

# A61 South of Chesterfield

TN01 – Option Testing

Project Number: 60634684

February 2021

## Quality information

<b>Prepared by</b>	<b>Checked by</b>	<b>Verified by</b>	<b>Approved by</b>
PJ	EG	DG	DG

## Revision History

Revision	Revision date	Details	Authorized	Name	Position

## Distribution List

# Hard Copies	PDF Required	Association / Company Name
0	Yes	Derbyshire County Council

Prepared for:  
Derbyshire County Council

Prepared by:

AECOM Infrastructure & Environment UK Ltd.  
Royal Court  
Basil Close  
Chesterfield  
S41 7SL  
United Kingdom  
aecom.com

© 2021 AECOM Infrastructure & Environment UK Ltd. All Rights Reserved.

This document has been prepared by AECOM Infrastructure & Environment UK Limited (“AECOM”) for sole use of our client (the “Client”) in accordance with generally accepted consultancy principles, the budget for fees and the terms of reference agreed between AECOM and the Client. Any information provided by third parties and referred to herein has not been checked or verified by AECOM, unless otherwise expressly stated in the document. No third party may rely upon this document without the prior and express written agreement of AECOM.

## Table of Contents

<b>1. Introduction</b> .....	<b>6</b>
Overview.....	6
Report Structure.....	6
Options Considered – Summary .....	6
<b>2. Background</b> .....	<b>8</b>
Traffic Flows.....	9
Journey Times.....	12
Select Link Analysis.....	13
<b>3. Testing of Options</b> .....	<b>20</b>
Option 0 – A61 Offline Improvement.....	20
Option 1 – A61 Online Improvement.....	22
Option 2 – A61 – B6038 Link, via the Avenue .....	24
Option 3 – A61 to A617, with new A617 slip roads .....	26
Option 4 – A632 Matlock Road – A61 Link.....	28
Forecast Traffic Flows by Option .....	30
Forecast Journey Times by Option.....	35
<b>4. Conclusions</b> .....	<b>37</b>
Appendix A Select Link Analysis Plots .....	39
Appendix B SATURN Difference Plots – Option 0.....	40
Appendix C SATURN Difference Plots – Option 1 .....	46
Appendix D SATURN Difference Plots – Option 2 .....	52
Appendix E SATURN Difference Plots – Option 3.....	58
Appendix F SATURN Difference Plots – Option 4.....	64

## Figures

Figure 1. Major Road Network – Chesterfield Area.....	8
Figure 2. Location of AADT on Key Links.....	11
Figure 3. AM – 2019 Base Year – Select Link Analysis on A61 between Langer Lane & Longedge Lane .....	14
Figure 4. AM – 2035 DM Forecast – Select Link Analysis on A61 between Langer Lane & Longedge Lane.....	14
Figure 5. IP – 2019 Base Year – Select Link Analysis on A61 between Langer Lane & Longedge Lane .....	15
Figure 6. IP – 2035 DM Forecast – Select Link Analysis on A61 between Langer Lane & Longedge Lane .....	15
Figure 7. PM – 2019 Base Year – Select Link Analysis on A61 between Langer Lane & Longedge Lane .....	16
Figure 8. PM – 2035 DM Forecast – Select Link Analysis on A61 between Langer Lane & Longedge Lane .....	16
Figure 9. AM – 2019 Base Year – Select Link Analysis on A61 directly north of A61/St Augustine’s Road junction.....	17
Figure 10. AM – 2035 DM Forecast – Select Link Analysis on A61 directly north of A61/St Augustine’s Road junction.....	17
Figure 11. IP – 2019 Base Year – Select Link Analysis on A61 directly north of A61/St Augustine’s Road junction.....	18
Figure 12. IP – 2035 DM Forecast – Select Link Analysis on A61 directly north of A61/St Augustine’s Road junction.....	18
Figure 13. PM – 2019 Base Year – Select Link Analysis on A61 directly north of A61/St Augustine’s Road junction.....	19
Figure 14. PM – 2035 DM Forecast – Select Link Analysis on A61 directly north of A61/St Augustine’s Road junction.....	19
Figure 15. Network Changes for Option 0.....	21
Figure 16. Network Changes for Option 1.....	23
Figure 17. Network Changes for Option 2.....	25
Figure 18. Network Changes for Option 3.....	27
Figure 19. Option 4 – Potential Alignments .....	28
Figure 20. Network Changes for Option 4.....	29
Figure 21. Modelled AADT Locations .....	32

## Tables

Table 1. Modelled Flows on Key Links – 2019 Base Year & 2035 Forecast Year Do-Minimum (in vehicles, AADT rounded to nearest 00s) .....	10
Table 2. Summary of Fixed-Route Journey Times Along the Existing A61 (Base and DM) .....	12
Table 3. Summary of Skimmed Journey Times Along the Existing A61 .....	(Base and DM) 13
Table 4. Speed Flow Curves – Option 0.....	21
Table 5. Speed Flow Curves – Option 1.....	22
Table 6. Speed Flow Curves – Option 2.....	24
Table 7. Speed Flow Curves – Option 3.....	26
Table 8. Speed Flow Curves – Option 4.....	29
Table 9. AADT Flows by Option (in vehicles, rounded to nearest 00s).....	33
Table 10. Summary of Fixed-Route Journey Times Along the Existing A61 (Base, DM and Options).....	35
Table 11. Summary of Skimmed Travel Times in the A61 Corridor (Base, DM and Options).....	36

# 1. Introduction

## Overview

- 1.1 AECOM has been commissioned by Derbyshire County Council (DCC), under the Midlands Highways Alliance Professional Services Partnership (MHAPSP3) framework, to assess potential highway-focused scheme options to address forecast increases in traffic flow & delay on the A61 south of Chesterfield.
- 1.2 The existing North Derbyshire Highway Assignment Model (NDHAM) was used to test these options. The modelled time periods in the NDHAM are the AM peak hour (08:00-09:00), IP average hour (10:00-16:00), and PM peak hour (17:00-18:00). The current version of NDHAM has been built to a 2019 base year, as described in the NDHAM Local Model Validation Report. 2035 Core Scenario Do Minimum (DM) Forecasts were prepared from this, as described in the NDHAM Traffic Forecasting Report.

- 1.3 It is important to note that, at this stage, **no engineering feasibility or environmental assessment has been conducted**. Such work may ultimately prove that options are not feasible, or identify constraints which would require a judgement by DCC as to whether or not the options should be pursued. In addition, the scope of this TN does not include for the detailed modelling that would be required to support a scheme through a planning application or business case.

- 1.4 This report has not considered sustainable transport options. A previous high-level review conducted in 2016 by Mouchel and reviewed in 2020 by AECOM listed these and relate to both public transport and walking / cycling options.

## Report Structure

- 1.5 The purpose of this Technical Note (TN) is to document the background to the initial testing of scheme options relating to the A61 South of Chesterfield, to explain the options tested and provide a summary of the impacts those options would have upon forecast traffic flows and journey times.
- 1.6 The structure of this document is:
  - Section 2 – Background,
  - Section 3 – Options Considered;
  - Section 4 – Conclusions.

## Options Considered – Summary

- 1.7 Five options have been tested at this stage to improve the performance of the A61 corridor south of Chesterfield.

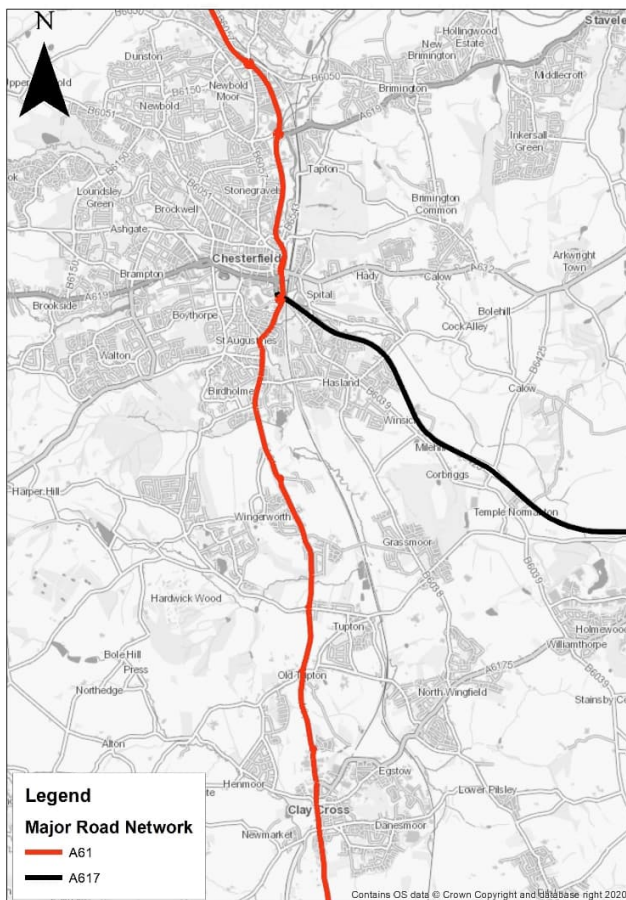
1.8 The options tested are as follows:

- Option 0 – A61 offline improvement.
- Option 1 – A61 online improvement.
- Option 2 – A61 – B6038 Link, via the Avenue.
- Option 3 – A61 to A617, with new A617 slip-roads.
- Option 4 – A632 – A61 Link.

## 2. Background

- 2.1 The A61 Corridor has been identified as part of the emerging 'Major Road Network' (MRN) which sits between the national 'Strategic Road Network' (SRN) and the 'Local Road Network'. Figure 1 illustrates the MRN in the Chesterfield area, which includes the A61 and A617.

Figure 1. Major Road Network – Chesterfield Area



- 2.2 The section of A61 south of Hornsbridge Roundabout has been identified as subject to existing delays. Forecasting work has shown increases in traffic volumes and associated delays in future years.



