Stratford upon Avon Wide Area Paramics Model

Core Strategy Model Development

August 2018

VM185176.TN001

Introduction

1. At the request of Warwickshire County Council (WCC), Vectos Microsim (VM) has recently undertaken an update of the existing 2013 Stratford upon Avon Wide Area (SuAWA) Paramics Base model, to create a 2017 Base model.

2. The update was intended to ensure that all developments within the Stratford area which have been granted planning permission since the last model update are included within the model.

3. Following the update of the Base model, two forecast year models were developed, the 2023 and 2031 Reference Case models. Detail behind the development of these models is provided in a supporting technical note[1], which should be read in conjunction with this Note.

4. Subsequently WCC and Stratford District Council (SDC) have requested a further set of models, which are to reflect the current understanding of the Local Plan (Core Strategy) assumptions. Accordingly, a 2031 Core Strategy model has been created, along with an 'interim year' (2023) Core Strategy model. These Core Strategy models are based upon the newly created Reference Models. These models contain the Core Strategy allocations and commitments in terms of developments and infrastructure.

Objectives

5. The objective of this exercise is to produce two future year (2023 and 2031) Paramics models of the Stratford-upon-Avon Wide Area model, which reflects the Core Strategy allocations and infrastructure.

6. Through this process, VM will seek to optimise the network which will include the introduction of the Stratford Transport Package and any other measures deemed appropriate by VM or WCC. The schemes will be included on the basis of what is most desirable in each area.

7. This modelling assessment will not replace the site specific transport assessment work produced by each of the site promoters and the schemes that VM include within the model should be treated as such (i.e. they are concept schemes, included in a similar level of detail to the original Stratford Transport Package (STP).

[1] VM175117.TN002 SuAWA Forecasting Note

Development Assumptions

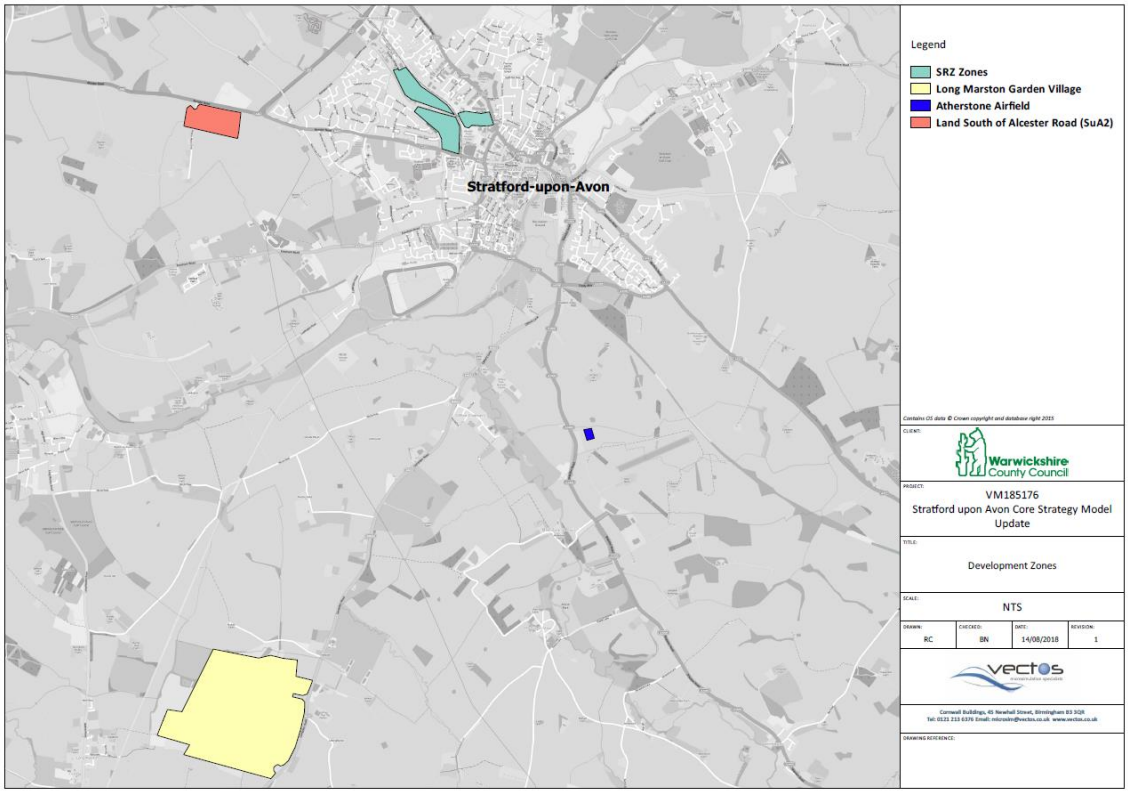
8. It is understood that the following development sites are valid for inclusion within the Core Strategy Model:

- Allocation of residential land in the Stratford Regeneration Zone (SRZ);
- Delivery of employment land off Alcester Road (SuA2);
- Allocation of residential land at Long Marston Airfield (in addition to the 400 included in the Reference Case)
- Allocation of employment land at Atherstone Airfield (SuA4)

9. It is understood that these site specific demands for these trips require inclusion within the existing 2031 Reference Case to form the 2031 Core Strategy scenario, along with in the 2023 Reference Case, to form the 2023 Core Strategy (interim year) scenario.

10. The location of each of these development sites is outlined within **Figure 1**, with additional detail provided in the following section.

Figure 1 Core Strategy Development Zone Locations



Stratford Regeneration Zone (SRZ)

11. It is understood that the SRZ development will re-allocate land within the existing SRZ model zones for housing and relocate some of the existing employment to Alcester Road and Atherstone Airfield.

12. As advised by SDC, 1,000 dwellings are to be included within the SRZ in the 2031 Core Strategy scenario, which will be allocated across three zones within the model, (as shown in **Figure 1**) with the number of dwellings split equally across the zones. SDC have also advised that 9,000m^2 of existing B1 employment land use will be retained within the SRZ.

13. The trip generation for the SRZ housing has been informed via the WCC standard residential trip rates, and the distribution applied as the recently collected WCC mobile network database (MND). As the SRZ is located to the north west of Stratford town centre, it was deemed appropriate and realistic to apply mode shift assumptions to all trips generated by this site. As such a 15% car share reduction has been assumed and applied to the SRZ demands accordingly.

14. The existing trips for the three SRZ zones have been removed from the background traffic matrix (matrix 1) as part of this process, to reflect the reallocation of the current employment land, and trips associated with the 9,000m^2 of B1 employment land re-instated, using WCC provided trip rates from the TRICS database.

15. As advised by SDC, the 2023 Core Strategy (interim year) model has assumed 90 dwellings will be delivered at the SRZ site by 2023. It was determined that at this stage, the trips in Matrix Level 1 for these zones would not be removed from the modelling, on the basis that the current land use at the SRZ will not have relocated by this point. Accordingly there is no requirement to include the additional 9,000m^2 of B1 employment trips within the 2023 models, as these trips will be accounted for in the background matrices.

Land South of Alcester Road Employment Land (SuA2)

16. The employment land removed from the SRZ has been re-allocated to a site off Alcester Road to the west of Stratford. It is understood that in the 2031 Core Strategy model, this employment land allocation at SuA2 will amount to around 105,000m^2, which includes 13,000m^2 B1 6,000m^2 B2, 24,000m^2 B8 land use types. SDC have advised that for the 2023 Core Strategy (interim year) scenario, a 50% build out of the site should be assumed.

17. The trip generation and distribution for the employment site has been informed via the site specific planning application work currently being undertaken by VM. VM understand that the trip distribution being used within the assessment is based upon 2011 Census journey to work data.

18. The access for this site has also been informed by the site specific planning application work being undertaken by VM, and has been included in both the 2031 and 2023 Core Strategy models in the form of a roundabout on the A46, to the west of the existing A46/Wildmoor junction.

Long Marston Airfield (LMA)

19. Development at this site has already been partially included in the form of 400 dwellings in the Reference Case models.

20. As advised by SDC a further 3,100 dwellings are to be included at the proposed at Long Marston Airfield site within the 2031 Core Strategy scenario. This site also includes new education facilities, which have been included within a specific matrix level in the modelling

21. Based upon the housing trajectory, there should only be 250 dwellings included at the LMA site in the 2023 Core Strategy (interim year) scenario, which is captured by the inclusion of the already committed 400 dwellings in this scenario.

22. The trip rates used for the inclusion of this site within the model are based upon details used in the site specific planning application work being undertaken by VM, whilst the distribution for the site is based upon WCC's mobile network database.

23. The site access arrangements have been coded in as per the planning application work, with two roundabout accesses provided off Campden Road. Additional to this the delivery of the full build out of the site (i.e. in the 2031 Core Strategy scenario), triggers the need for the South Western Relief Road, along with additional mitigation along Campden Road. This is detailed further later in this note.

Atherstone Airfield

24. SDC and WCC have advised that proposals exist for the development of around 40,000m2 of employment land use at the Atherstone Airfield site, which, it is understood, is intended to facilitate the relocation of employment uses from the SRZ.

25. SDC have advised that the employment land use breakdown at the proposed Atherstone Airfield site should be as follows:

- B1 Land Use - 20%;
- B2 Land Use - 30%;
- B8 Land Use 30%; and
- Sui Generis Land Use 20%.

26. The trips rates applied to this development site have been derived from TRICS and used in a previous assessment of this site undertaken by VM. The distribution for this site has been applied as per the WCC mobile network database.

27. SDC have advised that a 25% build out rate for this site should be assumed within the 2023 Core Strategy (interim year) scenario.

Local Plan Development - Trip Generation

28. As outlined above, each of the development sites listed above have specific trip rates, which have either been derived through site specific planning application studies, or advised by WCC. Additional to this the development quantum at each site has been advised by SDC, with the quantum at each site differing between the 2031 Core Strategy and Interim Year Core Strategy (2023) scenarios.

29. Accordingly the trip generation figures associated with each developments to be assigned to firstly the 2031 Core Strategy model, and secondly the 2023 Core Strategy model, are detailed in the following tables.

Core Strategy (2031) Development Trip Generation

Table 1 2031 Core Strategy - AM Development Site Trip Generation

Development	0700-0800		0800-0900		0900-1000	
	In	Out	In	Out	In	Out
SRZ*	112	265	240	402	179	206
Land South of Alcester Road	235	46	490	143	410	220
Long Marston Airfield	360	965	793	1419	470	667
Atherstone Airfield	133	38	258	71	167	90

* split equally across Zones 409,226 and 406

Table 2 2031 Core Strategy - PM Development Site Trip Generation

Development	1600-1700		1700-1800		1800-1900	
	In	Out	In	Out	In	Out
SRZ*	298	161	392	213	293	122
Land South of Alcester Road	243	476	196	498	149	293
Long Marston Airfield	1035	577	1407	636	1071	475
Atherstone Airfield	76	182	45	218	14	81

* split equally across Zones 409,226 and 406

30. The cumulative hourly trip generation assigned to the 2031 Core Strategy model, based on the above development trips is summarised in **Table 3**.

Table 3 2031 Core Strategy Development Sites - Net Trip Generation

Hour	Total Trips	Periodic
0700-0800	2154	8379
0800-0900	3816	
0900-1000	2409	
1600-1700	3048	9151
1700-1800	3605	
1800-1900	2498	

Core Strategy Interim Year (2023) Development Trip Generation

Table 4 2023 Core Strategy - AM Local Plan Development Site Trip Generation

Development	0700-0800		0800-0900		0900-1000	
	In	Out	In	Out	In	Out
SRZ*	6	25	9	37	9	17
Land South of Alcester Road	117	23	245	72	205	110
Long Marston**	-	-	-	-	-	-
Atherstone Airfield	33	10	64	18	42	23

* split equally across Zones 409,226 and 406 – employment trips accounted for within background traffic matrix

** 250 dwellings at Long Marston captured in 2023 Reference Case demands

Table 5 2023 Core Strategy - PM Local Plan Development Site Trip Generation

Development	1600-1700		1700-1800		1800-1900	
	In	Out	In	Out	In	Out
SRZ*	27	9	37	9	28	9
Land South of Alcester Road	121	238	98	250	75	147
Long Marston**	-	-	-	-	-	-
Atherstone Airfield	19	46	11	55	3	20

* split equally across Zones 409,226 and 406 - employment trips accounted for within background traffic matrix

** 250 dwellings at Long Marston captured in 2023 Reference Case demands

31. The cumulative hourly trip generation assigned to the 2023 Interim Year Core Strategy model, based on the above development trips is summarised in **Table 6**.

