3.20 As discussed above, whilst the Option 3A layout is shown to operate with a positive PRC, there is very little additional headroom at the junction, with the A43 and M40 southbound off-slip approaches being close to their maximum capacity. The limiting factors for these nodes is the very high flow from the A43 to the M40 southbound (1,729 pcus in the morning peak, 1,046 pcus in the evening peak) and the large 'right-turn' movement towards the MSA and the M40 southbound exits from the new Ardley Bypass (521 pcus in the morning peak, 740 pcus in the evening peak). This right-turn movement must run into a red at the A43 circulatory and therefore it becomes extremely difficult to balance the green time requirement of the large A43 flow against the queue on the circulating carriageway due to the 'right-turn'.

3.21 Since it would not be possible to provide three lanes on the M40 southbound exit, there is no scope to further resolve this issue and therefore the PRC demonstrated by this assessment represents the best-case scenario under these flow sets.

Option 3B

3.22 The work undertaken to develop Option 3A demonstrated the scale of the junction required in terms of the number of lanes, flared lane lengths and internal storage capacity that would be required. This layout was then used as the basis for Option 3B which was amended so that it would be compliant with the requirements of DMRB CD 116. The resulting layout is shown at **drawing number OxSRFI-BWB-GEN-XX-SK-CH-SK024-S1-P01**.

3.23 A detailed discussion on the requirements of DMRB and the implications for the junction arrangement is provided at Section 5 of this Technical Note. In summary, the key changes to the layout in order for it to comply with the requirements of DMRB CD116 are as follows:

- Only four lanes can be provided on the A43 approach.
- Only three lanes can be provided on the M40 southbound and northbound diverges.
- Reduction in the storage capacity on the A43 circulating carriageway.

3.24 A screen shot of the LinSig model structure is provided at **Figure 5**.

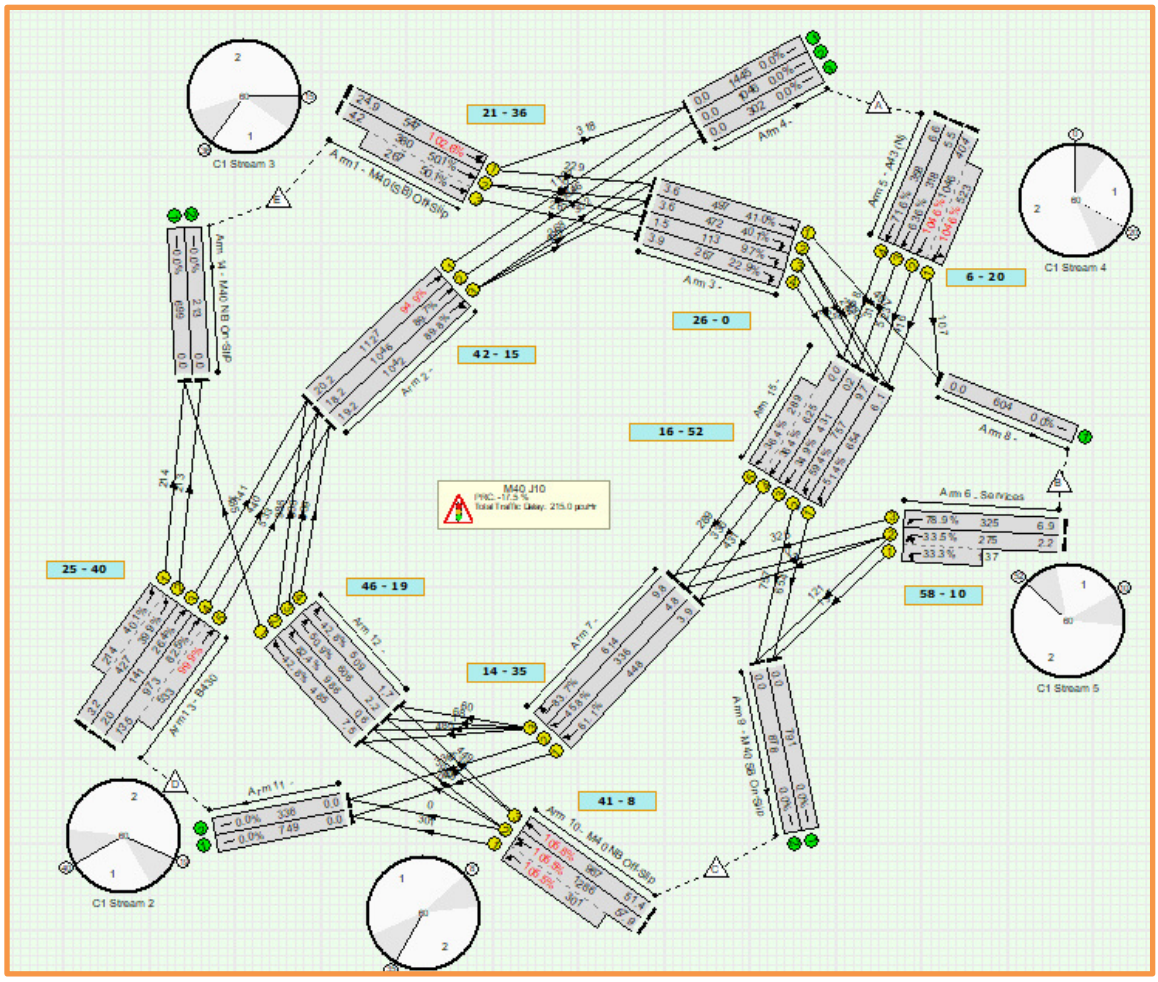
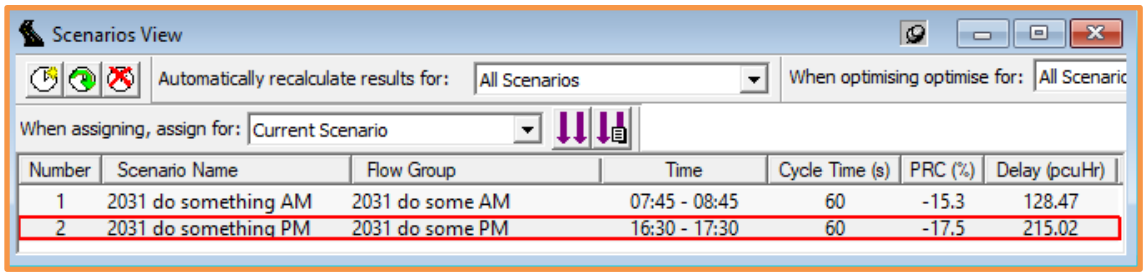


Figure 5: lane/link structure of Option 3B

3.25 Option 3B has been modelled using LinSig and the 2031 Do Something morning and evening peak hour traffic flows (Diagrams 63 and 64 at Appendix D of TN6). The results are summarised below and the full model report is contained in **Appendix C**.



Number	Scenario Name	Flow Group	Time	Cycle Time (s)	PRC (%)	Delay (pcuHr)
1	2031 do something AM	2031 do some AM	07:45 - 08:45	60	-15.3	128.47
2	2031 do something PM	2031 do some PM	16:30 - 17:30	60	-17.5	215.02

3.26 The results show that the Option 3B junction arrangement would not operate acceptably in the morning and evening peak hours for 2031 Do Something scenario. In the morning peak hour,

the PRC would be -15.3%, with the A43 southbound approach operating at 103.8% saturated, with the reduced storage capacity on the circulating carriageway (when compared to the Option 3A layout) impacting on the available green time for the A43 approach.

3.27 In the evening peak hour, the PRC would be -17.5%, with the A43 southbound approach operating at 104.6% saturated, the M40 southbound off-slip would be 102.6% saturated and the M40 northbound off-slip would be 105.8% saturated. As for the morning peak hour, the reduced storage capacity on the circulating carriageway reduces the available green time for the A43 approach, whilst the capacity issue on both M40 off-slip approaches is due to the reduction in lanes (when compared to the Option 3A layout).

3.28 The model results for the Option 3B layout show that it is not possible to accommodate the internal queueing on the A43 circulatory, with the excess queue limit exceeded in both the morning and evening peak hours which would cause the A43 exit to block. **Figure 6** below shows the storage capacity is on this part of the circulating carriageway. As can be seen on **Figure 6**, right-turning vehicles wishing to exit at the MSA or the M40 southbound are likely to struggle to enter the circulating lanes, with a queueing HGV likely to block both lanes. Whilst a fourth lane on the bridge allocated for right-turning traffic only may ease this issue, it is unlikely to completely resolve it. Option 3A also suffers from the same problem, though it is not shown to be as severe, with the requirement for a splitter island on the A43 approach effectively halving the storage capacity on the circulating carriageway.

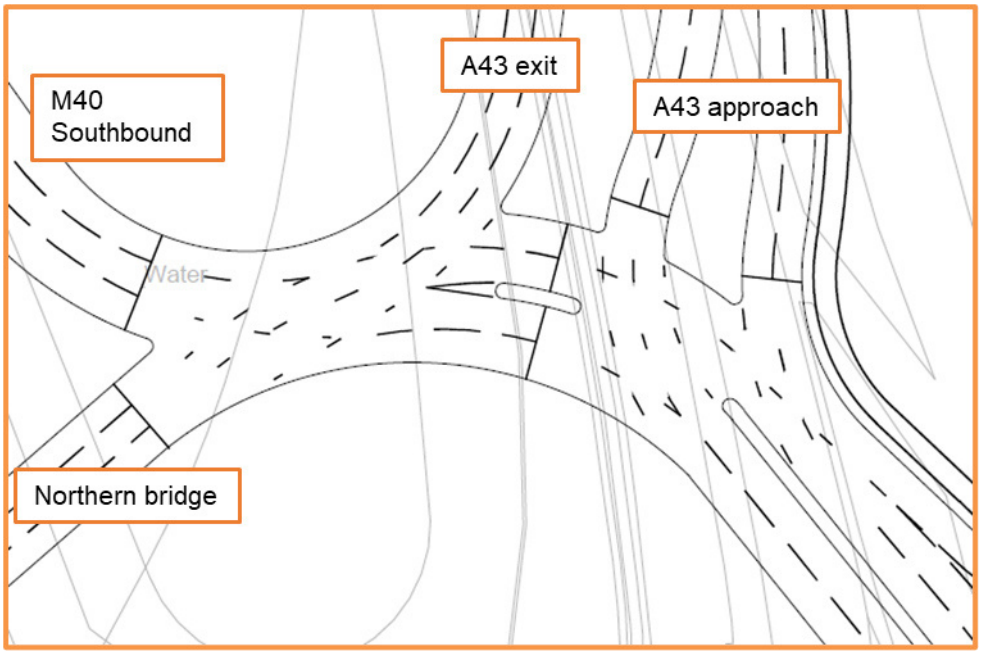


Figure 6: Option 3B A43 and M40 SB off-slip nodes

3.29 The design team consider that the capacity problems on the M40 northbound and southbound approaches could be resolved if a fourth lane could be added to both bridges. Whilst this would be possible in principle for the northern bridge, further investigation would be required for the southern bridge. However, this would not resolve the capacity issues on the A43 approach, which would remain.

Summary

3.30 The above analysis demonstrates that when solely focused on maximising the capacity of the junction, a sufficient number of lanes could be provided such that the junction would operate acceptably with the OxSRFI development in place. However, it is noted that such an

arrangement would not provide any material additional headroom at the junction, with the A43 and M40 southbound off-slip approaches being close to their maximum capacity.

3.31 However, when the geometrical requirements of DMRB CD 116 are applied to the junction arrangement, particularly the requirements for entry path curvature and entry width, the required number of entry lanes cannot be provided on the A43 approach and both M40 diverge approaches. The constrained geometry significantly effects capacity on these approaches, with the junction operating above with negative PRC in both the morning and evening peak hours.

3.32 There are also significant concerns regarding the potential for queuing on the circulating carriageway which could block the A43 northbound exit.

4.0 LONG TERM PLANNING FOR M40 J10

Headroom

4.1 The table below provides a comparison between the forecast capacity at the existing M40 Junction 10 (no OxSRFI development) with the forecast capacity at the junction under Options 3A, 3B, 11, 13, 18 and 19 with the OxSRFI development in place. Reference to TN5 should be made for details of Options 11, 13, 18 and 19.

Existing		Option 3A	Option 3B	Option 11/18		Option 13/19	
Cherwell (PRC)	Ardley (RFC)	Total (PRC)	Total (PRC)	Cherwell (PRC)	Ardley (PRC)	Cherwell (PRC)	Ardley (PRC)
-30.8% AM 2.3% PM	81% AM 99% PM	0.8% AM 3.1% PM	-15.3% AM -17.5% PM	21.7% AM 5.6% PM	13.3% AM 0.5% PM	21.7% AM 5.6% PM	4.5% AM 22.5% PM

4.2 As shown in the table above, the existing Cherwell and Ardley junctions would be over capacity in 2031 and would therefore require significant improvement to facilitate background growth to 2031 and the proposed development. The table also demonstrates that even compared to the best-case option for a single grade separated junction, the identified Options 11, 13, 18 and 19 offer headroom to accommodate future growth.

Future adaptability

4.3 As discussed in Section 3, Option 3A seeks to maximise the capacity for a single large grade separated junction. Under this option the initial modelling results suggest that the junction would operate acceptably in 2031 with the development in place, but with no material headroom. Option 3B then applies the geometrical requirements of DMRB CD 116 and the capacity of the junction significantly reduces such that the junction would suffer from congestion. Whilst it may be possible to agree some departures that would 'buy-back' some capacity and give performance levels similar to Option 3A, the end result is likely to be a junction that still operates at or above capacity.

4.4 Further, given the outcome of the Option 3A assessment work and the geometrical constraints, it is unlikely that a single grade separated junction could be improved again in the future to accommodate additional growth.

4.5 The predominant traffic flows at M40 Junction 10 are the flows travelling between the A43 and M40 and vice versa. Based on the 2031 Do Something traffic flows, the A43 southbound to M40 southbound movement would represent approximately 22% of the overall traffic flow at the junction in both the morning and peak hour period and 14% in the evening peak hour period. The M40 northbound to A43 northbound movement represent approximately 16% and 24% of the overall traffic flow at the junction in the morning and evening peak hour period, respectively.

4.6 Therefore, given the limitations of a single large grade separated junction outlined above, the most appropriate long-term solution for this part of the strategic road network is to remove traffic from the junction through the provision of free-flow links between the A43 and the M40 in both directions. This would remove some 38% of traffic from the junction during the morning and evening peak hour periods. Implementation of these free-flow links, if both were provided would:

- Bring about a significant reduction in journey times on these two key movements as they would not have to go through any junction;
- Provide a step change increase in capacity at the junctions, providing headroom to facilitate long-term growth as well as improving local connectivity by removing a significant amount of SRN traffic from the junction.

4.7 OxSRFI Options 11, 13, 18 and 19 all provide a free-flow connection from the A43 Southbound to M40 Southbound, which would achieve the above benefits in part.

4.8 Provision of a free-flow connection from the A43 Southbound to M40 Southbound would not be possible under Option 3A or Option 3B. As discussed at paragraph 5.10 of TN5, an extended auxiliary lane merge would be needed for the free flow link and hence it would not then be possible to retain the existing slip road and existing merge as they would be in the same location.

4.9 Options 11, 13, 18 and 19 could therefore be the first step to providing free-flow connections in both directions. In that regard, Options 11 and 18 would help to facilitate the future implementation of the M40 to A43 northbound free-flow link as they would change the position of the M40 northbound entry slip road, which in turn would then create space for a northbound free-flow link.

4.10 The future adaptability of Options 3A, 3B, 11, 13, 18 and 19 is summarised in the table below.

Option 3A/3B	Option 11/18	Option 13/19
Very restricted scope for further capacity enhancements	A43SB to M40SB Free flow connection provides step change, M40 NB slip road realigned to create space for a future M40NB to A43NB free flow connection	A43SB to M40SB Free flow connection provides step change

4.11 Therefore, for the reasons discussed above the design team consider that the proposed OxSRFI Options 11, 13, 18 and 19 offer significant long-term benefit over a large complex signal controlled multi-lane roundabout as shown in Options 3A or 3B.

5.0 GEOMETRY ISSUES AND IMPACT ON CAPACITY

Background and Standards

5.1 When DMRB CD 116 superseded TD 16/07, TD 50/04 and other standards in 2019, it became the standard for design of all roundabouts including large, signalised roundabouts.

5.2 While TD 50/04 only required signalised roundabouts to conform to the geometric requirements of TD16 (the previous standard for the geometric design of roundabouts) where an arm operated in a self-regulating (i.e., un-signalled) manner at any time, CD 116 paragraph 2.5 states that signal controlled roundabouts shall be designed using the requirements for normal roundabouts, without the clarification of its predecessor with respect to self-regulating elements.

5.3 This means that a signalised roundabout must comply with the requirements for, among other things:

- Entry Width
- Entry Path Deflection

5.4 Entry width is limited to 15m by paragraph 3.13 of CD 116. For larger signalised roundabouts, it is often necessary to provide numerous entry lanes and paragraph 4.6 of CD 116 covers a key requirement that the design of a signal-controlled roundabout shall allow for the swept turning paths of the design vehicle on all entry, circulatory and exit lanes.

5.5 In practice, this means that it is not possible to provide an entry wider than three lanes which will meet both the swept path and entry width requirements without introducing splitter islands.

5.6 Numerous lanes on entry necessarily translate to numerous lanes on the circulatory carriageway. The combination of these factors means that the size of the roundabout must be significantly increased in order to generate the necessary deflection on the entry path to achieve an entry path radius of 100m or less.

5.7 There is also a point at which it becomes impossible to achieve compliant entry path deflection regardless of the size of the roundabout. This is because of the number of lanes on the circulatory and entries which will always create a path that is greater than 100m radius. This point occurs when the circulatory carriageway is around 5 to 6 lanes wide.

5.8 To produce a design that is geometrically compliant with the requirements of CD 116, it is necessary (and indeed recommended by CD 116) to introduce traffic islands on the entries and circulatory carriageway.

5.9 These traffic islands break up the flows on the entry arms and provide multiple, narrower entries to the roundabout. On the circulatory carriageway, they provide segregation of flows and enable compliant entry path deflection to be achieved.

Option 3A

5.10 Option 3A demonstrates a large, signalised roundabout that is within the capacity requirements for the junction but which does not meet the geometric requirements of CD 116.

5.11 There is little to no entry path deflection and entry widths exceed the maximum in a number of cases.

5.12 This option would require the approval of a number of departures from standard and the designers' view is that these would be difficult to justify given that it is possible to present alternative, compliant layouts.

5.13 The wide approaches and circulatory carriageway with numerous lanes may also be confusing to drivers (especially if road markings are less clear after wearing) with a risk of lane changing and side swipe collisions introduced. It may also be challenging to provide traffic signals in positions where they would not be obscured by high sided vehicles.

Option 3B

5.14 Option 3B demonstrates a geometrically compliant junction. This has seen the introduction of traffic islands on the approaches from the A43 to the north and the proposed link road to the south. In addition there are traffic islands within the circulatory carriageway to segregate traffic flows and ensure compliant entry path deflection is achieved.

5.15 The capacity of the junction has been reduced through the reduction of entry lanes to comply with the standards as follows:

- M40 SB diverge and M40 NB diverge arms are reduced from 4 lanes to 3. Whilst these lanes can be made to work in terms of entry path, the restrictions on entry width (15m) mean that 4 lanes would not accommodate swept paths of large vehicles.
- A43 SB entry arm is reduced from 5 lanes to 4 (2 lots of 2 lanes) as the entry path deflection does not work for 5 lanes.

5.16 While geometrically compliant, this option presents numerous safety and operational issues. The traffic islands are substantial in length due to the entry path beginning 50m from the stop line. This means that advance signage will be crucial to ensure that people are in the correct lane well in advance of the junction.

5.17 The introduction of physical islands on the approaches presents the risk of vehicles changing lanes at late notice, potentially causing side swipe collisions as drivers may not expect lanes to be physically separated on the approach to such a roundabout.

5.18 Islands on the circulatory, especially where a single lane feeds numerous destinations, increases the risk of vehicles trying to perform manoeuvres to change lanes that are not permitted and may result in collisions. Such arrangement are difficult to sign and require a driver to make a decision much earlier than they may otherwise consider necessary.

5.19 In addition, and as discussed in Section 6 of this Technical Note, Option 3B would involve construction within an area of flood plain to the north, which would likely require compensation works.

5.20 The capacity of Option 3B could also be improved through a limited number of departures from entry width and entry path deflection requirements, especially at the M40 northbound and southbound diverges.

5.21 These further options have not been presented as even should the necessary departures be approved, such alternative layouts would still have the same issues with regards to safety and operation and while within the required capacity for the junction (best case as per Option 3A), would not provide any additional headroom for the future.

6.0 ENVIRONMENT AND BUILDABILITY

Environment

6.1 The key environmental constraints in relation to Option 3A and 3B are as follows:

- Watercourse and associated floodplain; and
- Woodland between J10 and the MSA.

6.2 The floodplain and watercourse is shown in **Figure 7** below. Both Options 3A and 3B are likely to impact the floodplain and compensation floodplain would be required. The area of the previous M40 southbound slip road is likely to be the most suitable location for this.

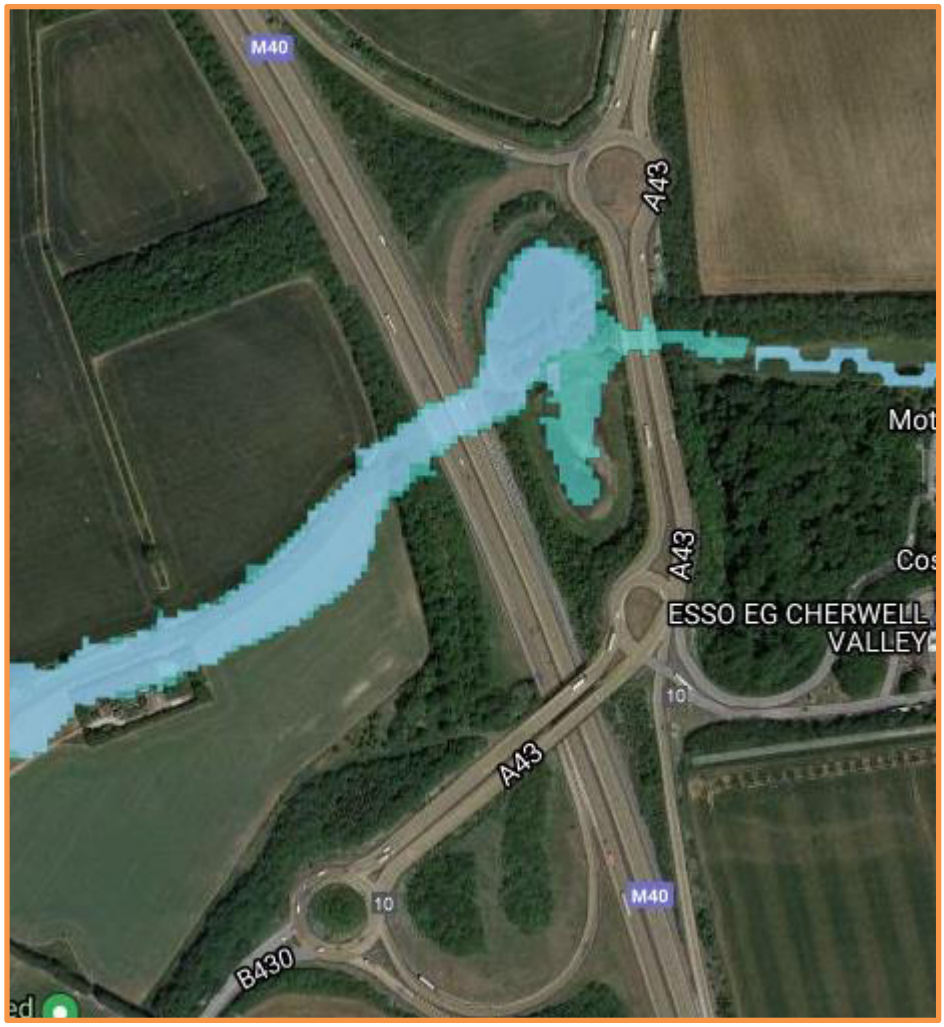


Figure 7: watercourse and floodplain at J10

6.3 Options 11 and 18 would require a new road link across the floodplain west of the M40, at this point the floodplain is narrower and there is land available to provide compensation floodplain.

6.4 Options 3A and 3B as currently drawn would have a significant impact on the woodland between J10 and the MSA.

Buildability

6.5 The current arrangement at Junction 10 is a dumb-bell roundabout junction with two M40 overbridges close together between the roundabouts. Both bridges carry two lanes of traffic.

Given the proposed layout of Options 3A and 3B, it will not be possible to utilise both of these bridges on the circulatory carriageway.

6.6 Instead, the northern bridge would require removing and the southern bridge widening to accommodate the three lanes of traffic required over the M40 on the southern side of the junction.

6.7 A new overbridge would be required to the north as well as new slip roads.

6.8 Given that Options 3A and 3B are significantly different from the current arrangement at junction 10, this provides some advantage with respect to construction phasing and disruption, with a large part of the proposed junction buildable offline with minimal disruption to the existing junction. Traffic could then be switched to the new section while the existing bridges are removed and widened.

6.9 However, both Options 3A and 3B pose a significant challenge to the A43. The Padbury roundabout is currently at a similar level to the existing M40 mainline. The new northern bridge in Options 3A and 3B would need to connect to the existing A43 a significant amount above the existing road level. This will result in a significant length of the existing A43 needing to be realigned vertically to connect to the new bridge and given that it is a high speed road the extent of realignment would extend a significant distance to the north of the reconfigured junction.

6.10 Vertical realignment of the existing A43 over such a distance would be very challenging and would likely require either a full closure for a considerable period (if both carriageways were amended at the same time), or a contraflow for an even longer period to realign the two carriageways at different times. Both options would be extremely disruptive to the SRN.