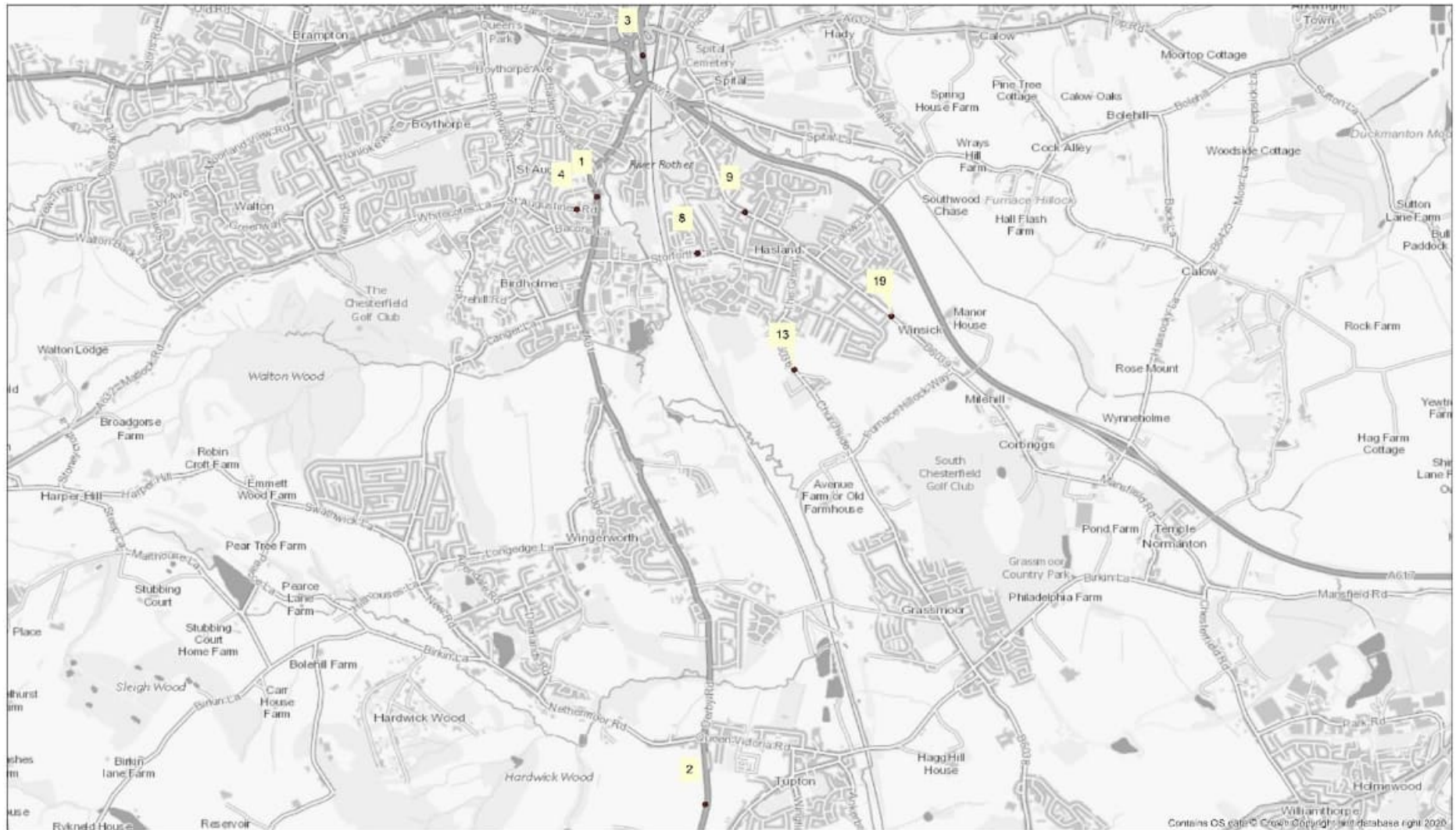
## Traffic Flows

- 2.3 Figure 2 shows the locations of key links on the A61 south of Chesterfield, and adjoining and parallel links. Table 1 shows the modelled traffic flows on these links in the 2019 base year and 2035 Do-Minimum forecast, for each of the three modelled time periods.
- 2.4 The forecast flows from the three one-hour modelled periods (AM, IP and PM) have also been combined, using factors calculated from long term traffic count data on the A619 Chesterfield Road near Brimington, to produce 24-hour Annual Average Daily Traffic flows (AADT24). These has been rounded to the nearest hundred vehicles per day.
- 2.5 The AM peak hour to AM peak period factor used was 2.69: for the conversion PM peak hour to PM peak period a factor of 2.79 was used. The IP used a factor of 6, as the model represents an average hour. The AM, IP and PM period flows were then summed to give a 12-hour Annual Average Weekday Traffic flow, which was multiplied by 1.157 to convert it to AADT24.
- 2.6 While Figure 2 shows flows on key links close to the A61, a wider area of flow data for Base Year & 2035 AADT flows is presented in Table 9 in Chapter 3.
- 2.7 The A61 near Tupton (location 2) and A61 north of Hornsbridge (location 3) show increased flows in the 2035 forecasts. These sections have spare capacity, which is reflected in the AADT growth of 29% and 8% respectively: on the A61 north of Hornsbridge, the flow in the peak periods is constrained by limited capacity nearby, and so most of the increase in flow seen on this section is during the interpeak period.
- 2.8 The flow on the A61 north of St Augustine's Road is being suppressed by the lack of spare capacity along this section. This in turn leads to increased flows on parallel routes, such as Churchside (location 8) and the B6039 Hasland Road (location 13). This is especially apparent in the peak periods.

**Table 1. Modelled Flows on Key Links – 2019 Base Year & 2035 Forecast Year Do-Minimum (in vehicles, AADT rounded to nearest 00s)**

Location	2 way AADT	2019 AM	2019 IP	2019 PM	2019 Base AADT24	2035 AM	2035 IP	2035 PM	2035 DM AADT24	Diff	AM Diff as %	IP Diff as %	PM Diff as %	AADT Diff as %
<b>1</b>	A61 north of St Augustine's Rd	1,419	1,497	1,613	<b>20,000</b>	1,498	1,626	1,560	<b>21,000</b>	1,000	6%	9%	-3%	<b>5%</b>
<b>2</b>	A61 near Tupton	1,145	1,047	1,306	<b>15,100</b>	1,518	1,358	1,641	<b>19,500</b>	4,400	33%	30%	26%	<b>29%</b>
<b>3</b>	A61 north of Hornsbridge	3,198	2,679	3,079	<b>38,500</b>	3,227	3,119	3,034	<b>41,500</b>	3,000	1%	16%	-1%	<b>8%</b>
<b>4</b>	St Augustine's Rd	713	797	773	<b>10,300</b>	685	806	791	<b>10,300</b>	0	-4%	1%	2%	<b>0%</b>
<b>8</b>	Churchside, Hasland	484	345	718	<b>6,200</b>	903	468	1,077	<b>9,500</b>	3,300	87%	36%	50%	<b>53%</b>
<b>9</b>	Mansfield Road, Hasland	481	262	363	<b>4,500</b>	307	280	309	<b>3,900</b>	-600	-36%	7%	-15%	<b>-13%</b>
<b>13</b>	B6039 Hasland Rd	1,267	816	1,267	<b>13,700</b>	1,511	1,001	1,546	<b>16,700</b>	3,000	19%	23%	22%	<b>22%</b>
<b>19</b>	Storforth Lane	983	676	1,036	<b>11,100</b>	1,047	772	1,100	<b>12,200</b>	1,100	7%	14%	6%	<b>10%</b>

Figure 2. Location of AADT on Key Links



## Journey Times

- 2.9 A comparison was made of fixed-route journey times along the existing A61 between Longedge Lane and Hornsbridge. 2019 base year and 2035 Do-Minimum journey times for this route are shown in Table 2.
- 2.10 Journey times are forecast to increase between 2019 and 2035, in the northbound direction towards Hornsbridge, in all time periods.
- 2.11 Similarly, in the southbound direction, in IP and PM peak hours, an increase in journey times is forecast. The AM peak southbound journey time is an exception, with a slight reduction (one second) in forecast journey time. The predominant tidal flow along this section of the A61 is northbound in the AM peak and southbound in the PM peak.

**Table 2. Summary of Fixed-Route Journey Times Along the Existing A61 (Base and DM)**

Times in mm:ss

Direction	Time period	Base 2019	DM 2035	Dif	Dif as %
<b>Northbound</b>	AM	07:43	08:44	01:01	13.2%
<b>Northbound</b>	IP	05:16	06:06	00:50	15.8%
<b>Northbound</b>	PM	08:06	08:34	00:28	5.8%
<b>Southbound</b>	AM	04:37	04:36	-00:01	-0.4%
<b>Southbound</b>	IP	04:35	04:48	00:13	4.7%
<b>Southbound</b>	PM	05:34	05:51	00:17	5.1%

- 2.12 In addition to this fixed-route journey time comparison, a summary of skimmed travel times in the A61 corridor has been prepared. These represent average (flow-weighted) travel times between two zones in the model using the routing paths which are used by the assignment.
- 2.13 Times are taken between zone 253 (on the north side of Clay Cross, loading onto the A61/Harris Way roundabout) and zone 91 (north of Chesterfield, at the A61/Rother Way roundabout). This analysis takes into account alternative routes, including re-routing due to increased delay. This zone pair has been chosen to illustrate changes in journey times over a longer section of the A61 than that used for fixed route journey times.
- 2.14 The results in Table 3 have been extracted as skimmed times for User Class 2, “Car, Employers’ Business”. As such, these represent a weighted average of journey times along all routes used by assigned trips for this user class between this origin and destination. Table 3 shows an increase in journey times between 2019 and 2035 in both directions and in all modelled time periods.

**Table 3. Summary of Skimmed Journey Times Along the Existing A61 (Base and DM)**

Times in mm:ss

Direction	Time period	Base 2019	DM 2035	Dif	Dif as %
<b>Northbound</b>	AM	17:15	18:15	01:00	5.8%
<b>Northbound</b>	IP	14:37	15:33	00:56	6.4%
<b>Northbound</b>	PM	17:29	18:11	00:41	3.9%
<b>Southbound</b>	AM	14:52	15:10	00:18	2.0%
<b>Southbound</b>	IP	14:13	14:33	00:20	2.4%
<b>Southbound</b>	PM	16:59	17:43	00:44	4.3%

## Select Link Analysis

- 2.15 Select link analyses have been carried out on two sections of the A61 using the 2019 base year & 2035 forecast DM models, to provide an illustration of the routing of trips which use the A61.
- 2.16 Figure 3 to Figure 8 shows the routing of trips using the link between Langer Lane & Longedge Lane. Figure 9 to Figure 14 shows the same plots but for trips using the A61 link directly north of the A61/St Augustine’s Road junction.
- 2.17 The plots show flows using the select links (which are highlighted red) in both directions, calculated as ‘actual flows’ (SATURN modelled actual flows are flows which reach the link for which the flow is being shown during the modelled time period) in PCU per hour, summed across all user classes.
- 2.18 Appendix A contains plots for the same select link analyses, but covering a wider area of the network.



Figure 3. AM – 2019 Base Year – Select Link Analysis on A61 between Langer Lane & Longedge Lane

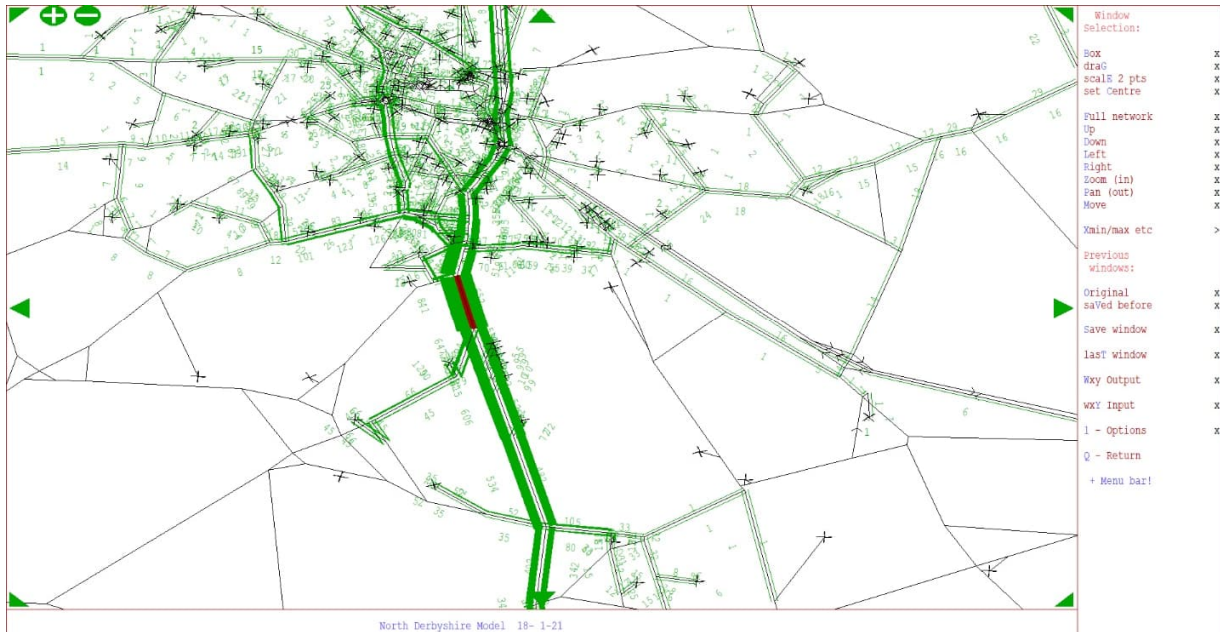


Figure 4. AM – 2035 DM Forecast – Select Link Analysis on A61 between Langer Lane & Longedge Lane