Table 6 2023 Core Strategy Development Sites - Net Trip Generation

Hour	Total Trips	Periodic
0700-0800	214	1065
0800-0900	445	
0900-1000	406	
1600-1700	460	1202
1700-1800	460	
1800-1900	282	

Development Release Profiles

32. The release of Core Strategy development trips has been controlled via the specific profiles assigned to the zones within similar characteristics within the base model.

33. For the SRZ and Long Marston development zones, the 'residential outbound' profile assigned within the base model has been applied. For the Long Marston education trips, the 'schools outbound' profile has been assigned, and for the Land South of Alcester Road, and Atherstone Airfield sites, the 'SUA Aggregate' profile has been assigned.

Development Matrix Level

34. The trip generation and distributions described above have been used to develop a new demand matrix for each development site, within each modelled hour, that reflects the Core Strategy development sites' trip levels and Origin-Destination (O-D) patterns.

35. These matrices have been included in 2031 Core Strategy and 2023 Core Strategy models as set out in **Table 7**.

Table 7 Core Strategy Demands – Matrix Level Assigned

Development Site	Matrix Level (2031 CS)	Matrix Level (2023 CS)
SRZ	5	5
Atherstone Airfield	6	6
Land South of Alcester Road	7	7
Long Marston Residential	8	Included in M3 (Com Dev)
Long Marston Education	9	n/a

Vehicle Type Proportions

36. As each of the Core Strategy development sites have been included in isolated matrix levels, it was necessary within the modelling to assign a specific vehicle type to each matrix level and therefore each development.

37. In some instances, it was necessary to assign more than one vehicle type to each development, i.e. lights and heavies, or residential and employment trips.

38. This was relevant for the Land South of Alcester Road site, which VM understand consist of a split between lights and heavies. Using details from the planning application modelling work being undertaken by VM, a suitable breakdown of Lights and Heavies was derived and applied within this modelling for each modelled hour.

39. All 'car' vehicle types have been assigned using the same familiarity and perturbation settings as assigned to the 'car' vehicle type within the Base model, and likewise all HGV vehicle types assigned the same settings as in the Base.

2031 Core Strategy Network Mitigation

40. Following the inclusion of the vehicle trip generation within the 2031 model network, it was clear that a number of highway intervention measures would be required to enable the network to function without significant congestion and gridlocking.

41. The following section of the note details the schemes that were included within the 2031 Core Strategy model network.

Stratford Transport Package

42. It is understood that alongside the inclusion of the Core Strategy demands, a requirement exists to include the Stratford Transport Package (STP) mitigation schemes.

43. The STP includes mitigation schemes at the following locations:

- **Tiddington Road/ Banbury Road** - this is now a committed scheme and already included within the 2023 and 2031 Reference Case networks
- **Stratford Gyratory/Bridgeway/Bridgefoot Signals** – this is now a committed scheme and already included within the 2023 and 2031 Reference Case networks

- **Birmingham Road Scheme** – this is now a committed scheme and already included within the 2023 and 2031 Reference Case networks
- **Shipston Road/Clifford Lane and Seven Meadows/Trinity Way roundabout**
- **A46/A3400 Bishopton Roundabout Improvements**
- **Evesham Place/Evesham Road Roundabout Improvements**
- **A46/A422 Wildmoor Roundabout Improvements**

44. Of the schemes listed above the Shipston Road/Clifford Lane and Seven Meadows/Trinity Way roundabouts, Bishopton roundabout, Wildmoor junction and Evesham Place/Evesham Road schemes required inclusion within the model. Details on these schemes and how they have been included within the modelling are provided below:

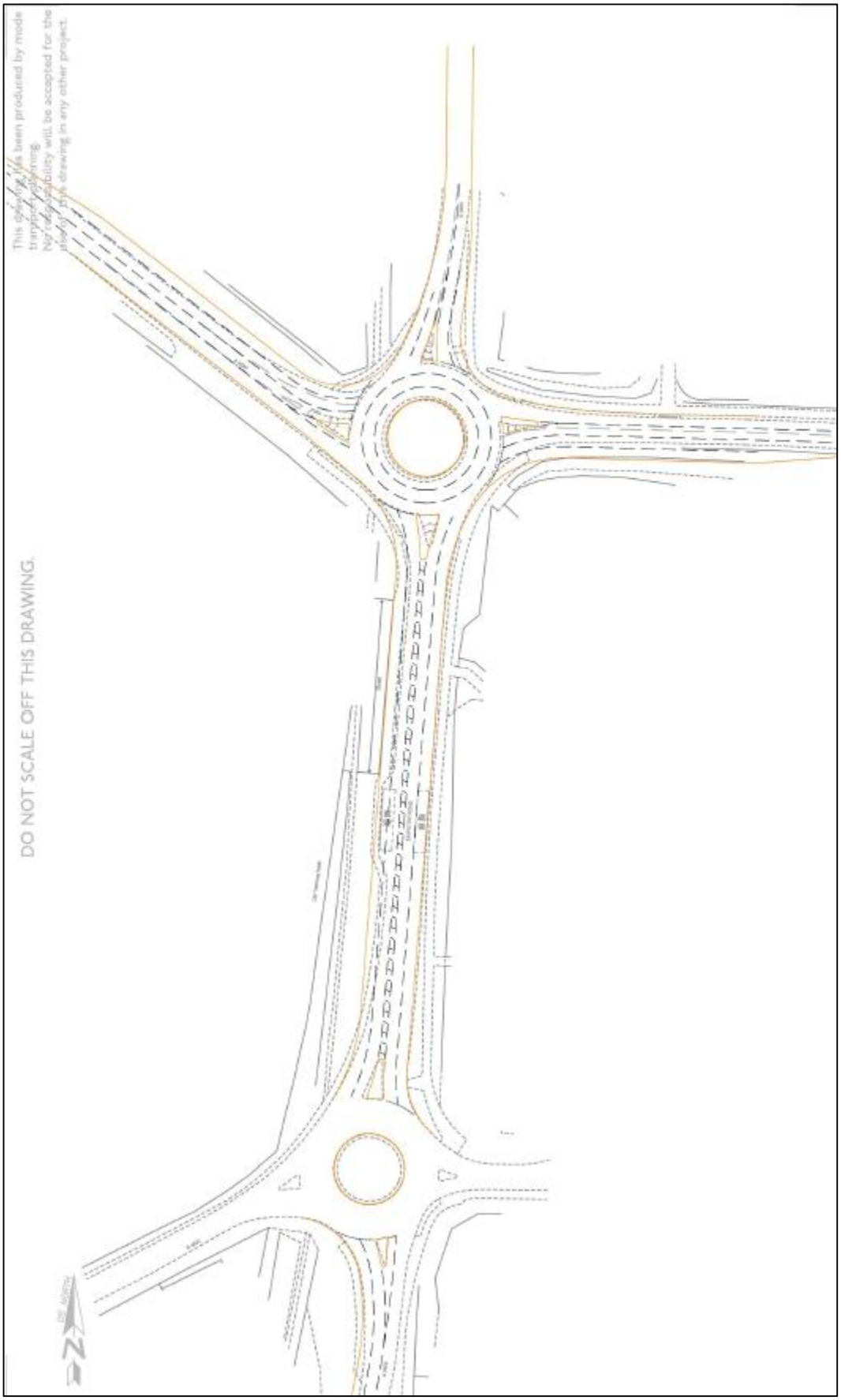
Shipston Road/Clifford Lane and Seven Meadows/Trinity Way roundabout

45. Following the inclusion of the Long Marston Airfield demands within the model, traffic volumes between the site and the town centre increase significantly. One of the key routes into the town centre is via the Shipston Road/Clifford Lane and Seven Meadows/Trinity Way roundabouts.

46. A scheme exists within the Stratford Transport Package at this junction, in the form of widening of the circulatory and entry/exit arms of these roundabouts. The scheme also includes dualling between the two roundabouts.

47. **Figure 2** demonstrates the scheme details which have been included within the model at this location.

Figure 2 Shipston Road/Clifford Lane and Seven Meadows/Trinity Way Mitigation Scheme



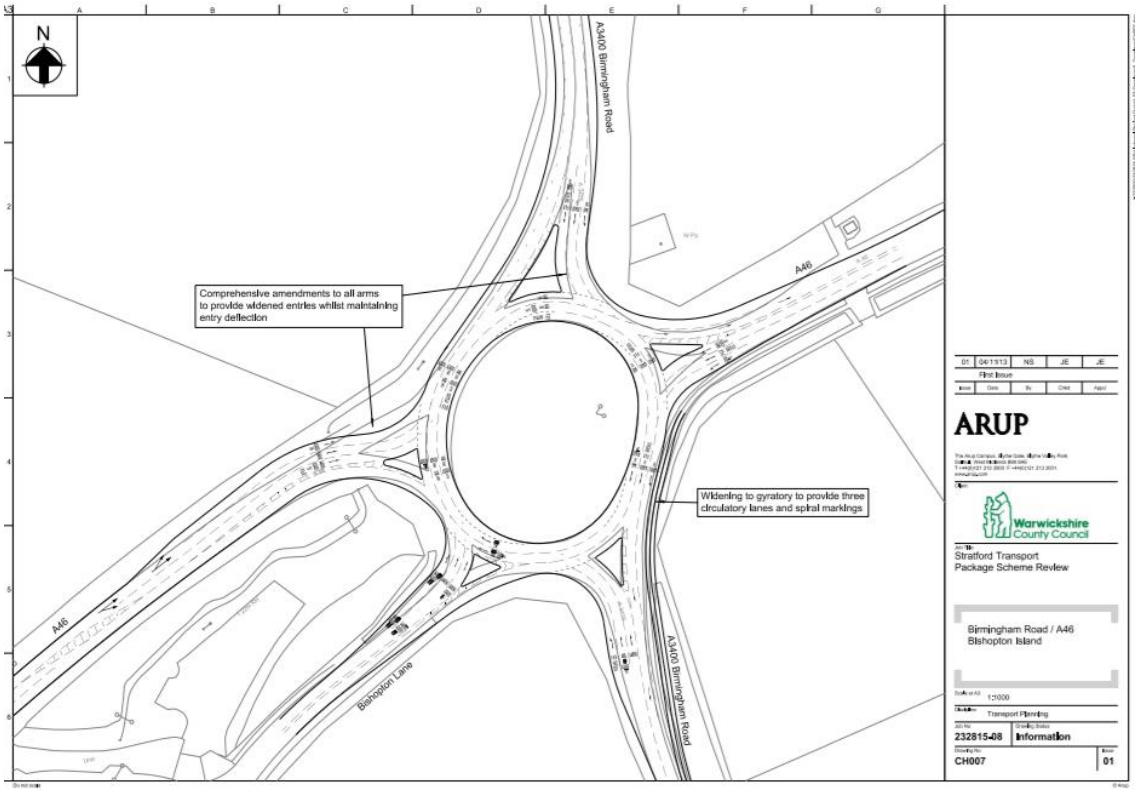
A46/A3400 Bishopton Roundabout Scheme

48. Upon inclusion of the Core Strategy demands within the modelling it was clear that the Bishopton Roundabout junction became a key constraint to the network, with significant delay forming during the AM and PM period.

49. As such it was determined that an indicative scheme would be included at this location. The scheme consists of substantial widening of the circulatory carriageway, and entry/exit flares.

50. **Figure 3** demonstrates the format that this scheme has been coded into the model.