7.0 LOCAL ACCESS, WALKING, CYCLING AND HORSE RIDING

Local access issues

7.1 As well as providing for strategic road traffic between the M40 and A43, M40 Junction 10 is the local junction on the M40 for access to Ardley, Heyford Park, and, via the Baynard's Green roundabout, the northern side of Bicester. M40 Junction 10 is also the junction for the Cherwell Valley MSA.

Ardley

7.2 Options 3A or 3B would only provide for one road connection to the west of the signalised roundabout and to facilitate the OxSRFI development, this would have to be the Ardley Bypass. Hence unlike Options 11, 13, 18 and 19, Options 3A and 3B would sever the local connection into Ardley along the existing B430 from Junction 10. This would mean that access to Ardley would need to be taken from the Ardley East roundabout on the Ardley Road that runs between Ardley and Bucknell.

7.3 Ardley Road is a minor local road and this would clearly see a significant increase in traffic between the bypass and Ardley village, requiring the road to be improved to accommodate the increased traffic and cater for non-motorised traffic (see below). Further, the junction between Ardley Road and the existing B430 may need to be improved/reconfigured as the Ardley Road east-west direction would become dominant flow.

Bucknell

7.4 Provision of Options 3A or 3B, together with the Ardley East junction on Ardley Road, would see the Ardley Road and Bicester Road route become the most direct route between Bicester and M40 Junction 10, although the North West Bicester development works would make this route less attractive. Whilst the traffic modelling would need to be run to confirm the impact in Bucknell, it would stand to reason that Options 3A or 3B could increase traffic flows through the village due to the enhanced connectivity around Junction 10.

7.5 This same issue is likely to be the case with Options 11 or 13, hence why Options 18 and 19 are also being investigated.

Cherwell Valley MSA

7.6 Options 3A or 3B would provide direct access to the MSA from the signalised roundabout. For M40 users this would mean that access to the MSA would be from the single large junction once leaving the motorway.

7.7 Options 11, 13, 18 and 19 would require road users to use several individual junctions to use the MSA as follows:

Direction	Access to MSA	Exit from MSA
M40 Southbound	Via Padbury and Cherwell junctions (as existing)	Via Cherwell, Ardley and Ardley East (two additional junctions)
M40 Northbound	Via Ardley East, Ardley, Cherwell (one extra junction)	Via Cherwell and Ardley (as existing)

Direction	Access to MSA	Exit from MSA
A43 Southbound	Via Padbury and Cherwell junctions (as existing but with a simplified Padbury junction)	n/a
A43 Northbound	n/a	Via Cherwell and Padbury junctions (as existing but with a simplified Padbury junction)

7.8 The modelling results presented in Section 3 of this Technical Note show that a DMRB compliant single large grade-separated junction would not operate with sufficient capacity to cater for the background and proposed development traffic in 2031. Further, it is unlikely that any material additional capacity could be provided at a single junction to cater for future long-term growth. Hence, ongoing issues of congestion, queueing and delay are likely to impact on the accessibility of the MSA and its attractiveness to drivers as a suitable facility.

7.9 The design team is aware that MSAs accessed from similar large, signalised roundabouts can suffer acute congestion at times – the notable examples being on the M5 at Gordano (J19) and M11 at Birchanger (J8). Hence the step change in capacity created by options 11, 13, 18 and 19 would be of significant long-term benefit to the MSA.

Walking and cycling

Connectivity through Junction 10

7.10 Potential facilities for pedestrian and cycle connectivity for Option 3A and Option 3B are shown on **drawing number OxSRFI-ADC-GEN-XX-SK-CH-SK06-S1-P1** and **drawing number OxSRFI-BWB-GEN-XX-SK-CH-SK024-S1-P01**, respectively. Both schemes could provide a link between Ardley and the MSA from the existing B430 and providing a footway/cycleway connection along the southern side of the widened bridge, with Toucan crossings facilities.

7.11 Whilst not currently shown on drawings presented in TN5, pedestrian and cycle connectivity through Junction 10 could be provided under options 11, 13, 18 and 19 in much the same way as for Options 3A and 3B. Hence, there would be no material difference in the provision of safe, direct connectivity under any of the options under consideration.

Ardley Road

7.12 As noted above, for Options 3A and 3B, Ardley Road between the proposed Ardley Bypass and Ardley would become the primary route into Ardley from the M40, A43 and B430. Ardley Road currently functions as a local road between local areas and is relatively lightly trafficked making it suitable for cyclists. Using Ardley Road as the principal access to Ardley would therefore have a negative impact on cyclists that would need to be addressed.

8.0 SUMMARY AND CONCLUSIONS

8.1 ADC Infrastructure Ltd and BWB Consulting Ltd are appointed by Oxfordshire Railfreight Ltd (the Applicant) to assess and design the transport and infrastructure requirements of a Nationally Significant Infrastructure Project (NSIP), that being a proposed Strategic Rail Freight Interchange in Oxfordshire, to be known as Oxfordshire Strategic Rail Freight Interchange (OxSRFI).

8.2 As part of the ongoing work to define the access and mitigation strategy for the proposed development, Technical Note 5 was prepared by ADC Infrastructure Ltd and BWB Consulting Ltd, considering 19 different potential interventions at M40 Junction 10 that could be implemented by the OxSRFI scheme to mitigate the impact of the development. A short list of four options were identified (Options 11, 13, 18 and 19), with the option for a single large grade-separated junction (Option 3) being discounted on capacity grounds.

8.3 However, National Highways requested that the option for a large single grade-separated gyratory be given further consideration to examine whether the capacity constraints could be overcome.

8.4 The assessment of the future baseline position at M40 Junction 10 demonstrates that the Cherwell and Ardley roundabouts that form M40 Junction 10 would already be operating over capacity in 2031 without the OxSRFI development. Once the development traffic from the proposed OxSRFI scheme is added, the analysis shows that these existing issues would be further exacerbated and there would be significant congestion at M40 Junction 10.

8.5 A two-stage approach has been followed to further consider a large single grade-separated gyratory at M40 Junction 10, resulting in two options; Option 3A which seeks to maximise capacity and Option 3B which applies the requirements of DMRB CD 116 to the Option 3A layout.

8.6 The analysis of the resulting layouts demonstrates that when solely focused on delivering the required capacity, a junction of sufficient size could be provided such that the junction would operate acceptably with the OxSRFI development in place. However, such an arrangement would not provide any material additional headroom, with the A43 and M40 southbound off-slip approaches being close to their maximum capacity. There are also concerns regarding the potential for queuing on the circulating carriageway to block the A43 northbound exit.

8.7 When the geometrical requirements of DMRB CD 116 are applied to the Option 3A arrangement, particularly the requirements for entry path curvature and entry width, the required number of entry lanes cannot be provided on the A43 approach and both M40 diverge approaches. The constrained geometry significantly effects capacity on these approaches, with the Option 3B junction operating above capacity in both the morning and evening peak hours. The concerns regarding the potential for queuing on the circulating carriageway to block the A43 northbound exit are exacerbated by Option 3B.

8.8 Whilst it may be possible to agree some departures for Option 3B that would 'buy-back' some capacity and give performance levels similar to Option 3A, the end result is likely to be a junction that operates at or above capacity. Further, given the outcome of the Option 3A assessment work and the geometrical constraints, it is unlikely that a single grade separated junction could be improved again in the future to accommodate additional growth.

8.9 The predominant traffic flows at M40 Junction 10 are the flows travelling between the A43 and M40 and vice versa. Based on the 2031 Do Something traffic flows, the A43 southbound to M40

southbound movement would represent approximately 22% of the overall traffic flow at the junction in both the morning and peak hour period and 14% in the evening peak hour period. The M40 northbound to A43 northbound movement represent approximately 16% and 24% of the overall traffic flow at the junction in the morning and evening peak hour period, respectively.

8.10 Given the limitations of a single large grade separated junction outlined above, and the predominant traffic flows, the design team consider that the most appropriate long-term solution for this part of the strategic road network is to remove traffic from the junction through the provision of free-flow links between the A43 and the M40 in both directions.

8.11 OxSRFI Options 11, 13, 18 and 19 (identified in Technical Note 5) all provide a free-flow connection from the A43 Southbound to M40 Southbound, removing significant traffic from M40 Junction 10 and hence delivering headroom for future growth. Provision of a free-flow connection from the A43 Southbound to M40 Southbound would not be possible under Option 3A or Option 3B.

8.12 In contrast with the large complex signal controlled multi-lane roundabout, Options 11, 13, 18 and 19 would therefore be the first step to providing free-flow connections in both directions. Further, options 11 and 18 would help to facilitate the future implementation of the M40 to A43 northbound free-flow link as they would change the position of the northbound entry slip road, which in turn would then create space for a northbound free-flow link.

8.13 The key environmental constraints are considered to be:

- Both Options 3A and 3B are likely to impact the floodplain and compensation floodplain would be required.
- Options 3A and 3B would have a significant impact on the woodland between J10 and the MSA.

8.14 In terms of buildability, Options 3A and 3B are significantly different from the current arrangement at Junction 10 which would allow a large part of the proposed junction to be built offline with minimal disruption to the existing junction. Traffic could then be switched to the new section while the existing bridges are removed and widened. However, both Options 3A and 3B pose a challenge to the A43. The new northern bridge in Options 3A and 3B would need to connect to the existing A43 a significant amount above the existing road level. This will result in a large length of the existing A43 needing to be realigned vertically to connect to the new bridge.

8.15 Vertical realignment of the existing A43 over such a distance would be very challenging and would likely require either a full closure for a considerable period, or a contraflow for an even longer period to realign the two carriageways at different times. Both options would be extremely disruptive to the SRN.

8.16 In terms of local access, whilst the Option 3A and 3B layouts offer some minor advantages in terms of access to the MSA, there are wider concerns regarding access to Ardley and Bucknell, with Ardley particularly affected as a direct connection to M40 Junction 10 would not be possible, with access switching to Ardley Road and the new bypass.

8.17 Therefore, for the reasons discussed above the design team consider that the proposed OxSRFI Options 11, 13, 18 and 19 offer significant long-term benefit over a large complex signal controlled multi-lane roundabout as shown in Options 3A or 3B.

DRAWINGS

Rev	Description	Date

Client:

Oxfordshire Rail Freight Interchange Ltd

Project:

OxSRFI OXFORDSHIRE STRATEGIC RAIL FREIGHT INTERCHANGE

Title:

M40 Junction 10 - Sketch option 3a

ADC INFRASTRUCTURE

ADC Ref:	Drawn:	Reviewed:
ADC1794	M. Higgins	S. Dunhill

Drg Size:	Scale:	Date:
A1	1:1000	10/09/2021

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
OxSRFI-ADC-GEN-XX-SK-CH-SK06	S1	P1

Notes

1. Do not scale this drawing. All dimensions must be checked/ verified on site. If in doubt ask.
2. This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications.
3. All dimensions in millimetres unless noted otherwise. All levels in metres unless noted otherwise.
4. Any discrepancies noted on site are to be reported to the engineer immediately.

Rev	Date	Details of issue / revision	Drw	Rev
P01	13.09.21	Preliminary Issue	SC	SRH

Issues & Revisions

BWB A CAF GROUP COMPANY
- Birmingham | 0121 233 3322
- Leeds | 0113 233 8000
- London | 020 7407 3879
- Manchester | 0161 233 4260
- Nottingham | 0115 924 1100

www.bwbconsulting.com

Client

OXFORDSHIRE RAILFREIGHT LTD.

Project Title

OxSRFI OXFORDSHIRE STRATEGIC RAIL FREIGHT INTERCHANGE

Drawing Title

M40 J10 OPTION 3B GENERAL ARRANGEMENT

Drawn:	S Carter	Reviewed:	S Hilditch
BWB Ref: NTH2479	Date: 13.09.21	Scale@A1:	1:1000

Drawing Status

PRELIMINARY

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
OxSRFI-BWB-GEN-XX-SK-CH-SK024	S1	P01

Y:\NTH\NTH2479_Oxfordshire RFI\02. Project Delivery\01. WIP\Sketches\OxSRFI-BWB-GEN-XX-SK-CH-SK024_M40 J10 Single Roundabout with Bridge Widening.dwg

APPENDIX A

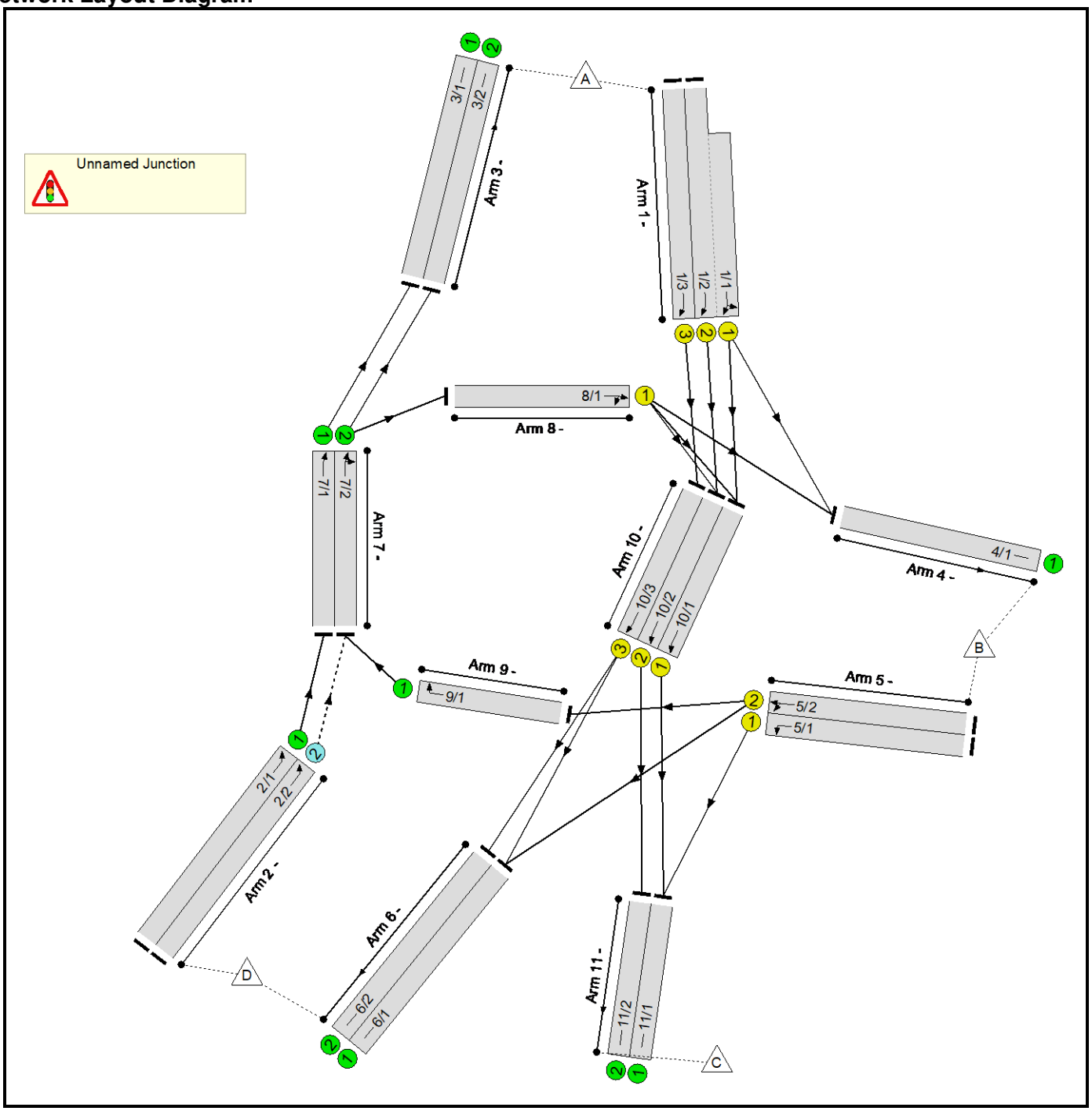
Cherwell Roundabout existing layout – revised LinSig results

Full Input Data And Results

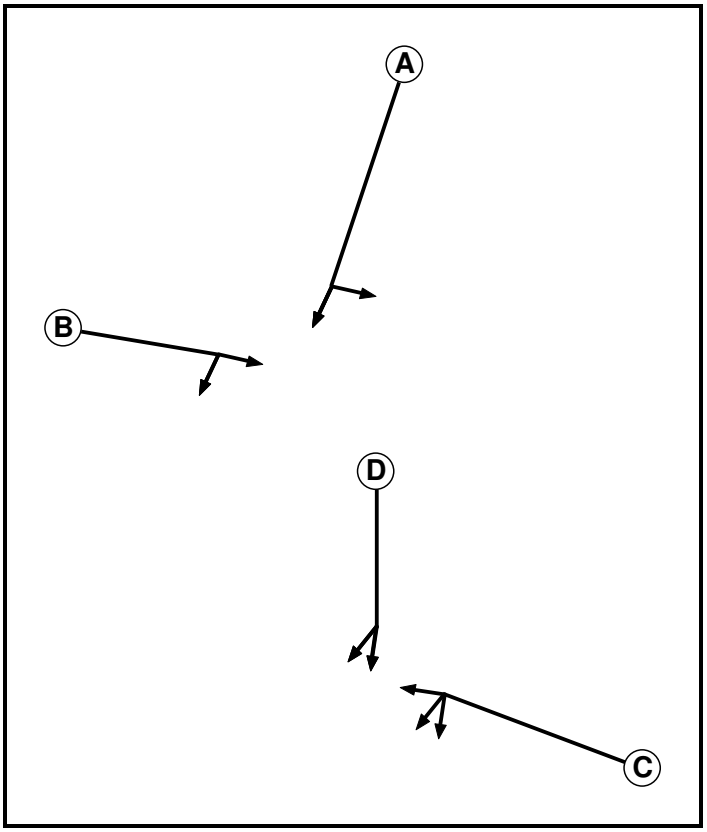
User and Project Details

Project:	**Oxfordshire SRFI**
Title:	**Existing Cherwell Roundabout**
Location:	
Additional detail:	Amended to include Aecom comments on Sat Flows
File name:	2031_DS_M40J10_Cherwell_reference case.lsg3x
Author:	Mark Higgins
Company:	ADC Infrastructure
Address:	Nottingham

Network Layout Diagram



Phase Diagram



Phase Input Data

Phase Name	Phase Type	Stage Stream	Assoc. Phase	Street Min	Cont Min
A	Traffic	1		7	7
B	Traffic	1		7	7
C	Traffic	2		7	7
D	Traffic	2		7	7

Phase Intergreens Matrix

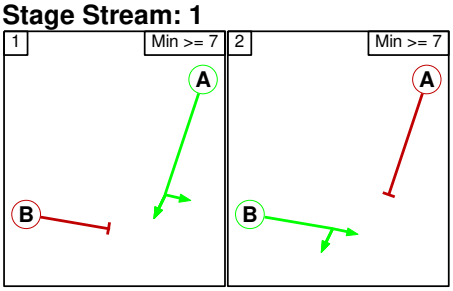
	Starting Phase				
Terminating Phase		A	B	C	D
	A		6	-	-
	B	6		-	-
	C	-	-		6
	D	-	-	6	

Phases in Stage

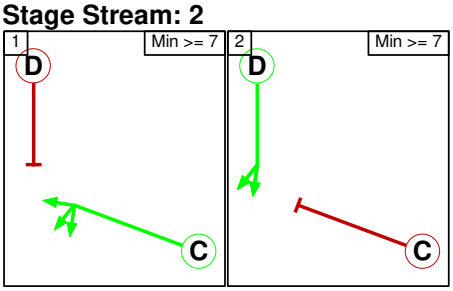
Stream	Stage No.	Phases in Stage
1	1	A
1	2	B
2	1	C
2	2	D

Stage Diagram

Stage Stream: 1



Stage Stream: 2



Prohibited Stage Change

Stage Stream: 1

	To Stage		
From Stage		1	2
	1		6
	2	6	

Stage Stream: 2

	To Stage		
From Stage		1	2
	1		6
	2	6	

Lane Input Data

Junction: Unnamed Junction												
Lane	Lane Type	Phases	Start Disp.	End Disp.	Physical Length (PCU)	Sat Flow Type	Def User Saturation Flow (PCU/Hr)	Lane Width (m)	Gradient	Nearside Lane	Turns	Turning Radius (m)
1/1	U	A	2	3	13.9	Geom	-	3.65	0.00	Y	Arm 4 Left	20.00
											Arm 10 Ahead	Inf
1/2	U	A	2	3	60.0	Geom	-	3.65	0.00	N	Arm 10 Ahead	Inf
1/3	U	A	2	3	60.0	Geom	-	3.65	0.00	N	Arm 10 Ahead	Inf
2/1	U		2	3	60.0	Inf	-	-	-	-	-	-
2/2	O		2	3	60.0	Inf	-	-	-	-	-	-
3/1	U		2	3	60.0	Inf	-	-	-	-	-	-
3/2	U		2	3	60.0	Inf	-	-	-	-	-	-
4/1	U		2	3	60.0	Inf	-	-	-	-	-	-
5/1	U	C	2	3	60.0	Geom	-	3.50	0.00	Y	Arm 11 Left	30.00
5/2	U	C	2	3	60.0	Geom	-	3.50	0.00	Y	Arm 6 Left	40.00
											Arm 9 Ahead	Inf
6/1	U		2	3	60.0	Inf	-	-	-	-	-	-
6/2	U		2	3	60.0	Inf	-	-	-	-	-	-
7/1	U		2	3	7.0	Inf	-	-	-	-	-	-
7/2	U		2	3	7.0	Inf	-	-	-	-	-	-
8/1	U	B	2	3	5.2	Geom	-	3.65	0.00	Y	Arm 4 Ahead	40.00
											Arm 10 Right	40.00
9/1	U		2	3	7.8	Inf	-	-	-	-	-	-
10/1	U	D	2	3	8.7	Geom	-	3.65	0.00	Y	Arm 11 Ahead	Inf
10/2	U	D	2	3	8.7	Geom	-	3.65	0.00	N	Arm 11 Ahead	Inf
10/3	U	D	2	3	8.7	Geom	-	3.65	0.00	N	Arm 6 Ahead	Inf
11/1	U		2	3	60.0	Inf	-	-	-	-	-	-
11/2	U		2	3	60.0	Inf	-	-	-	-	-	-

Traffic Flow Groups

Flow Group	Start Time	End Time	Duration	Formula
1: 'Cherwell1_AM'	07:45	08:45	01:00	
2: 'Cherwell1_PM'	16:30	17:30	01:00	
3: 'CherwellRef1_AM'	07:45	08:45	01:00	
4: 'CherwellRef1_PM'	16:30	17:30	01:00	

Scenario 1: '2031 Reference Case - AM Peak' (FG3: 'CherwellRef1_AM', Plan 1: 'Network Control Plan 1')

Traffic Flows, Desired

Desired Flow :

		Destination				
		A	B	C	D	Tot.
Origin	A	0	343	1605	1169	3117
	B	85	0	295	202	582
	C	0	0	0	0	0
	D	1458	239	101	0	1798
	Tot.	1543	582	2001	1371	5497

Traffic Lane Flows

Lane	Scenario 1: 2031 Reference Case - AM Peak
Junction: Unnamed Junction	
1/1 (short)	769
1/2 (with short)	1948(In) 1179(Out)
1/3	1169
2/1	1458
2/2	340
3/1	1458
3/2	85
4/1	582
5/1	295
5/2	287
6/1	787
6/2	584
7/1	1458
7/2	425
8/1	340
9/1	85
10/1	426
10/2	1280
10/3	1169
11/1	721
11/2	1280

Lane Saturation Flows

Junction: Unnamed Junction								
Lane	**Lane Width (m)**	**Gradient**	**Nearside Lane**	**Allowed Turns**	**Turning Radius (m)**	**Turning Prop.**	**Sat Flow (PCU/Hr)**	**Flared Sat Flow (PCU/Hr)**
1/1	3.65	0.00	Y	Arm 4 Left	20.00	44.6 %	1916	1916
				Arm 10 Ahead	Inf	55.4 %		
1/2	3.65	0.00	N	Arm 10 Ahead	Inf	100.0 %	2120	2120
1/3	3.65	0.00	N	Arm 10 Ahead	Inf	100.0 %	2120	2120
2/1	Infinite Saturation Flow						Inf	Inf
2/2	Infinite Saturation Flow						Inf	Inf
3/1	Infinite Saturation Flow						Inf	Inf
3/2	Infinite Saturation Flow						Inf	Inf
4/1	Infinite Saturation Flow						Inf	Inf
5/1	3.50	0.00	Y	Arm 11 Left	30.00	100.0 %	1871	1871
5/2	3.50	0.00	Y	Arm 6 Left	40.00	70.4 %	1914	1914
				Arm 9 Ahead	Inf	29.6 %		
6/1	Infinite Saturation Flow						Inf	Inf
6/2	Infinite Saturation Flow						Inf	Inf
7/1	Infinite Saturation Flow						Inf	Inf
7/2	Infinite Saturation Flow						Inf	Inf
8/1	3.65	0.00	Y	Arm 4 Ahead	40.00	70.3 %	1908	1908
				Arm 10 Right	40.00	29.7 %		
9/1	Infinite Saturation Flow						Inf	Inf
10/1	3.65	0.00	Y	Arm 11 Ahead	Inf	100.0 %	1980	1980
10/2	3.65	0.00	N	Arm 11 Ahead	Inf	100.0 %	2120	2120
10/3	3.65	0.00	N	Arm 6 Ahead	Inf	100.0 %	2120	2120
11/1	Infinite Saturation Flow						Inf	Inf
11/2	Infinite Saturation Flow						Inf	Inf