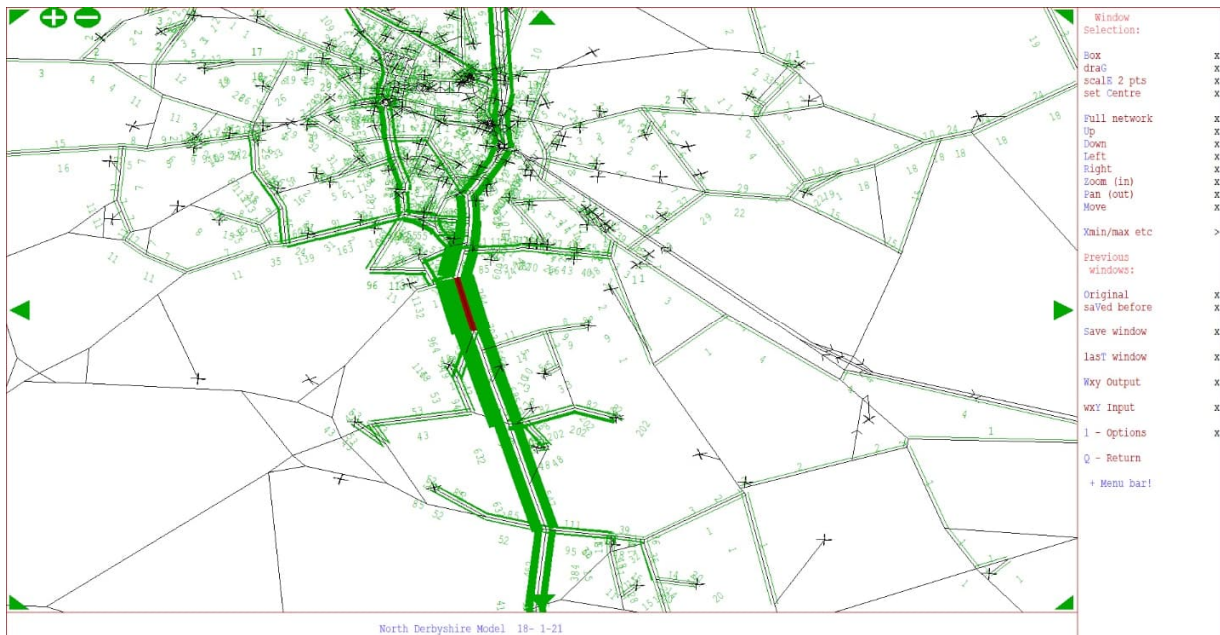


Figure 5. IP – 2019 Base Year – Select Link Analysis on A61 between Langer Lane & Longedge Lane

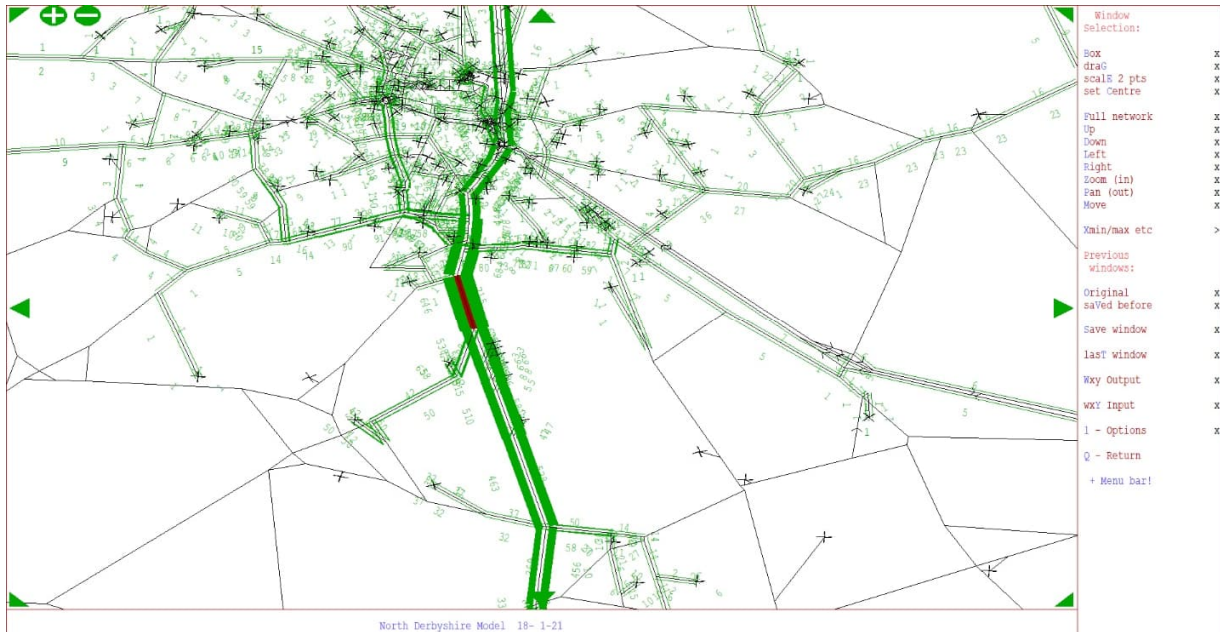


Figure 6. IP – 2035 DM Forecast – Select Link Analysis on A61 between Langer Lane & Longedge Lane

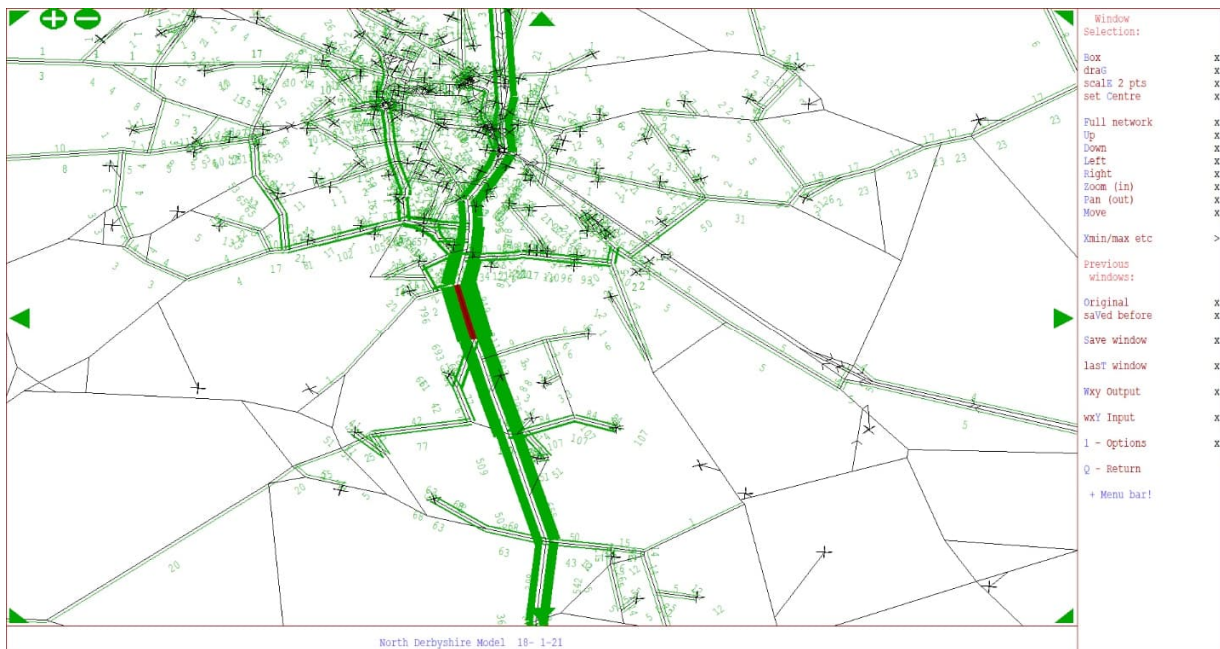




Figure 7. PM – 2019 Base Year – Select Link Analysis on A61 between Langer Lane & Longedge Lane

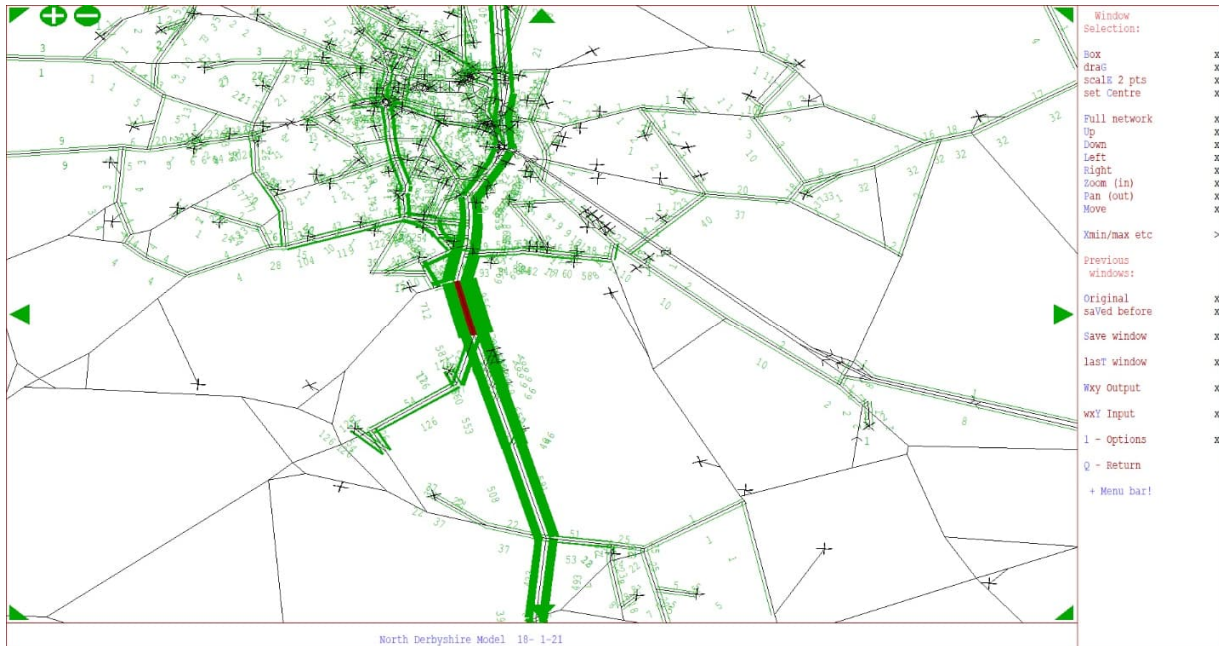


Figure 8. PM – 2035 DM Forecast – Select Link Analysis on A61 between Langer Lane & Longedge Lane

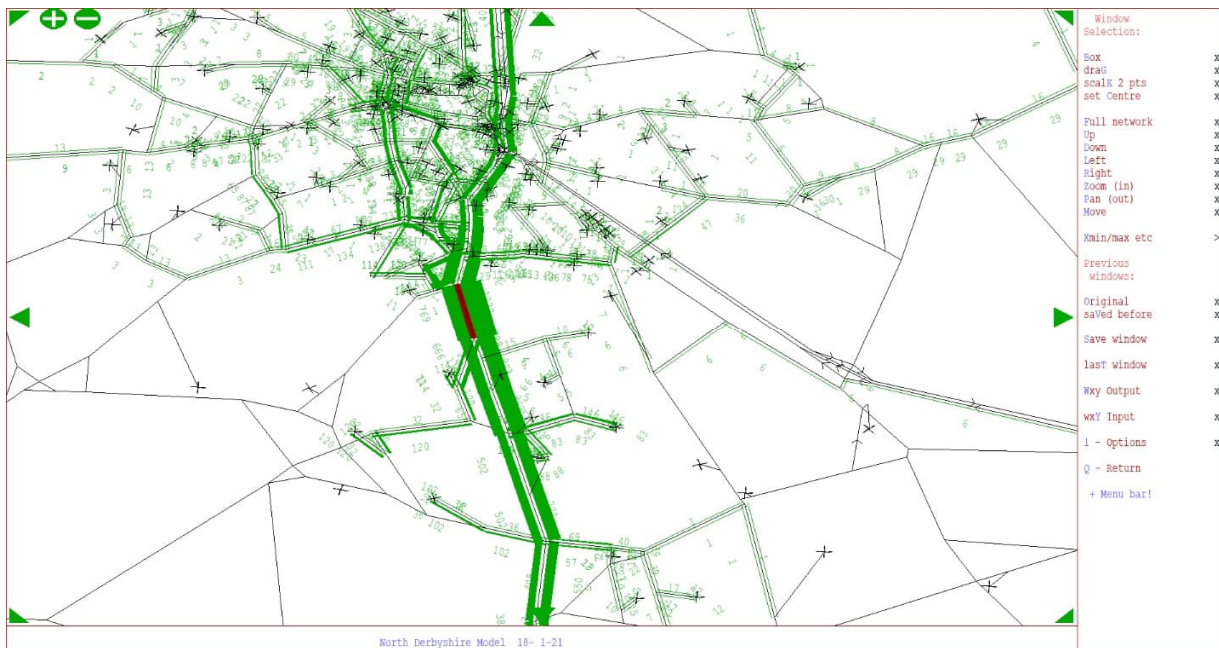




Figure 9. AM – 2019 Base Year – Select Link Analysis on A61 directly north of A61/St Augustine’s Road junction