Figure 3 Bishopton Island Mitigation Scheme



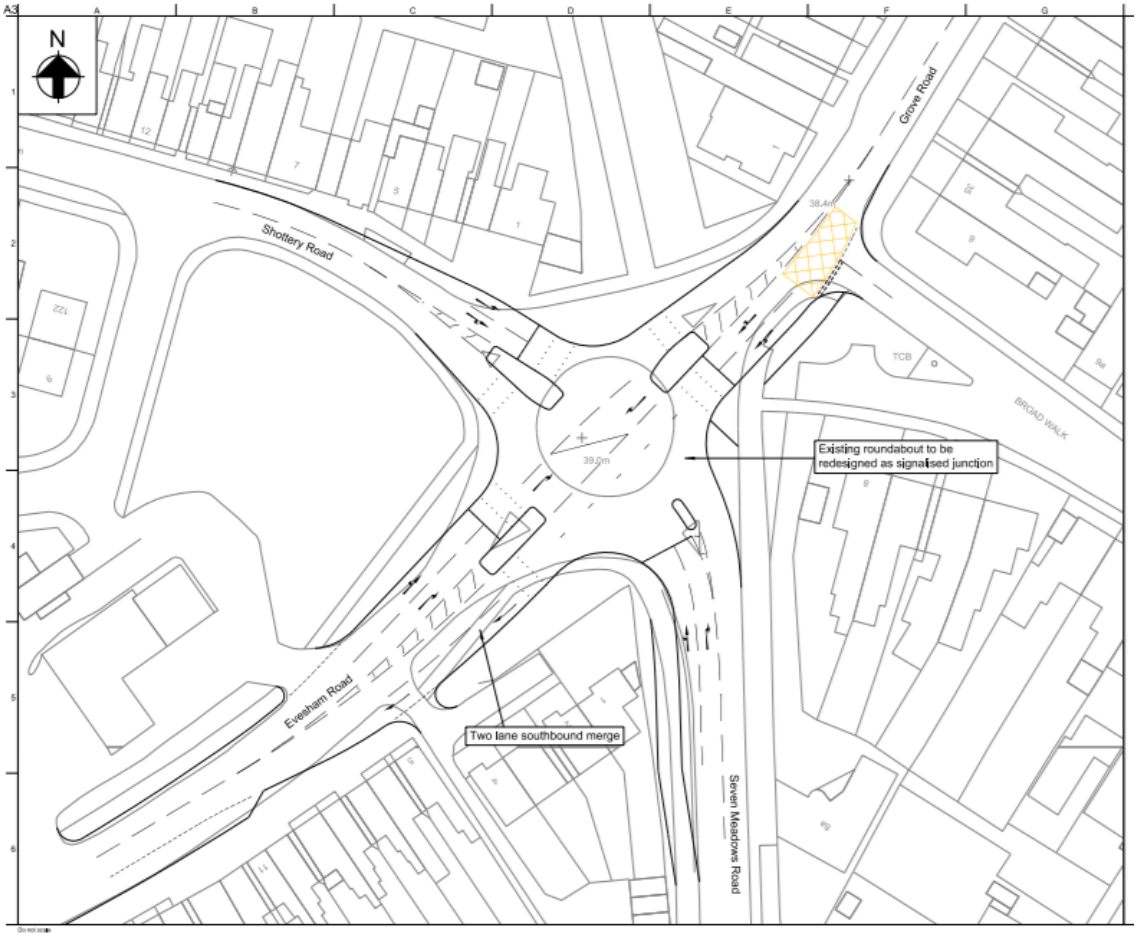
Evesham Place/Evesham Road Scheme

51. The inclusion of the Core Strategy demands within the modelling highlighted the need for the inclusion of a scheme at this junction, with queues and delay being particularly high on the Seven Meadows Road approach to the junction.

52. In line with the STP the existing roundabout at this location was removed and re-coded as a signal junction.

53. The format of the revised junction is demonstrated by **Figure 4**.

Figure 4 Evesham Place/Evesham Road Mitigation Scheme



54. Following a review of the operation of this scheme, it was determined that the right turn from Evesham Road into Seven Meadows would be banned, in order to encourage more traffic to use the SWRR. Accordingly the Evesham Road S approach was reduced to one lane on entry to the junction, with only the left turn and straight ahead movements catered for.

A46/A422 Wildmoor Roundabout Scheme

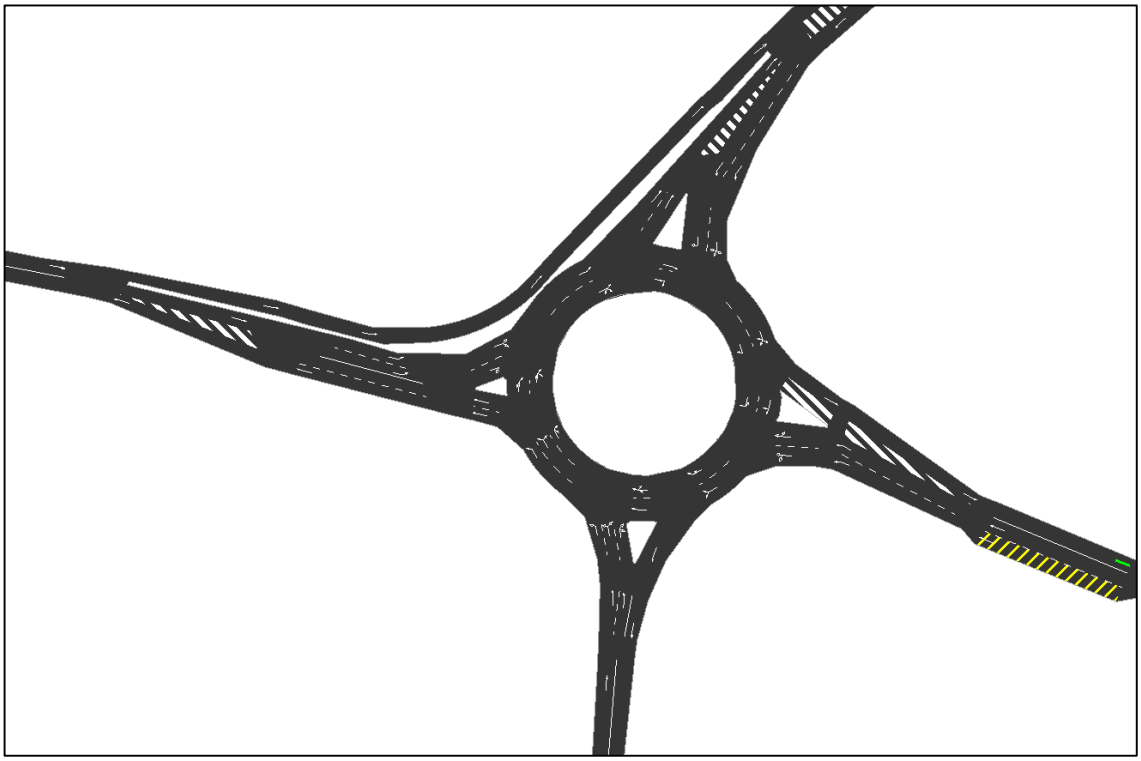
55. As a result of the inclusion of the Core Strategy demands, and in particular the Long Marston development, and Land South of Alcester Road development, which is located directly to the west of the junction, there was a clear need for the inclusion of a mitigation scheme at this junction.

56. Accordingly an indicative scheme has been included in line with the principles adopted within the STP. A segregated left turn lane has been included, for the movement from the A46 W to A46 N.

57. Additional to this, the circulatory and entry/exit lanes have been widened to specifically allow the movements from the A46 N to A46 W to be made in two lanes, along with the movement from the Shottery Link to the A46 N to also be made in two lanes.

58. The layout of the scheme included within the modelling is demonstrated in **Figure 5**.

Figure 5 A46/Wildmoor Mitigation Scheme



59. Following the inclusion of the STP schemes outlined above, a further review of the model operation was undertaken, and the clear need for further mitigation highlighted. As such the following additional schemes were included within the model.

A46/A439 Marraway Roundabout

60. A review of the model highlighted significant congestion issues at this roundabout junction, most notably on the Warwick Road approach. This junction becomes a significant constraint within the Core Strategy modelling, as a high volume of trips route through this junction when travelling between the Core Strategy sites and the M40.

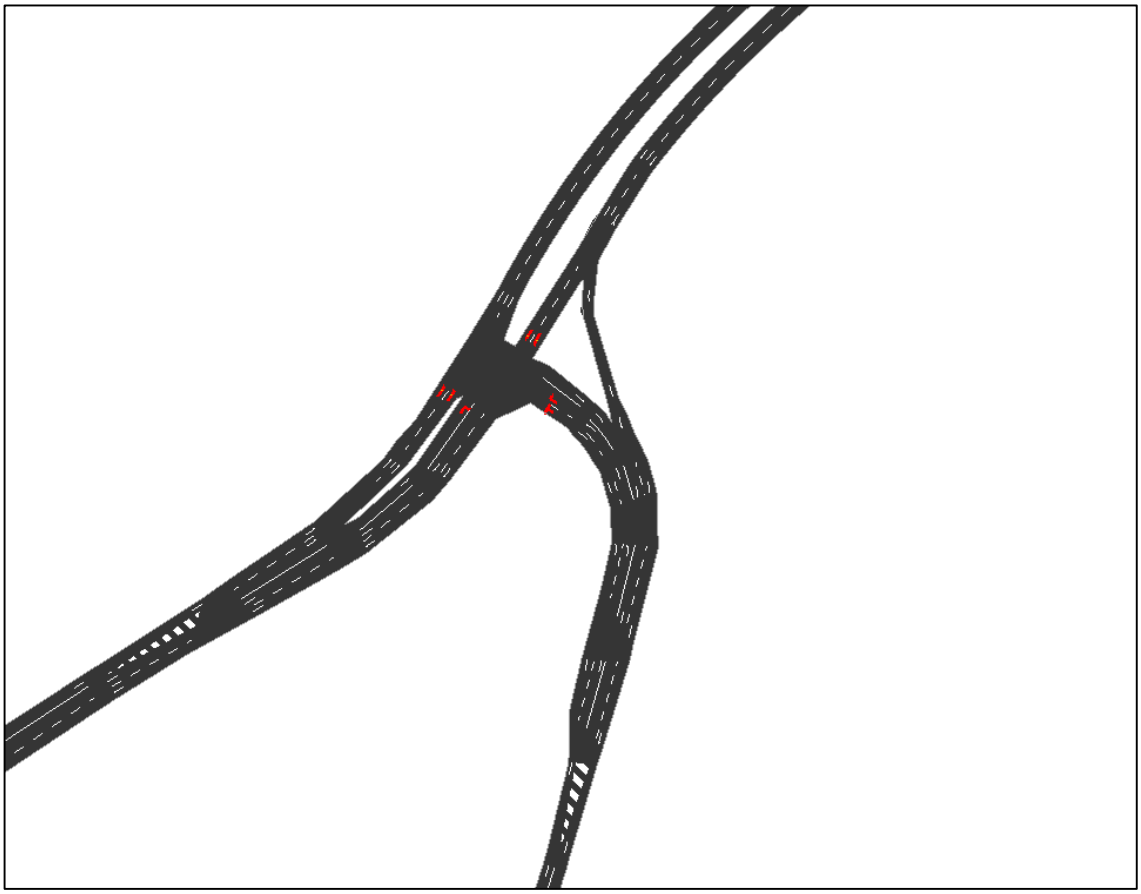
61. Accordingly a number of mitigation options were tested at this location, with the specific intention of ensuring any scheme was delivered within the existing highway boundary.

62. It was determined that the best performing scheme at this location would be the inclusion of a signal junction, which replaces the existing roundabout. The indicative improvement scheme included a two lane entry/exit on the A46 N and S movements, along with a segregated left turn for movements from the A46 N to Warwick Road[2].

63. The layout of the indicative signal scheme is demonstrated in **Figure 6**.

[2] This proposed scheme has been shared with Highways England for comment, whom have indicated that they reserve position on the scheme until a clear development strategy comes forward

Figure 6 A46/A439 Marraway Mitigation Scheme



South Western Relief Road

64. A scheme associated with the Core Strategy models is the delivery of the South Western Relief Road (SWRR). It is considered that this infrastructure is critical to the delivery of the full build out of the Long Marston site.

65. The alignment of the SWRR has been included within the modelling as per the testing undertaken for the planning application work related to the Long Marston site, which is outlined within **Figure 7**.