Scenario 2: '2031 Do Something - AM Peak' (FG1: 'Cherwell1_AM', Plan 1: 'Network Control Plan 1')

Traffic Flows, Desired

Desired Flow :

	Destination					
Origin		A	B	C	D	Tot.
	A	0	343	1605	1641	3589
	B	85	0	295	202	582
	C	0	0	0	0	0
	D	1577	239	282	0	2098
	Tot.	1662	582	2182	1843	6269

Traffic Lane Flows

Lane	Scenario 2: 2031 Do Something - AM Peak
Junction: Unnamed Junction	
1/1 (short)	794
1/2 (with short)	1948(In) 1154(Out)
1/3	1641
2/1	1577
2/2	521
3/1	1577
3/2	85
4/1	582
5/1	295
5/2	287
6/1	1023
6/2	820
7/1	1577
7/2	606
8/1	521
9/1	85
10/1	502
10/2	1385
10/3	1641
11/1	797
11/2	1385

Lane Saturation Flows

Junction: Unnamed Junction								
Lane	**Lane Width (m)**	**Gradient**	**Nearside Lane**	**Allowed Turns**	**Turning Radius (m)**	**Turning Prop.**	**Sat Flow (PCU/Hr)**	**Flared Sat Flow (PCU/Hr)**
1/1	3.65	0.00	Y	Arm 4 Left	20.00	43.2 %	1918	1918
				Arm 10 Ahead	Inf	56.8 %		
1/2	3.65	0.00	N	Arm 10 Ahead	Inf	100.0 %	2120	2120
1/3	3.65	0.00	N	Arm 10 Ahead	Inf	100.0 %	2120	2120
2/1	Infinite Saturation Flow						Inf	Inf
2/2	Infinite Saturation Flow						Inf	Inf
3/1	Infinite Saturation Flow						Inf	Inf
3/2	Infinite Saturation Flow						Inf	Inf
4/1	Infinite Saturation Flow						Inf	Inf
5/1	3.50	0.00	Y	Arm 11 Left	30.00	100.0 %	1871	1871
5/2	3.50	0.00	Y	Arm 6 Left	40.00	70.4 %	1914	1914
				Arm 9 Ahead	Inf	29.6 %		
6/1	Infinite Saturation Flow						Inf	Inf
6/2	Infinite Saturation Flow						Inf	Inf
7/1	Infinite Saturation Flow						Inf	Inf
7/2	Infinite Saturation Flow						Inf	Inf
8/1	3.65	0.00	Y	Arm 4 Ahead	40.00	45.9 %	1908	1908
				Arm 10 Right	40.00	54.1 %		
9/1	Infinite Saturation Flow						Inf	Inf
10/1	3.65	0.00	Y	Arm 11 Ahead	Inf	100.0 %	1980	1980
10/2	3.65	0.00	N	Arm 11 Ahead	Inf	100.0 %	2120	2120
10/3	3.65	0.00	N	Arm 6 Ahead	Inf	100.0 %	2120	2120
11/1	Infinite Saturation Flow						Inf	Inf
11/2	Infinite Saturation Flow						Inf	Inf

Scenario 3: '2031 Reference Case - PM Peak' (FG4: 'CherwellRef1_PM', Plan 1: 'Network Control Plan 1')

Traffic Flows, Desired

Desired Flow :

	Destination					
		A	B	C	D	Tot.
Origin	A	0	336	939	800	2075
	B	129	0	258	213	600
	C	0	0	0	0	0
	D	2071	268	88	0	2427
	Tot.	2200	604	1285	1013	5102

Traffic Lane Flows

Lane	Scenario 3: 2031 Reference Case - PM Peak
Junction: Unnamed Junction	
1/1 (short)	483
1/2 (with short)	1275(In) 792(Out)
1/3	800
2/1	2071
2/2	356
3/1	2071
3/2	129
4/1	604
5/1	258
5/2	342
6/1	613
6/2	400
7/1	2071
7/2	485
8/1	356
9/1	129
10/1	149
10/2	878
10/3	800
11/1	407
11/2	878

Lane Saturation Flows

Junction: Unnamed Junction								
Lane	**Lane Width (m)**	**Gradient**	**Nearside Lane**	**Allowed Turns**	**Turning Radius (m)**	**Turning Prop.**	**Sat Flow (PCU/Hr)**	**Flared Sat Flow (PCU/Hr)**
1/1	3.65	0.00	Y	Arm 4 Left	20.00	69.6 %	1882	1882
				Arm 10 Ahead	Inf	30.4 %		
1/2	3.65	0.00	N	Arm 10 Ahead	Inf	100.0 %	2120	2120
1/3	3.65	0.00	N	Arm 10 Ahead	Inf	100.0 %	2120	2120
2/1	Infinite Saturation Flow						Inf	Inf
2/2	Infinite Saturation Flow						Inf	Inf
3/1	Infinite Saturation Flow						Inf	Inf
3/2	Infinite Saturation Flow						Inf	Inf
4/1	Infinite Saturation Flow						Inf	Inf
5/1	3.50	0.00	Y	Arm 11 Left	30.00	100.0 %	1871	1871
5/2	3.50	0.00	Y	Arm 6 Left	40.00	62.3 %	1920	1920
				Arm 9 Ahead	Inf	37.7 %		
6/1	Infinite Saturation Flow						Inf	Inf
6/2	Infinite Saturation Flow						Inf	Inf
7/1	Infinite Saturation Flow						Inf	Inf
7/2	Infinite Saturation Flow						Inf	Inf
8/1	3.65	0.00	Y	Arm 4 Ahead	40.00	75.3 %	1908	1908
				Arm 10 Right	40.00	24.7 %		
9/1	Infinite Saturation Flow						Inf	Inf
10/1	3.65	0.00	Y	Arm 11 Ahead	Inf	100.0 %	1980	1980
10/2	3.65	0.00	N	Arm 11 Ahead	Inf	100.0 %	2120	2120
10/3	3.65	0.00	N	Arm 6 Ahead	Inf	100.0 %	2120	2120
11/1	Infinite Saturation Flow						Inf	Inf
11/2	Infinite Saturation Flow						Inf	Inf

Scenario 4: '2031 Do something - PM Peak' (FG2: 'Cherwell1_PM', Plan 1: 'Network Control Plan 1')

Traffic Flows, Desired

Desired Flow :

	Destination					
		A	B	C	D	Tot.
Origin	A	0	336	939	1056	2331
	B	129	0	258	213	600
	C	0	0	0	0	0
	D	2346	268	472	0	3086
	Tot.	2475	604	1669	1269	6017

Traffic Lane Flows

Lane	Scenario 4: 2031 Do something - PM Peak
Junction: Unnamed Junction	
1/1 (short)	602
1/2 (with short)	1275(In) 673(Out)
1/3	1056
2/1	2346
2/2	740
3/1	2346
3/2	129
4/1	604
5/1	258
5/2	342
6/1	741
6/2	528
7/1	2346
7/2	869
8/1	740
9/1	129
10/1	298
10/2	1113
10/3	1056
11/1	556
11/2	1113

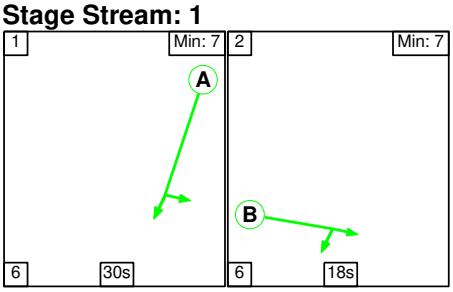
Lane Saturation Flows

Junction: Unnamed Junction								
Lane	**Lane Width (m)**	**Gradient**	**Nearside Lane**	**Allowed Turns**	**Turning Radius (m)**	**Turning Prop.**	**Sat Flow (PCU/Hr)**	**Flared Sat Flow (PCU/Hr)**
1/1	3.65	0.00	Y	Arm 4 Left	20.00	55.8 %	1900	1900
				Arm 10 Ahead	Inf	44.2 %		
1/2	3.65	0.00	N	Arm 10 Ahead	Inf	100.0 %	2120	2120
1/3	3.65	0.00	N	Arm 10 Ahead	Inf	100.0 %	2120	2120
2/1	Infinite Saturation Flow						Inf	Inf
2/2	Infinite Saturation Flow						Inf	Inf
3/1	Infinite Saturation Flow						Inf	Inf
3/2	Infinite Saturation Flow						Inf	Inf
4/1	Infinite Saturation Flow						Inf	Inf
5/1	3.50	0.00	Y	Arm 11 Left	30.00	100.0 %	1871	1871
5/2	3.50	0.00	Y	Arm 6 Left	40.00	62.3 %	1920	1920
				Arm 9 Ahead	Inf	37.7 %		
6/1	Infinite Saturation Flow						Inf	Inf
6/2	Infinite Saturation Flow						Inf	Inf
7/1	Infinite Saturation Flow						Inf	Inf
7/2	Infinite Saturation Flow						Inf	Inf
8/1	3.65	0.00	Y	Arm 4 Ahead	40.00	36.2 %	1908	1908
				Arm 10 Right	40.00	63.8 %		
9/1	Infinite Saturation Flow						Inf	Inf
10/1	3.65	0.00	Y	Arm 11 Ahead	Inf	100.0 %	1980	1980
10/2	3.65	0.00	N	Arm 11 Ahead	Inf	100.0 %	2120	2120
10/3	3.65	0.00	N	Arm 6 Ahead	Inf	100.0 %	2120	2120
11/1	Infinite Saturation Flow						Inf	Inf
11/2	Infinite Saturation Flow						Inf	Inf

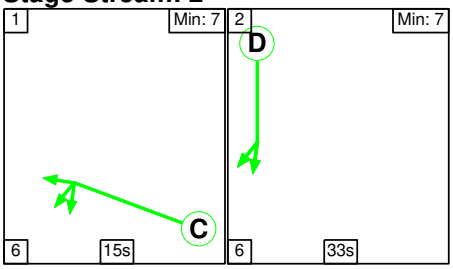
Scenario 1: '2031 Reference Case - AM Peak' (FG3: 'CherwellRef1_AM', Plan 1: 'Network Control Plan 1')

Stage Sequence Diagram

Stage Stream: 1



Stage Stream: 2



Stage Timings

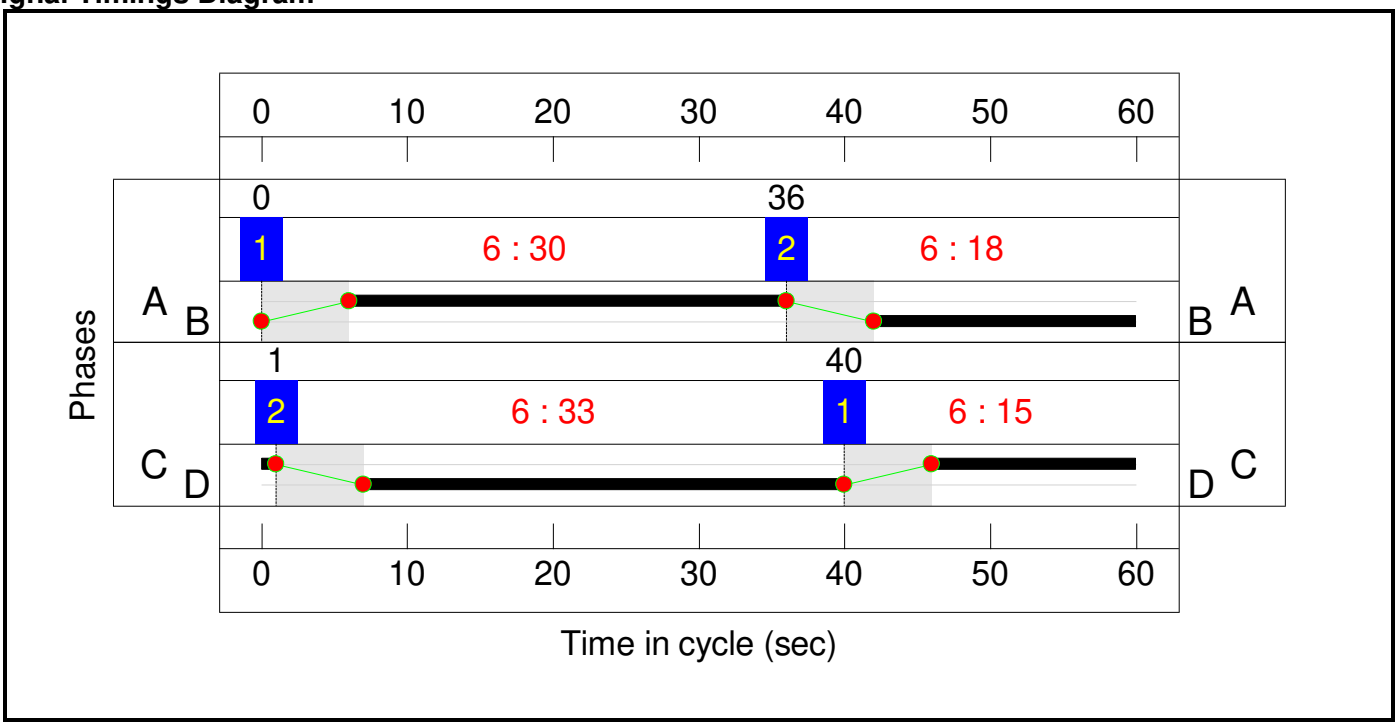
Stage Stream: 1

Stage	1	2
Duration	30	18
Change Point	0	36

Stage Stream: 2

Stage	1	2
Duration	15	33
Change Point	40	1

Signal Timings Diagram



Network Results

Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)
Network: Existing Cherwell Roundabout	**-**	**-**	**N/A**	**-**	**-**		**-**	**-**	**-**	**-**	**-**	**-**	**117.7%**
Unnamed Junction	**-**	**-**	**N/A**	**-**	**-**		**-**	**-**	**-**	**-**	**-**	**-**	**117.7%**
1/2+1/1	Left Ahead	U	1	N/A	A		1	30	-	1948	2120:1916	1001+653	117.7 : 117.7%
1/3	Ahead	U	1	N/A	A		1	30	-	1169	2120	1095	106.7%
2/2	Ahead	O	N/A	N/A	-		-	-	-	340	Inf	972	35.0%
5/1	Left	U	2	N/A	C		1	15	-	295	1871	499	59.1%
5/2	Left Ahead	U	2	N/A	C		1	15	-	287	1914	510	56.2%
8/1	Ahead Right	U	1	N/A	B		1	18	-	340	1908	604	56.3%
10/1	Ahead	U	2	N/A	D		1	33	-	426	1980	1122	32.3%
10/2	Ahead	U	2	N/A	D		1	33	-	1280	2120	1201	91.8%
10/3	Ahead	U	2	N/A	D		1	33	-	1169	2120	1201	91.2%

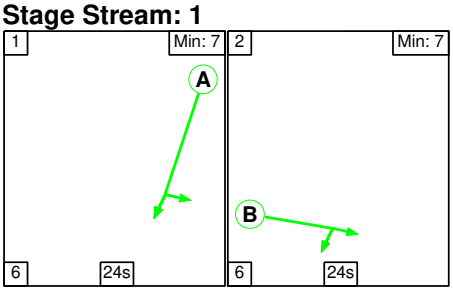
Item	Arriving (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand + Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per PCU (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand + Oversat Queue (pcu)	Mean Max Queue (pcu)
Network: Existing Cherwell Roundabout	**-**	**-**	**340**	**0**	**0**	**26.5**	**196.0**	**0.0**	**222.5**	**-**	**-**	**-**	**-**
Unnamed Junction	**-**	**-**	**340**	**0**	**0**	**26.5**	**196.0**	**0.0**	**222.5**	**-**	**-**	**-**	**-**
1/2+1/1	1948	1655	-	-	-	14.7	149.9	-	164.6	304.2	34.7	149.9	184.6
1/3	1169	1095	-	-	-	6.7	43.5	-	50.2	154.7	20.7	43.5	64.3
2/2	340	340	340	0	0	0.0	0.3	-	0.3	2.8	0.0	0.3	0.3
5/1	295	295	-	-	-	1.6	0.7	-	2.3	27.9	4.3	0.7	5.0
5/2	287	287	-	-	-	1.5	0.6	-	2.2	27.0	4.1	0.6	4.7
8/1	340	340	-	-	-	1.6	0.6	-	2.3	23.8	4.6	0.6	5.3
10/1	362	362	-	-	-	0.0	0.2	-	0.2	2.4	0.0	0.2	0.2
10/2	1103	1103	-	-	-	0.5	0.0	-	0.5	1.5	1.7	0.0	1.7
10/3	1095	1095	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0

C1	Stream: 1	PRC for Signalled Lanes (%):	-30.8	Total Delay for Signalled Lanes (pcuHr):	217.08	Cycle Time (s):	60
C1	Stream: 2	PRC for Signalled Lanes (%):	-2.0	Total Delay for Signalled Lanes (pcuHr):	5.14	Cycle Time (s):	60
		PRC Over All Lanes (%):	-30.8	Total Delay Over All Lanes(pcuHr):	222.49		

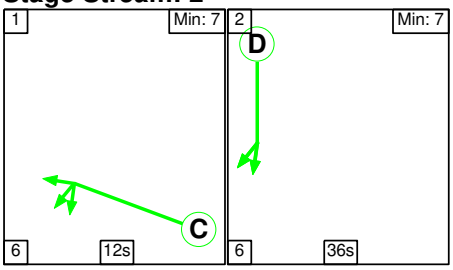
Scenario 2: '2031 Do Something - AM Peak' (FG1: 'Cherwell1_AM', Plan 1: 'Network Control Plan 1')

Stage Sequence Diagram

Stage Stream: 1



Stage Stream: 2



Stage Timings

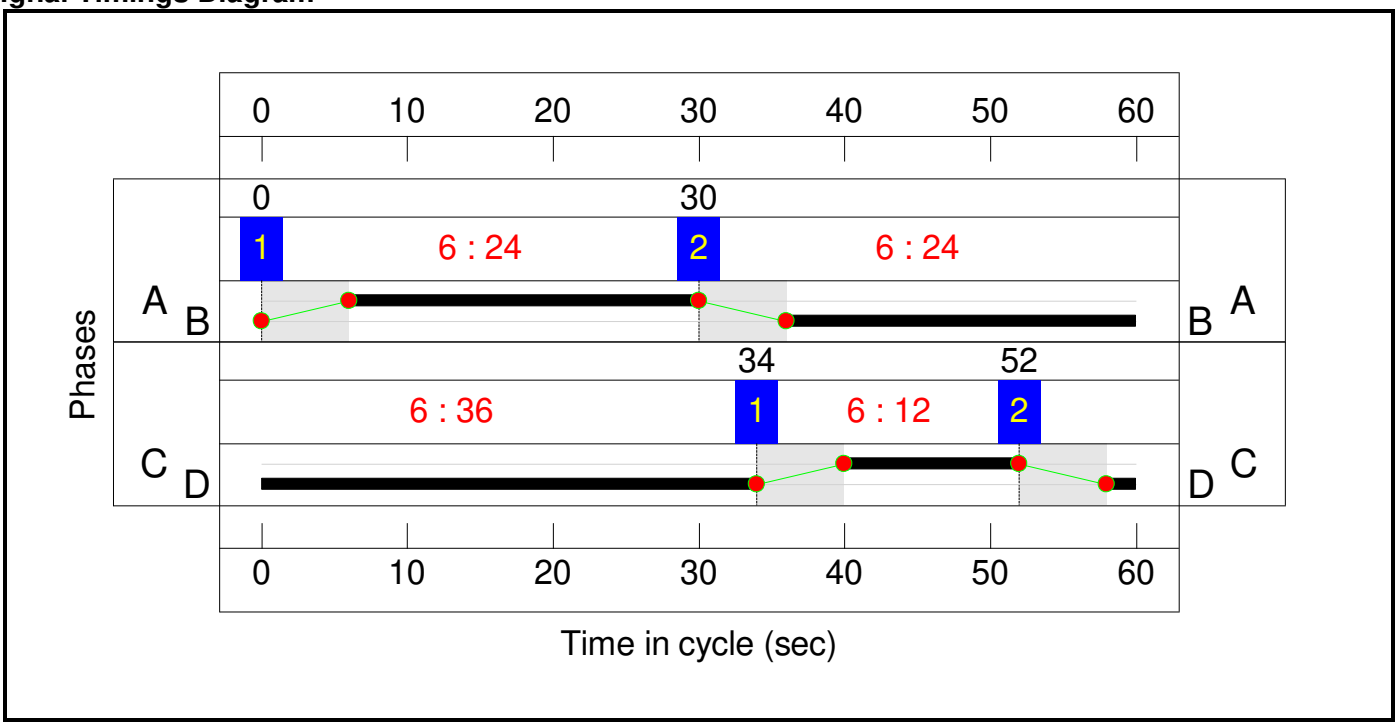
Stage Stream: 1

Stage	1	2
Duration	24	24
Change Point	0	30

Stage Stream: 2

Stage	1	2
Duration	12	36
Change Point	34	52

Signal Timings Diagram



Network Results

Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)
Network: Existing Cherwell Roundabout	**-**	**-**	**N/A**	**-**	**-**		**-**	**-**	**-**	**-**	**-**	**-**	**185.8%**
Unnamed Junction	**-**	**-**	**N/A**	**-**	**-**		**-**	**-**	**-**	**-**	**-**	**-**	**185.8%**
1/2+1/1	Left Ahead	U	1	N/A	A		1	24	-	1948	2120:1918	877+604	131.5 : 131.5%
1/3	Ahead	U	1	N/A	A		1	24	-	1641	2120	883	185.8%
2/2	Ahead	O	N/A	N/A	-		-	-	-	521	Inf	972	53.6%
5/1	Left	U	2	N/A	C		1	12	-	295	1871	405	72.8%
5/2	Left Ahead	U	2	N/A	C		1	12	-	287	1914	415	69.2%
8/1	Ahead Right	U	1	N/A	B		1	24	-	521	1908	795	65.5%
10/1	Ahead	U	2	N/A	D		1	36	-	502	1980	1221	32.3%
10/2	Ahead	U	2	N/A	D		1	36	-	1385	2120	1307	84.8%
10/3	Ahead	U	2	N/A	D		1	36	-	1641	2120	1307	67.6%

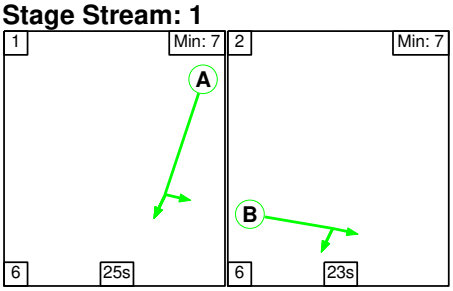
Item	Arriving (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand + Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per PCU (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand + Oversat Queue (pcu)	Mean Max Queue (pcu)
Network: Existing Cherwell Roundabout	**-**	**-**	**521**	**0**	**0**	**57.8**	**619.6**	**0.0**	**677.3**	**-**	**-**	**-**	**-**
Unnamed Junction	**-**	**-**	**521**	**0**	**0**	**57.8**	**619.6**	**0.0**	**677.3**	**-**	**-**	**-**	**-**
1/2+1/1	1948	1481	-	-	-	21.9	235.5	-	257.4	475.7	35.6	235.5	271.1
1/3	1641	883	-	-	-	29.3	379.9	-	409.3	897.8	40.3	379.9	420.2
2/2	521	521	521	0	0	0.0	0.6	-	0.6	4.0	0.0	0.6	0.6
5/1	295	295	-	-	-	1.8	1.3	-	3.1	37.8	4.5	1.3	5.8
5/2	287	287	-	-	-	1.7	1.1	-	2.8	35.5	4.4	1.1	5.5
8/1	521	521	-	-	-	2.0	0.9	-	3.0	20.6	6.9	0.9	7.9
10/1	394	394	-	-	-	0.1	0.2	-	0.4	3.5	0.8	0.2	1.0
10/2	1108	1108	-	-	-	0.8	0.0	-	0.8	2.6	3.8	0.0	3.8
10/3	883	883	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0

C1	Stream: 1	PRC for Signalled Lanes (%):	-106.4	Total Delay for Signalled Lanes (pcuHr):	669.67	Cycle Time (s):	60
C1	Stream: 2	PRC for Signalled Lanes (%):	6.2	Total Delay for Signalled Lanes (pcuHr):	7.09	Cycle Time (s):	60
		PRC Over All Lanes (%):	-106.4	Total Delay Over All Lanes(pcuHr):	677.34		

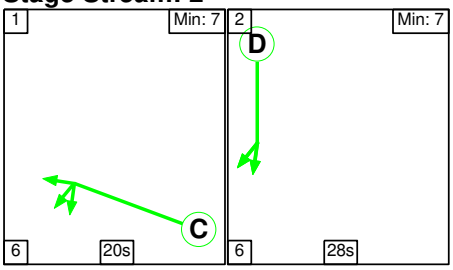
Scenario 3: '2031 Reference Case - PM Peak' (FG4: 'CherwellRef1_PM', Plan 1: 'Network Control Plan 1')