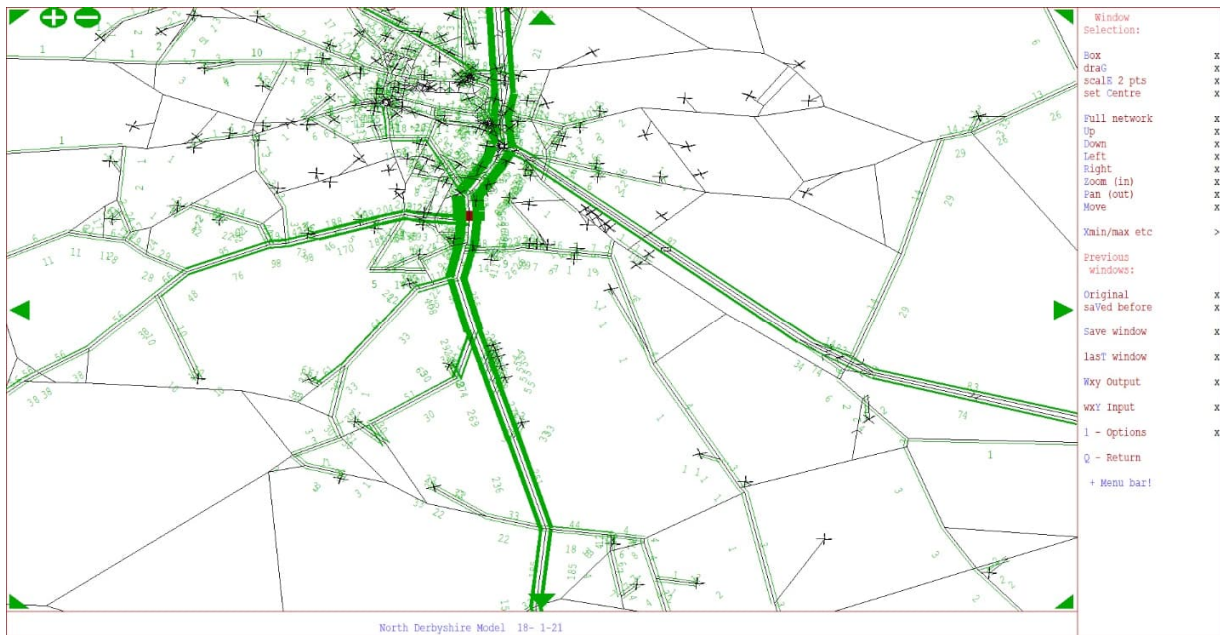
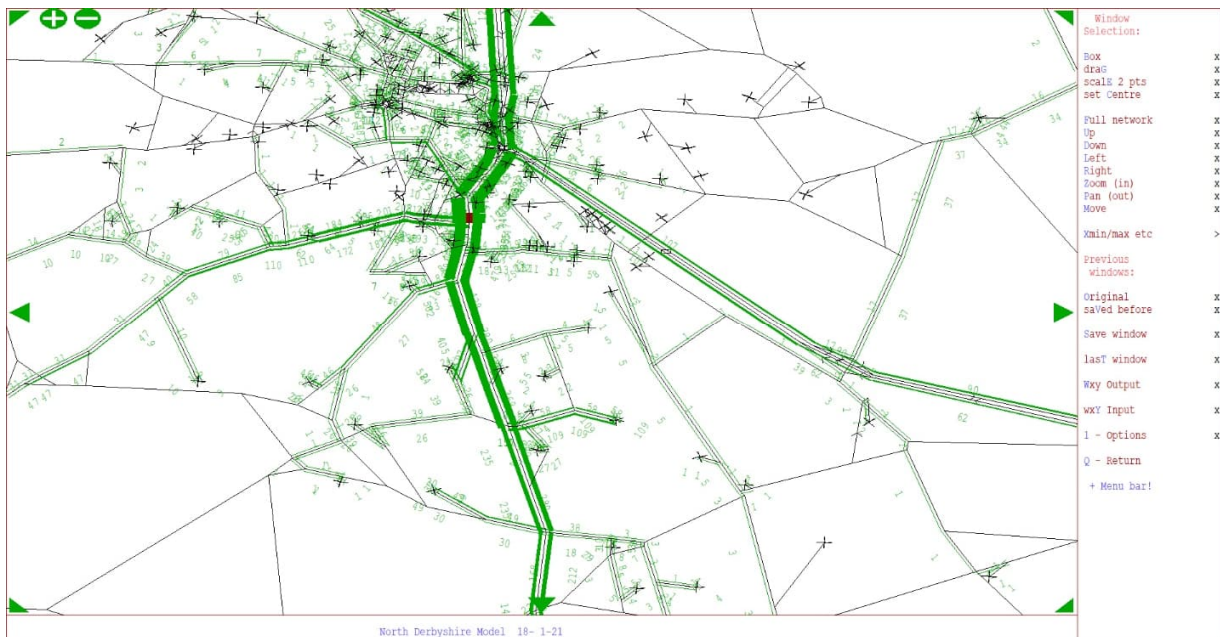
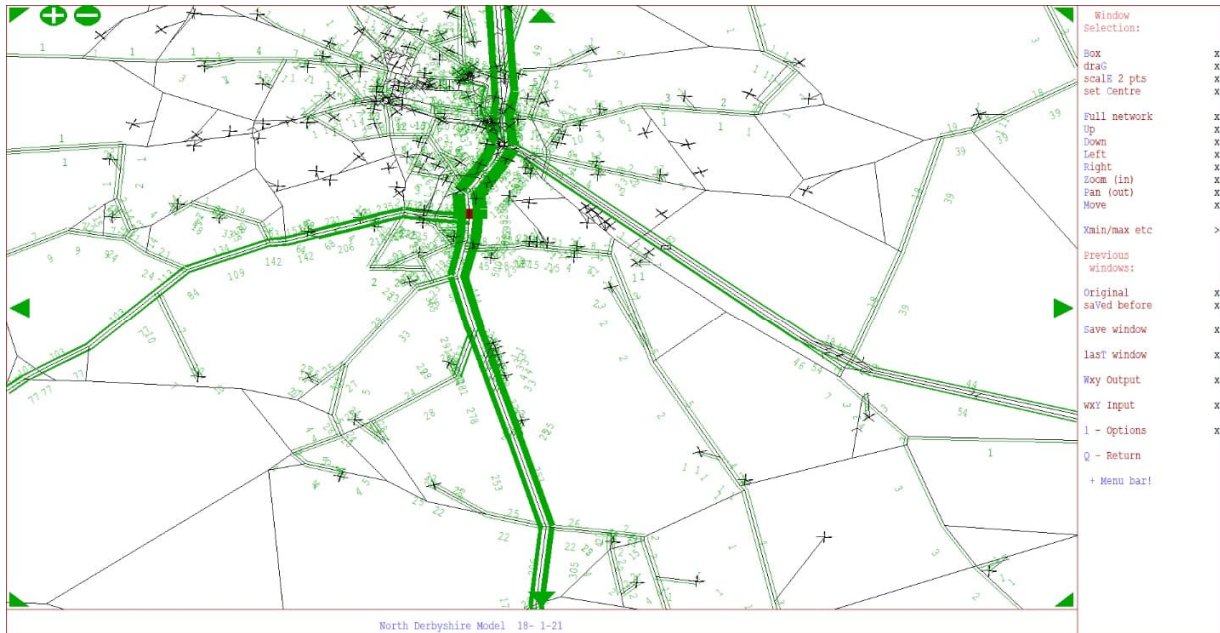


Figure 10. AM – 2035 DM Forecast – Select Link Analysis on A61 directly north of A61/St Augustine’s Road junction



**Figure 11. IP – 2019 Base Year – Select Link Analysis on A61 directly north of A61/St Augustine’s Road junction**



**Figure 12. IP – 2035 DM Forecast – Select Link Analysis on A61 directly north of A61/St Augustine’s Road junction**

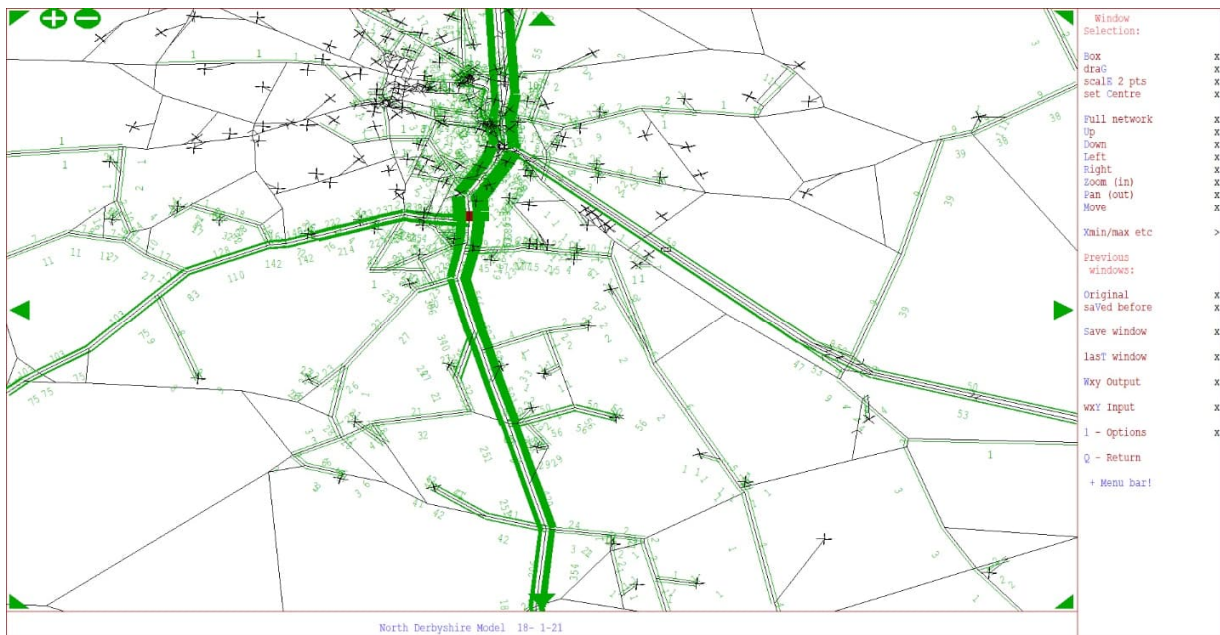


Figure 13. PM – 2019 Base Year – Select Link Analysis on A61 directly north of A61/St Augustine's Road junction