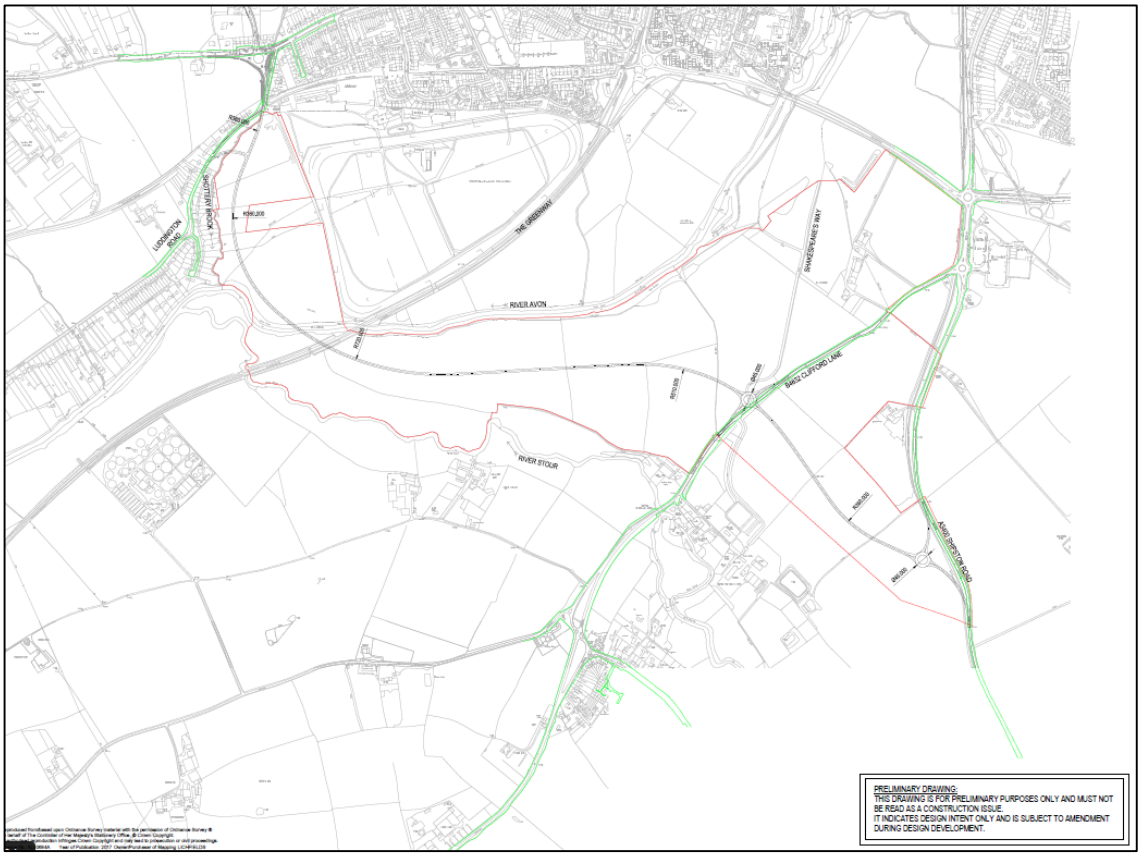
66. At its northern extent, the SWRR meets with the Evesham Road/West of Shottery Relief Road in the form of a four arm signalised junction[3].

67. The SWRR meets with Campden Road in the form of a four arm roundabout, continuing south-east from this point to meet with Shipston Road in the form of a three arm roundabout.

68. The SWRR has been included within the modelling as a single carriageway 50mph road along its extent, which reduces to 40mph on approach to the Evesham Road signalised junction.

[3] It is understood that as part of the planning application for the SWRR a signalised junction is proposed to replace the roundabout at the Evesham Road/West of Shottery Relief Road junction

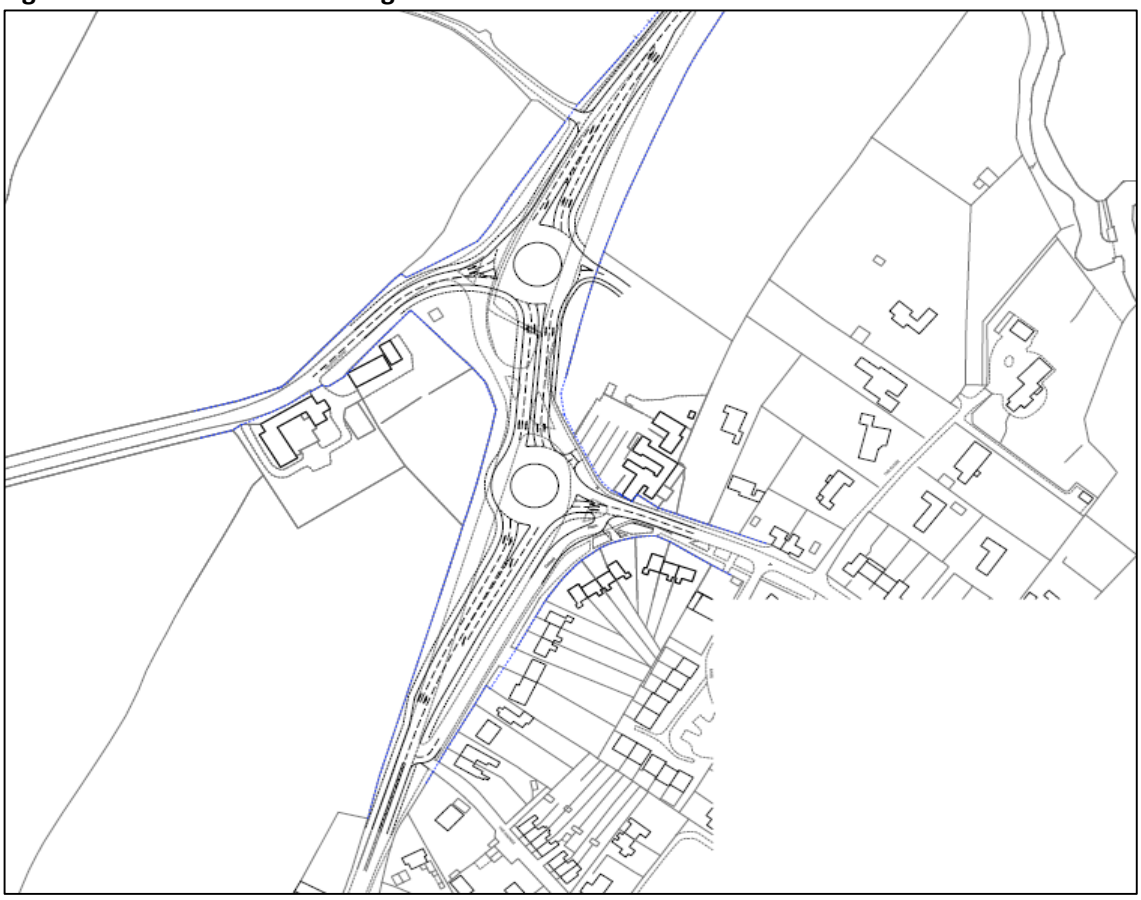
Figure 7 SWRR Alignment



Long Marston Specific Mitigation

69. Additional to the inclusion of the SWRR, the Long Marston development triggered the need for additional mitigation on the network, specifically at the Clifford Chambers junction along Campden Road. The scheme included at this location is outlined within **Figure 8**.

Figure 8 Clifford Chambers Mitigation Scheme



2031 Core Strategy Mitigation Summary

70. Following the inclusion of the Core Strategy demands within the 2031 model network, it was necessary to include a number of mitigation schemes. This largely consisted of the delivery of four schemes along the A46, along with the inclusion of the proposed SWRR.

71. Additional to this, schemes were included within the modelling at the Shipston Road/Clifford Lane and Seven Meadows/Trinity Way roundabouts, the Evesham Road/Evesham Place junction, along with at the Clifford Chambers junction.

72. Upon the inclusion of the above schemes, the model performance was reviewed and run for comparison of network conditions against 2031 Reference conditions.

2023 Core Strategy Network Mitigation

73. Following the inclusion of the relevant vehicle trip generation within the 2023 Reference model network, a review of the network operation was undertaken, and where relevant mitigation included.

74. It was clear that mitigation was not required to the same extent as highlighted in the 2031 Core Strategy model. Importantly, there was not deemed the requirement for the SWRR and the full STP mitigation measures within this model network.

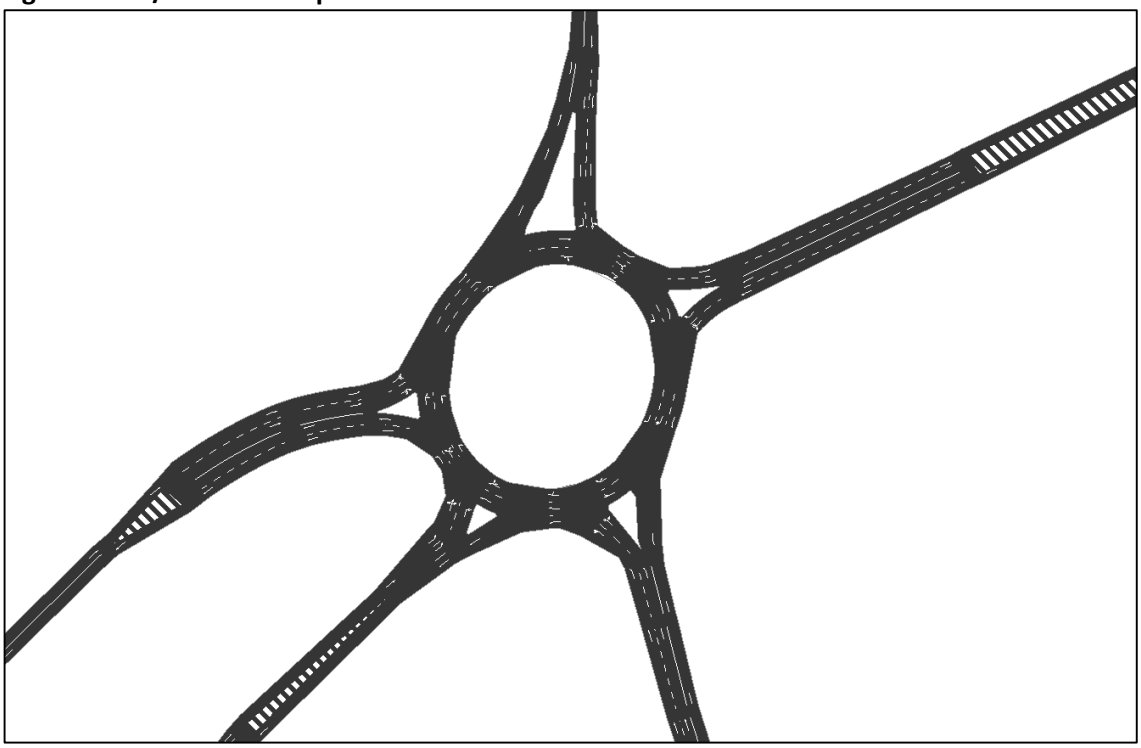
75. Accordingly the following schemes were included within the model, additional to the committed schemes already included within the 2023 Reference Case model:

A46/Bishopton Roundabout Interim Scheme

76. The indicative scheme included at this location involved the widening of the A46 N and A46 S entry and exit arms, along with widening of the circulatory, with the specific intention of enabling trips travelling through the junction on the A46 to do so in two lanes.

77. This scheme was beneficial at increasing the throughput on the A46 at the junction. The layout of this junction with the scheme included is demonstrated by **Figure 9**.