Stage Sequence Diagram

Stage Stream: 1



Stage Stream: 2



Stage Timings

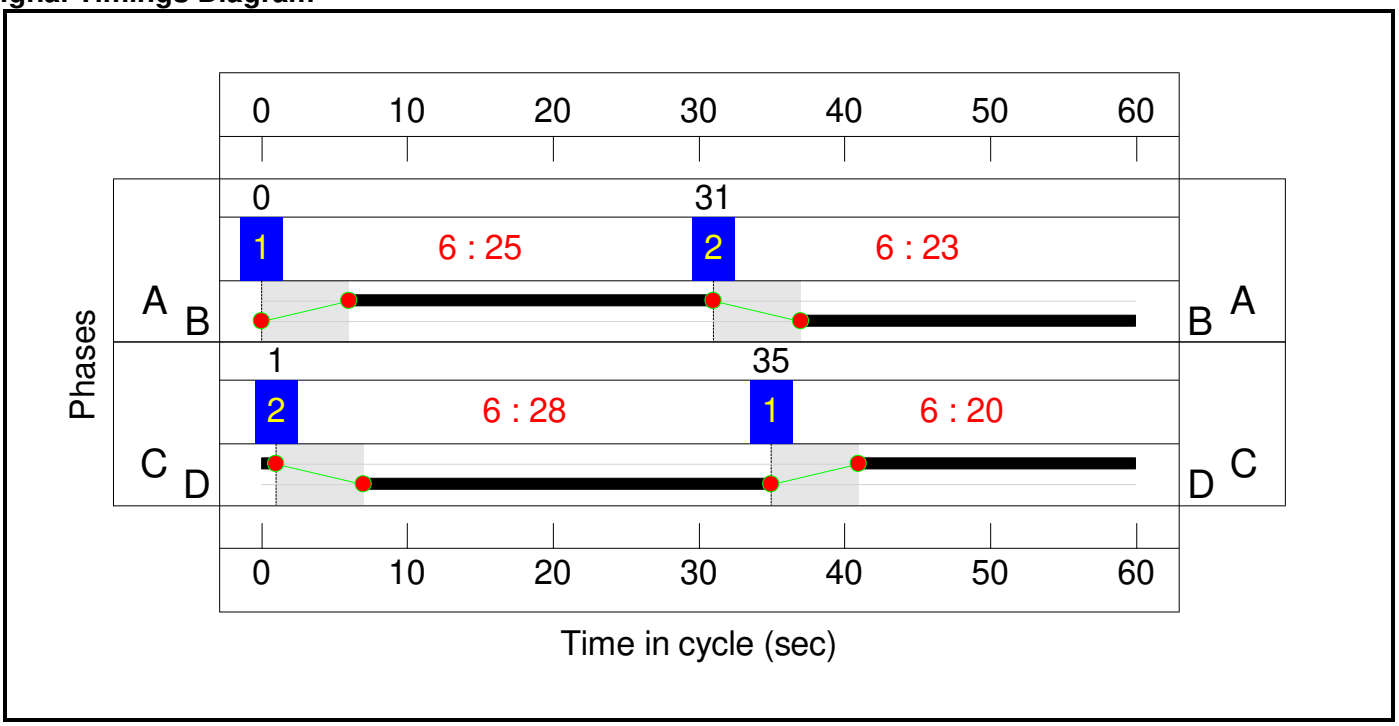
Stage Stream: 1

Stage	1	2
Duration	25	23
Change Point	0	31

Stage Stream: 2

Stage	1	2
Duration	20	28
Change Point	35	1

Signal Timings Diagram



Network Results

Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)
Network: Existing Cherwell Roundabout	**-**	**-**	**N/A**	**-**	**-**		**-**	**-**	**-**	**-**	**-**	**-**	**88.0%**
Unnamed Junction	**-**	**-**	**N/A**	**-**	**-**		**-**	**-**	**-**	**-**	**-**	**-**	**88.0%**
1/2+1/1	Left Ahead	U	1	N/A	A		1	25	-	1275	2120:1882	900+549	88.0 : 88.0%
1/3	Ahead	U	1	N/A	A		1	25	-	800	2120	919	87.1%
2/2	Ahead	O	N/A	N/A	-		-	-	-	356	Inf	957	37.2%
5/1	Left	U	2	N/A	C		1	20	-	258	1871	655	39.4%
5/2	Left Ahead	U	2	N/A	C		1	20	-	342	1920	672	50.9%
8/1	Ahead Right	U	1	N/A	B		1	23	-	356	1908	763	46.6%
10/1	Ahead	U	2	N/A	D		1	28	-	149	1980	957	15.6%
10/2	Ahead	U	2	N/A	D		1	28	-	878	2120	1025	85.7%
10/3	Ahead	U	2	N/A	D		1	28	-	800	2120	1025	78.1%

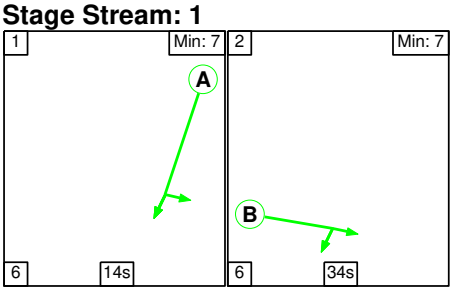
Item	Arriving (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand + Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per PCU (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand + Oversat Queue (pcu)	Mean Max Queue (pcu)
Network: Existing Cherwell Roundabout	**-**	**-**	**356**	**0**	**0**	**12.9**	**8.4**	**0.0**	**21.3**	**-**	**-**	**-**	**-**
Unnamed Junction	**-**	**-**	**356**	**0**	**0**	**12.9**	**8.4**	**0.0**	**21.3**	**-**	**-**	**-**	**-**
1/2+1/1	1275	1275	-	-	-	5.1	3.5	-	8.6	24.4	11.9	3.5	15.4
1/3	800	800	-	-	-	3.4	3.2	-	6.6	29.9	12.0	3.2	15.2
2/2	356	356	356	0	0	0.0	0.3	-	0.3	3.0	0.0	0.3	0.3
5/1	258	258	-	-	-	1.1	0.3	-	1.4	19.2	3.2	0.3	3.5
5/2	342	342	-	-	-	1.5	0.5	-	2.0	20.9	4.5	0.5	5.0
8/1	356	356	-	-	-	1.3	0.4	-	1.7	17.7	4.4	0.4	4.8
10/1	149	149	-	-	-	0.0	0.1	-	0.1	2.5	0.0	0.1	0.1
10/2	878	878	-	-	-	0.5	0.0	-	0.5	2.0	1.4	0.0	1.4
10/3	800	800	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0

C1	Stream: 1	PRC for Signalled Lanes (%):	2.3	Total Delay for Signalled Lanes (pcuHr):	17.03	Cycle Time (s):	60
C1	Stream: 2	PRC for Signalled Lanes (%):	5.0	Total Delay for Signalled Lanes (pcuHr):	3.94	Cycle Time (s):	60
		PRC Over All Lanes (%):	2.3	Total Delay Over All Lanes(pcuHr):	21.27		

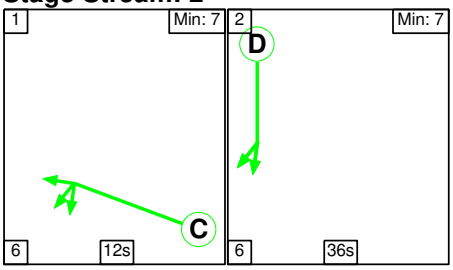
Scenario 4: '2031 Do something - PM Peak' (FG2: 'Cherwell1_PM', Plan 1: 'Network Control Plan 1')

Stage Sequence Diagram

Stage Stream: 1



Stage Stream: 2



Stage Timings

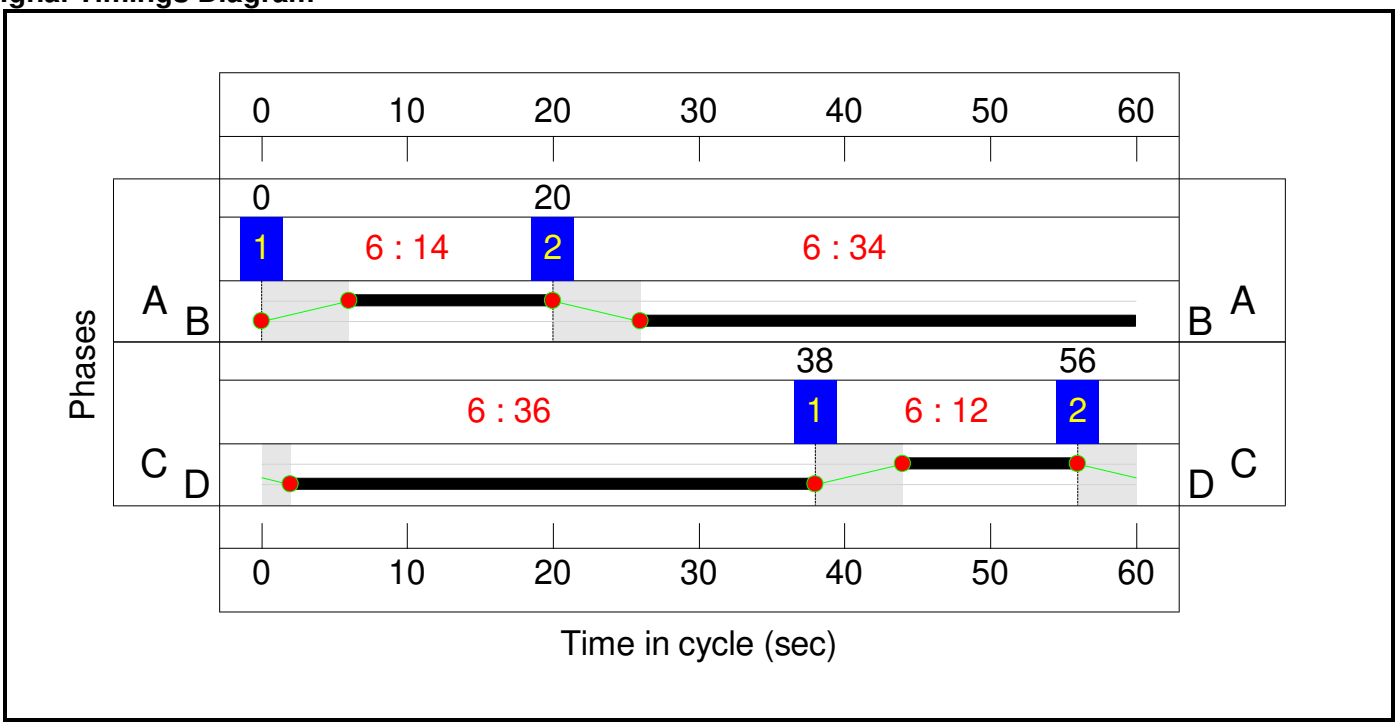
Stage Stream: 1

Stage	1	2
Duration	14	34
Change Point	0	20

Stage Stream: 2

Stage	1	2
Duration	12	36
Change Point	38	56

Signal Timings Diagram



Network Results

Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)
Network: Existing Cherwell Roundabout	**-**	**-**	**N/A**	**-**	**-**		**-**	**-**	**-**	**-**	**-**	**-**	**199.2%**
Unnamed Junction	**-**	**-**	**N/A**	**-**	**-**		**-**	**-**	**-**	**-**	**-**	**-**	**199.2%**
1/2+1/1	Left Ahead	U	1	N/A	A		1	14	-	1275	2120:1900	530+475	127.0 : 126.7%
1/3	Ahead	U	1	N/A	A		1	14	-	1056	2120	530	199.2%
2/2	Ahead	O	N/A	N/A	-		-	-	-	740	Inf	957	77.3%
5/1	Left	U	2	N/A	C		1	12	-	258	1871	405	63.6%
5/2	Left Ahead	U	2	N/A	C		1	12	-	342	1920	416	82.2%
8/1	Ahead Right	U	1	N/A	B		1	34	-	740	1908	1113	66.5%
10/1	Ahead	U	2	N/A	D		1	36	-	298	1980	1221	19.8%
10/2	Ahead	U	2	N/A	D		1	36	-	1113	2120	1307	74.2%
10/3	Ahead	U	2	N/A	D		1	36	-	1056	2120	1307	40.5%

Item	Arriving (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand + Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per PCU (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand + Oversat Queue (pcu)	Mean Max Queue (pcu)
Network: Existing Cherwell Roundabout	**-**	**-**	**740**	**0**	**0**	**44.5**	**407.2**	**0.0**	**451.7**	**-**	**-**	**-**	**-**
Unnamed Junction	**-**	**-**	**740**	**0**	**0**	**44.5**	**407.2**	**0.0**	**451.7**	**-**	**-**	**-**	**-**
1/2+1/1	1275	1005	-	-	-	15.8	137.3	-	153.2	432.5	16.7	137.3	154.1
1/3	1056	530	-	-	-	21.9	264.0	-	285.9	974.8	28.4	264.0	292.4
2/2	740	740	740	0	0	0.0	1.7	-	1.7	8.2	0.0	1.7	1.7
5/1	258	258	-	-	-	1.5	0.9	-	2.4	33.4	3.9	0.9	4.7
5/2	342	342	-	-	-	2.1	2.2	-	4.3	45.4	5.4	2.2	7.6
8/1	740	740	-	-	-	1.7	1.0	-	2.7	13.3	8.2	1.0	9.2
10/1	242	242	-	-	-	0.1	0.1	-	0.2	2.9	0.3	0.1	0.4
10/2	970	970	-	-	-	1.2	0.0	-	1.2	4.6	4.5	0.0	4.5
10/3	530	530	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0

C1	Stream: 1	PRC for Signalled Lanes (%):	-121.4	Total Delay for Signalled Lanes (pcuHr):	441.84	Cycle Time (s):	60
C1	Stream: 2	PRC for Signalled Lanes (%):	9.5	Total Delay for Signalled Lanes (pcuHr):	8.15	Cycle Time (s):	60
		PRC Over All Lanes (%):	-121.4	Total Delay Over All Lanes(pcuHr):	451.67		

APPENDIX 2

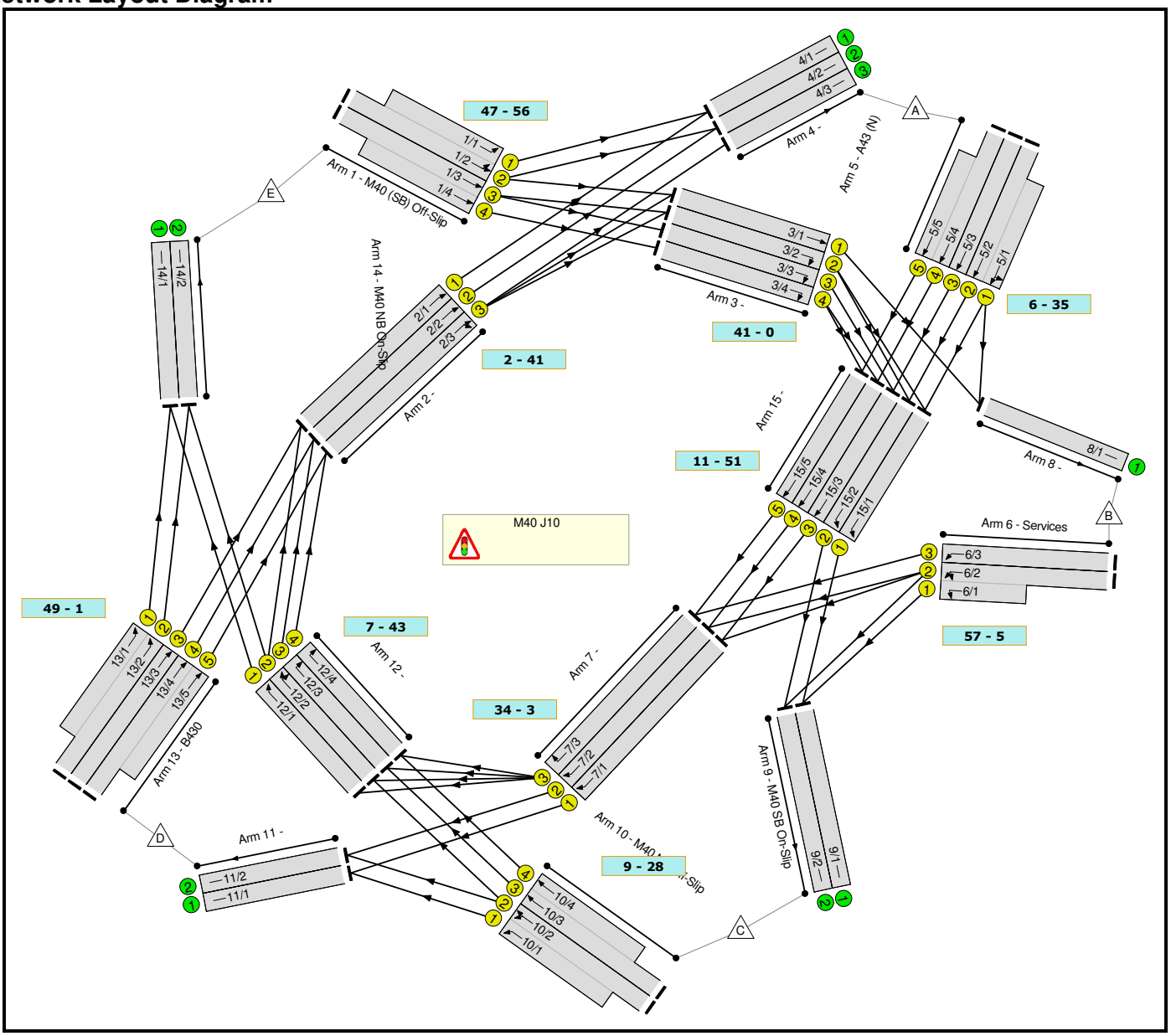
Option 3A – LinSig results

Full Input Data And Results

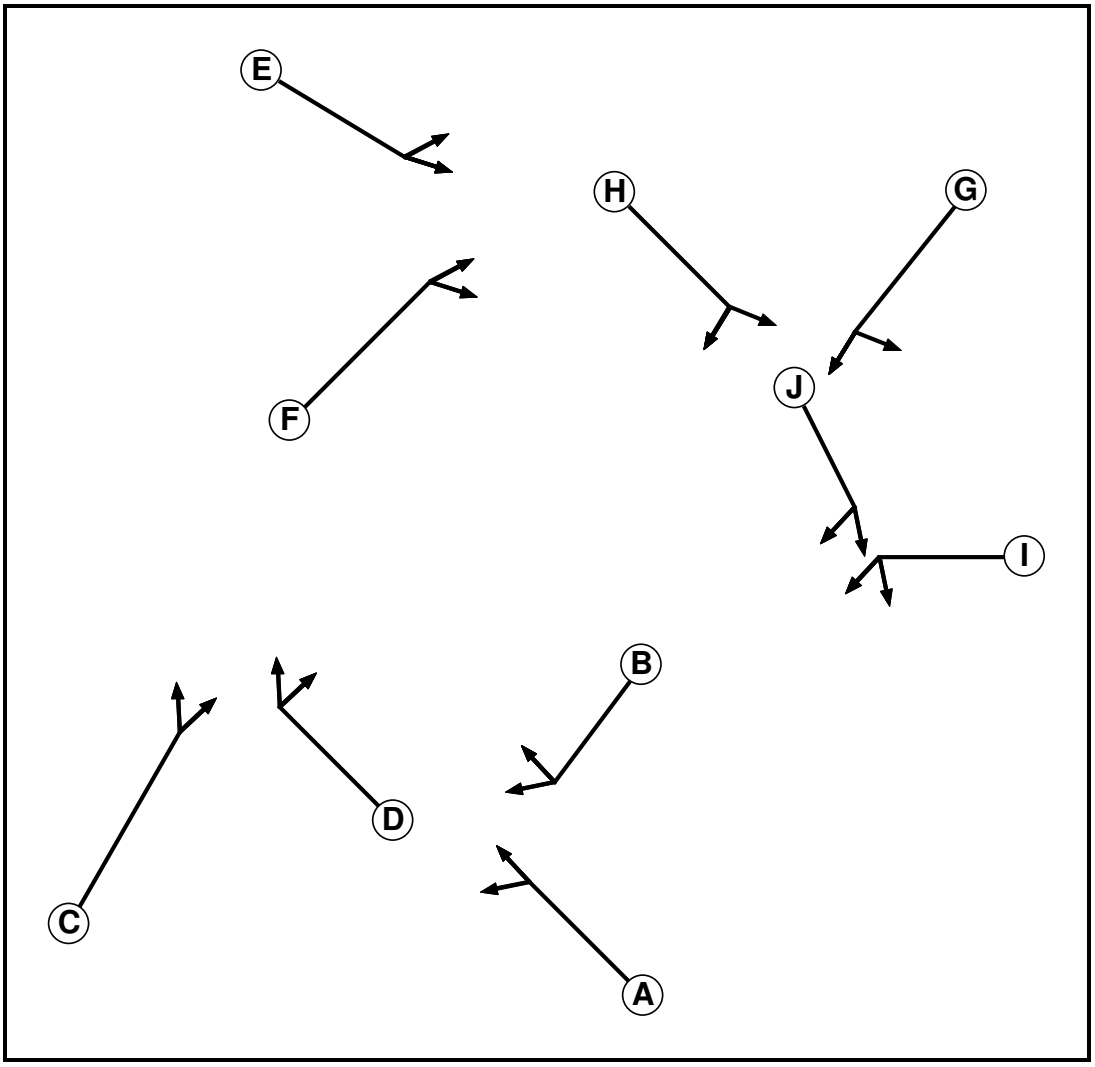
User and Project Details

Project:	**Oxfordshire SRFI**
Title:	**Single grade-separated roundabout - Option 3A**
Location:	
Additional detail:	
File name:	210927 M4J10 two bridge roundabout 3A.lsg3x
Author:	Mark Higgins
Company:	ADC Infrastructure
Address:	Nottingham

Network Layout Diagram



Phase Diagram



Phase Input Data

Phase Name	Phase Type	Stage Stream	Assoc. Phase	Street Min	Cont Min
A	Traffic	1		7	7
B	Traffic	1		7	7
C	Traffic	2		7	7
D	Traffic	2		7	7
E	Traffic	3		7	7
F	Traffic	3		7	7
G	Traffic	4		7	7
H	Traffic	4		7	7
I	Traffic	5		7	7
J	Traffic	5		7	7

Phase Intergreens Matrix

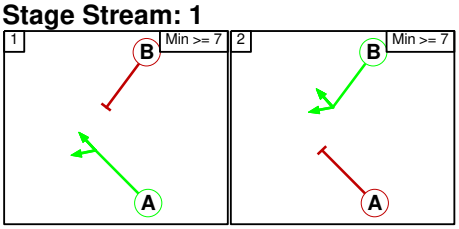
		Starting Phase									
		A	B	C	D	E	F	G	H	I	J
Terminating Phase	A		6	-	-	-	-	-	-	-	-
	B	6		-	-	-	-	-	-	-	-
	C	-	-		6	-	-	-	-	-	-
	D	-	-	6		-	-	-	-	-	-
	E	-	-	-	-		6	-	-	-	-
	F	-	-	-	-	6		-	-	-	-
	G	-	-	-	-	-	-		6	-	-
	H	-	-	-	-	-	-	6		-	-
	I	-	-	-	-	-	-	-	-		6
	J	-	-	-	-	-	-	-	-	6	

Phases in Stage

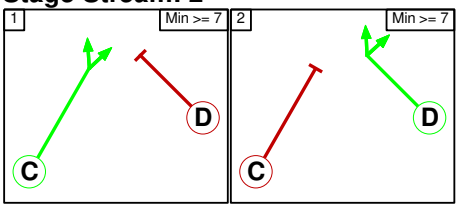
Stream	Stage No.	Phases in Stage
1	1	A
1	2	B
2	1	C
2	2	D
3	1	E
3	2	F
4	1	G
4	2	H
5	1	I
5	2	J

Stage Diagram

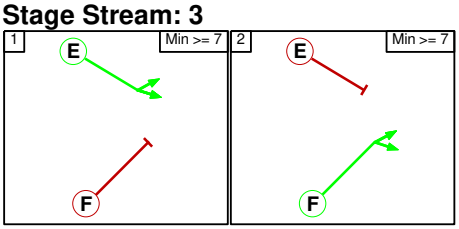
Stage Stream: 1



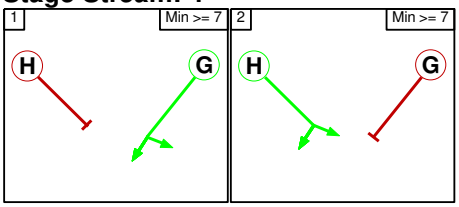
Stage Stream: 2



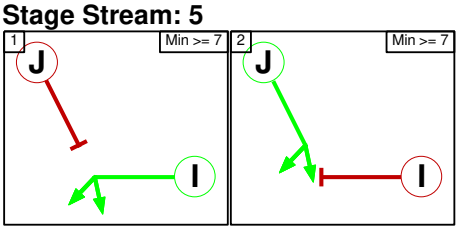
Stage Stream: 3



Stage Stream: 4



Stage Stream: 5



Prohibited Stage Change

Stage Stream: 1

	To Stage		
From Stage		1	2
	1		6
	2	6	

Stage Stream: 2

	To Stage		
From Stage		1	2
	1		6
	2	6	

Stage Stream: 3

	To Stage		
From Stage		1	2
	1		6
	2	6	

Stage Stream: 4

	To Stage		
From Stage		1	2
	1		6
	2	6	

Stage Stream: 5

	To Stage		
From Stage		1	2
	1		6
	2	6	

Lane Input Data

Junction: M40 J10												
Lane	Lane Type	Phases	Start Disp.	End Disp.	Physical Length (PCU)	Sat Flow Type	Def User Saturation Flow (PCU/Hr)	Lane Width (m)	Gradient	Nearside Lane	Turns	Turning Radius (m)
1/1 (M40 (SB) Off-Slip)	U	E	2	3	19.1	User	2000	-	-	-	-	-
1/2 (M40 (SB) Off-Slip)	U	E	2	3	60.0	User	2000	-	-	-	-	-
1/3 (M40 (SB) Off-Slip)	U	E	2	3	60.0	User	2000	-	-	-	-	-
1/4 (M40 (SB) Off-Slip)	U	E	2	3	10.4	User	2000	-	-	-	-	-
2/1	U	F	2	3	34.8	User	2000	-	-	-	-	-
2/2	U	F	2	3	34.8	User	2000	-	-	-	-	-
2/3	U	F	2	3	34.8	User	2000	-	-	-	-	-
3/1	U	H	2	3	10.4	User	2000	-	-	-	-	-
3/2	U	H	2	3	10.4	User	2000	-	-	-	-	-
3/3	U	H	2	3	10.4	User	2000	-	-	-	-	-
3/4	U	H	2	3	10.4	User	2000	-	-	-	-	-
4/1	U		2	3	60.0	Inf	-	-	-	-	-	-
4/2	U		2	3	60.0	Inf	-	-	-	-	-	-
4/3	U		2	3	60.0	Inf	-	-	-	-	-	-
5/1 (A43 (N))	U	G	2	3	15.7	User	2000	-	-	-	-	-
5/2 (A43 (N))	U	G	2	3	60.0	User	2000	-	-	-	-	-
5/3 (A43 (N))	U	G	2	3	60.0	User	2000	-	-	-	-	-
5/4 (A43 (N))	U	G	2	3	60.0	User	2000	-	-	-	-	-
5/5 (A43 (N))	U	G	2	3	15.7	User	2000	-	-	-	-	-
6/1 (Services)	U	I	2	3	7.0	User	1900	-	-	-	-	-
6/2 (Services)	U	I	2	3	60.0	User	1900	-	-	-	-	-
6/3 (Services)	U	I	2	3	60.0	User	1900	-	-	-	-	-
7/1	U	B	2	3	21.7	User	2000	-	-	-	-	-
7/2	U	B	2	3	21.7	User	2000	-	-	-	-	-
7/3	U	B	2	3	21.7	User	2000	-	-	-	-	-
8/1	U		2	3	60.0	Inf	-	-	-	-	-	-
9/1 (M40 SB On-Slip)	U		2	3	60.0	Inf	-	-	-	-	-	-
9/2 (M40 SB On-Slip)	U		2	3	60.0	Inf	-	-	-	-	-	-