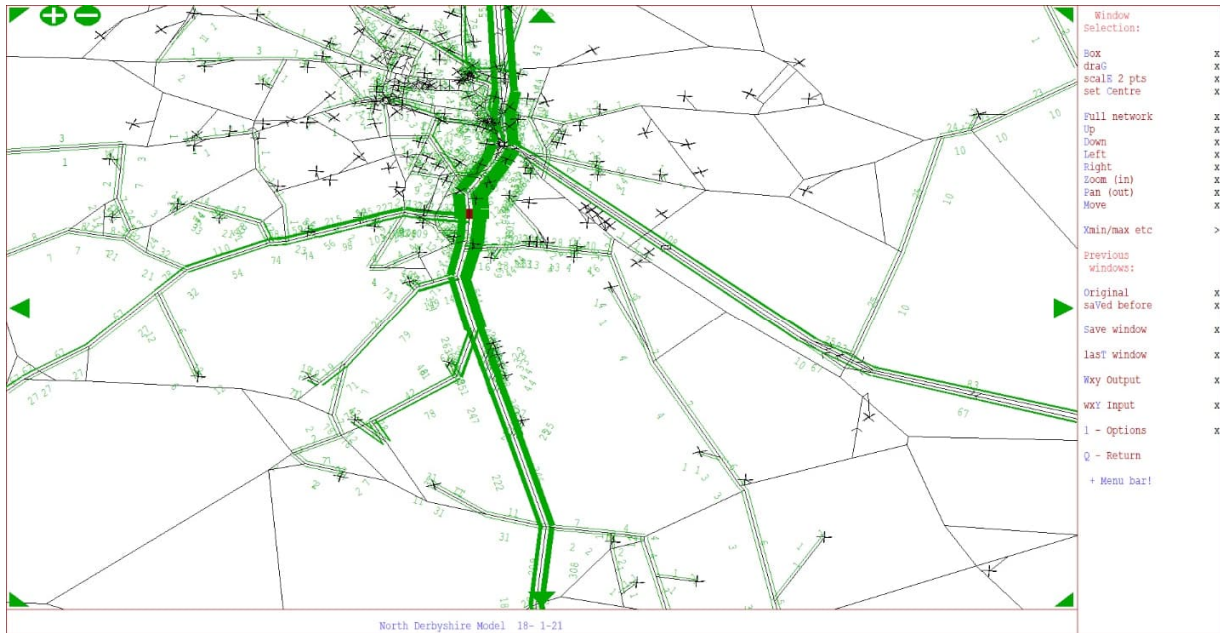
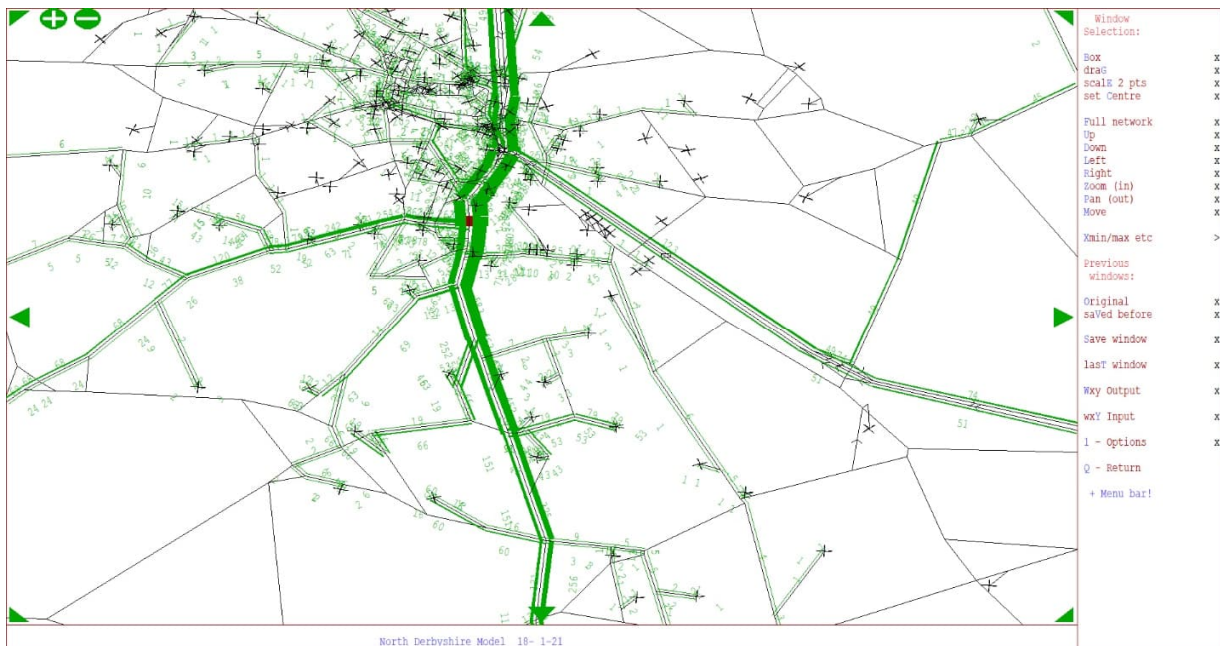


Figure 14. PM – 2035 DM Forecast – Select Link Analysis on A61 directly north of A61/St Augustine's Road junction





## 3. Testing of Options

- 3.1 The following options have been tested against the 2035 DM Forecast from the NDHAM model. Variable Demand Modelling (VDM) has been used in the preparation of the Do-Minimum trip forecasts, which represent a converged supply/demand equilibrium for the DM case. The options have been assessed using a fixed trip assignment of the DM trip demands on to modified networks (i.e. VDM has not been applied to the Options).

### Option 0 – A61 Offline Improvement

- 3.2 Option 0 represents a hypothetical scenario which uses very simple assumptions. The purpose of this test is to establish the impact of completely removing the delays at junctions within the key constrained section between Storthforth Lane and Hornsbridge.

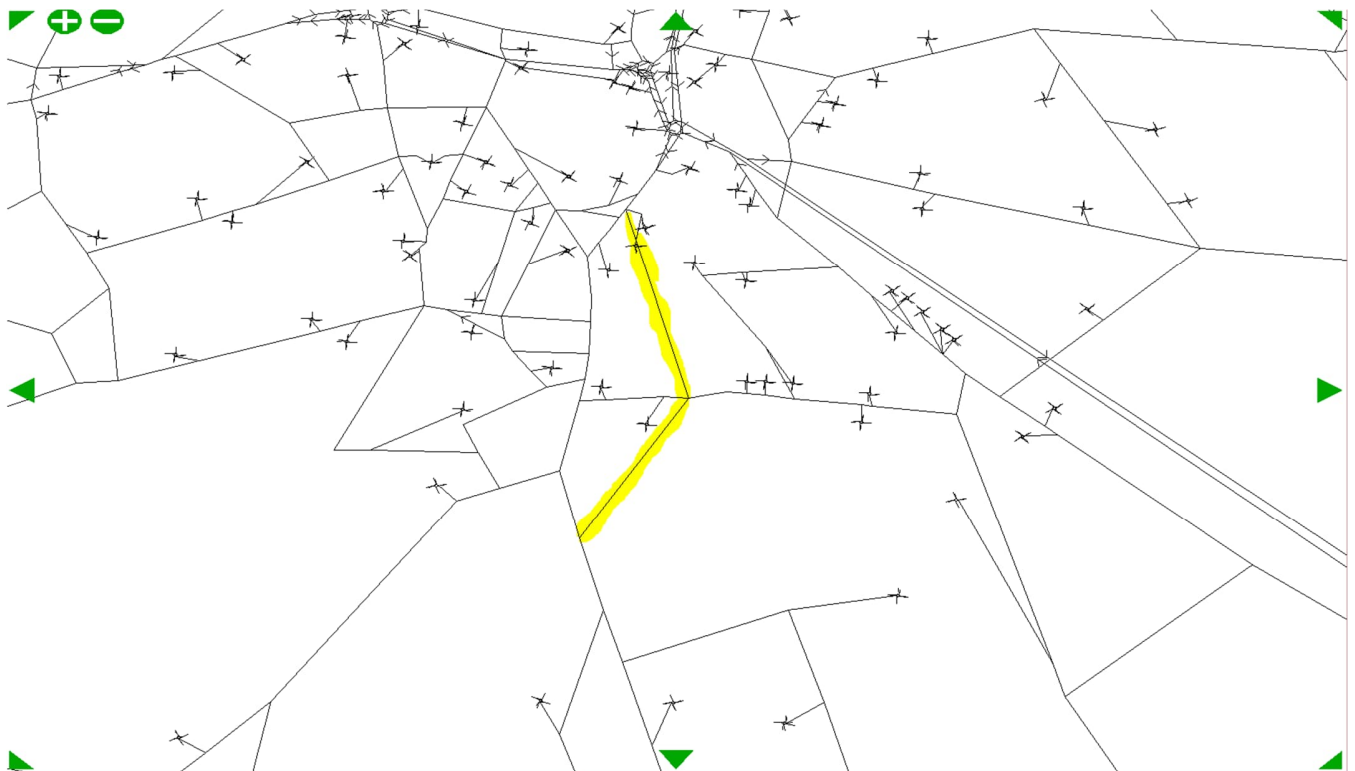
A61 Offline Improvements is a **hypothetical** scenario.
- 3.3 No assessment of the feasibility of a parallel route bypassing the existing A61 south of Chesterfield has been carried out at this time. As such, the two new links modelled to represent this option uses straight line (crow-fly) distances as approximations. This provides the shortest possible length for these links, and hence an upper bound estimate of the journey time saving and reassignment effects of such a scheme.
- 3.4 In terms of coding assumptions, three priority roundabout junctions were modelled. The northernmost of these is at the A61/Herriot Drive junction. This replaces an existing 3 arm priority junction. It should be noted the new link is modelled as a separate arm to the existing zone connector for the residential area at this location. This is therefore represented as a four-arm roundabout.
- 3.5 The middle roundabout is on Storthforth Lane, between Britannia Road and the rail bridge. The offline improvement has been modelled as two entirely new links: no interaction with adjoining roads (either in the residential areas to the north of Storthforth Lane or the industrial estates to the south) has been modelled.
- 3.6 The southernmost new roundabout is situated on the A61 between Langer Lane and Longedge Lane.
- 3.7 Figure 15 shows the two new links which form an A61 bypass via Storthforth Lane, highlighted in yellow. The new links have been modelled as a single carriageway with a 30mph speed limit. The relationship between the flow using the link and its speed has been modelled using a speed flow curve (SFC) as detailed in Table 4 (SFC 96).
- 3.8 At each of the three new roundabouts modelled, saturation flows of 2400 pcu/hour for the circulatory flow and 2000 pcu/hour for each entry arm have been used. The time to fully circulate each roundabout was modelled as 8 seconds.

**Table 4. Speed Flow Curves – Option 0**

Speed flow curve	Description	Free flow speed (kph)	Speed at capacity (kph)	Capacity (PCU/Hr)	N Value*
43	Small Town 90% development	41	27	1344	1.27
96	Suburban S2 (30mph)	48	23	1680	1.28

\* 'n' value, a parameter which defines the shape of the power-law relationship between flow (as a proportion of capacity) and link delay. In general terms high values of n are appropriate to high-capacity links without junctions at the end to limit capacity, e.g., motorways, while lower values are more appropriate to low-capacity urban roads where the effects of congestion are mainly associated with the junctions.

**Figure 15. Network Changes for Option 0**



## Option 1 – A61 Online Improvement

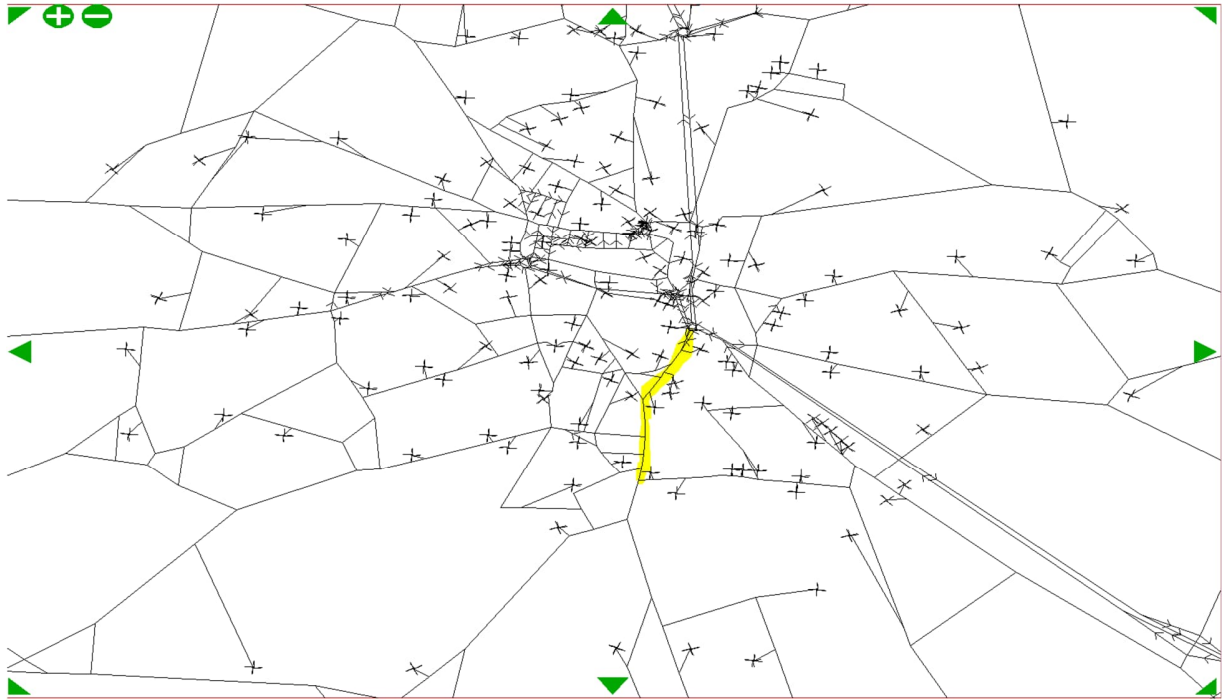
- 3.9 The following option uses the existing highway corridor along the A61 with no new links modelled. This option provides an indication of the traffic impacts of a 10% increase in capacity, provided by way of on-line improvements to the existing A61 and its junctions.
- A61 Online Improvements is a **hypothetical** scenario.
- 3.10 The purpose of this test is to establish the impact of a modest improvement in existing junction efficiency. However, the engineering feasibility of providing such an increase in capacity by way of this type of localised improvement has not been assessed. It is understood that signals along the A61 have recently been upgraded and are now operating at their maximum efficiency and therefore further capacity enhancement would likely involve lane widening and land-take (potentially outside of the highway boundary).
- 3.11 The area covered is between the A61 Derby Road / Storforth Lane Junction at the southern end and the southern entries to A61 / A617 Hornsbridge roundabout at the northern end. This is illustrated in yellow on Figure 16.
- 3.12 Along this section of the A61, SFC capacities were increased by 10%. As illustrated in Table 4, the currently single carriageway links were changed from SFC 43 to 431 with the exception of the dual links just south of Hornsbridge Roundabout which were changed from SFC 27 to 271.
- 3.13 In terms of the junctions, at traffic signal nodes (including pedestrian crossings), saturation flows were increased by 10% for all arms. At priority junctions, saturation flows were increased by 10% for A61 arms only.