Figure 9 A46/A3400 Bishopton Roundabout Interim Scheme

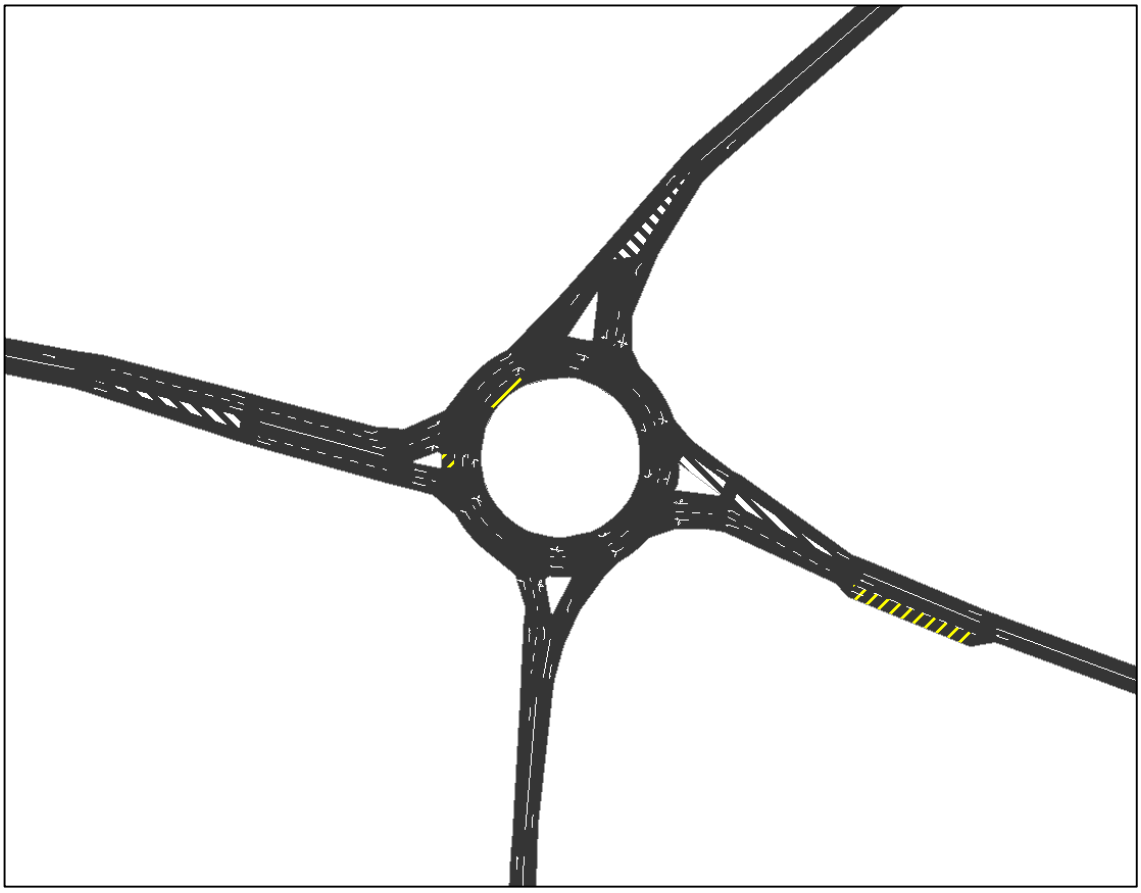


A46/A422 Wildmoor Roundabout Interim Scheme

78. The indicative scheme at this location involved the widening of the A46 W exit arm, to enable the movement from the A46 N to A46 W to be made in two lanes. This scheme had the benefit of significantly increasing the throughput of A46 flows at the junction.

79. The layout of this junction is demonstrated by **Figure 10**.

Figure 10 A46/A422 Wildmoor Roundabout Interim Mitigation Scheme



A46/A439 Marraway Roundabout Interim Scheme

80. The indicative mitigation scheme included at this junction involved the partial signalisation of the roundabout at the A46 N entry arm and adjacent circulatory link.

81. The scheme was included in response to significant queues forming on the Warwick Road approach to the roundabout. By including signals on the A46 N entry arm, gaps in traffic were created to enable additional throughput from the Warwick Road entry arm.

2023 Core Strategy Mitigation Measures

82. Upon inclusion of the 2023 Core Strategy demands within the model, a network review was undertaken, and appropriate levels of mitigation identified for inclusion within the network.

83. The mitigation included consists of three schemes along the A46, largely in the form of widening of entry and exit arms.

Summary and Conclusions

84. This Note details the steps undertaken in the development of a 2031 SuA Core Strategy model, and following on from this the development of a 2023 SuA Interim Year Core Strategy model.

85. The relevant Core Strategy development trips have been added to the existing 2031 and 2023 Reference Case networks as advised by WCC and SDC.

86. The demands have been added on top of the existing reference case demands, with no further adjustment in growth levels of peak spreading applied.

87. Upon inclusion of the relevant demands within the Core Strategy models, a review of the model operation was undertaken, and appropriate schemes included in both the 2031 and 2023 Core Strategy networks.

88. The 2031 Core Strategy mitigation consists of the delivery of the Stratford Transport Package, alongside the SWRR and schemes at the A46/Marraway junction and Campden Road/Clifford Chambers junctions.

89. The 2023 Core Strategy mitigation consists of the delivery of three interim mitigation schemes along the A46. The SWRR has not been included within this scenario.

SDC Reserve Housing Sites Assessment

Stratford-upon-Avon Area

April 2019

VM185174.TN002

Introduction

1. This Note forms part of a series produced by Vectos Microsim (VM) in response to a request from Stratford District Council (SDC) for assistance in assessing the potential implications of the delivery of a strategy for the identification of Reserve Sites, which may be necessary to bridge any potential shortfall that has arisen in the housing delivery profile for Stratford District, post adoption of the Core Strategy.

2. This Note sets out the assessment undertaken to ascertain the likely impact on the Stratford upon Avon modelled network of the potential Reserve Sites within the Stratford area.

Background

3. The original Stratford-upon-Avon Wide Area (SuAWA) model that was used to assess the impacts of the Core Strategy was developed from 2007 data. By 2013 the next model update had been scheduled which was completed by 2015. However, at that time the base model was still representative of a 2013 year and, as there were a number of large scale developments expected to come forward by 2018, it was decided the model should be subject to a further targeted update to ensure it is as reflective of current network conditions as possible. This was undertaken in 2017.

4. The Stratford model was also further extended to ensure Wellesbourne was included in more detail given its close functional relationship (and since this is an area previously promoted for potential development), and the network around Long Marston was also extended and calibrated to a higher level of detail.

5. Since the time of the original Core Strategy work, additional work has been undertaken on a number of sites which are allocated within the Strategy. This included the assumptions pertaining to Long Marston Airfield and Land South of Alcester Road (SUA2). Therefore, separate to this stage of the assessment, the Core Strategy Sensitivity test model has been updated to reflect the latest assumptions related to these sites. This is detailed in the technical note which accompanies this model update.[1]

6. The current SuAWA model network extent is outlined in **Figure 1**.

[1] VM185176.TN001 SuAWA Core Strategy Model Development Note

Figure 1 SuAWA Model Extent

Model Scenario

7. The testing documented within this note is has been undertaken within the latest SuAWA 2031 Core Strategy and 2023 Interim Year Core Strategy models.

8. These models have been developed by VM in compliance with WebTAG, based upon the calibrated and validated 2017 SuAWA Base model.

9. The models have been developed to be inclusive of all committed developments and infrastructure and subsequently all Core Strategy aspirations up to 2031. The 2031 scenario also contains the South Western Relief Road (SWRR) in its currently proposed format.

10. The 2023 Interim Year Core Strategy model used within this assessment is again based upon the 2017 SuAWA Base model, and included all committed developments and infrastructure, along with Core Strategy aspirations up until 2023. The level of development included within this model has been informed by the Stratford District Council Housing Trajectory. This scenario does not contain the SWRR.

Objective

11. Through discussions between WCC and SDC, VM have identified a primary objective which is to be assessed by this stage of the assessment work. Accordingly, the assessment summarised within this note addresses the following objective:

- To assess at a final point, and interim year, the impacts on the SuAWA network associated with the delivery of the potential Reserve Sites identified by SDC, and where possible to do so, identify measures to overcome the impacts identified

12. In order to address the above objective, the following stages of assessment have been undertaken, which are summarised within the remainder of this note.

- Stage 1 – 2031 Core Strategy Assessment
- Stage 2 – 2023 Interim Core Strategy Assessment

Stage 1 – 2031 Core Strategy Assessment

Methodology

13. This first stage of the assessment centres on the assignment of trips predicted to be generated by the potential Reserve Sites into the 2031 SuAWA Core Strategy Scenario network. The trips will be assigned based upon a trip generation and distribution agreed with WCC, and a review of resultant network conditions will then be undertaken in light of the inclusion of these sites, with a focus on the impact that each additional Reserve Site will elicit on the network.

14. This stage of the assessment will establish what additional mitigation measures or mode shift assumptions will be required to ensure the network will continue to operate satisfactorily when all sites are included.

Reserve Sites Inclusion

15. Following discussions between VM, WCC and SDC a list of potential Reserve Sites was provided, along with the predicted number of dwellings at each site, for inclusion within the 2031 Core Strategy model. These sites are outlined in **Table 1** and **Figure 2**.

Table 1 Reserve Sites Details

Site	Dwellings	Trip Rates to Assign	Model Zone
Land North of Evesham Road	90	STA Trip Rates	1000
Land East of Banbury Road	240	Milestone Road Trip Rates	1001
Land South of Trinity Way	330	Milestone Road Trip Rates	1002
Land East of Kineton Road	90	STA Trip Rates	*923
Land West of Kineton Road	60	STA Trip Rates	*923
Land West of Walton Road	45	STA Trip Rates	1006
Land South of Loxley Road	45	STA Trip Rates	1005
Atherstone Airfield	350	STA Trip Rates	1007
Former Long Marston Depot	250	STA Trip Rates	1008
Adjacent to former Long Marston Depot	90	STA Trip Rates	1009
Land East of Shipston Road	180	STA Trip Rates	1010

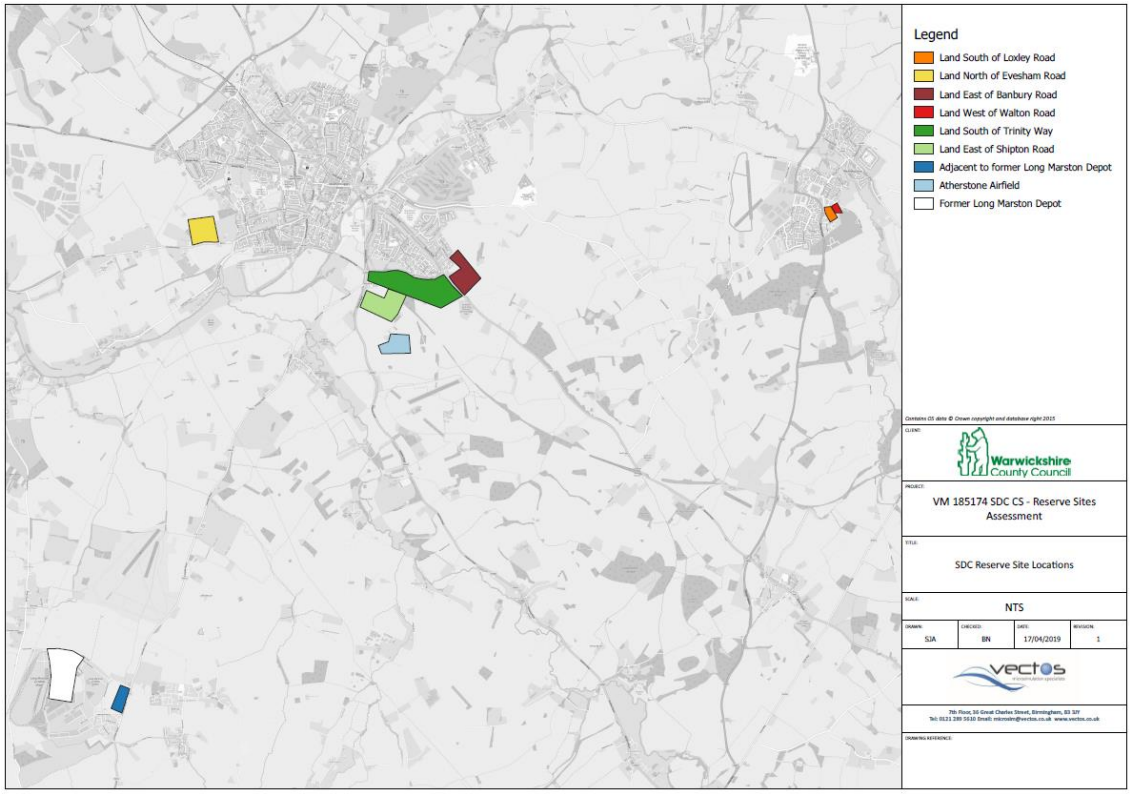
***** The Land East of Kineton Road and Land West of Kineton Road sites lie outside of the model extent. Any trips predicted to enter the model from these zones have been assigned to the closest external zone to these sites, which in this case is Zone 923.

16. WCC have advised on the appropriate trip rates to assign to each site, which are either the WCC Strategic Transport Assessment Residential trip rates, or bespoke trip rates derived from traffic counts at Milestone Road. The Milestone Road trip rates are appropriate for application to the two residential sites in close proximity to this count, whilst the STA trip rate has been applied to all other sites.

17. Each of the above sites have been coded into the 2031 Core Strategy model, with access arrangements based upon concept schemes, which are designed to ensure that all traffic leaving each site gets onto the network, rather than queuing within the site attempting to access the network.

18. In all instances, accesses have been included as either priority junctions (with ghost island right turn bays) or small roundabouts.