10/1 (M40 NB Off-Slip)	U	A	2	3	17.4	User	2000	-	-	-	-	-
10/2 (M40 NB Off-Slip)	U	A	2	3	60.0	User	2000	-	-	-	-	-
10/3 (M40 NB Off-Slip)	U	A	2	3	60.0	User	2000	-	-	-	-	-
10/4 (M40 NB Off-Slip)	U	A	2	3	17.4	User	2000	-	-	-	-	-
11/1	U		2	3	10.4	Inf	-	-	-	-	-	-
11/2	U		2	3	10.4	Inf	-	-	-	-	-	-
12/1	U	D	2	3	13.9	User	2000	-	-	-	-	-
12/2	U	D	2	3	13.9	User	2000	-	-	-	-	-
12/3	U	D	2	3	13.9	User	2000	-	-	-	-	-
12/4	U	D	2	3	13.9	User	2000	-	-	-	-	-
13/1 (B430)	U	C	2	3	21.7	User	2000	-	-	-	-	-
13/2 (B430)	U	C	2	3	60.0	User	2000	-	-	-	-	-
13/3 (B430)	U	C	2	3	60.0	User	2000	-	-	-	-	-
13/4 (B430)	U	C	2	3	60.0	User	2000	-	-	-	-	-
13/5 (B430)	U	C	2	3	21.7	User	2000	-	-	-	-	-
14/1 (M40 NB On-Slip)	U		2	3	10.4	Inf	-	-	-	-	-	-
14/2 (M40 NB On-Slip)	U		2	3	10.4	Inf	-	-	-	-	-	-
15/1	U	J	2	3	22.6	User	2000	-	-	-	-	-
15/2	U	J	2	3	22.6	User	2000	-	-	-	-	-
15/3	U	J	2	3	22.6	User	2000	-	-	-	-	-
15/4	U	J	2	3	22.6	User	2000	-	-	-	-	-
15/5	U	J	2	3	22.6	User	2000	-	-	-	-	-

Traffic Flow Groups

Flow Group	Start Time	End Time	Duration	Formula
5: '2031 do some AM'	07:45	08:45	01:00	
6: '2031 do some PM'	16:30	17:30	01:00	

Scenario 1: '2031 do something AM' (FG5: '2031 do some AM', Plan 1: 'Network Control Plan 1')

Traffic Flows, Desired

Desired Flow :

		Destination					
		A	B	C	D	E	Tot.
Origin	A	0	124	1605	858	264	2851
	B	85	0	295	57	145	582
	C	1169	211	40	446	0	1866
	D	408	28	242	0	391	1069
	E	337	219	0	506	13	1075
	Tot.	1999	582	2182	1867	813	7443

Traffic Lane Flows

Lane	Scenario 1: 2031 do something AM
Junction: M40 J10	
1/1 (short)	271
1/2 (with short)	556(In) 285(Out)
1/3 (with short)	519(In) 270(Out)
1/4 (short)	249
2/1	668
2/2	737
2/3	778
3/1	458
3/2	282
3/3	270
3/4	249
4/1	939
4/2	803
4/3	257
5/1 (short)	878
5/2 (with short)	1729(In) 851(Out)
5/3	388
5/4 (with short)	734(In) 470(Out)
5/5 (short)	264
6/1 (short)	173
6/2 (with short)	352(In) 179(Out)
6/3	230
7/1	695
7/2	726
7/3	507
8/1	582
9/1	1068
9/2	1114
10/1 (short)	413
10/2 (with short)	916(In) 503(Out)
10/3 (with short)	950(In) 468(Out)
10/4 (short)	482
11/1	1108

11/2	759
12/1	212
12/2	710
12/3	512
12/4	493
13/1 (short)	196
13/2 (with short)	391(In) 195(Out)
13/3	168
13/4 (with short)	510(In) 225(Out)
13/5 (short)	285
14/1	408
14/2	405
15/1	895
15/2	992
15/3	658
15/4	706
15/5	277

Lane Saturation Flows

Junction: M40 J10								
Lane	**Lane Width (m)**	**Gradient**	**Nearside Lane**	**Allowed Turns**	**Turning Radius (m)**	**Turning Prop.**	**Sat Flow (PCU/Hr)**	**Flared Sat Flow (PCU/Hr)**
1/1 (M40 (SB) Off-Slip Lane 1)	This lane uses a directly entered Saturation Flow						2000	2000
1/2 (M40 (SB) Off-Slip Lane 2)	This lane uses a directly entered Saturation Flow						2000	2000
1/3 (M40 (SB) Off-Slip Lane 3)	This lane uses a directly entered Saturation Flow						2000	2000
1/4 (M40 (SB) Off-Slip Lane 4)	This lane uses a directly entered Saturation Flow						2000	2000
2/1	This lane uses a directly entered Saturation Flow						2000	2000
2/2	This lane uses a directly entered Saturation Flow						2000	2000
2/3	This lane uses a directly entered Saturation Flow						2000	2000
3/1	This lane uses a directly entered Saturation Flow						2000	2000
3/2	This lane uses a directly entered Saturation Flow						2000	2000
3/3	This lane uses a directly entered Saturation Flow						2000	2000
3/4	This lane uses a directly entered Saturation Flow						2000	2000
4/1	Infinite Saturation Flow						Inf	Inf
4/2	Infinite Saturation Flow						Inf	Inf
4/3	Infinite Saturation Flow						Inf	Inf
5/1 (A43 (N) Lane 1)	This lane uses a directly entered Saturation Flow						2000	2000
5/2 (A43 (N) Lane 2)	This lane uses a directly entered Saturation Flow						2000	2000
5/3 (A43 (N) Lane 3)	This lane uses a directly entered Saturation Flow						2000	2000
5/4 (A43 (N) Lane 4)	This lane uses a directly entered Saturation Flow						2000	2000
5/5 (A43 (N) Lane 5)	This lane uses a directly entered Saturation Flow						2000	2000
6/1 (Services Lane 1)	This lane uses a directly entered Saturation Flow						1900	1900
6/2 (Services Lane 2)	This lane uses a directly entered Saturation Flow						1900	1900
6/3 (Services Lane 3)	This lane uses a directly entered Saturation Flow						1900	1900
7/1	This lane uses a directly entered Saturation Flow						2000	2000
7/2	This lane uses a directly entered Saturation Flow						2000	2000
7/3	This lane uses a directly entered Saturation Flow						2000	2000
8/1	Infinite Saturation Flow						Inf	Inf
9/1 (M40 SB On-Slip Lane 1)	Infinite Saturation Flow						Inf	Inf
9/2 (M40 SB On-Slip Lane 2)	Infinite Saturation Flow						Inf	Inf
10/1 (M40 NB Off-Slip Lane 1)	This lane uses a directly entered Saturation Flow						2000	2000

10/2 (M40 NB Off-Slip Lane 2)	This lane uses a directly entered Saturation Flow	2000	2000
10/3 (M40 NB Off-Slip Lane 3)	This lane uses a directly entered Saturation Flow	2000	2000
10/4 (M40 NB Off-Slip Lane 4)	This lane uses a directly entered Saturation Flow	2000	2000
11/1	Infinite Saturation Flow	Inf	Inf
11/2	Infinite Saturation Flow	Inf	Inf
12/1	This lane uses a directly entered Saturation Flow	2000	2000
12/2	This lane uses a directly entered Saturation Flow	2000	2000
12/3	This lane uses a directly entered Saturation Flow	2000	2000
12/4	This lane uses a directly entered Saturation Flow	2000	2000
13/1 (B430 Lane 1)	This lane uses a directly entered Saturation Flow	2000	2000
13/2 (B430 Lane 2)	This lane uses a directly entered Saturation Flow	2000	2000
13/3 (B430 Lane 3)	This lane uses a directly entered Saturation Flow	2000	2000
13/4 (B430 Lane 4)	This lane uses a directly entered Saturation Flow	2000	2000
13/5 (B430 Lane 5)	This lane uses a directly entered Saturation Flow	2000	2000
14/1 (M40 NB On-Slip Lane 1)	Infinite Saturation Flow	Inf	Inf
14/2 (M40 NB On-Slip Lane 2)	Infinite Saturation Flow	Inf	Inf
15/1	This lane uses a directly entered Saturation Flow	2000	2000
15/2	This lane uses a directly entered Saturation Flow	2000	2000
15/3	This lane uses a directly entered Saturation Flow	2000	2000
15/4	This lane uses a directly entered Saturation Flow	2000	2000
15/5	This lane uses a directly entered Saturation Flow	2000	2000

Scenario 2: '2031 do something PM' (FG6: '2031 do some PM', Plan 1: 'Network Control Plan 1')

Traffic Flows, Desired

Desired Flow :

		Destination					
		A	B	C	D	E	Tot.
Origin	A	0	107	939	405	271	1722
	B	129	0	258	17	196	600
	C	1657	248	67	301	0	2273
	D	689	20	405	0	427	1541
	E	318	229	0	362	18	927
	Tot.	2793	604	1669	1085	912	7063

Traffic Lane Flows

Lane	Scenario 2: 2031 do something PM
Junction: M40 J10	
1/1 (short)	266
1/2 (with short)	547(In) 281(Out)
1/3 (with short)	380(In) 213(Out)
1/4 (short)	167
2/1	1062
2/2	1075
2/3	1078
3/1	497
3/2	472
3/3	213
3/4	167
4/1	1328
4/2	1127
4/3	338
5/1 (short)	524
5/2 (with short)	1046(In) 522(Out)
5/3	136
5/4 (with short)	540(In) 269(Out)
5/5 (short)	271
6/1 (short)	135
6/2 (with short)	275(In) 140(Out)
6/3	325
7/1	363
7/2	421
7/3	614
8/1	604
9/1	824
9/2	845
10/1 (short)	301
10/2 (with short)	975(In) 674(Out)
10/3 (with short)	1298(In) 701(Out)
10/4 (short)	597
11/1	664

11/2	421
12/1	307
12/2	906
12/3	740
12/4	633
13/1 (short)	214
13/2 (with short)	427(In) 213(Out)
13/3	334
13/4 (with short)	780(In) 335(Out)
13/5 (short)	445
14/1	521
14/2	391
15/1	689
15/2	722
15/3	349
15/4	418
15/5	289

Lane Saturation Flows

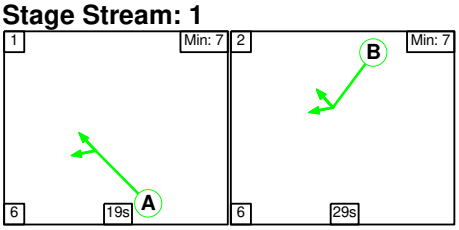
Junction: M40 J10								
Lane	**Lane Width (m)**	**Gradient**	**Nearside Lane**	**Allowed Turns**	**Turning Radius (m)**	**Turning Prop.**	**Sat Flow (PCU/Hr)**	**Flared Sat Flow (PCU/Hr)**
1/1 (M40 (SB) Off-Slip Lane 1)	This lane uses a directly entered Saturation Flow						2000	2000
1/2 (M40 (SB) Off-Slip Lane 2)	This lane uses a directly entered Saturation Flow						2000	2000
1/3 (M40 (SB) Off-Slip Lane 3)	This lane uses a directly entered Saturation Flow						2000	2000
1/4 (M40 (SB) Off-Slip Lane 4)	This lane uses a directly entered Saturation Flow						2000	2000
2/1	This lane uses a directly entered Saturation Flow						2000	2000
2/2	This lane uses a directly entered Saturation Flow						2000	2000
2/3	This lane uses a directly entered Saturation Flow						2000	2000
3/1	This lane uses a directly entered Saturation Flow						2000	2000
3/2	This lane uses a directly entered Saturation Flow						2000	2000
3/3	This lane uses a directly entered Saturation Flow						2000	2000
3/4	This lane uses a directly entered Saturation Flow						2000	2000
4/1	Infinite Saturation Flow						Inf	Inf
4/2	Infinite Saturation Flow						Inf	Inf
4/3	Infinite Saturation Flow						Inf	Inf
5/1 (A43 (N) Lane 1)	This lane uses a directly entered Saturation Flow						2000	2000
5/2 (A43 (N) Lane 2)	This lane uses a directly entered Saturation Flow						2000	2000
5/3 (A43 (N) Lane 3)	This lane uses a directly entered Saturation Flow						2000	2000
5/4 (A43 (N) Lane 4)	This lane uses a directly entered Saturation Flow						2000	2000
5/5 (A43 (N) Lane 5)	This lane uses a directly entered Saturation Flow						2000	2000
6/1 (Services Lane 1)	This lane uses a directly entered Saturation Flow						1900	1900
6/2 (Services Lane 2)	This lane uses a directly entered Saturation Flow						1900	1900
6/3 (Services Lane 3)	This lane uses a directly entered Saturation Flow						1900	1900
7/1	This lane uses a directly entered Saturation Flow						2000	2000
7/2	This lane uses a directly entered Saturation Flow						2000	2000
7/3	This lane uses a directly entered Saturation Flow						2000	2000
8/1	Infinite Saturation Flow						Inf	Inf
9/1 (M40 SB On-Slip Lane 1)	Infinite Saturation Flow						Inf	Inf
9/2 (M40 SB On-Slip Lane 2)	Infinite Saturation Flow						Inf	Inf
10/1 (M40 NB Off-Slip Lane 1)	This lane uses a directly entered Saturation Flow						2000	2000

10/2 (M40 NB Off-Slip Lane 2)	This lane uses a directly entered Saturation Flow	2000	2000
10/3 (M40 NB Off-Slip Lane 3)	This lane uses a directly entered Saturation Flow	2000	2000
10/4 (M40 NB Off-Slip Lane 4)	This lane uses a directly entered Saturation Flow	2000	2000
11/1	Infinite Saturation Flow	Inf	Inf
11/2	Infinite Saturation Flow	Inf	Inf
12/1	This lane uses a directly entered Saturation Flow	2000	2000
12/2	This lane uses a directly entered Saturation Flow	2000	2000
12/3	This lane uses a directly entered Saturation Flow	2000	2000
12/4	This lane uses a directly entered Saturation Flow	2000	2000
13/1 (B430 Lane 1)	This lane uses a directly entered Saturation Flow	2000	2000
13/2 (B430 Lane 2)	This lane uses a directly entered Saturation Flow	2000	2000
13/3 (B430 Lane 3)	This lane uses a directly entered Saturation Flow	2000	2000
13/4 (B430 Lane 4)	This lane uses a directly entered Saturation Flow	2000	2000
13/5 (B430 Lane 5)	This lane uses a directly entered Saturation Flow	2000	2000
14/1 (M40 NB On-Slip Lane 1)	Infinite Saturation Flow	Inf	Inf
14/2 (M40 NB On-Slip Lane 2)	Infinite Saturation Flow	Inf	Inf
15/1	This lane uses a directly entered Saturation Flow	2000	2000
15/2	This lane uses a directly entered Saturation Flow	2000	2000
15/3	This lane uses a directly entered Saturation Flow	2000	2000
15/4	This lane uses a directly entered Saturation Flow	2000	2000
15/5	This lane uses a directly entered Saturation Flow	2000	2000

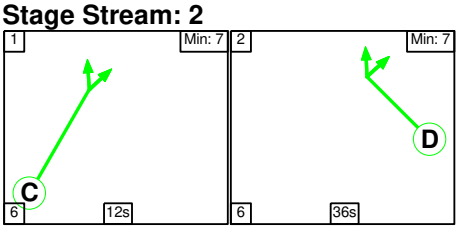
Scenario 1: '2031 do something AM' (FG5: '2031 do some AM', Plan 1: 'Network Control Plan 1')

Stage Sequence Diagram

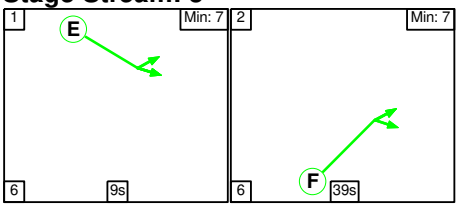
Stage Stream: 1



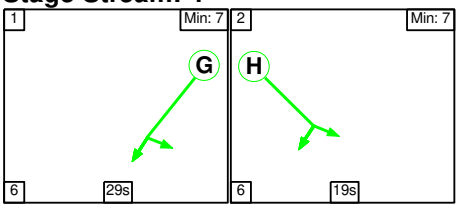
Stage Stream: 2



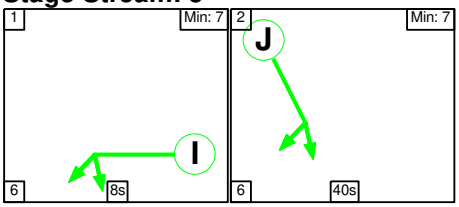
Stage Stream: 3



Stage Stream: 4



Stage Stream: 5



Stage Timings

Stage Stream: 1

Stage	1	2
Duration	19	29
Change Point	3	28

Stage Stream: 2

Stage	1	2
Duration	12	36
Change Point	43	1

Stage Stream: 3

Stage	1	2
Duration	9	39
Change Point	41	56

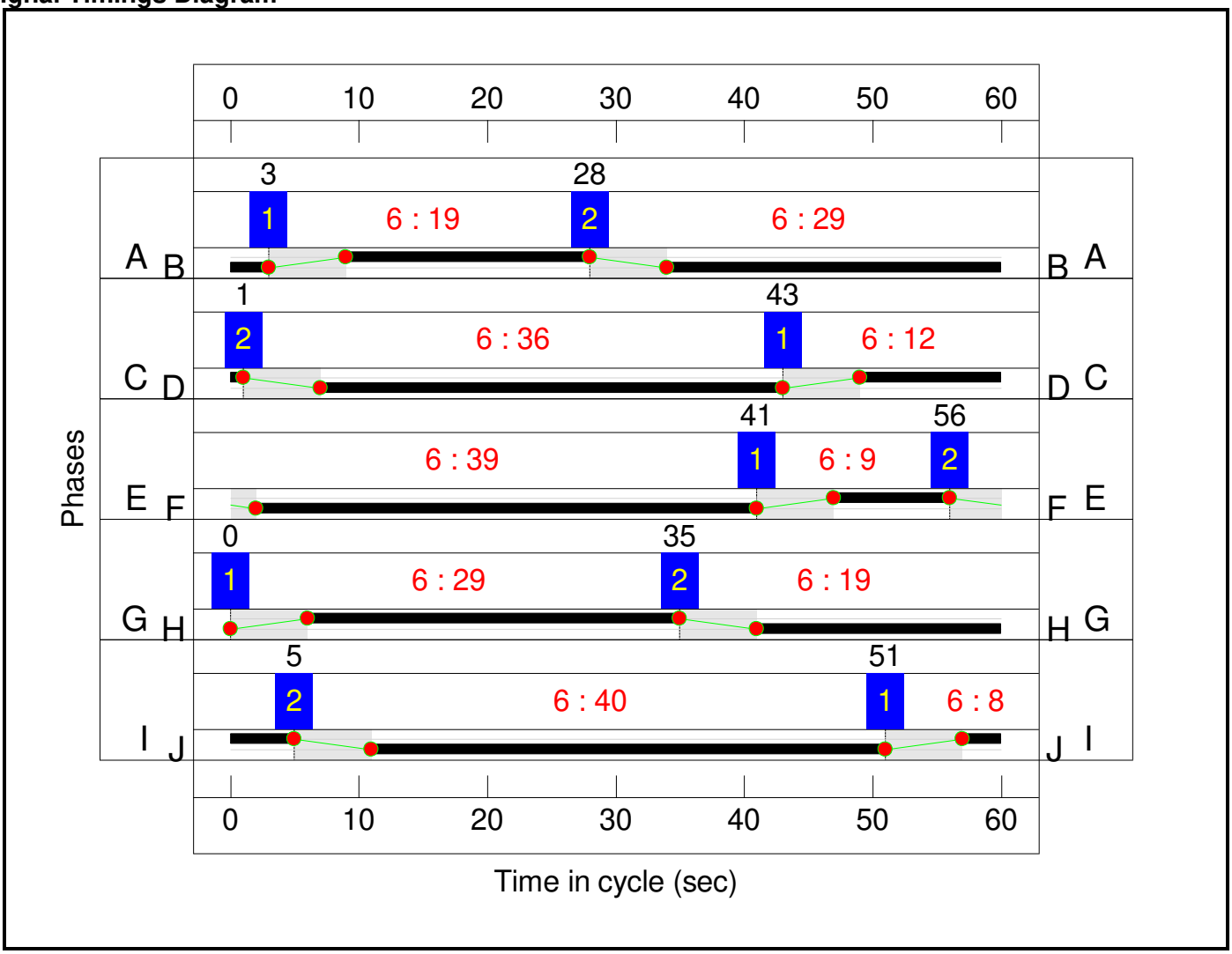
Stage Stream: 4

Stage	1	2
Duration	29	19
Change Point	0	35

Stage Stream: 5

Stage	1	2
Duration	8	40
Change Point	51	5

Signal Timings Diagram



Network Results

Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)
Network: Single grade-seperated roundabout - Option 3A	**-**	**-**	**N/A**	**-**	**-**		**-**	**-**	**-**	**-**	**-**	**-**	**89.3%**
M40 J10	**-**	**-**	**N/A**	**-**	**-**		**-**	**-**	**-**	**-**	**-**	**-**	**89.3%**
1/2+1/1	M40 (SB) Off-Slip Ahead Left	U	3	N/A	E		1	9	-	556	2000:2000	333+333	85.5 : 81.3%
1/3+1/4	M40 (SB) Off-Slip Ahead	U	3	N/A	E		1	9	-	519	2000:2000	333+333	81.0 : 74.7%
2/1	Ahead	U	3	N/A	F		1	39	-	668	2000	1333	50.1%
2/2	Ahead	U	3	N/A	F		1	39	-	737	2000	1333	55.3%
2/3	Right Ahead	U	3	N/A	F		1	39	-	778	2000	1333	58.4%
3/1	Ahead	U	4	N/A	H		1	19	-	458	2000	667	68.7%
3/2	Right	U	4	N/A	H		1	19	-	282	2000	667	42.3%
3/3	Right	U	4	N/A	H		1	19	-	270	2000	667	40.5%
3/4	Right	U	4	N/A	H		1	19	-	249	2000	667	37.4%
5/2+5/1	A43 (N) Left Ahead	U	4	N/A	G		1	29	-	1729	2000:2000	953+984	89.3 : 89.3%
5/3	A43 (N) Ahead	U	4	N/A	G		1	29	-	388	2000	1000	38.8%
5/4+5/5	A43 (N) Ahead	U	4	N/A	G		1	29	-	734	2000:2000	993+558	47.3 : 47.3%
6/2+6/1	Services Left Left2	U	5	N/A	I		1	8	-	352	1900:1900	285+285	62.8 : 60.7%
6/3	Services Left	U	5	N/A	I		1	8	-	230	1900	285	80.7%
7/1	Ahead	U	1	N/A	B		1	29	-	695	2000	1000	69.5%
7/2	Ahead	U	1	N/A	B		1	29	-	726	2000	1000	72.6%
7/3	Right	U	1	N/A	B		1	29	-	507	2000	1000	50.7%
10/2+10/1	M40 NB Off-Slip Left Ahead	U	1	N/A	A		1	19	-	916	2000:2000	667+667	75.5 : 62.0%
10/3+10/4	M40 NB Off-Slip Ahead	U	1	N/A	A		1	19	-	950	2000:2000	667+667	70.2 : 72.3%
12/1	Ahead	U	2	N/A	D		1	36	-	212	2000	1233	17.2%

12/2	Right Ahead	U	2	N/A	D		1	36	-	710	2000	1233	57.6%
12/3	Right	U	2	N/A	D		1	36	-	512	2000	1233	41.5%
12/4	Right	U	2	N/A	D		1	36	-	493	2000	1233	40.0%
13/2+13/1	B430 Ahead	U	2	N/A	C		1	12	-	391	2000:2000	433+433	45.0 : 45.2%
13/3	B430 Ahead	U	2	N/A	C		1	12	-	168	2000	433	38.8%
13/4+13/5	B430 Ahead	U	2	N/A	C		1	12	-	510	2000:2000	433+433	51.9 : 65.8%
15/1	Ahead	U	5	N/A	J		1	40	-	895	2000	1367	65.5%
15/2	Ahead	U	5	N/A	J		1	40	-	992	2000	1367	72.6%
15/3	Ahead	U	5	N/A	J		1	40	-	658	2000	1367	48.1%
15/4	Ahead	U	5	N/A	J		1	40	-	706	2000	1367	51.7%
15/5	Ahead	U	5	N/A	J		1	40	-	277	2000	1367	20.3%