**Table 5. Speed Flow Curves – Option 1**

Speed flow curve	Description	Free flow speed (kph)	Speed at capacity (kph)	Capacity (PCU/Hr)	N Value*
<b>43</b>	Small Town 90% development	41	27	1344	1.27
<b>431</b>	Small Town 90% development improved.	41	27	1478	1.27
<b>27</b>	Suburban D2 (30mph)	43	27	3540	1.28
<b>271</b>	Suburban D2 (30mph) improved.	43	27	3894	1.28

\* 'n' value, a parameter which defines the shape of the power-law relationship between flow (as a proportion of capacity) and link delay. In general terms high values of n are appropriate to high-capacity links without junctions at the end to limit capacity, e.g., motorways, while lower values are more appropriate to low-capacity urban roads where the effects of congestion are mainly associated with the junctions.

Figure 16. Network Changes for Option 1



## Option 2 – A61 – B6038 Link, via the Avenue

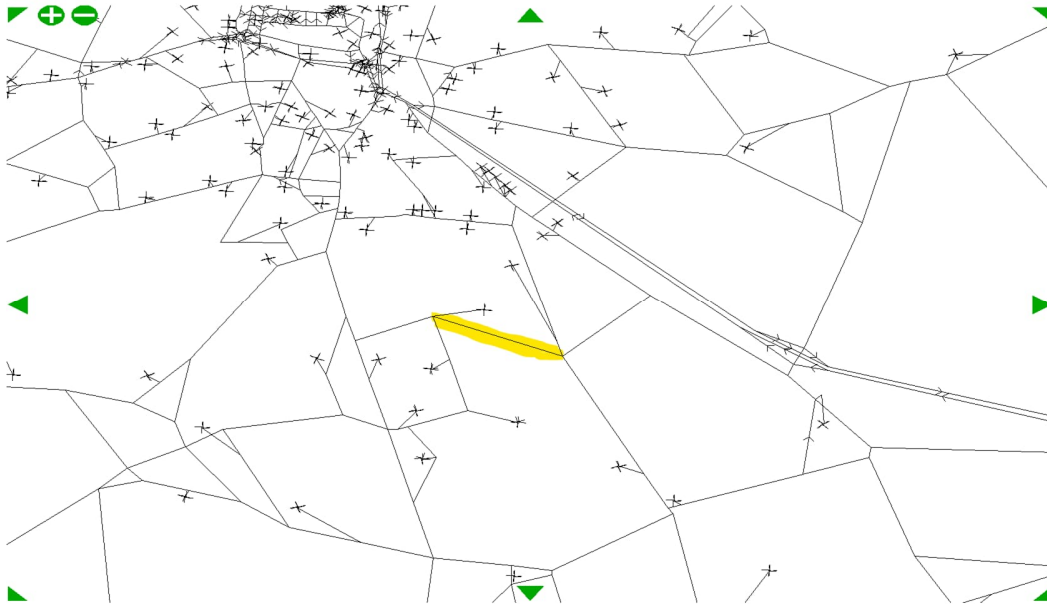
- 3.14 The purpose of this test is to re-examine a scheme contained in planning policy documentation, using the latest version of NDHAM. This option would provide a new link road between the A61 and B6038, linking around the north of the Avenue Estate, with a bridge over the Midland Mainline Railway, and connecting to the junction of B6038 & Furnace Hillock Way. The link is shown highlighted in yellow in Figure 17. No engineering or environmental assessment of this scheme has been undertaken as part of this study; however, this is a potential historic scheme option that was protected in the planning conditions of the Avenue development and as policy considerations in the North East Derbyshire Local Plan.
- A61 – B6038 Link is a potential scheme protected by the Avenue development.
- 3.15 It has been assumed for modelling that the new link road would be a 40mph, 1,047m link. This is a straight-line measurement between the existing roads and does not take into account any detailed design or routing. Due to the residential nature of the Avenue Estate, the existing Hornbeam Drive has a 30mph limit. At the eastern side, this section of the B6038 (Churchside to the north and North Wingfield Road to the south) is subject to a 40mph speed limit, although it should be noted that the connecting Furnace Hillock Way is 60mph (national speed limit). The speed flow curve used is shown in Table 6.
- 3.16 The existing roundabout at the western end of Furnace Hillock Way is represented in the base year and Do-Minimum models as a 3-arm roundabout. The western arm, which currently provides private access to Avenue Farm and to part of the Avenue site east of the railway, is not modelled. Trips to and from this area would be associated with a modelled zone which loads further north along the B6038, and which covers a wider area of traffic demand. It is noted that planning application 20/00634/FL seeks to develop the former ‘Coal Yard’ (which is accessed via this existing western arm of the roundabout) for office & warehousing uses. DCC’s responses to this application make note of the need to maintain the viability of the Option 2 link, which is referred to in both the North East Derbyshire Local Plan and the Derbyshire Local Transport Plan. DCC appears to be in active discussion with the applicant on this
- 3.17 In the Do Something coding for Options 2 and 3, the fourth arm modelled at this roundabout is the new link road, which represents an upgrade to the existing track connecting here.

**Table 6. Speed Flow Curves – Option 2**

Speed flow curve	Description	Free flow speed (kph)	Speed at capacity (kph)	Capacity (PCU/Hr)	N Value*
31	Suburban S2 (light development)	59	23	1680	2.63



Figure 17. Network Changes for Option 2



## Option 3 – A61 to A617, with new A617 slip roads

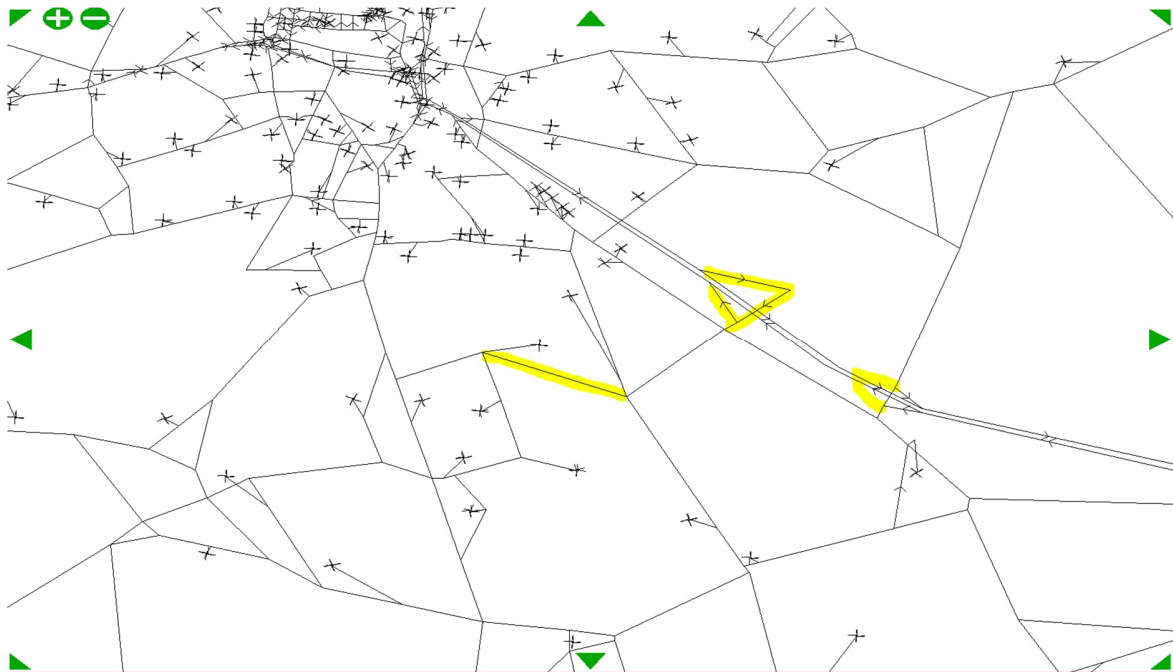
- 3.18 The purpose of this test is to establish the additional benefit of a reconfiguration of the A617 junctions, to maximise the potential benefits of Option 2 by (1) reducing capacity constraints associated with the existing Temple Normanton junction and (2) shortening trip lengths to the A617 for northbound traffic, thus reducing the impact on Churchside (Hasland). Option 3 is coded in the same manner as Option 2 (A61 – B6038 Link) with the addition of a new grade separated junction, with north-west facing slips only onto the A617, adjacent to Chesterfield Garden Centre on the B6039, Mansfield Road. Due to highway standards on weaving lengths, this would also require the removal of the existing north-west facing slips at the A617/B6425 Temple Normanton junction.
- 3.19 For the purposes of coding, the new slip roads use the same lengths as the existing slip roads which they replace, namely 486m for the on-slip (westbound) and 391m for the off-slip (eastbound). The new slip roads have been coded as 60mph, with the new bridge over the A617 and connecting link to the B6039 as 40mph, using the speed flow curve type '17' as detailed in Table 7.
- 3.20 The existing pair of signalised cross-roads at the Temple Normanton grade separated junction have changed to three-arm priority junctions. This is considered appropriate as the removal of the north-facing slips would reduce the number of conflicting turning movements at these junctions and hence the need for the signals.
- 3.21 The existing single-track bridge providing access to Manor House is not modelled in the Do-Minimum scenario and is similarly not modelled in the test of this option. Whilst this option has not been designed in detail, it is likely that the existing bridge would be removed, and access provided to adjoining properties such as Manor House via the new two-lane bridge constructed as part of the junction. A summary of the network changes, including the changes carried over from option 2, is shown in Figure 18.

The engineering and environmental feasibility of new A617 slip roads and junction has not been assessed.

**Table 7. Speed Flow Curves – Option 3**

Speed flow curve	Description	Free flow speed (kph)	Speed at capacity (kph)	Capacity (PCU/Hr)	N Value*
17	Rural S2 A Road 40mph	58	32	1328	2.39

Figure 18. Network Changes for Option 3



## Option 4 – A632 Matlock Road – A61 Link

3.22 The Select Link Analysis previously presented in this report indicated potential demand from A61 South into Chesterfield town centre. The purpose of this test, therefore, is to establish the impact of providing connection to alternative routes into western and central Chesterfield.

An A632 to A61 route is a **hypothetical** scenario. An initial engineering study has identified several constraints – see separate report.

3.23 Option 4 proposes a new link road between A632 Matlock Road and the A61 south of Chesterfield, via an intermediate junction with Langer Lane. An initial engineering assessment identified several potential routes, shown below. Alignment 1 has been modelled for this option which is shown in Figure 19. A separate TN has been prepared on the potential for these routes, though it should be noted that no environmental assessment has been conducted and the engineering assessment was limited to concept-stage, only.

Figure 19. Option 4 – Potential Alignments



3.24 Similar to Option 0, three roundabouts are proposed under this option. The westernmost is a 3-arm roundabout to the south of Walton on A632 Matlock Road. A direct alignment cutting through Walton Wood has been modelled, with a length of 1,800m, connecting into a second, four arm roundabout at Langer Lane. A second 900m link would then lead to the easternmost, three-arm roundabout situated on the A61 between its junctions with Langer Lane & Longedge Lane. The new links are highlighted in Figure 20.