Figure 2 Reserve Site Locations



19. The trips generated by each site have been distributed using the WCC mobile network database (MND). The MND has been interrogated, with a distribution being derived dependant on the LSOA (Lower Super Output Area) that each site lies within.

20. Four different distributions have been derived from the MND, based upon the spread of sites across the network. The trip distributions derived and assigned to each site are detailed in **Table 2** and **Figure 3-6**

Table 2 Trip Distribution Assignment

Site	Distribution Assigned
Land North of Evesham Road	East of Stratford Distribution (Stratford upon Avon 011D)
Land East of Banbury Road	West of Stratford Distribution (Stratford upon Avon 010E)
Land South of Trinity Way	West of Stratford Distribution (Stratford upon Avon 010E)
Land East of Kineton Road	Wellesbourne Distribution (Stratford upon Avon 008D)
Land West of Kineton Road	Wellesbourne Distribution (Stratford upon Avon 008D)
Land West of Walton Road	Wellesbourne Distribution (Stratford upon Avon 008D)
Land South of Loxley Road	Wellesbourne Distribution (Stratford upon Avon 008D)
Atherstone Airfield	West of Stratford Distribution (Stratford upon Avon 010E)
Former Long Marston Depot	LMA Distribution
Adjacent to former Long Marston Depot	LMA Distribution
Land East of Shipston Road	West of Stratford Distribution (Stratford upon Avon 010E)

Figure 3 East of Stratford Distribution

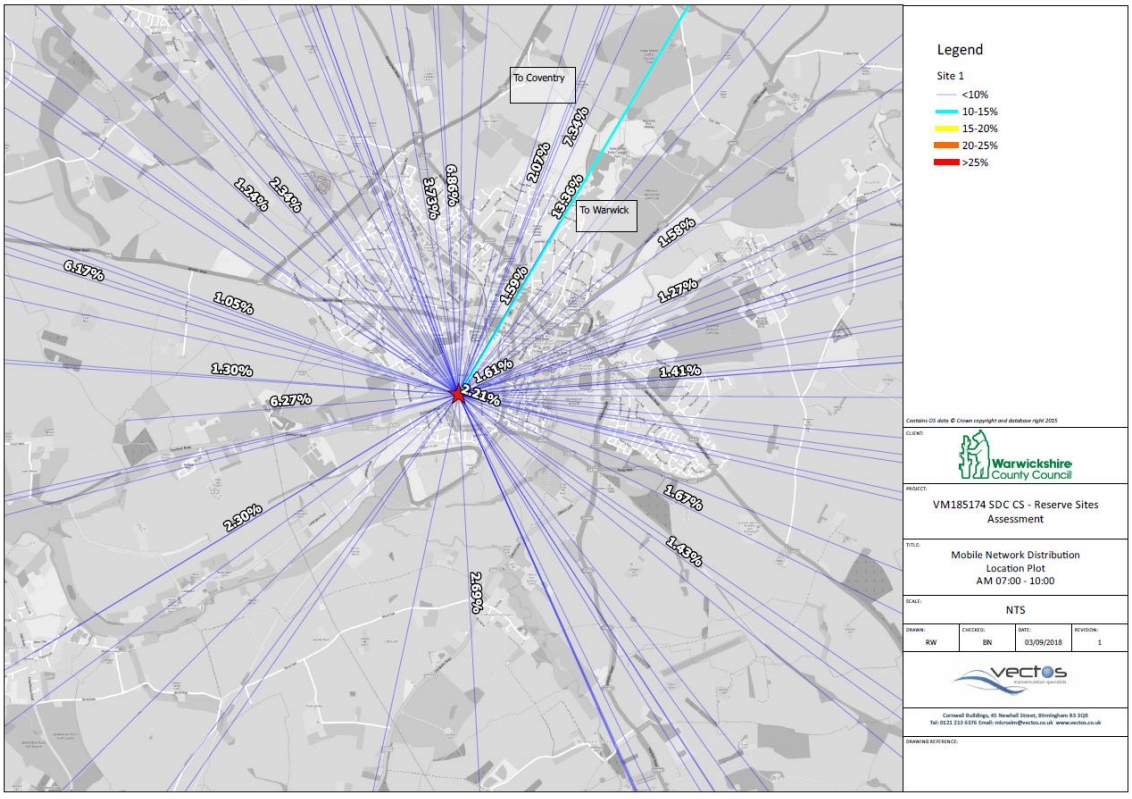


Figure 4 West of Stratford Distribution

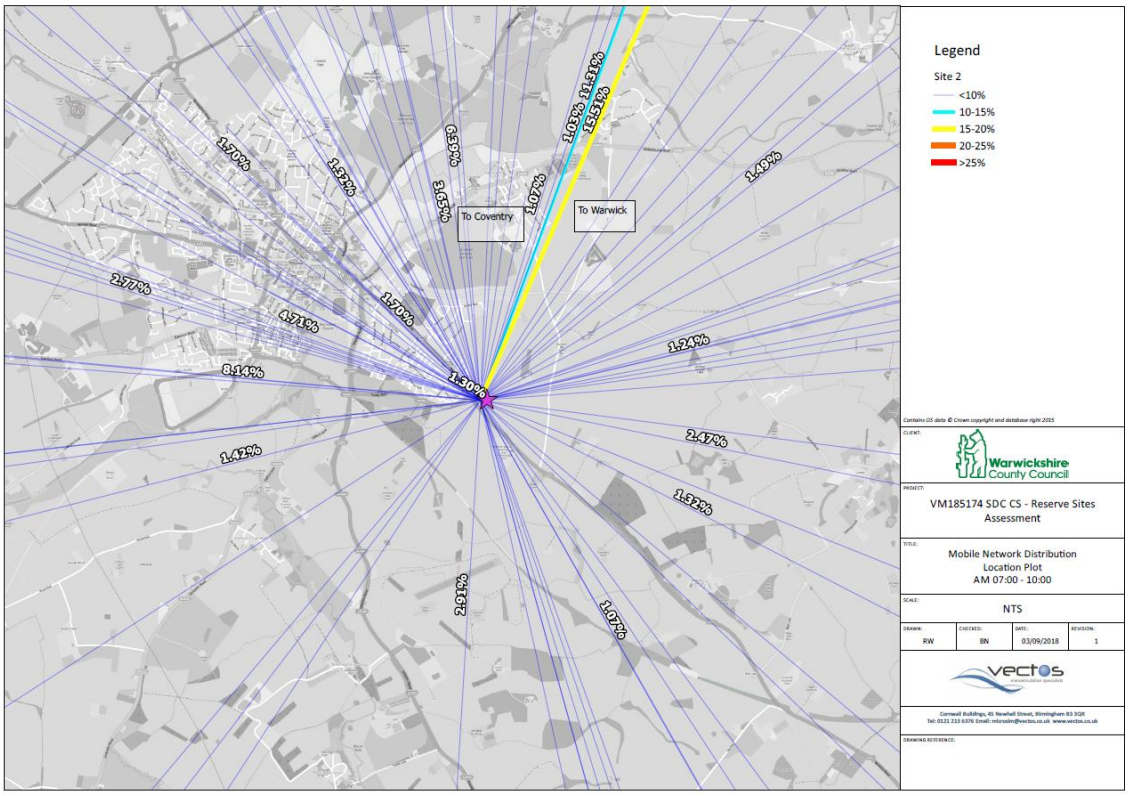


Figure 5 LMA Distribution

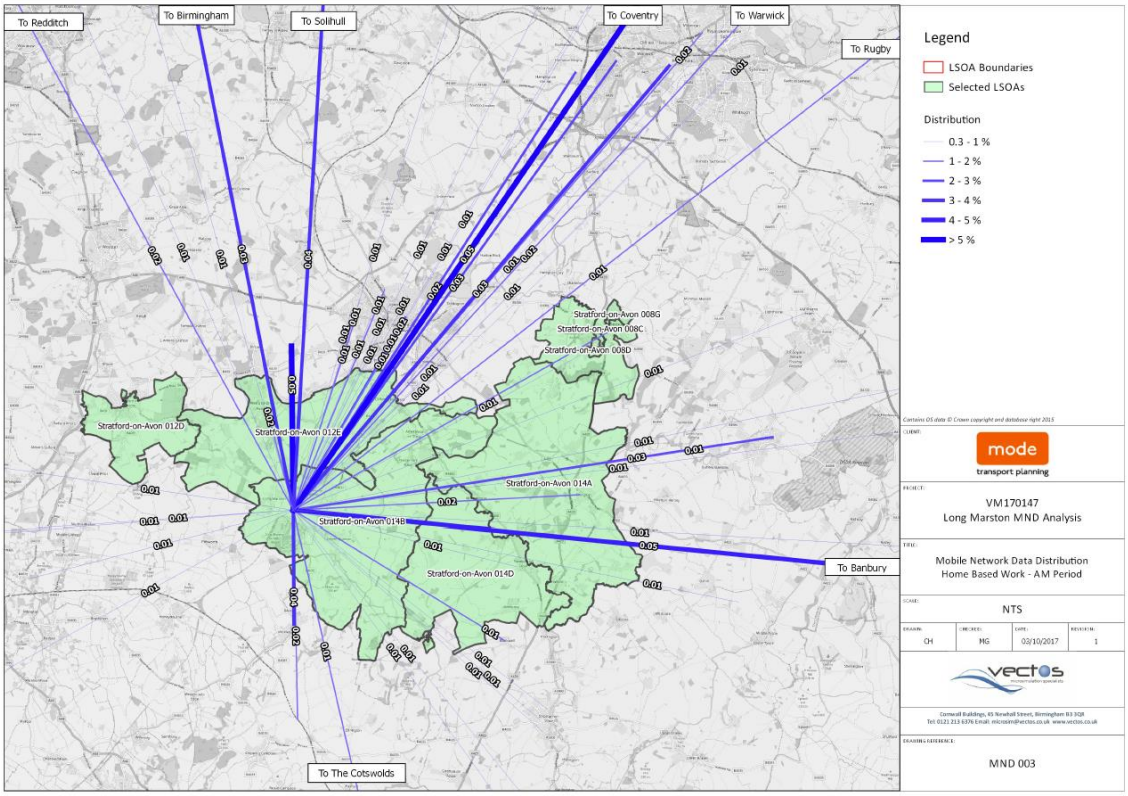
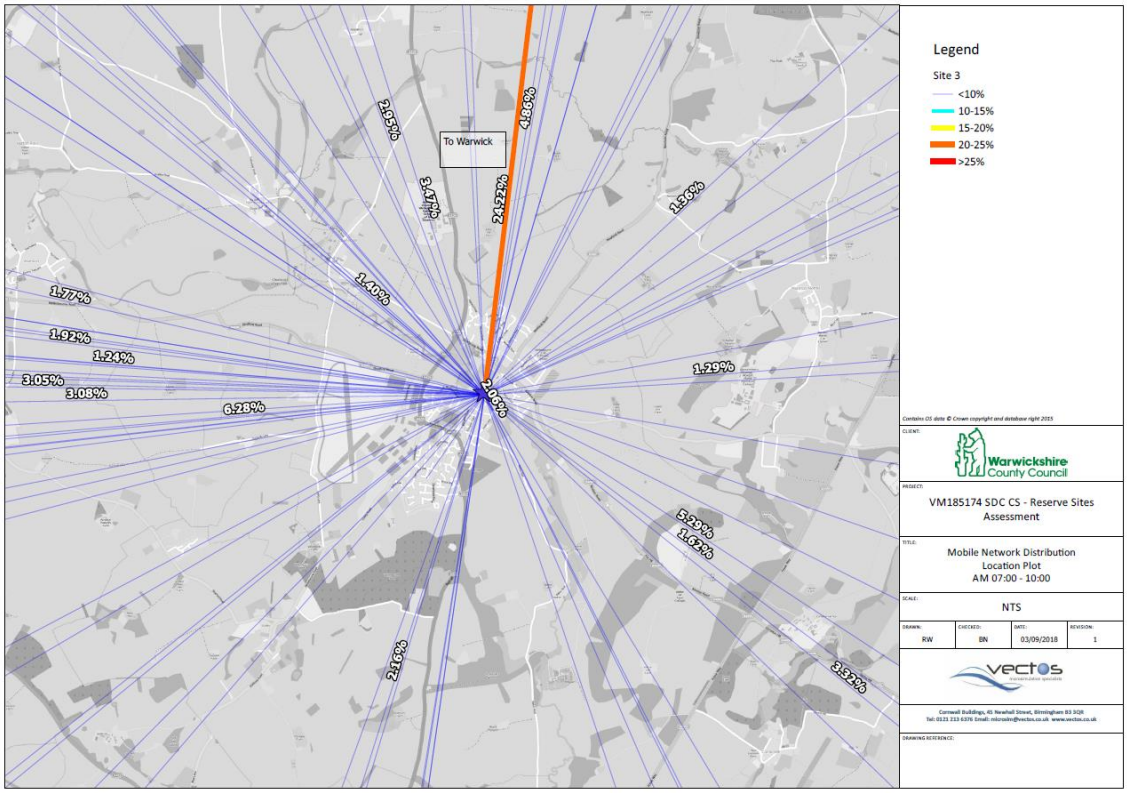


Figure 6 Wellesbourne Distribution



21. Each of the sites detailed have been included within the 2031 Core Strategy network using the trip rates and distribution outlined above, along with their associated access arrangements.