Item	Arriving (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand + Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per PCU (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand + Oversat Queue (pcu)	Mean Max Queue (pcu)
Network: Single grade-seperated roundabout - Option 3A	**-**	**-**	**0**	**0**	**0**	**54.1**	**20.2**	**0.0**	**74.3**	**-**	**-**	**-**	**-**
M40 J10	**-**	**-**	**0**	**0**	**0**	**54.1**	**20.2**	**0.0**	**74.3**	**-**	**-**	**-**	**-**
1/2+1/1	556	556	-	-	-	3.7	2.4	-	6.1 (3.2+3.0)	39.8 (39.9:39.7)	4.6	2.4	7.0
1/3+1/4	519	519	-	-	-	3.5	1.7	-	5.2 (2.7+2.5)	35.9 (36.0:35.7)	4.3	1.7	6.0
2/1	668	668	-	-	-	0.5	0.5	-	1.0	5.6	3.7	0.5	4.2
2/2	737	737	-	-	-	0.6	0.6	-	1.2	5.8	4.7	0.6	5.3
2/3	778	778	-	-	-	0.6	0.7	-	1.3	5.8	5.3	0.7	6.0
3/1	458	458	-	-	-	1.0	0.0	-	1.0	8.0	4.1	0.0	4.1
3/2	282	282	-	-	-	2.3	0.0	-	2.3	29.2	4.7	0.0	4.7
3/3	270	270	-	-	-	0.1	0.0	-	0.1	0.9	0.1	0.0	0.1
3/4	249	249	-	-	-	0.0	0.0	-	0.0	0.7	0.1	0.0	0.1
5/2+5/1	1729	1729	-	-	-	6.3	4.0	-	10.4 (5.1+5.3)	21.6 (21.4:21.7)	12.9	4.0	16.9
5/3	388	388	-	-	-	1.0	0.3	-	1.3	12.2	4.0	0.3	4.3
5/4+5/5	734	734	-	-	-	1.9	0.4	-	2.4 (1.6+0.8)	11.6 (12.0:10.9)	5.1	0.4	5.5
6/2+6/1	352	352	-	-	-	2.3	0.8	-	3.1 (1.6+1.5)	32.1 (32.1:32.1)	2.8	0.8	3.6
6/3	230	230	-	-	-	1.6	2.0	-	3.5	55.2	3.7	2.0	5.7
7/1	695	695	-	-	-	2.9	1.1	-	4.0	20.9	11.3	1.1	12.5
7/2	726	726	-	-	-	2.9	1.3	-	4.2	20.9	11.9	1.3	13.2
7/3	507	507	-	-	-	2.8	0.5	-	3.3	23.3	7.9	0.5	8.4
10/2+10/1	916	916	-	-	-	4.4	1.1	-	5.5 (3.1+2.4)	21.7 (22.1:21.1)	7.4	1.1	8.5
10/3+10/4	950	950	-	-	-	4.6	1.2	-	5.8 (2.9+3.0)	22.2 (22.1:22.2)	7.0	1.2	8.2
12/1	212	212	-	-	-	0.8	0.0	-	0.8	12.7	2.3	0.0	2.3
12/2	710	710	-	-	-	1.0	0.0	-	1.0	5.3	3.2	0.0	3.2

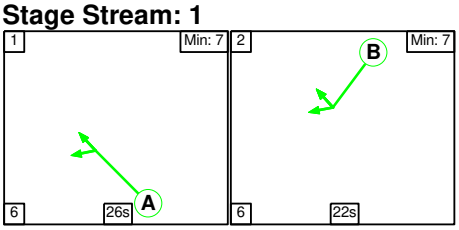
12/3	512	512	-	-	-	0.1	0.0	-	0.1	0.5	0.2	0.0	0.2
12/4	493	493	-	-	-	0.0	0.0	-	0.0	0.1	0.1	0.0	0.1
13/2+13/1	391	391	-	-	-	2.2	0.4	-	2.6 (1.3+1.3)	24.2 (24.2:24.2)	2.8	0.4	3.2
13/3	168	168	-	-	-	0.9	0.3	-	1.3	26.9	2.4	0.3	2.7
13/4+13/5	510	510	-	-	-	3.0	0.7	-	3.7 (1.6+2.1)	26.2 (25.8:26.5)	4.3	0.7	5.0
15/1	895	895	-	-	-	0.5	0.0	-	0.5	2.0	1.9	0.0	1.9
15/2	992	992	-	-	-	0.5	0.0	-	0.5	1.8	1.9	0.0	1.9
15/3	658	658	-	-	-	1.1	0.0	-	1.1	5.7	8.7	0.0	8.7
15/4	706	706	-	-	-	0.9	0.0	-	0.9	4.7	9.1	0.0	9.1
15/5	277	277	-	-	-	0.0	0.0	-	0.0	0.4	0.2	0.0	0.2

C1	Stream: 1	PRC for Signalled Lanes (%):	19.3	Total Delay for Signalled Lanes (pcuHr):	22.89	Cycle Time (s):	60
C1	Stream: 2	PRC for Signalled Lanes (%):	36.8	Total Delay for Signalled Lanes (pcuHr):	9.48	Cycle Time (s):	60
C1	Stream: 3	PRC for Signalled Lanes (%):	5.3	Total Delay for Signalled Lanes (pcuHr):	14.80	Cycle Time (s):	60
C1	Stream: 4	PRC for Signalled Lanes (%):	0.8	Total Delay for Signalled Lanes (pcuHr):	17.45	Cycle Time (s):	60
C1	Stream: 5	PRC for Signalled Lanes (%):	11.5	Total Delay for Signalled Lanes (pcuHr):	9.64	Cycle Time (s):	60
		PRC Over All Lanes (%):	0.8	Total Delay Over All Lanes(pcuHr):	74.27		

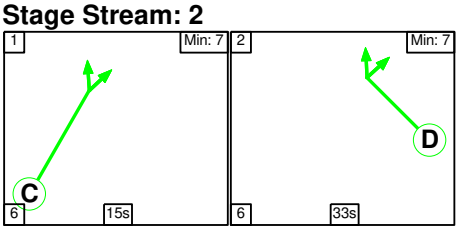
Scenario 2: '2031 do something PM' (FG6: '2031 do some PM', Plan 1: 'Network Control Plan 1')

Stage Sequence Diagram

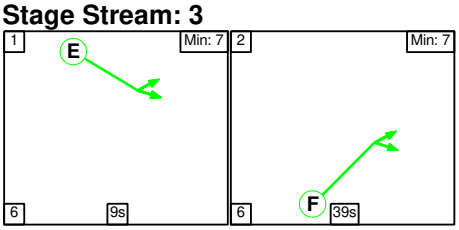
Stage Stream: 1



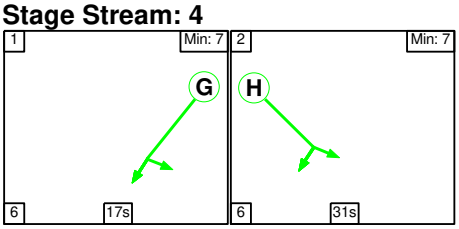
Stage Stream: 2



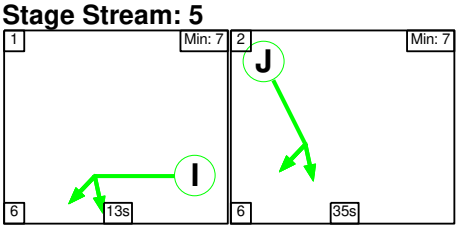
Stage Stream: 3



Stage Stream: 4



Stage Stream: 5



Stage Timings

Stage Stream: 1

Stage	1	2
Duration	26	22
Change Point	45	17

Stage Stream: 2

Stage	1	2
Duration	15	33
Change Point	20	41

Stage Stream: 3

Stage	1	2
Duration	9	39
Change Point	18	33

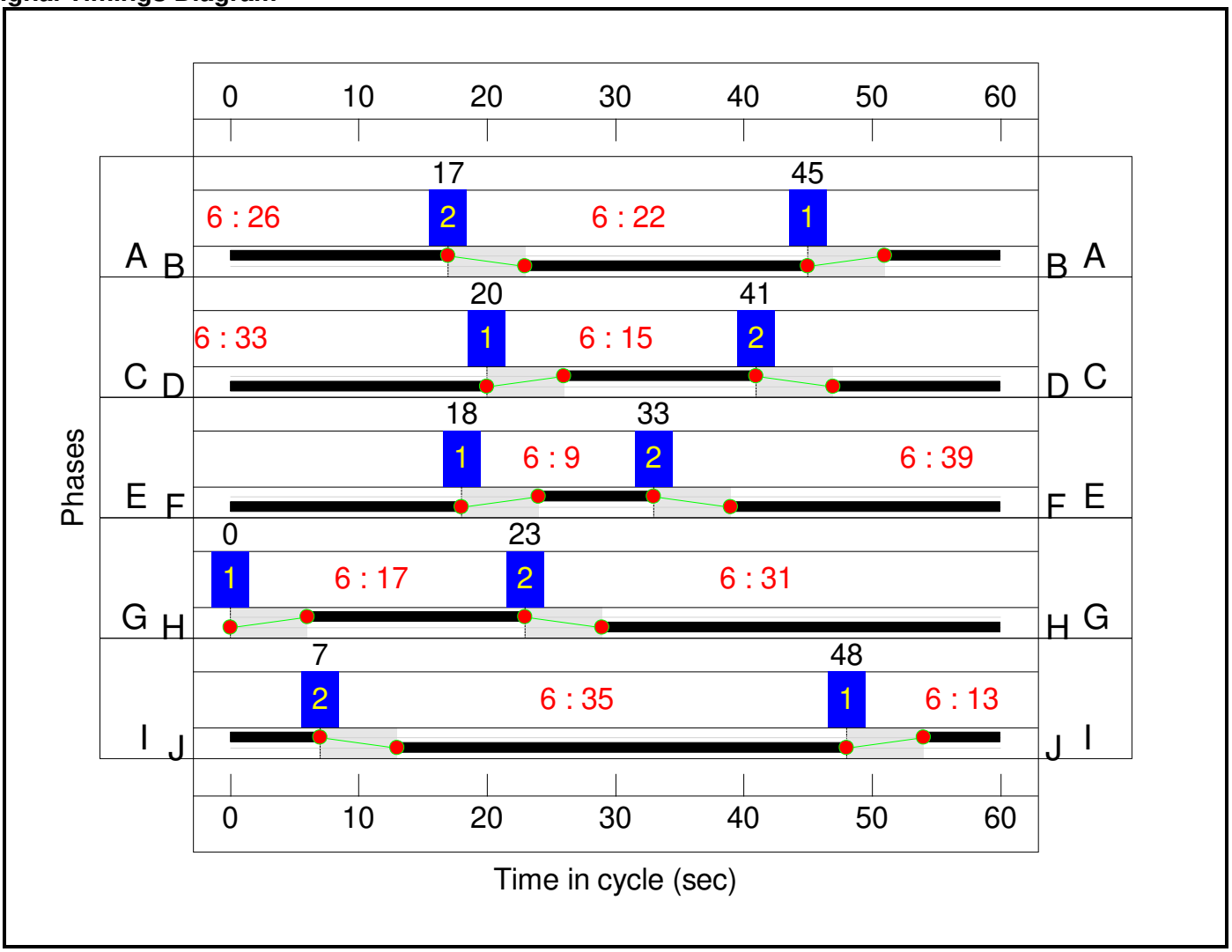
Stage Stream: 4

Stage	1	2
Duration	17	31
Change Point	0	23

Stage Stream: 5

Stage	1	2
Duration	13	35
Change Point	48	7

Signal Timings Diagram



Network Results

Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)
Network: Single grade-seperated roundabout - Option 3A	**-**	**-**	**N/A**	**-**	**-**		**-**	**-**	**-**	**-**	**-**	**-**	**87.3%**
M40 J10	**-**	**-**	**N/A**	**-**	**-**		**-**	**-**	**-**	**-**	**-**	**-**	**87.3%**
1/2+1/1	M40 (SB) Off-Slip Ahead Left	U	3	N/A	E		1	9	-	547	2000:2000	333+333	84.3 : 79.8%
1/3+1/4	M40 (SB) Off-Slip Ahead	U	3	N/A	E		1	9	-	380	2000:2000	333+333	63.9 : 50.1%
2/1	Ahead	U	3	N/A	F		1	39	-	1062	2000	1333	79.7%
2/2	Ahead	U	3	N/A	F		1	39	-	1075	2000	1333	80.6%
2/3	Right Ahead	U	3	N/A	F		1	39	-	1078	2000	1333	80.9%
3/1	Ahead	U	4	N/A	H		1	31	-	497	2000	1067	46.6%
3/2	Right	U	4	N/A	H		1	31	-	472	2000	1067	44.3%
3/3	Right	U	4	N/A	H		1	31	-	213	2000	1067	20.0%
3/4	Right	U	4	N/A	H		1	31	-	167	2000	1067	15.7%
5/2+5/1	A43 (N) Left Ahead	U	4	N/A	G		1	17	-	1046	2000:2000	600+600	87.0 : 87.3%
5/3	A43 (N) Ahead	U	4	N/A	G		1	17	-	136	2000	600	22.7%
5/4+5/5	A43 (N) Ahead	U	4	N/A	G		1	17	-	540	2000:2000	600+600	44.8 : 45.2%
6/2+6/1	Services Left Left2	U	5	N/A	I		1	13	-	275	1900:1900	436+421	32.1 : 32.1%
6/3	Services Left	U	5	N/A	I		1	13	-	325	1900	443	73.3%
7/1	Ahead	U	1	N/A	B		1	22	-	363	2000	767	47.3%
7/2	Ahead	U	1	N/A	B		1	22	-	421	2000	767	54.9%
7/3	Right	U	1	N/A	B		1	22	-	614	2000	767	80.1%
10/2+10/1	M40 NB Off-Slip Left Ahead	U	1	N/A	A		1	26	-	975	2000:2000	900+402	74.9 : 74.9%
10/3+10/4	M40 NB Off-Slip Ahead	U	1	N/A	A		1	26	-	1298	2000:2000	900+766	77.9 : 77.9%
12/1	Ahead	U	2	N/A	D		1	33	-	307	2000	1133	27.1%

12/2	Right Ahead	U	2	N/A	D		1	33	-	906	2000	1133	79.9%
12/3	Right	U	2	N/A	D		1	33	-	740	2000	1133	65.3%
12/4	Right	U	2	N/A	D		1	33	-	633	2000	1133	55.9%
13/2+13/1	B430 Ahead	U	2	N/A	C		1	15	-	427	2000:2000	533+533	39.9 : 40.1%
13/3	B430 Ahead	U	2	N/A	C		1	15	-	334	2000	533	62.6%
13/4+13/5	B430 Ahead	U	2	N/A	C		1	15	-	780	2000:2000	533+533	62.8 : 83.4%
15/1	Ahead	U	5	N/A	J		1	35	-	689	2000	1200	57.4%
15/2	Ahead	U	5	N/A	J		1	35	-	722	2000	1200	60.2%
15/3	Ahead	U	5	N/A	J		1	35	-	349	2000	1200	29.1%
15/4	Ahead	U	5	N/A	J		1	35	-	418	2000	1200	34.8%
15/5	Ahead	U	5	N/A	J		1	35	-	289	2000	1200	24.1%

Item	Arriving (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand + Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per PCU (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand + Oversat Queue (pcu)	Mean Max Queue (pcu)
Network: Single grade-seperated roundabout - Option 3A	**-**	**-**	**0**	**0**	**0**	**55.0**	**23.1**	**0.0**	**78.0**	**-**	**-**	**-**	**-**
M40 J10	**-**	**-**	**0**	**0**	**0**	**55.0**	**23.1**	**0.0**	**78.0**	**-**	**-**	**-**	**-**
1/2+1/1	547	547	-	-	-	3.7	2.2	-	5.9 (3.0+2.8)	38.7 (38.8:38.5)	4.5	2.2	6.7
1/3+1/4	380	380	-	-	-	2.4	0.7	-	3.1 (1.7+1.3)	29.3 (29.6:29.0)	3.3	0.7	3.9
2/1	1062	1062	-	-	-	2.6	1.9	-	4.5	15.3	11.4	1.9	13.3
2/2	1075	1075	-	-	-	2.8	2.0	-	4.9	16.4	12.2	2.0	14.3
2/3	1078	1078	-	-	-	2.2	2.1	-	4.3	14.3	12.3	2.1	14.4
3/1	497	497	-	-	-	0.9	0.0	-	0.9	6.3	6.2	0.0	6.2
3/2	472	472	-	-	-	0.9	0.0	-	0.9	7.0	2.3	0.0	2.3
3/3	213	213	-	-	-	0.1	0.0	-	0.1	1.0	3.1	0.0	3.1
3/4	167	167	-	-	-	0.0	0.0	-	0.0	1.0	2.3	0.0	2.3
5/2+5/1	1046	1046	-	-	-	5.8	3.3	-	9.0 (4.5+4.5)	31.1 (31.1:31.1)	8.2	3.3	11.4
5/3	136	136	-	-	-	0.6	0.1	-	0.7	19.7	1.7	0.1	1.8
5/4+5/5	540	540	-	-	-	2.6	0.4	-	3.0 (1.5+1.5)	19.7 (19.7:19.7)	3.6	0.4	4.0
6/2+6/1	275	275	-	-	-	1.5	0.2	-	1.7 (0.9+0.8)	22.1 (22.2:22.1)	1.9	0.2	2.1
6/3	325	325	-	-	-	1.9	1.3	-	3.3	36.2	5.0	1.3	6.3
7/1	363	363	-	-	-	1.9	0.4	-	2.3	23.1	4.9	0.4	5.3
7/2	421	421	-	-	-	1.3	0.6	-	1.9	16.3	5.6	0.6	6.2
7/3	614	614	-	-	-	2.7	2.0	-	4.7	27.3	10.0	2.0	12.0
10/2+10/1	975	975	-	-	-	3.5	1.5	-	4.9 (3.6+1.3)	18.2 (19.1:16.1)	9.2	1.5	10.7
10/3+10/4	1298	1298	-	-	-	4.9	1.7	-	6.6 (3.7+2.9)	18.3 (18.8:17.8)	9.7	1.7	11.5
12/1	307	307	-	-	-	1.1	0.0	-	1.1	13.4	5.1	0.0	5.1
12/2	906	906	-	-	-	1.0	0.0	-	1.0	4.1	4.3	0.0	4.3

12/3	740	740	-	-	-	0.4	0.0	-	0.4	1.7	1.1	0.0	1.1
12/4	633	633	-	-	-	0.3	0.0	-	0.3	1.8	1.0	0.0	1.0
13/2+13/1	427	427	-	-	-	2.1	0.3	-	2.5 (1.2+1.2)	20.9 (20.9:20.9)	2.9	0.3	3.2
13/3	334	334	-	-	-	1.8	0.8	-	2.6	28.3	4.8	0.8	5.7
13/4+13/5	780	780	-	-	-	4.4	1.3	-	5.7 (2.4+3.3)	26.4 (25.6:27.0)	6.9	1.3	8.3
15/1	689	689	-	-	-	0.9	0.0	-	0.9	4.5	9.1	0.0	9.1
15/2	722	722	-	-	-	0.7	0.0	-	0.7	3.5	10.6	0.0	10.6
15/3	349	349	-	-	-	0.1	0.0	-	0.1	0.6	0.2	0.0	0.2
15/4	418	418	-	-	-	0.0	0.0	-	0.0	0.3	0.1	0.0	0.1
15/5	289	289	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0

C1	Stream: 1	PRC for Signalled Lanes (%):	12.4	Total Delay for Signalled Lanes (pcuHr):	20.45	Cycle Time (s):	60
C1	Stream: 2	PRC for Signalled Lanes (%):	7.9	Total Delay for Signalled Lanes (pcuHr):	13.66	Cycle Time (s):	60
C1	Stream: 3	PRC for Signalled Lanes (%):	6.8	Total Delay for Signalled Lanes (pcuHr):	22.66	Cycle Time (s):	60
C1	Stream: 4	PRC for Signalled Lanes (%):	3.1	Total Delay for Signalled Lanes (pcuHr):	14.65	Cycle Time (s):	60
C1	Stream: 5	PRC for Signalled Lanes (%):	22.8	Total Delay for Signalled Lanes (pcuHr):	6.60	Cycle Time (s):	60
		PRC Over All Lanes (%):	3.1	Total Delay Over All Lanes(pcuHr):	78.02		

APPENDIX 3

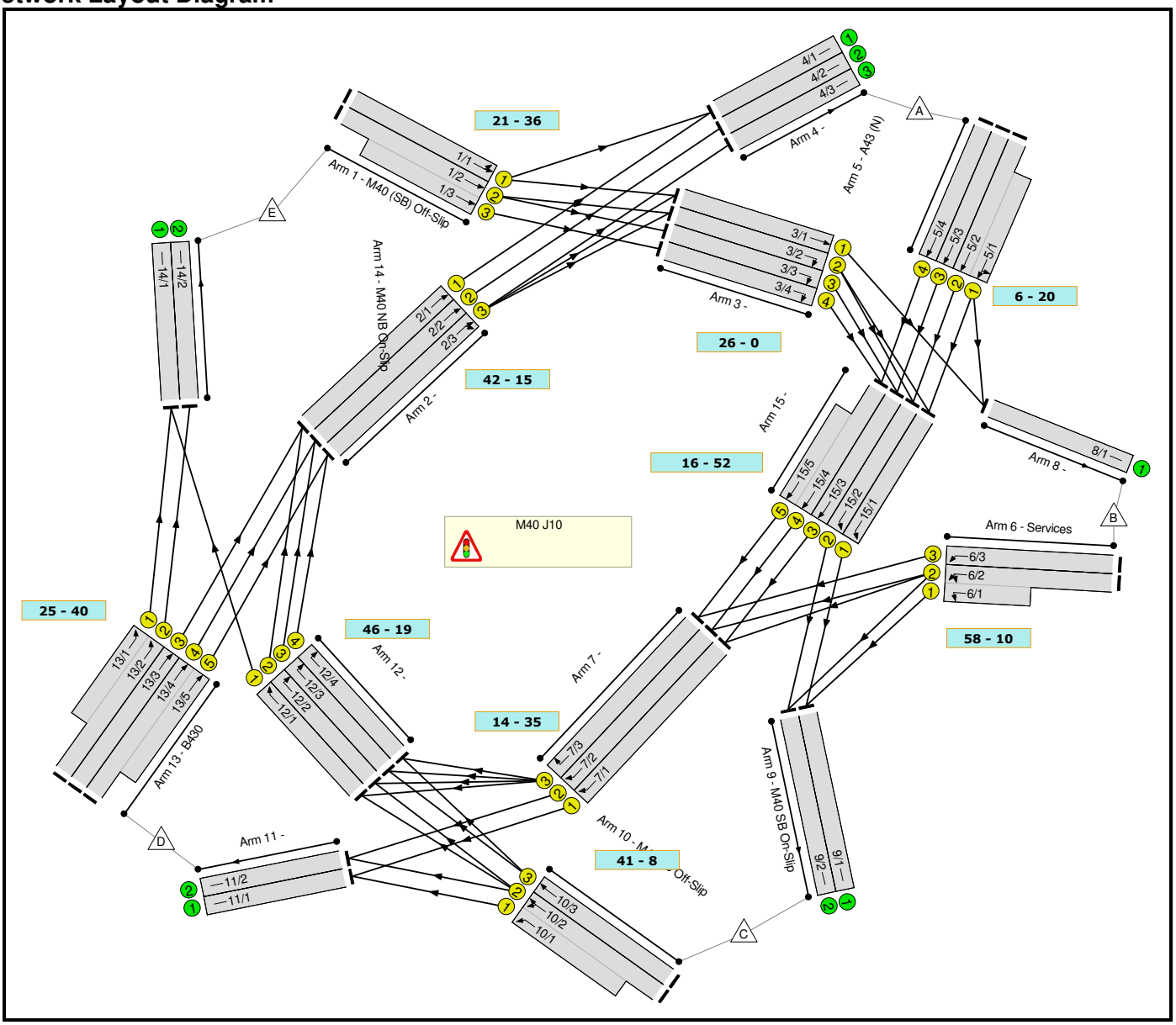
Option 3B – LinSig results

Full Input Data And Results

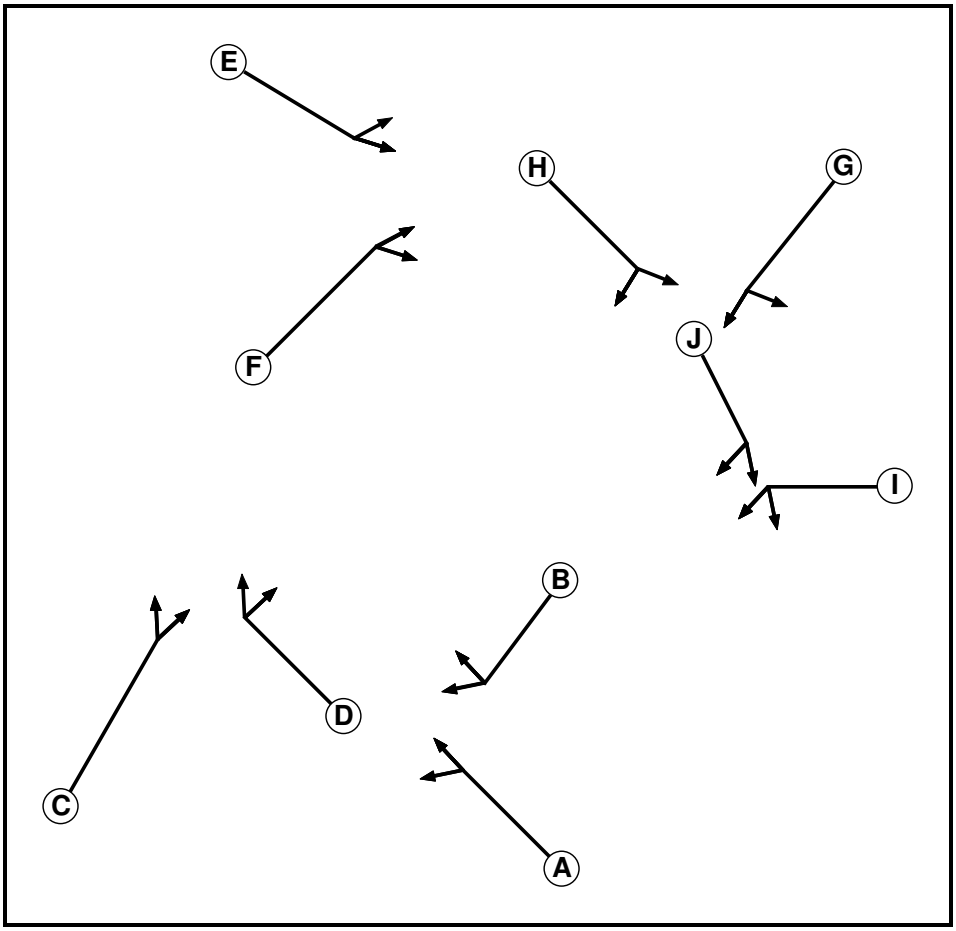
User and Project Details

Project:	**Oxfordshire SRFI**
Title:	**Single grade-separated roundabout - Option 3B**
Location:	
Additional detail:	
File name:	210928 M4J10 two bridge roundabout 3B.lsg3x
Author:	Mark Higgins
Company:	ADC Infrastructure
Address:	Nottingham