3.25 While the potential alignments above have been investigated, this is only an initial assessment and does not guarantee that these options are feasible. In particular, while the route has been chosen to conform to horizontal and vertical alignment standards, the

steep gradients, watercourses and other land-use constraints in the area could mean that a new link following this alignment was not deliverable.

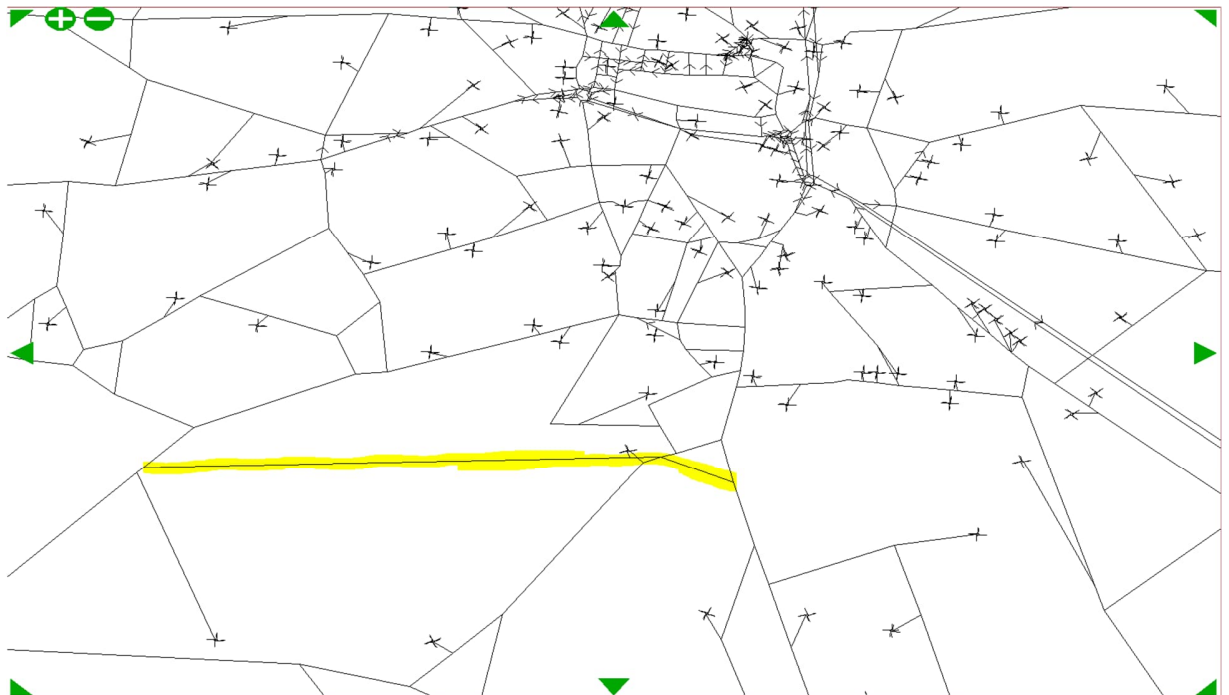
3.26 The two new links are coded at 40mph single carriageway, with a speed flow curve of type '31' as shown in Table 8.

3.27 At each of the three new roundabouts modelled, saturation flows of 2400 pcu/hour for the circulatory flow and 2000 pcu/hour for each entry arm have been used. The time to fully circulate each roundabout was modelled as 8 seconds.

**Table 8. Speed Flow Curves – Option 4**

Speed flow curve	Description	Free flow speed (kph)	Speed at capacity (kph)	Capacity (PCU/Hr)	N Value*
31	Suburban S2 (light development)	59	23	1680	2.00

**Figure 20. Network Changes for Option 4**



## Forecast Traffic Flows by Option

- 3.28 SATURN assignments have been carried out for the three modelled time periods (AM, IP and PM) using the 2035 forecast demands, for each option. Hourly traffic flows have been extracted from these assignments, and AADT flows have been calculated using the factoring process described previously.
- 3.29 Key links affected by flow changes under these options have been identified across the wider area: the locations of these links are presented in Figure 21. Table 9 shows 24-hour AADT flows at each of these locations for the 2019 base year, 2035 Do-Minimum and 2035 Do-Something Option forecasts. All flows are rounded to the nearest hundred vehicles per day.
- 3.30 Sites 20 to 25 are situated on new links created as part of some of the options. Site 22 is located on the new link road between the A61 to B6038 via the Avenue, which is common to Option 2 and Option 3.

### Option 0

- 3.31 Option 0 would have the greatest impact on the A61 north of St Augustine's Road in terms of AADT flow, as it provides a direct alternative alignment to the existing A61 in this area. The A61 near Tupton & A61 Hornsbridge would remain at similar AADT flow in this option to the DM.
- 3.32 Locations 20 and 21 are located on the new A61 bypass links unique to option 0. These links would each carry a two-way flow of between 16,000 and 17,000 vehicles per day.
- 3.33 Baden Powell Road would see an increase in trips under Option 0, partly because the reduction of flow on the section of existing A61, parallel to the new link, would be relieved of flow and becomes more attractive for use by trips via Baden Powell Road. Conversely, the B6039 Hasland Road shows a reduction in trips as traffic is instead attracted to use Storforth Lane.
- 3.34 The full impact on flow by time period can be seen in Appendix B for Option 0. These plots compare 2035 DM to 2035 DS Option 0. Blue represents a reduction in flow while green represents an increase. The magnitude of flow changes is represented by bandwidths: the thicker the line, the greater the flow change.

### Option 1

- 3.35 Option 1 provides online capacity increases along the existing A61. As a result, more traffic is drawn into the existing A61 corridor, with AADT increases on the A61 north of St Augustine's Road. There is also a small increase in flow at Hornsbridge.
- 3.36 Similar to Option 0, there is a decrease in traffic using B6039 Hasland Road, but under Option 1, there is a negligible change in flow along Baden Powell Road. There is a decrease in AADT flow along B6038 North Wingfield Road.
- 3.37 Hourly flow difference plots for Option 1 are presented in Appendix C.

### Options 2 and 3

- 3.38 It is useful to compare Option 2 and Option 3 together. Both these options would introduce a new link between A61 and B6038 via the Avenue estate as described above. This link is shown in Table 9 as location 22. This link is forecast to carry a two-way AADT flow of 9,200

vehicles/day under Option 2, and 10,900 vehicles/day under Option 3. Option 3 would also introduce new grade-separated north-facing slip roads on the A617.

- 3.39 While Option 2 would have a small impact (400 vehicle reduction in 2-way AADT) on the A61 north of St. Augustine's Road, Option 3 would provide a much larger reduction in AADT, from 21,000 to 18,900. On the A61 near Tupton, two-way daily flow would increase in Option 2, while Option 3 would see flow levels remain similar to the Do-Minimum.
- 3.40 At the B6038 North Wingfield Road, the DM two-way AADT flow of 8,500 veh/day would be reduced by Option 2 to 7,300 veh/day, but would show a large increase in Option 3, to 12,200 veh/day.
- 3.41 Furnace Hillock Way, which is the existing link between the B6038 and B6039, would show by far the largest increase in traffic flows in Option 2 and Option 3. As the new bridge over the railway line would create a connection to the south-western end of Furnace Hillock Way, traffic would be attracted along this route between the A61 and A617. The forecast two-way AADT would increase from 1,700 vehicles/day in DM to 5,800 veh/day in Option 2. In Option 3, the new north-facing slip-roads onto the A617 would make this route still more attractive, increasing the two-way AADT flows to 18,500 veh/day.
- 3.42 As Option 2 would provide a new link between the A61 and B6038, but no access to the A617 except at the existing Temple Normanton junction to the south, this option would cause the two-way AADT flow on Churchside, into Hasland, to increase slightly, from 9,500 veh/day in the Do-Minimum to 9,800 veh/day in Option 2. Option 3, by providing easier access to the A617 to the north, would reduce this flow to 4,000 veh/day.
- 3.43 The new north-facing slip roads onto the A617 at Chesterfield Garden Centre under Option 3 are forecast to carry AADT flows between 70% and 90% higher than those carried in the Do-Minimum case by the corresponding north-facing slip-roads at Temple Normanton, which they would replace.
- 3.44 Hourly flow difference plots for Options 2 and 3 are presented in Appendix D and Appendix E respectively.

#### Option 4

- 3.45 Option 4 would have the least impact on flows on the key links identified. Whitecotes Lane & St Augustine's Road show reductions in flow under this option, but all flows on all three of the A61 links which have been included in the comparison would remain largely unchanged. The largest impacts would be on Somersall Lane, where flows would increase from 8,200 veh/day two-way AADT in the Do-Minimum to 11,500 veh/day in Option 4. Flows on Storforth Lane would also increase under this option, from 12,200 veh/day two-way AADT in the Do-Minimum to 12,600 veh/day in Option 4.
- 3.46 These changes in flow would occur because the proposed A632 to A61 link would attract trips onto existing routes at each end of the new link, including Storforth Lane (between Hasland and the A61) to the south-east, and Walton Back Lane and Somersall Lane (between Matlock Road and Chatsworth Road) to the north-west.
- 3.47 Hourly flow difference plots for Option 4 are presented in Appendix F.



Figure 21. Modelled AADT Locations





**Table 9. AADT Flows by Option (in vehicles, rounded to nearest 00s)**

Site ID	Link description	2019 Base AADT24	2035 DM AADT24	2035 Opt 0 AADT24	2035 Opt 1 AADT24	2035 Opt 2 AADT24	2035 Opt 3 AADT24	2035 Opt 4 AADT24
1	<b>A61 north of St Augustine's Rd, NB</b>	9,400	9,600	4,500	10,600	9,400	8,700	9,900
1	<b>A61 north of St Augustine's Rd, SB</b>	10,700	11,400	7,200	12,000	11,200	10,200	11,200
2	<b>A61 near Tupton, NB</b>	7,400	9,100	10,200	9,600	10,100	9,600	9,700
2	<b>A61 near Tupton, SB</b>	7,700	10,300	10,700	10,400	10,500	9,800	10,500
3	<b>A61 north of Hornsbridge, NB</b>	16,700	17,600	17,900	17,900	17,800	17,800	17,700
3	<b>A61 north of Hornsbridge, SB</b>	21,800	23,900	23,800	24,000	23,700	24,000	23,800
4	<b>St Augustine's Rd, EB</b>	6,300	6,400	6,000	7,000	6,500	6,500	6,300
4	<b>St Augustine's Rd, WB</b>	3,900	3,900	6,400	4,200	4,000	4,300	3,700
5	<b>Whitecotes Lane, EB</b>	7,900	8,200	8,300	8,500	8,400	8,500	6,600
5	<b>Whitecotes Lane, WB</b>	8,200	8,500	9,100	8,400	8,400	8,700	7,000
6	<b>A632 Matlock Rd, Walton, EB</b>	6,200	6,600	6,400	6,800	6,600	6,600	6,900
6	<b>A632 Matlock Rd, Walton, WB</b>	5,700	6,100	6,000	6,100	5,900	5,900	6,300
7	<b>B6038 North Wingfield Rd, Grassmoor, NB</b>	2,800	4,800	4,000	4,400	3,900	5,700	4,900
7	<b>B6038 North Wingfield Rd, Grassmoor, SB</b>	2,900	3,700	3,600	3,600	3,400	6,500	3,900
8	<b>Churchside, Hasland, NB</b>	3,100	5,400	4,300	5,000	6,000	2,200	5,500
8	<b>Churchside, Hasland, SB</b>	3,100	4,100	4,000	4,000	3,800	1,700	4,300
9	<b>Mansfield Road, Hasland, NB</b>	2,000	2,000	2,100	2,000	2,300	2,200	1,900
9	<b>Mansfield Road, Hasland, SB</b>	2,400	1,900	2,200	1,900	1,700	2,500	1,900
10	<b>Furnace Hillock Way, EB</b>	300	800	700	700	2,900	9,600	700
10	<b>Furnace Hillock Way, WB</b>	300	900	500	800	2,900	9,000	900
11	<b>A617 Temple Normanton Jn, N-facing merge</b>	5,900	6,200	6,200	6,200	5,600	-	6,000
11	<b>A617 Temple Normanton Jn, N-facing diverge</b>	4,200	4,500	3,900	4,400	4,300	-	4,300
12	<b>A617 Temple Normanton Jn, S-facing merge</b>	2,700	3,200	3,300	3,200	3,300	4,300	3,100
12	<b>A617 Temple Normanton Jn, S-facing diverge</b>	2,700	3,000	2,700	2,900	3,200	3,300	2,800
13	<b>B6039 Hasland Rd, NB</b>	7,800	10,100	8,900	9,700	10,700	6,500	9,500