22. The resultant trips generated by each of the sites are presented for the AM and PM modelled hours in **Table 3** and **Table 4**.

Table 3 Reserve Sites Trip Generation (AM Period)

Development	0700-0800		0800-0900		0900-1000	
	In	Out	In	Out	In	Out
Land North of Evesham Road	8	53	19	66	15	24
Land East of Banbury Road	30	85	49	120	50	47
Land South of Trinity Way	41	117	67	165	69	64
Land East of Kineton Road	6	40	14	50	11	18
Land West of Kineton Road	4	27	9	33	7	12
Land West of Walton Road	3	20	7	25	5	9
Land South of Loxley Road	3	20	7	25	5	9
Atherstone Airfield	25	156	55	193	42	69
Former Long Marston Depot	18	111	40	138	30	49
Adjacent to former Long Marston Depot	6	40	14	50	11	18
Land East of Shipston Road	13	80	28	99	22	35

Table 4 Reserve Sites Trip Generation (PM Period)

Development	1600-1700		1700-1800		1800-1900	
	In	Out	In	Out	In	Out
Land North of Evesham Road	39	20	58	22	47	24
Land East of Banbury Road	96	60	107	58	80	56
Land South of Trinity Way	133	82	147	80	110	77
Land East of Kineton Road	29	15	44	16	35	18
Land West of Kineton Road	20	10	29	11	23	12
Land West of Walton Road	15	8	22	8	18	9
Land South of Loxley Road	15	8	22	8	18	9
Atherstone Airfield	114	60	169	64	137	69
Former Long Marston Depot	82	43	121	46	98	49
Adjacent to former Long Marston Depot	29	15	44	16	35	18
Land East of Shipston Road	59	31	87	33	70	35

23. The cumulative hourly trip generation for the Reserve Site demands is summarised in **Table 5**.

Table 5 Reserve Sites Net Trip Generation

Hour	Total Trips	Periodic
0700-0800	906	2802
0800-0900	1275	
0900-1000	621	
1600-1700	981	3235
1700-1800	1210	
1800-1900	1044	

24. Once the demands had been derived, and in line with STA testing undertaken elsewhere within the county, a modal shift allowance was made for all Reserve Sites of a 10% car reduction. The mode shift factor has been applied on the basis that site promoters will be tasked with achieving this target through the delivery process, and, on that basis, was considered an appropriate assumption for this stage of testing. These adjustments have been applied only to the Reserve Sites included within the modelling.

25. No assumptions have been applied to account for the potential shift in background traffic in response to the delivery of enhancements to existing and provision of new sustainable transport services and, as a result, when assessed in the context of the overall demands assigned within the model, these adjustments affect less than 1% of the assigned demand totals within the model.

Model Review

26. Following the inclusion of the Reserve Site demands within the 2031 Core Strategy model network, a review of the model operation was undertaken, in order to ascertain the areas of impact, and the model stability.

27. In order to review the model stability the congestion profile of the model simulation has been assessed, along with a visual review of the model operation. A typical congestion profile would indicate a build-up of traffic toward the peak hour, before traffic dissipates away in the final hour of the simulation. A run is considered 'failed' if this build-up of traffic constantly grows throughout the modelled period.

28. The congestion profile of the 2031 Core Strategy + Reserve Sites model has been provided in **Figure 7** and **Figure 8** for the AM and PM simulation periods respectively, based upon 10 AM and 10 PM model runs.

Figure 7 AM Congestion Profile – 2031 Core Strategy + Reserve Sites Scenario

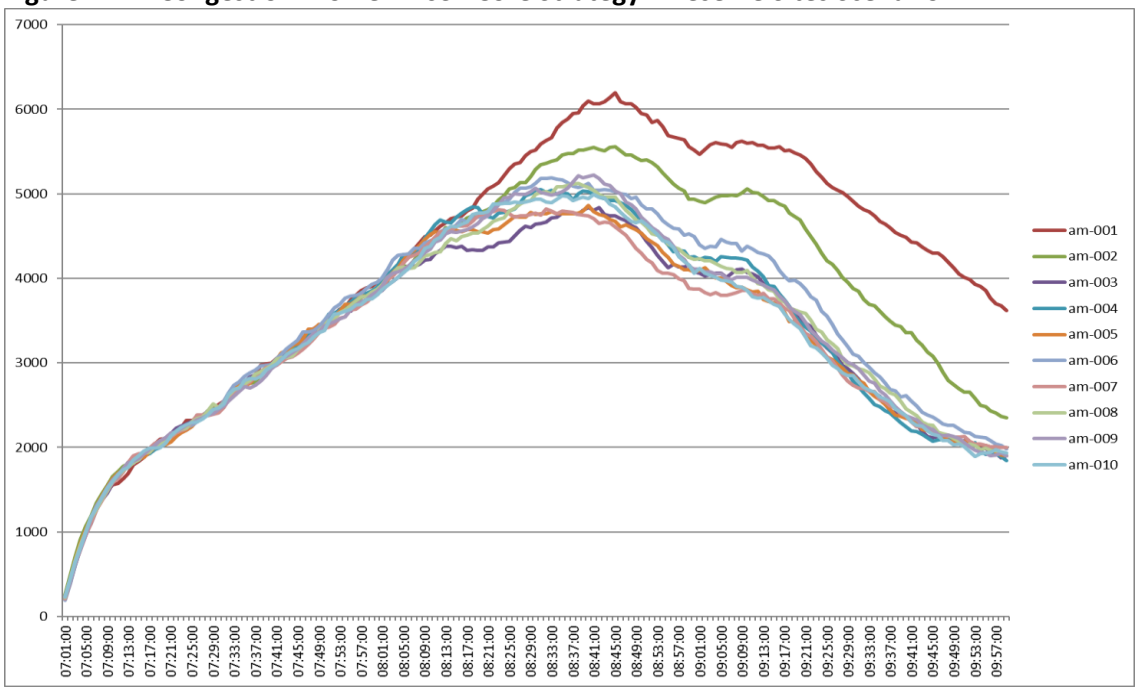
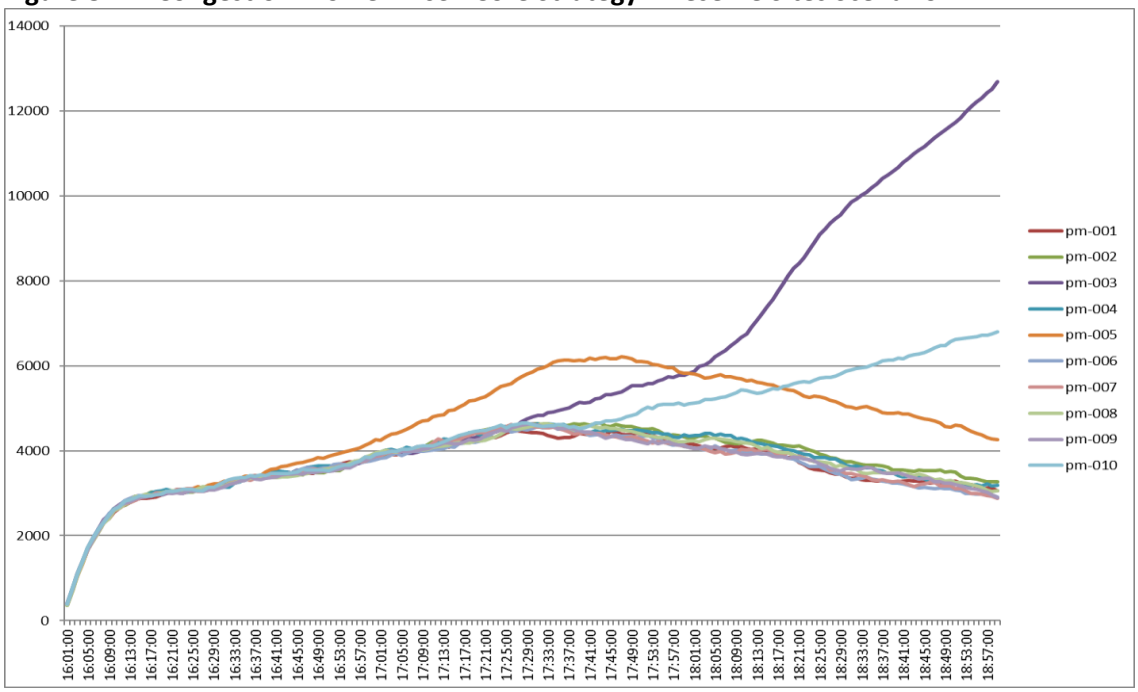


Figure 8 PM Congestion Profile – 2031 Core Strategy + Reserve Sites Scenario



29. A review of the congestion profiles, along with a visual review of the model operation, indicates that the model is unstable in both the AM and PM period once the Reserve Sites demands are included.

30. The AM period results in a high level of variability between runs in terms of the peak number of vehicles on the network, suggesting highly congested conditions, whilst the PM period indicates that a number of runs have 'failed'.

31. The model operation has been visually reviewed, which reveals that during the AM period, high volumes of trips travel from the south of Stratford to the north of Stratford, towards the M40, via the A46, with congestion occurring on the A46 EB and West of Shottery Relief Road approaches to the Wildmoor junction, along with on the A46 NB approach to the Marraway junction.

32. As this route becomes congested, a significant number of trips making this movement switch to route through the town centre, which then exacerbates congestion issues already occurring here, particularly at the Bridgefoot Gyratory, and at the A3400/A4390/Seven Meadows Road junction.

33. During the PM period, the reverse of this pattern emerges, as a high volume of trips route between the M40 and the south of Stratford in this scenario. Trips making this journey route via the A46 to the Wildmoor junction, before travelling along the West of Shottery Relief Road, and South Western Relief Road. As this route becomes congested, vehicles making this journey seek alternative routes, which are mainly along Warwick Road and into the town centre, which again exacerbates already congested conditions at this location.

34. This pattern is highlighted by the queue analysis plots presented in the following section. The queue analysis plots present the changes in average hourly maximum queue lengths across each junction within the model, once the Reserve Sites demands are added to the 2031 Core Strategy network.

35. Junctions where queue differences have not been presented on the maps simply represent those which did not trigger any of the assessment criteria across any one approach.