Network Layout Diagram



Phase Diagram



Phase Input Data

Phase Name	Phase Type	Stage Stream	Assoc. Phase	Street Min	Cont Min
A	Traffic	1		7	7
B	Traffic	1		7	7
C	Traffic	2		7	7
D	Traffic	2		7	7
E	Traffic	3		7	7
F	Traffic	3		7	7
G	Traffic	4		7	7
H	Traffic	4		7	7
I	Traffic	5		7	7
J	Traffic	5		7	7

Phase Intergreens Matrix

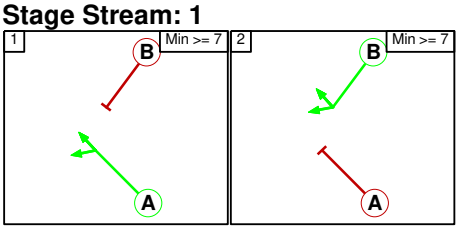
		Starting Phase									
		A	B	C	D	E	F	G	H	I	J
Terminating Phase	A		6	-	-	-	-	-	-	-	-
	B	6		-	-	-	-	-	-	-	-
	C	-	-		6	-	-	-	-	-	-
	D	-	-	6		-	-	-	-	-	-
	E	-	-	-	-		6	-	-	-	-
	F	-	-	-	-	6		-	-	-	-
	G	-	-	-	-	-	-		6	-	-
	H	-	-	-	-	-	-	6		-	-
	I	-	-	-	-	-	-	-	-		6
	J	-	-	-	-	-	-	-	-	6	

Phases in Stage

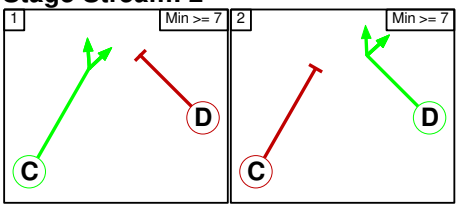
Stream	Stage No.	Phases in Stage
1	1	A
1	2	B
2	1	C
2	2	D
3	1	E
3	2	F
4	1	G
4	2	H
5	1	I
5	2	J

Stage Diagram

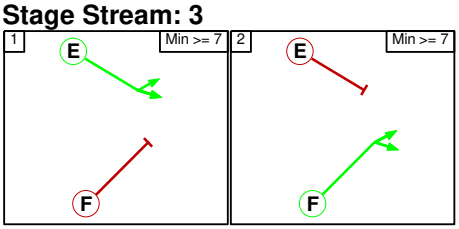
Stage Stream: 1



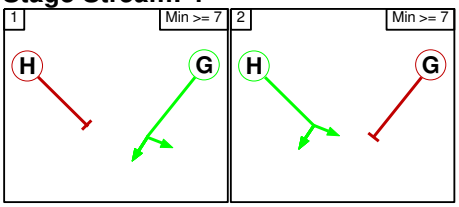
Stage Stream: 2



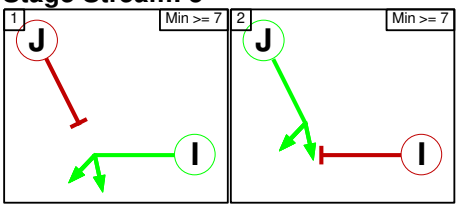
Stage Stream: 3



Stage Stream: 4



Stage Stream: 5



Prohibited Stage Change

Stage Stream: 1

	To Stage		
From Stage		1	2
	1		6
	2	6	

Stage Stream: 2

	To Stage		
From Stage		1	2
	1		6
	2	6	

Stage Stream: 3

	To Stage		
From Stage		1	2
	1		6
	2	6	

Stage Stream: 4

	To Stage		
From Stage		1	2
	1		6
	2	6	

Stage Stream: 5

	To Stage		
From Stage		1	2
	1		6
	2	6	

Lane Input Data

Junction: M40 J10												
Lane	Lane Type	Phases	Start Disp.	End Disp.	Physical Length (PCU)	Sat Flow Type	Def User Saturation Flow (PCU/Hr)	Lane Width (m)	Gradient	Nearside Lane	Turns	Turning Radius (m)
1/1 (M40 (SB) Off-Slip)	U	E	2	3	60.0	User	2000	-	-	-	-	-
1/2 (M40 (SB) Off-Slip)	U	E	2	3	60.0	User	2000	-	-	-	-	-
1/3 (M40 (SB) Off-Slip)	U	E	2	3	12.2	User	2000	-	-	-	-	-
2/1	U	F	2	3	45.2	User	2000	-	-	-	-	-
2/2	U	F	2	3	45.2	User	2000	-	-	-	-	-
2/3	U	F	2	3	45.2	User	2000	-	-	-	-	-
3/1	U	H	2	3	9.0	User	2000	-	-	-	-	-
3/2	U	H	2	3	9.0	User	2000	-	-	-	-	-
3/3	U	H	2	3	9.0	User	2000	-	-	-	-	-
3/4	U	H	2	3	9.0	User	2000	-	-	-	-	-
4/1	U		2	3	60.0	Inf	-	-	-	-	-	-
4/2	U		2	3	60.0	Inf	-	-	-	-	-	-
4/3	U		2	3	60.0	Inf	-	-	-	-	-	-
5/1 (A43 (N))	U	G	2	3	15.7	User	2000	-	-	-	-	-
5/2 (A43 (N))	U	G	2	3	60.0	User	2000	-	-	-	-	-
5/3 (A43 (N))	U	G	2	3	60.0	User	2000	-	-	-	-	-
5/4 (A43 (N))	U	G	2	3	60.0	User	2000	-	-	-	-	-
6/1 (Services)	U	I	2	3	7.0	User	1900	-	-	-	-	-
6/2 (Services)	U	I	2	3	60.0	User	1900	-	-	-	-	-
6/3 (Services)	U	I	2	3	60.0	User	1900	-	-	-	-	-
7/1	U	B	2	3	19.1	User	2000	-	-	-	-	-
7/2	U	B	2	3	19.1	User	2000	-	-	-	-	-
7/3	U	B	2	3	19.1	User	2000	-	-	-	-	-
8/1	U		2	3	60.0	Inf	-	-	-	-	-	-
9/1 (M40 SB On-Slip)	U		2	3	60.0	Inf	-	-	-	-	-	-
9/2 (M40 SB On-Slip)	U		2	3	60.0	Inf	-	-	-	-	-	-
10/1 (M40 NB Off-Slip)	U	A	2	3	20.9	User	2000	-	-	-	-	-
10/2 (M40 NB Off-Slip)	U	A	2	3	60.0	User	2000	-	-	-	-	-

10/3 (M40 NB Off-Slip)	U	A	2	3	60.0	User	2000	-	-	-	-	-
11/1	U		2	3	10.4	Inf	-	-	-	-	-	-
11/2	U		2	3	10.4	Inf	-	-	-	-	-	-
12/1	U	D	2	3	13.9	User	2000	-	-	-	-	-
12/2	U	D	2	3	13.9	User	2000	-	-	-	-	-
12/3	U	D	2	3	13.9	User	2000	-	-	-	-	-
12/4	U	D	2	3	13.9	User	2000	-	-	-	-	-
13/1 (B430)	U	C	2	3	8.7	User	2000	-	-	-	-	-
13/2 (B430)	U	C	2	3	60.0	User	2000	-	-	-	-	-
13/3 (B430)	U	C	2	3	60.0	User	2000	-	-	-	-	-
13/4 (B430)	U	C	2	3	60.0	User	2000	-	-	-	-	-
13/5 (B430)	U	C	2	3	17.4	User	2000	-	-	-	-	-
14/1 (M40 NB On-Slip)	U		2	3	10.4	Inf	-	-	-	-	-	-
14/2 (M40 NB On-Slip)	U		2	3	10.4	Inf	-	-	-	-	-	-
15/1	U	J	2	3	30.4	User	2000	-	-	-	-	-
15/2	U	J	2	3	30.4	User	2000	-	-	-	-	-
15/3	U	J	2	3	30.4	User	2000	-	-	-	-	-
15/4	U	J	2	3	30.4	User	2000	-	-	-	-	-
15/5	U	J	2	3	8.7	User	2000	-	-	-	-	-

Traffic Flow Groups

Flow Group	Start Time	End Time	Duration	Formula
5: '2031 do some AM'	07:45	08:45	01:00	
6: '2031 do some PM'	16:30	17:30	01:00	

Scenario 1: '2031 do something AM' (FG5: '2031 do some AM', Plan 1: 'Network Control Plan 1')

Traffic Flows, Desired

Desired Flow :

		Destination					
		A	B	C	D	E	Tot.
Origin	A	0	124	1605	858	264	2851
	B	85	0	295	57	145	582
	C	1169	211	40	446	0	1866
	D	408	28	242	0	391	1069
	E	337	219	0	506	13	1075
	Tot.	1999	582	2182	1867	813	7443

Traffic Lane Flows

Lane	Scenario 1: 2031 do something AM
Junction: M40 J10	
1/1	556
1/2 (with short)	519(In) 170(Out)
1/3 (short)	349
2/1	736
2/2	722
2/3	725
3/1	458
3/2	282
3/3	170
3/4	349
4/1	1073
4/2	722
4/3	204
5/1 (short)	865
5/2 (with short)	1729(In) 864(Out)
5/3	549
5/4	573
6/1 (short)	173
6/2 (with short)	352(In) 179(Out)
6/3	230
7/1	719
7/2	702
7/3	507
8/1	582
9/1	1055
9/2	1127
10/1 (short)	446
10/2 (with short)	1172(In) 726(Out)
10/3	694
11/1	1165
11/2	702
12/1	422
12/2	726
12/3	404
12/4	375
13/1 (short)	196

13/2 (with short)	391(In) 195(Out)
13/3	10
13/4 (with short)	668(In) 318(Out)
13/5 (short)	350
14/1	618
14/2	195
15/1	882
15/2	1005
15/3	719
15/4 (with short)	922(In) 645(Out)
15/5 (short)	277

Lane Saturation Flows

Junction: M40 J10								
Lane	**Lane Width (m)**	**Gradient**	**Nearside Lane**	**Allowed Turns**	**Turning Radius (m)**	**Turning Prop.**	**Sat Flow (PCU/Hr)**	**Flared Sat Flow (PCU/Hr)**
1/1 (M40 (SB) Off-Slip Lane 1)	This lane uses a directly entered Saturation Flow						2000	2000
1/2 (M40 (SB) Off-Slip Lane 2)	This lane uses a directly entered Saturation Flow						2000	2000
1/3 (M40 (SB) Off-Slip Lane 3)	This lane uses a directly entered Saturation Flow						2000	2000
2/1	This lane uses a directly entered Saturation Flow						2000	2000
2/2	This lane uses a directly entered Saturation Flow						2000	2000
2/3	This lane uses a directly entered Saturation Flow						2000	2000
3/1	This lane uses a directly entered Saturation Flow						2000	2000
3/2	This lane uses a directly entered Saturation Flow						2000	2000
3/3	This lane uses a directly entered Saturation Flow						2000	2000
3/4	This lane uses a directly entered Saturation Flow						2000	2000
4/1	Infinite Saturation Flow						Inf	Inf
4/2	Infinite Saturation Flow						Inf	Inf
4/3	Infinite Saturation Flow						Inf	Inf
5/1 (A43 (N) Lane 1)	This lane uses a directly entered Saturation Flow						2000	2000
5/2 (A43 (N) Lane 2)	This lane uses a directly entered Saturation Flow						2000	2000
5/3 (A43 (N) Lane 3)	This lane uses a directly entered Saturation Flow						2000	2000
5/4 (A43 (N) Lane 4)	This lane uses a directly entered Saturation Flow						2000	2000
6/1 (Services Lane 1)	This lane uses a directly entered Saturation Flow						1900	1900
6/2 (Services Lane 2)	This lane uses a directly entered Saturation Flow						1900	1900
6/3 (Services Lane 3)	This lane uses a directly entered Saturation Flow						1900	1900
7/1	This lane uses a directly entered Saturation Flow						2000	2000
7/2	This lane uses a directly entered Saturation Flow						2000	2000
7/3	This lane uses a directly entered Saturation Flow						2000	2000
8/1	Infinite Saturation Flow						Inf	Inf
9/1 (M40 SB On-Slip Lane 1)	Infinite Saturation Flow						Inf	Inf
9/2 (M40 SB On-Slip Lane 2)	Infinite Saturation Flow						Inf	Inf
10/1 (M40 NB Off-Slip Lane 1)	This lane uses a directly entered Saturation Flow						2000	2000
10/2 (M40 NB Off-Slip Lane 2)	This lane uses a directly entered Saturation Flow						2000	2000
10/3 (M40 NB Off-Slip Lane 3)	This lane uses a directly entered Saturation Flow						2000	2000
11/1	Infinite Saturation Flow						Inf	Inf

11/2	Infinite Saturation Flow	Inf	Inf
12/1	This lane uses a directly entered Saturation Flow	2000	2000
12/2	This lane uses a directly entered Saturation Flow	2000	2000
12/3	This lane uses a directly entered Saturation Flow	2000	2000
12/4	This lane uses a directly entered Saturation Flow	2000	2000
13/1 (B430 Lane 1)	This lane uses a directly entered Saturation Flow	2000	2000
13/2 (B430 Lane 2)	This lane uses a directly entered Saturation Flow	2000	2000
13/3 (B430 Lane 3)	This lane uses a directly entered Saturation Flow	2000	2000
13/4 (B430 Lane 4)	This lane uses a directly entered Saturation Flow	2000	2000
13/5 (B430 Lane 5)	This lane uses a directly entered Saturation Flow	2000	2000
14/1 (M40 NB On-Slip Lane 1)	Infinite Saturation Flow	Inf	Inf
14/2 (M40 NB On-Slip Lane 2)	Infinite Saturation Flow	Inf	Inf
15/1	This lane uses a directly entered Saturation Flow	2000	2000
15/2	This lane uses a directly entered Saturation Flow	2000	2000
15/3	This lane uses a directly entered Saturation Flow	2000	2000
15/4	This lane uses a directly entered Saturation Flow	2000	2000
15/5	This lane uses a directly entered Saturation Flow	2000	2000

Scenario 2: '2031 do something PM' (FG6: '2031 do some PM', Plan 1: 'Network Control Plan 1')

Traffic Flows, Desired

Desired Flow :

		Destination					
		A	B	C	D	E	Tot.
Origin	A	0	107	939	405	271	1722
	B	129	0	258	17	196	600
	C	1657	248	67	301	0	2273
	D	689	20	405	0	427	1541
	E	318	229	0	362	18	927
	Tot.	2793	604	1669	1085	912	7063

Traffic Lane Flows

Lane	Scenario 2: 2031 do something PM
Junction: M40 J10	
1/1	547
1/2 (with short)	380(In) 113(Out)
1/3 (short)	267
2/1	1127
2/2	1046
2/3	1042
3/1	497
3/2	472
3/3	113
3/4	267
4/1	1445
4/2	1046
4/3	302
5/1 (short)	523
5/2 (with short)	1046(In) 523(Out)
5/3	318
5/4	358
6/1 (short)	137
6/2 (with short)	275(In) 138(Out)
6/3	325
7/1	448
7/2	336
7/3	614
8/1	604
9/1	791
9/2	878
10/1 (short)	301
10/2 (with short)	1286(In) 985(Out)
10/3	987
11/1	749
11/2	336
12/1	485
12/2	986
12/3	606
12/4	509
13/1 (short)	214

13/2 (with short)	427(In) 213(Out)
13/3	141
13/4 (with short)	973(In) 440(Out)
13/5 (short)	533
14/1	699
14/2	213
15/1	654
15/2	757
15/3	431
15/4 (with short)	625(In) 336(Out)
15/5 (short)	289

Lane Saturation Flows

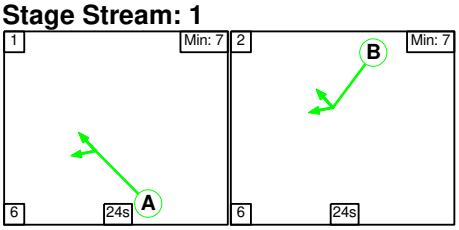
Junction: M40 J10								
Lane	**Lane Width (m)**	**Gradient**	**Nearside Lane**	**Allowed Turns**	**Turning Radius (m)**	**Turning Prop.**	**Sat Flow (PCU/Hr)**	**Flared Sat Flow (PCU/Hr)**
1/1 (M40 (SB) Off-Slip Lane 1)	This lane uses a directly entered Saturation Flow						2000	2000
1/2 (M40 (SB) Off-Slip Lane 2)	This lane uses a directly entered Saturation Flow						2000	2000
1/3 (M40 (SB) Off-Slip Lane 3)	This lane uses a directly entered Saturation Flow						2000	2000
2/1	This lane uses a directly entered Saturation Flow						2000	2000
2/2	This lane uses a directly entered Saturation Flow						2000	2000
2/3	This lane uses a directly entered Saturation Flow						2000	2000
3/1	This lane uses a directly entered Saturation Flow						2000	2000
3/2	This lane uses a directly entered Saturation Flow						2000	2000
3/3	This lane uses a directly entered Saturation Flow						2000	2000
3/4	This lane uses a directly entered Saturation Flow						2000	2000
4/1	Infinite Saturation Flow						Inf	Inf
4/2	Infinite Saturation Flow						Inf	Inf
4/3	Infinite Saturation Flow						Inf	Inf
5/1 (A43 (N) Lane 1)	This lane uses a directly entered Saturation Flow						2000	2000
5/2 (A43 (N) Lane 2)	This lane uses a directly entered Saturation Flow						2000	2000
5/3 (A43 (N) Lane 3)	This lane uses a directly entered Saturation Flow						2000	2000
5/4 (A43 (N) Lane 4)	This lane uses a directly entered Saturation Flow						2000	2000
6/1 (Services Lane 1)	This lane uses a directly entered Saturation Flow						1900	1900
6/2 (Services Lane 2)	This lane uses a directly entered Saturation Flow						1900	1900
6/3 (Services Lane 3)	This lane uses a directly entered Saturation Flow						1900	1900
7/1	This lane uses a directly entered Saturation Flow						2000	2000
7/2	This lane uses a directly entered Saturation Flow						2000	2000
7/3	This lane uses a directly entered Saturation Flow						2000	2000
8/1	Infinite Saturation Flow						Inf	Inf
9/1 (M40 SB On-Slip Lane 1)	Infinite Saturation Flow						Inf	Inf
9/2 (M40 SB On-Slip Lane 2)	Infinite Saturation Flow						Inf	Inf
10/1 (M40 NB Off-Slip Lane 1)	This lane uses a directly entered Saturation Flow						2000	2000
10/2 (M40 NB Off-Slip Lane 2)	This lane uses a directly entered Saturation Flow						2000	2000
10/3 (M40 NB Off-Slip Lane 3)	This lane uses a directly entered Saturation Flow						2000	2000
11/1	Infinite Saturation Flow						Inf	Inf

11/2	Infinite Saturation Flow	Inf	Inf
12/1	This lane uses a directly entered Saturation Flow	2000	2000
12/2	This lane uses a directly entered Saturation Flow	2000	2000
12/3	This lane uses a directly entered Saturation Flow	2000	2000
12/4	This lane uses a directly entered Saturation Flow	2000	2000
13/1 (B430 Lane 1)	This lane uses a directly entered Saturation Flow	2000	2000
13/2 (B430 Lane 2)	This lane uses a directly entered Saturation Flow	2000	2000
13/3 (B430 Lane 3)	This lane uses a directly entered Saturation Flow	2000	2000
13/4 (B430 Lane 4)	This lane uses a directly entered Saturation Flow	2000	2000
13/5 (B430 Lane 5)	This lane uses a directly entered Saturation Flow	2000	2000
14/1 (M40 NB On-Slip Lane 1)	Infinite Saturation Flow	Inf	Inf
14/2 (M40 NB On-Slip Lane 2)	Infinite Saturation Flow	Inf	Inf
15/1	This lane uses a directly entered Saturation Flow	2000	2000
15/2	This lane uses a directly entered Saturation Flow	2000	2000
15/3	This lane uses a directly entered Saturation Flow	2000	2000
15/4	This lane uses a directly entered Saturation Flow	2000	2000
15/5	This lane uses a directly entered Saturation Flow	2000	2000

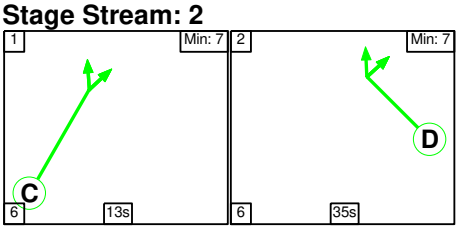
Scenario 1: '2031 do something AM' (FG5: '2031 do some AM', Plan 1: 'Network Control Plan 1')