Site ID	Link description	2019 Base AADT24	2035 DM AADT24	2035 Opt 0 AADT24	2035 Opt 1 AADT24	2035 Opt 2 AADT24	2035 Opt 3 AADT24	2035 Opt 4 AADT24
13	<b>B6039 Hasland Rd, SB</b>	6,000	6,600	5,800	6,400	6,700	4,700	6,600
14	<b>Baden Powell Rd, NB</b>	2,100	2,400	3,200	2,400	2,400	2,400	2,400
14	<b>Baden Powell Rd, SB</b>	3,100	3,700	5,500	3,700	3,800	4,200	3,300
15	<b>Boythorpe Road, NB</b>	6,700	7,600	8,000	7,300	7,400	7,000	7,500
15	<b>Boythorpe Road, SB</b>	6,700	7,200	7,200	7,200	7,100	7,100	7,400
16	<b>Somersall Lane, NB</b>	3,000	3,900	3,800	3,800	3,800	3,500	6,100
16	<b>Somersall Lane, SB</b>	3,800	4,300	4,300	4,300	4,300	4,200	5,400
17	<b>Langer Lane, NEB</b>	2,000	2,200	1,400	2,200	2,300	2,300	1,800
17	<b>Langer Lane, SWB</b>	2,200	2,200	2,300	2,200	2,000	1,800	1,700
18	<b>Longedge Lane, NB</b>	2,000	1,600	2,400	1,600	2,000	2,300	1,600
18	<b>Longedge Lane, SB</b>	2,100	2,000	2,000	2,000	2,700	3,000	1,600
19	<b>Storforth Lane, EB</b>	5,800	6,300	7,900	6,200	4,100	4,200	6,400
19	<b>Storforth Lane, WB</b>	5,300	5,900	6,000	5,700	4,200	4,500	6,300
20	<b>Opt 0 new link S of Storforth Lane, NB</b>	-	-	8,300	-	-	-	-
20	<b>Opt 0 new link S of Storforth Lane, SB</b>	-	-	8,500	-	-	-	-
21	<b>Opt 0 new link N of Storforth Lane, NB</b>	-	-	7,400	-	-	-	-
21	<b>Opt 0 new link N of Storforth Lane, SB</b>	-	-	8,900	-	-	-	-
22	<b>Opt 2+3 new link over railway, EB</b>	-	-	-	-	5,400	6,300	-
22	<b>Opt 2+3 new link over railway, WB</b>	-	-	-	-	3,800	4,600	-
23	<b>Opt 3 new A617 N-facing merge</b>	-	-	-	-	-	10,700	-
23	<b>Opt 3 new A617 N-facing diverge</b>	-	-	-	-	-	8,400	-
24	<b>Opt 4 new link A61-Langer Lane, WB</b>	-	-	-	-	-	-	6,100
24	<b>Opt 4 new link Langer Lane-A61, EB</b>	-	-	-	-	-	-	3,500
25	<b>Opt 4 new link Langer Lane-A632 Matlock Rd, WB</b>	-	-	-	-	-	-	7,100
25	<b>Opt 4 new link A632 Matlock Rd-Langer Lane, EB</b>	-	-	-	-	-	-	5,500

## Forecast Journey Times by Option

- 3.48 In order to evaluate the impact of the various options, both fixed-route and skimmed journey times have been compared. This follows the approach set out previously: the fixed trip journey time route has been carried out along the existing A61 between Longedge Lane & Hornsbridge, and the skimmed journey time calculation between zones adjoining the Harris Way and Rother Way roundabouts.
- 3.49 The comparison of fixed-route journey times is shown in Table 10.
- 3.50 It should be noted that for the fixed-route journey times, the time for Option 0 does not cover the new alignment, but rather the existing A61 corridor. Therefore, these results do not fully represent the journey time savings that Option 0 would provide to through trips on the A61.
- 3.51 For Options 0 & 4, the new roundabout junctions would add new sources of delay to the existing A61 route. For Option 0, in the AM & IP southbound, there is an increase in journey times, partly due to delay at the new junctions. In southbound PM & all northbound time periods, Option 0 would provide a reduction in journey times on the existing A61.
- 3.52 Option 1 provides modest improvements to journey times across all time periods, when compared to DM 2035.
- 3.53 Option 2 also shows minor improvements across all time periods.
- 3.54 Option 3 provides the greatest reduction in journey times along the A61 corridor within the fixed route journey times. This is due to the new link road and new grade separated junction providing an attractive alternative route to the existing A61.
- 3.55 As mentioned above, Option 4 introduces a new roundabout to the existing A61 alignment. While this does introduce new delays, journey times would be reduced overall in the AM and PM northbound, and in the PM southbound.

**Table 10. Summary of Fixed-Route Journey Times Along the Existing A61 (Base, DM and Options)**

Times in mm:ss

Direction	Time period	Base 2019	DM 2035	Option 0 (2035)	Option 1 (2035)	Option 2 (2035)	Option 3 (2035)	Option 4 (2035)
<b>Northbound</b>	AM	07:43	08:44	08:42	08:29	08:08	07:11	08:16
<b>Northbound</b>	IP	05:16	06:06	05:46	05:44	05:49	05:21	06:14
<b>Northbound</b>	PM	08:06	08:34	08:25	08:16	07:53	07:09	08:22
<b>Southbound</b>	AM	04:37	04:36	04:53	04:30	04:34	04:25	04:45
<b>Southbound</b>	IP	04:35	04:38	04:42	04:32	04:33	04:22	04:48
<b>Southbound</b>	PM	05:34	05:51	05:12	05:26	05:43	04:43	05:49

- 3.56 The comparison of skimmed journey times takes into account alternative routes, including rerouting due to increased delay or the provision of alternative routes as a result of the options. The zone pair chosen also illustrate changes in journey times over a longer section of the A61 than that used for fixed route journey times. This comparison is shown in Table 11.
- 3.57 Unlike the previous test, the Option 0 skimmed time comparison considers alternative routing options. Subsequently, the times in Table 11 show a greater reduction in journey times for Option 0 than in Table 10.
- 3.58 For Option 1, the online A61 improvements provide modest reductions in journey time across all time periods.
- 3.59 Option 2 provides greater benefit in the northbound direction, especially in the counter-tidal flow in the PM time period.
- 3.60 Option 3 has, for the majority of combinations of time period and direction, the greatest reduction in journey times. This is because the combination of the new link road and A617 north-facing slip-roads would provide the most effective link between the alternative radial routes to the south and east of Chesterfield.
- 3.61 Option 4 would provide the least reduction in skimmed journey times on the A61, but would still offer minor reductions in some combinations of directions and time period.

**Table 11. Summary of Skimmed Travel Times in the A61 Corridor (Base, DM and Options)**

Times in mm:ss

Direction	Time period	Base 2019	DM 2035	Option 0 (2035)	Option 1 (2035)	Option 2 (2035)	Option 3 (2035)	Option 4 (2035)
<b>Northbound</b>	AM	17:15	18:15	17:33	18:07	17:52	16:40	18:01
<b>Northbound</b>	IP	14:37	15:33	15:05	15:17	15:22	14:51	15:36
<b>Northbound</b>	PM	17:29	18:11	17:33	18:01	17:26	16:08	17:56
<b>Southbound</b>	AM	14:52	15:10	15:04	15:09	15:08	14:57	15:32
<b>Southbound</b>	IP	14:13	14:33	14:29	14:27	14:27	14:09	14:48
<b>Southbound</b>	PM	16:59	17:43	16:57	17:31	17:40	17:00	17:42

## 4. Conclusions

4.1 The following options have been tested, using the North Derbyshire Highways Assignment Model (NDHAM) to comparing the impacts of each option against the 2035 Do-Minimum forecast. At this stage, five options have been tested:

- Option 0 – A61 offline improvement.
- Option 1 – A61 online improvement.
- Option 2 – A61 – B6038 Link via the Avenue.
- Option 3 – A61 to A617, with new A617 slip roads.
- Option 4 – A632 – A61 Link.

4.2 It is important to note that, at this stage, **no engineering feasibility or environmental assessment has been conducted**. Such work may ultimately prove that options are not feasible, or identify constraints which would require a judgement by DCC as to whether or not the options should be pursued. In addition, the scope of this TN does not include for the detailed modelling that would be required to support a scheme through a planning application or business case.

4.3 In order to compare the traffic volume impact of each option, Annual Average Daily Traffic Volumes have been calculated.

4.4 Fixed-route journey times have been assessed along the A61 between Longedge Lane & Hornsbridge. In addition, skimmed journey times between zone 253 (on the north side of Clay Cross, loading onto the A61/Harris Way roundabout) and zone 91 (north of Chesterfield, at the A61/Rother Way roundabout) has been used to compare journey times along a greater section of the A61 corridor, taking into account different routing options between these zones.

4.5 Option 0, by nature of being a bypass option around the existing alignment, reduces the AADT flow on the existing A61 to the north of St Augustine's Road by the largest volume. However, once off the bypass link, the flows on adjacent sections are similar. Option 0 would produce modest journey time savings across both tests. However, it appears likely that finding a suitable route for Option 0 would prove difficult, as it would run through an industrial area to the south of Storforth Lane and a residential area, with adjoining parkland, to the north, in close proximity to the River Rother and railway line. The journey time savings and benefits of flow reduction on the section of A61 bypassed by this option might not be exceed the cost of constructing such an alignment.

4.6 Option 1 represents online improvements to existing junctions, increasing the capacity on the current A61 by 10%. While these capacity increases have been modelled to assess their impact on flows and journey times, further investigation would be required to establish whether such capacity increases could be achieved through localised improvements to the existing A61: there may not be room to enlarge the junctions to the scale required. While this option would offer a reduction in journey times, higher levels of traffic flow would be drawn into the existing A61 corridor due to increased attractiveness of the route.

4.7 Option 2 would provide some relief to the existing A61 corridor and other key links within the area. It would also provide journey time improvements across all time periods. The

proposed link between the A61 and B6038 also benefits from inclusion within the 'North East Derbyshire Local Plan' & 'Derbyshire Local Transport Plan'. The existing roundabout on the A61/Hornbeam Drive was designed with the intention of supporting this new link which is a safeguarded route across the new Avenue estate. This link could also support development of the former coal yard site to the east of the railway line. On the basis of this assessment, it appears likely that Option 2 could be a viable option to reduce traffic flows and journey times on the A61 to the south of Chesterfield.

- 4.8 Option 3 provides greater journey time reductions and is more attractive to North – South trips along the A61 corridor than Option 2. As this study has not taken into account engineering feasibility, further work would be required to investigate whether a new grade separated junction providing north-facing slip roads to and from the A617 adjoining the B6039/Furnace Hillock Way roundabout is achievable. The existing roundabout is on a similar ground level to the A617, and so the provision of an overbridge at this location might require a high land take. However, if the capital costs and other impacts of removing the existing north facing slips at Temple Normanton and creating a new junction on the A617 to the north are acceptable, this assessment suggests that this option would generate the most journey time improvements of the five options assessed.
- 4.9 Option 4 would generate the least benefit in terms of scheme objectives of traffic flow and journey time reduction along the A61. While Option 4 would improve connectivity around the southwest side of Chesterfield (including Wingerworth and Walton), in doing so it would attract increased flows onto Walton Back Lane & Somersall Lane (which includes a narrow bridge on a sharp bend). This option would have little impact on the A61 south of Chesterfield. The traffic model indicates that much of the traffic using the existing A632 Matlock Road currently routes via Walton Road to A619 Chatsworth Road, offering little scope to reduce flows on the A61 by providing a link to the A632. While an engineering study has assessed the feasibility of several alignments for this option, one of which has been modelled, all potential alignments investigated so far have constraints including the golf course, forestry/woodland, watercourses and steep gradients. This may result in the benefits of this option being insufficient to justify its cost and environmental impacts.