Stage Sequence Diagram

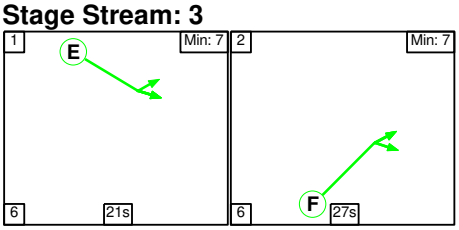
Stage Stream: 1



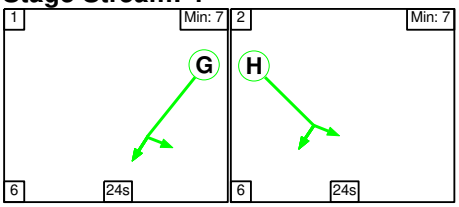
Stage Stream: 2



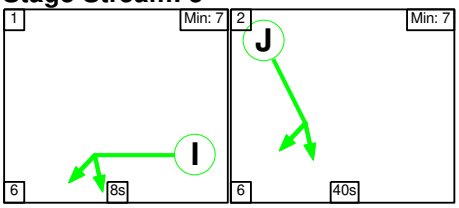
Stage Stream: 3



Stage Stream: 4



Stage Stream: 5



Stage Timings

Stage Stream: 1

Stage	1	2
Duration	24	24
Change Point	53	23

Stage Stream: 2

Stage	1	2
Duration	13	35
Change Point	39	58

Stage Stream: 3

Stage	1	2
Duration	21	27
Change Point	29	56

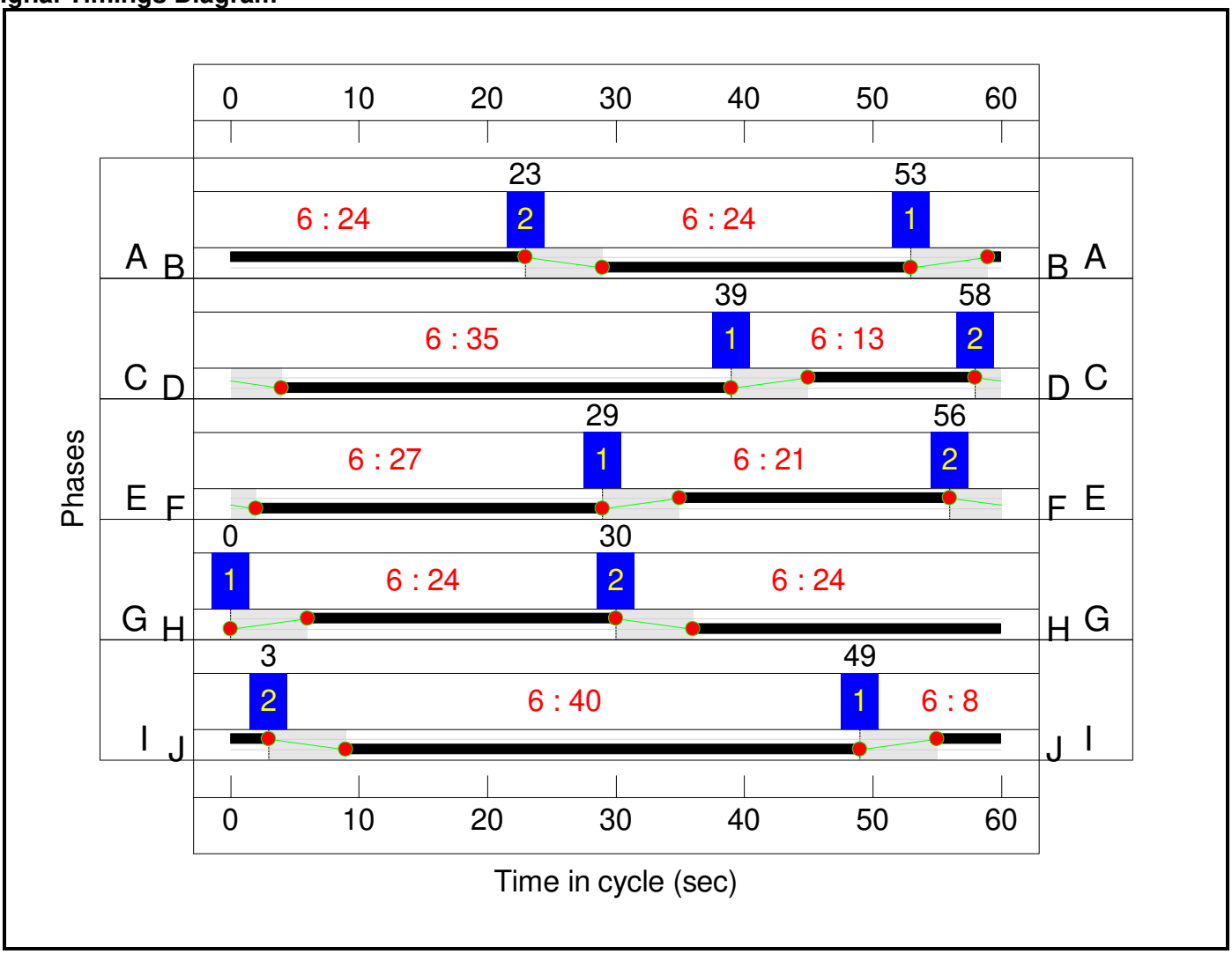
Stage Stream: 4

Stage	1	2
Duration	24	24
Change Point	0	30

Stage Stream: 5

Stage	1	2
Duration	8	40
Change Point	49	3

Signal Timings Diagram



Network Results

Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)
Network: Single grade-seperated roundabout - Option 3B	**-**	**-**	**N/A**	**-**	**-**		**-**	**-**	**-**	**-**	**-**	**-**	**103.8%**
M40 J10	**-**	**-**	**N/A**	**-**	**-**		**-**	**-**	**-**	**-**	**-**	**-**	**103.8%**
1/1	M40 (SB) Off-Slip Ahead Left	U	3	N/A	E		1	21	-	556	2000	733	75.8%
1/2+1/3	M40 (SB) Off-Slip Ahead	U	3	N/A	E		1	21	-	519	2000:2000	357+732	47.7 : 47.7%
2/1	Ahead	U	3	N/A	F		1	27	-	736	2000	933	78.9%
2/2	Ahead	U	3	N/A	F		1	27	-	722	2000	933	77.4%
2/3	Right Ahead	U	3	N/A	F		1	27	-	725	2000	933	77.7%
3/1	Ahead	U	4	N/A	H		1	24	-	458	2000	833	55.0%
3/2	Right	U	4	N/A	H		1	24	-	282	2000	833	33.8%
3/3	Right	U	4	N/A	H		1	24	-	170	2000	833	20.4%
3/4	Right	U	4	N/A	H		1	24	-	349	2000	833	41.9%
5/2+5/1	A43 (N) Left Ahead	U	4	N/A	G		1	24	-	1729	2000:2000	833+833	103.7 : 103.8%
5/3	A43 (N) Ahead	U	4	N/A	G		1	24	-	549	2000	833	65.9%
5/4	A43 (N) Ahead	U	4	N/A	G		1	24	-	573	2000	833	68.8%
6/2+6/1	Services Left Left2	U	5	N/A	I		1	8	-	352	1900:1900	285+285	62.8 : 60.7%
6/3	Services Left	U	5	N/A	I		1	8	-	230	1900	285	80.7%
7/1	Ahead	U	1	N/A	B		1	24	-	719	2000	833	86.3%
7/2	Ahead	U	1	N/A	B		1	24	-	702	2000	833	84.2%
7/3	Right	U	1	N/A	B		1	24	-	507	2000	833	60.8%
10/2+10/1	M40 NB Off-Slip Left Ahead	U	1	N/A	A		1	24	-	1172	2000:2000	833+521	87.1 : 85.6%
10/3	M40 NB Off-Slip Ahead	U	1	N/A	A		1	24	-	694	2000	833	83.3%
12/1	Ahead	U	2	N/A	D		1	35	-	422	2000	1200	35.2%

12/2	Right	U	2	N/A	D		1	35	-	726	2000	1200	60.5%
12/3	Right	U	2	N/A	D		1	35	-	404	2000	1200	33.7%
12/4	Right	U	2	N/A	D		1	35	-	375	2000	1200	31.3%
13/2+13/1	B430 Ahead	U	2	N/A	C		1	13	-	391	2000:2000	467+467	41.8 : 42.0%
13/3	B430 Ahead	U	2	N/A	C		1	13	-	10	2000	467	2.1%
13/4+13/5	B430 Ahead	U	2	N/A	C		1	13	-	668	2000:2000	467+467	68.1 : 75.0%
15/1	Ahead	U	5	N/A	J		1	40	-	882	2000	1367	62.6%
15/2	Ahead	U	5	N/A	J		1	40	-	1005	2000	1367	71.3%
15/3	Ahead	U	5	N/A	J		1	40	-	719	2000	1367	52.6%
15/4+15/5	Ahead	U	5	N/A	J		1	40	-	922	2000:2000	1137+488	56.7 : 56.7%

Item	Arriving (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand + Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per PCU (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand + Oversat Queue (pcu)	Mean Max Queue (pcu)
Network: Single grade-seperated roundabout - Option 3B	**-**	**-**	**0**	**0**	**0**	**61.4**	**67.1**	**0.0**	**128.5**	**-**	**-**	**-**	**-**
M40 J10	**-**	**-**	**0**	**0**	**0**	**61.4**	**67.1**	**0.0**	**128.5**	**-**	**-**	**-**	**-**
1/1	556	556	-	-	-	2.6	1.5	-	4.1	26.6	8.0	1.5	9.6
1/2+1/3	519	519	-	-	-	2.0	0.5	-	2.5 (0.8+1.7)	17.3 (16.3:17.7)	4.5	0.5	4.9
2/1	736	736	-	-	-	4.1	1.8	-	5.9	29.0	8.2	1.8	10.0
2/2	722	722	-	-	-	2.4	1.7	-	4.1	20.6	9.6	1.7	11.3
2/3	725	725	-	-	-	2.4	1.7	-	4.1	20.3	9.6	1.7	11.4
3/1	458	458	-	-	-	1.7	0.0	-	1.7	13.4	5.8	0.0	5.8
3/2	282	282	-	-	-	1.8	0.0	-	1.8	23.1	4.7	0.0	4.7
3/3	170	170	-	-	-	0.0	0.0	-	0.0	0.1	0.0	0.0	0.0
3/4	349	349	-	-	-	0.0	0.0	-	0.0	0.1	0.0	0.0	0.0
5/2+5/1	1729	1667	-	-	-	10.1	41.6	-	51.7 (25.6+26.1)	107.7 (106.6:108.7)	14.9	41.6	56.5
5/3	549	549	-	-	-	2.1	1.0	-	3.1	20.4	7.3	1.0	8.3
5/4	573	573	-	-	-	2.3	1.1	-	3.4	21.2	7.8	1.1	8.9
6/2+6/1	352	352	-	-	-	2.3	0.8	-	3.1 (1.6+1.5)	32.1 (32.1:32.1)	2.8	0.8	3.6
6/3	230	230	-	-	-	1.6	2.0	-	3.5	55.2	3.7	2.0	5.7
7/1	719	719	-	-	-	2.0	3.0	-	5.0	25.0	11.5	3.0	14.5
7/2	702	702	-	-	-	2.9	2.6	-	5.5	28.2	11.5	2.6	14.1
7/3	507	507	-	-	-	2.2	0.8	-	2.9	20.9	7.9	0.8	8.6
10/2+10/1	1172	1172	-	-	-	4.9	3.1	-	8.0 (5.2+2.8)	24.5 (25.6:22.7)	10.9	3.1	14.0
10/3	694	694	-	-	-	3.0	2.4	-	5.4	28.1	10.2	2.4	12.6
12/1	422	422	-	-	-	1.9	0.0	-	1.9	16.5	5.0	0.0	5.0
12/2	726	726	-	-	-	0.0	0.0	-	0.0	0.0	0.6	0.0	0.6
12/3	404	404	-	-	-	0.1	0.0	-	0.1	0.7	0.3	0.0	0.3

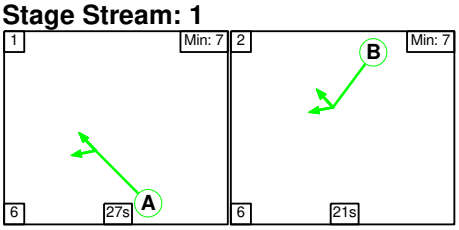
12/4	375	375	-	-	-	0.0	0.0	-	0.0	0.3	0.2	0.0	0.2
13/2+13/1	391	391	-	-	-	2.1	0.4	-	2.5 (1.2+1.2)	22.9 (22.9:22.9)	2.7	0.4	3.1
13/3	10	10	-	-	-	0.1	0.0	-	0.1	22.0	0.1	0.0	0.1
13/4+13/5	668	668	-	-	-	3.9	1.2	-	5.2 (2.4+2.7)	27.9 (27.7:28.1)	5.3	1.2	6.6
15/1	855	855	-	-	-	0.5	0.0	-	0.5	1.9	1.7	0.0	1.7
15/2	974	974	-	-	-	0.5	0.0	-	0.5	1.7	1.7	0.0	1.7
15/3	719	719	-	-	-	0.5	0.0	-	0.5	2.3	2.0	0.0	2.0
15/4+15/5	922	922	-	-	-	1.4	0.0	-	1.4 (1.3+0.0)	5.4 (7.5:0.5)	5.2	0.0	5.2

C1	Stream: 1	PRC for Signalled Lanes (%):	3.3	Total Delay for Signalled Lanes (pcuHr):	26.82	Cycle Time (s):	60
C1	Stream: 2	PRC for Signalled Lanes (%):	20.0	Total Delay for Signalled Lanes (pcuHr):	9.77	Cycle Time (s):	60
C1	Stream: 3	PRC for Signalled Lanes (%):	14.1	Total Delay for Signalled Lanes (pcuHr):	20.74	Cycle Time (s):	60
C1	Stream: 4	PRC for Signalled Lanes (%):	-15.3	Total Delay for Signalled Lanes (pcuHr):	61.70	Cycle Time (s):	60
C1	Stream: 5	PRC for Signalled Lanes (%):	11.5	Total Delay for Signalled Lanes (pcuHr):	9.45	Cycle Time (s):	60
		PRC Over All Lanes (%):	-15.3	Total Delay Over All Lanes(pcuHr):	128.47		

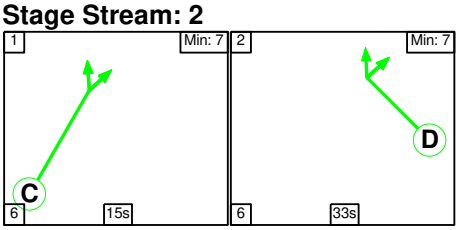
Scenario 2: '2031 do something PM' (FG6: '2031 do some PM', Plan 1: 'Network Control Plan 1')

Stage Sequence Diagram

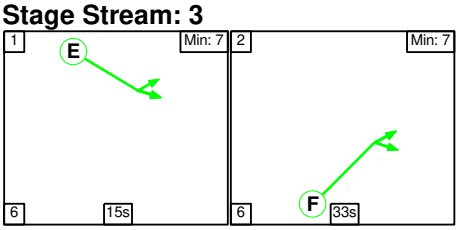
Stage Stream: 1



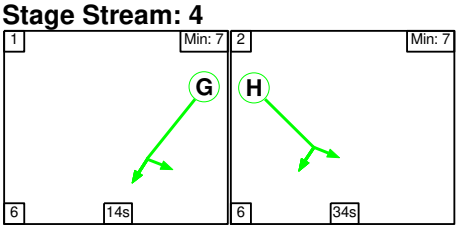
Stage Stream: 2



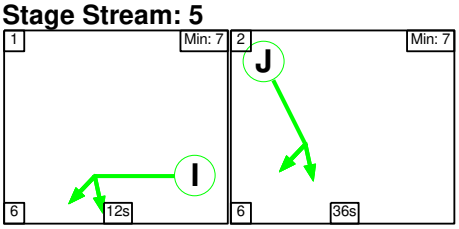
Stage Stream: 3



Stage Stream: 4



Stage Stream: 5



Stage Timings

Stage Stream: 1

Stage	1	2
Duration	27	21
Change Point	35	8

Stage Stream: 2

Stage	1	2
Duration	15	33
Change Point	19	40

Stage Stream: 3

Stage	1	2
Duration	15	33
Change Point	15	36

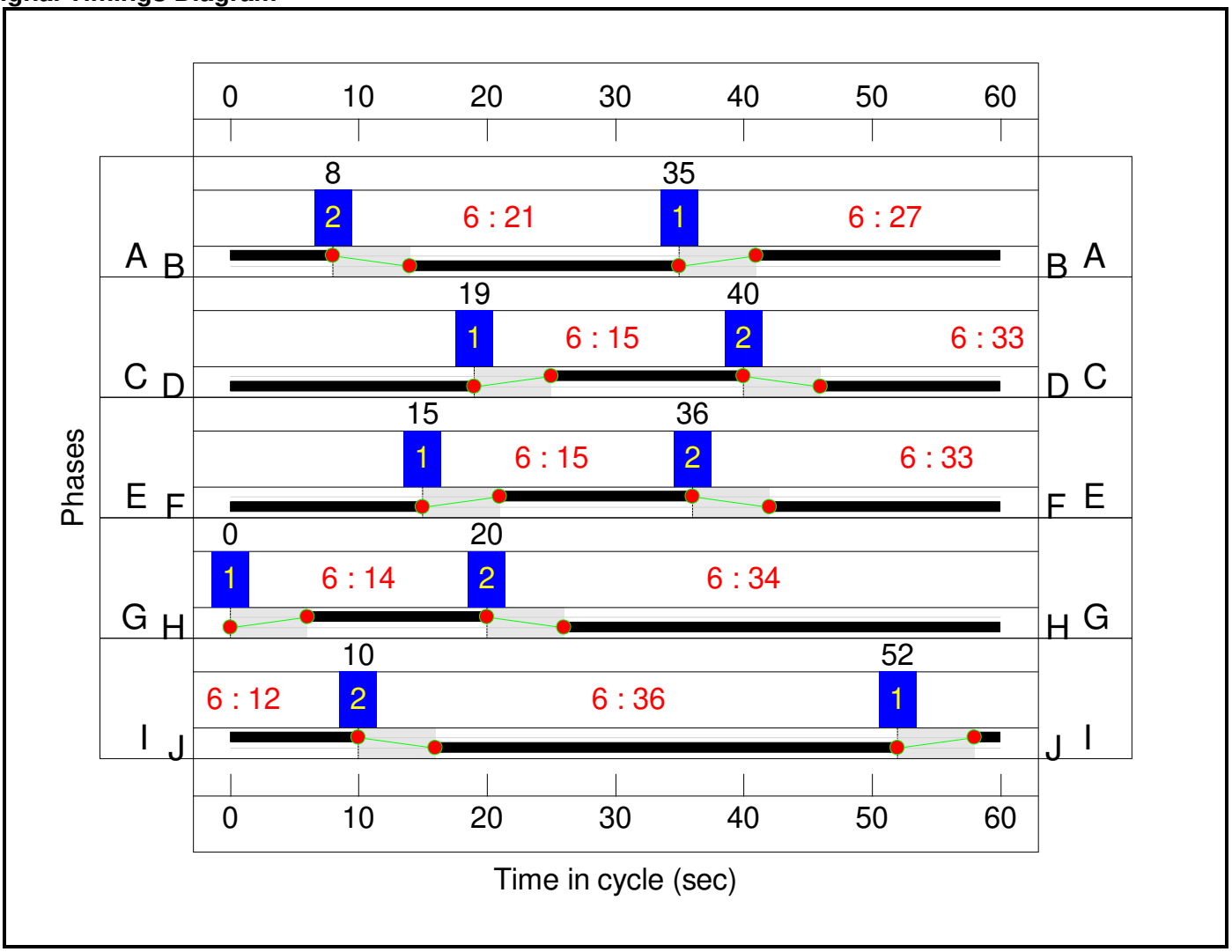
Stage Stream: 4

Stage	1	2
Duration	14	34
Change Point	0	20

Stage Stream: 5

Stage	1	2
Duration	12	36
Change Point	52	10

Signal Timings Diagram



Network Results

Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)
Network: Single grade-seperated roundabout - Option 3B	**-**	**-**	**N/A**	**-**	**-**		**-**	**-**	**-**	**-**	**-**	**-**	**105.8%**
M40 J10	**-**	**-**	**N/A**	**-**	**-**		**-**	**-**	**-**	**-**	**-**	**-**	**105.8%**
1/1	M40 (SB) Off-Slip Ahead Left	U	3	N/A	E		1	15	-	547	2000	533	102.6%
1/2+1/3	M40 (SB) Off-Slip Ahead	U	3	N/A	E		1	15	-	380	2000:2000	226+533	50.1 : 50.1%
2/1	Ahead	U	3	N/A	F		1	33	-	1127	2000	1133	94.9%
2/2	Ahead	U	3	N/A	F		1	33	-	1046	2000	1133	89.7%
2/3	Right Ahead	U	3	N/A	F		1	33	-	1042	2000	1133	89.8%
3/1	Ahead	U	4	N/A	H		1	34	-	497	2000	1167	41.0%
3/2	Right	U	4	N/A	H		1	34	-	472	2000	1167	40.1%
3/3	Right	U	4	N/A	H		1	34	-	113	2000	1167	9.7%
3/4	Right	U	4	N/A	H		1	34	-	267	2000	1167	22.9%
5/2+5/1	A43 (N) Left Ahead	U	4	N/A	G		1	14	-	1046	2000:2000	500+500	104.6 : 104.6%
5/3	A43 (N) Ahead	U	4	N/A	G		1	14	-	318	2000	500	63.6%
5/4	A43 (N) Ahead	U	4	N/A	G		1	14	-	358	2000	500	71.6%
6/2+6/1	Services Left Left2	U	5	N/A	I		1	12	-	275	1900:1900	412+412	33.5 : 33.3%
6/3	Services Left	U	5	N/A	I		1	12	-	325	1900	412	78.9%
7/1	Ahead	U	1	N/A	B		1	21	-	448	2000	733	61.1%
7/2	Ahead	U	1	N/A	B		1	21	-	336	2000	733	45.8%
7/3	Right	U	1	N/A	B		1	21	-	614	2000	733	83.7%
10/2+10/1	M40 NB Off-Slip Left Ahead	U	1	N/A	A		1	27	-	1286	2000:2000	933+285	105.5 : 105.5%
10/3	M40 NB Off-Slip Ahead	U	1	N/A	A		1	27	-	987	2000	933	105.8%
12/1	Ahead	U	2	N/A	D		1	33	-	485	2000	1133	42.8%
12/2	Right	U	2	N/A	D		1	33	-	986	2000	1133	82.4%

12/3	Right	U	2	N/A	D		1	33	-	606	2000	1133	50.9%
12/4	Right	U	2	N/A	D		1	33	-	509	2000	1133	42.8%
13/2+13/1	B430 Ahead	U	2	N/A	C		1	15	-	427	2000:2000	533+533	39.9 : 40.1%
13/3	B430 Ahead	U	2	N/A	C		1	15	-	141	2000	533	26.4%
13/4+13/5	B430 Ahead	U	2	N/A	C		1	15	-	973	2000:2000	533+533	82.5 : 99.9%
15/1	Ahead	U	5	N/A	J		1	36	-	654	2000	1233	51.4%
15/2	Ahead	U	5	N/A	J		1	36	-	757	2000	1233	59.4%
15/3	Ahead	U	5	N/A	J		1	36	-	431	2000	1233	34.9%
15/4+15/5	Ahead	U	5	N/A	J		1	36	-	625	2000:2000	924+795	36.4 : 36.4%

Item	Arriving (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand + Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per PCU (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand + Oversat Queue (pcu)	Mean Max Queue (pcu)
Network: Single grade-seperated roundabout - Option 3B	**-**	**-**	**0**	**0**	**0**	**63.4**	**151.6**	**0.0**	**215.0**	**-**	**-**	**-**	**-**
M40 J10	**-**	**-**	**0**	**0**	**0**	**63.4**	**151.6**	**0.0**	**215.0**	**-**	**-**	**-**	**-**
1/1	547	533	-	-	-	3.7	15.6	-	19.3	126.9	9.3	15.6	24.9
1/2+1/3	380	380	-	-	-	1.9	0.5	-	2.4 (0.7+1.7)	22.9 (21.9:23.4)	3.7	0.5	4.2
2/1	1075	1075	-	-	-	4.5	7.4	-	11.9	39.7	12.8	7.4	20.2
2/2	1017	1017	-	-	-	2.8	4.1	-	6.9	24.5	14.1	4.1	18.2
2/3	1018	1018	-	-	-	2.5	4.1	-	6.6	23.4	15.1	4.1	19.2
3/1	478	478	-	-	-	0.5	0.0	-	0.5	4.0	3.6	0.0	3.6
3/2	468	468	-	-	-	1.4	0.0	-	1.4	10.6	3.6	0.0	3.6
3/3	113	113	-	-	-	0.1	0.0	-	0.1	1.9	1.5	0.0	1.5
3/4	267	267	-	-	-	0.1	0.0	-	0.1	2.0	3.9	0.0	3.9
5/2+5/1	1046	1000	-	-	-	7.9	31.3	-	39.2 (19.6+19.6)	135.0 (135.0:135.0)	9.1	31.3	40.4
5/3	318	318	-	-	-	1.8	0.9	-	2.6	29.9	4.7	0.9	5.5
5/4	358	358	-	-	-	2.0	1.2	-	3.3	33.0	5.4	1.2	6.6
6/2+6/1	275	275	-	-	-	1.5	0.3	-	1.8 (0.9+0.9)	23.1 (23.2:23.1)	1.9	0.3	2.2
6/3	325	325	-	-	-	2.0	1.8	-	3.8	42.2	5.1	1.8	6.9
7/1	448	448	-	-	-	1.5	0.8	-	2.3	18.3	3.1	0.8	3.9
7/2	336	336	-	-	-	2.1	0.4	-	2.5	26.7	4.3	0.4	4.8
7/3	614	614	-	-	-	1.4	2.5	-	3.8	22.5	7.3	2.5	9.8
10/2+10/1	1286	1234	-	-	-	6.1	41.5	-	47.6 (37.1+10.5)	133.3 (135.4:126.2)	16.4	41.5	57.9
10/3	987	933	-	-	-	6.2	34.1	-	40.3	147.0	17.3	34.1	51.4
12/1	485	485	-	-	-	2.8	0.0	-	2.8	20.6	7.5	0.0	7.5
12/2	934	934	-	-	-	0.0	0.0	-	0.0	0.1	0.6	0.0	0.6
12/3	577	577	-	-	-	0.4	0.0	-	0.4	2.6	2.2	0.0	2.2

12/4	485	485	-	-	-	0.4	0.0	-	0.4	2.7	1.7	0.0	1.7
13/2+13/1	427	427	-	-	-	2.1	0.3	-	2.5 (1.2+1.2)	20.9 (20.9:20.9)	2.9	0.3	3.2
13/3	141	141	-	-	-	0.7	0.2	-	0.9	22.0	1.8	0.2	2.0
13/4+13/5	973	973	-	-	-	5.8	4.7	-	10.5 (4.7+5.8)	38.9 (38.1:39.5)	8.7	4.7	13.5
15/1	634	634	-	-	-	0.5	0.0	-	0.5	2.7	6.1	0.0	6.1
15/2	732	732	-	-	-	0.6	0.0	-	0.6	3.1	9.7	0.0	9.7
15/3	431	431	-	-	-	0.0	0.0	-	0.0	0.1	0.2	0.0	0.2
15/4+15/5	625	625	-	-	-	0.0	0.0	-	0.0 (0.0+0.0)	0.1 (0.1:0.0)	0.0	0.0	0.0

C1	Stream: 1	PRC for Signalled Lanes (%):	-17.5	Total Delay for Signalled Lanes (pcuHr):	96.52	Cycle Time (s):	60
C1	Stream: 2	PRC for Signalled Lanes (%):	-11.0	Total Delay for Signalled Lanes (pcuHr):	17.41	Cycle Time (s):	60
C1	Stream: 3	PRC for Signalled Lanes (%):	-14.0	Total Delay for Signalled Lanes (pcuHr):	47.11	Cycle Time (s):	60
C1	Stream: 4	PRC for Signalled Lanes (%):	-16.2	Total Delay for Signalled Lanes (pcuHr):	47.26	Cycle Time (s):	60
C1	Stream: 5	PRC for Signalled Lanes (%):	14.0	Total Delay for Signalled Lanes (pcuHr):	6.72	Cycle Time (s):	60
		PRC Over All Lanes (%):	-17.5	Total Delay Over All Lanes(pcuHr):	215.02		