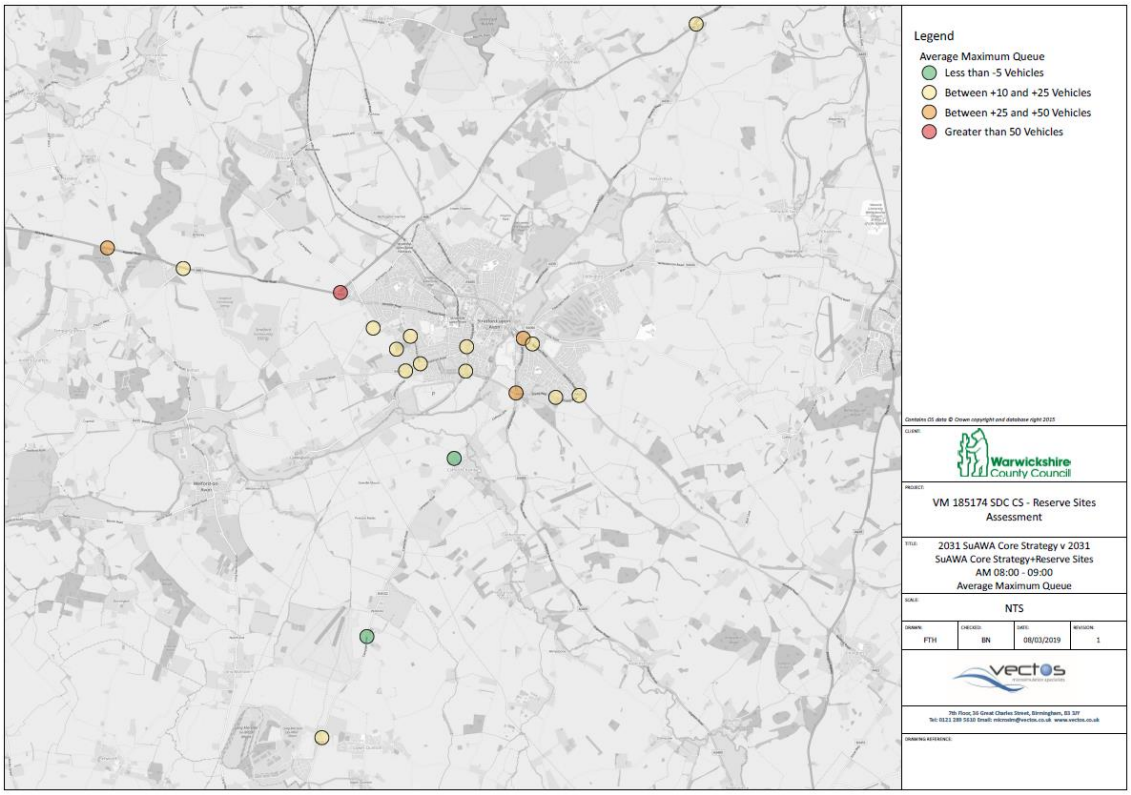
36. The classifications for the queue length analysis within these plots are outlined as follows:

- **Queue Reduction** (a reduction in queue lengths of greater than 5 vehicles)
- **Moderate Increase** (an increase in queue lengths of between 10 and 25 vehicles)
- **Significant Increase** (an increase in queue lengths of between 25 and 50 vehicles)
- **Very Significant Increase** (an increase in queue length of over 50 vehicles)

37. The classifications detailed above are based upon best practice and the approach adopted in similar studies elsewhere within the county.

38. The queue results for the 2031 Core Strategy + Reserve Sites scenario have been presented in **Figure 9** and **Figure 10**. The queue lengths have been compared against queue levels in the 2031 Core Strategy scenario for the AM and PM peak hours respectively.

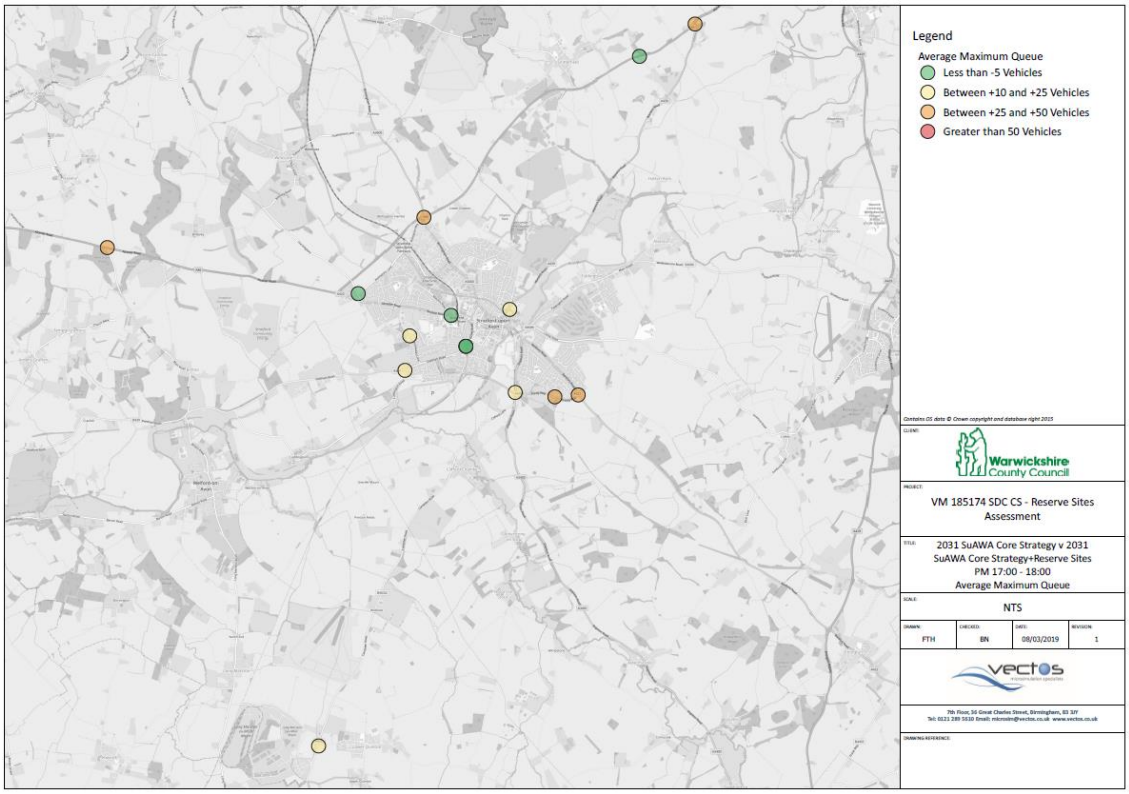
Figure 9 Queue Length Analysis – 2031 Core Strategy vs 2031 Core Strategy + Reserve Sites (AM Peak Hour)



39. **Figure 9** outlines the impact on queueing levels during the AM peak hour, once the Reserve Site demands are added to the 2031 Core Strategy scenario.

40. Congestion occurs on approaches to the Wildmoor junction, along with at the Marraway junction. As the A46 becomes congested, a significant number of trips switch to route through the town centre, which then exacerbates congestion issues already occurring here, particularly at the Bridgefoot Gyratory, and at the A3400/A4390/Seven Meadows Road junction.

Figure 10 Queue Length Analysis – 2031 Core Strategy vs 2031 Core Strategy + Reserve Sites (PM Peak Hour)



41. **Figure 10** outlines the impact on queueing levels during the PM peak hour, once the Reserve Sites demands are added to the 2031 Core Strategy scenario. During this period, the reverse of the AM queueing pattern emerges, as a high volume of trips routes between the M40 and the south of Stratford in this scenario.

42. Trips making this journey route via the A46 to the Wildmoor junction, before travelling along the West of Shottery Relief Road, and South Western Relief Road. As this route becomes congested, vehicles making this movement seek alternative routes, which are mainly along Warwick Road and into the town centre, which again exacerbates already congested conditions at this location.

43. The Core Strategy model already contains significant junction improvements at the A46/A422 Wildmoor, A46/Bishopton and A46/Warwick Road 'Marraway' junction, (see supporting technical note[2]). Accordingly, it is difficult to identify additional mitigation measures that could improve the network conditions once the Reserve Sites have been added, without investigating the requirement for large grade separated junctions, or additional link roads.

44. Given that the inclusion of the Reserve Sites equates to the delivery of 1,620 additional dwellings, it is considered that this scale of mitigation is not appropriate for the additional quantum of development being included here.

[2] VM185176.TN001 SuAWA Core Strategy Model Development Note

45. As such some smaller scale mitigation measures will be tested, in order to investigate whether there is any scope to deliver any additional capacity out of the existing network.

Mitigation Testing

46. As detailed above, significant congestion issues have been modelled when the Reserve Sites have been included within the Core Strategy model network. This is considered to be a result of the cumulative impact of all Core Strategy sites, plus the Reserve Sites, rather than directly attributable to the Reserve Sites.

47. As there are significant mitigation schemes included at the major junctions along the A46 within the Core Strategy network, it has been determined that no additional changes to these junctions would be made at this stage.

48. In an attempt to improve the throughput on the A46 however, dualling has been included in the network at the following locations:

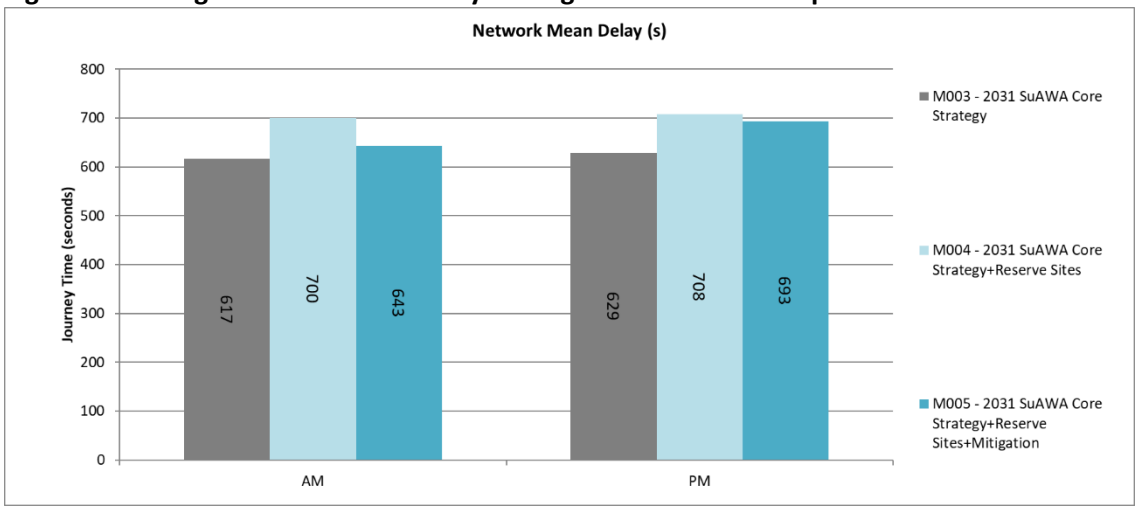
- A46 EB approach to the Wildmoor roundabout - 100 metres of dualling prior to segregated left turn lane
- A46 NB exit from Wildmoor roundabout - 200 metres of dualling on exit from the junction, to improve merge from segregated left turn lane and mainline flows
- A46 SB exit from Marraway Junction – 200 metres of dualling beyond previously modelled merge from two lanes back to one, to reduce blocking back through the signal junction from the downstream merge

49. The above mitigation has been included within a version of the 2031 Core Strategy + Reserve Sites model network to form the 2031 Core Strategy + Reserve Sites + Mitigation scenario. This scenario has been run 10 times for the AM and PM period, and the headline statistics presented below.

50. The small scale mitigation included within the model network indicates that some congestion relief is delivered, however, it is clear that the network continues to operate close to capacity, with the level of network wide delay still significantly higher than 2031 Core Strategy conditions during the PM period.

51. This is largely a result of the significant volume of trips travelling between the Long Marston area, across the model network towards the M40 during the AM and the reverse of this during the PM. The introduction of the SWRR along with junction upgrades along the A46 does alleviate some of this congestion, however the network is still operating at or very close to capacity. The resultant network wide delay is presented in **Figure 11**.

Figure 11 Average Network Wide Delay – Mitigation Scenario Comparisons



52. The requirement for mitigation within the model network once the Reserve Site demands are included is further highlighted by the following queue length analysis.

53. The following analysis presents the changes in average hourly maximum queue lengths across each junction within the model, once the Reserve Sites demands and identified mitigation schemes are added to the 2031 Core Strategy network. The queue results for the 2031 Core Strategy + Reserve Sites + Mitigation scenario have been presented in **Figure 12** and **Figure 13**. The queue lengths have been compared against queue levels in the 2031 Core Strategy scenario for the AM and PM peak hours respectively. The classifications previously identified have been applied in this analysis.

Figure 12 Queue Length Analysis – 2031 Core Strategy vs 2031 Core Strategy + Reserve Sites + Mitigation (AM Peak Hour)

54. The queue analysis presented in **Figure 12** indicates that the mitigation identified improves queuing conditions, particularly within the town centre. This is a result of the improved conditions on the A46, resulting in less trip re-routing through the town centre when travelling north to south and south to north across the network.

55. The results do however highlight that significant queues continue to occur at the Shipston Road/Trinity Way/Seven Meadows Road junction, particularly on the Clifford Lane approach to the junction.

Figure 13 Queue Length Analysis – 2031 Core Strategy vs 2031 Core Strategy + Reserve Sites + Mitigation (PM Peak Hour)

56. The queue results in **Figure 13** indicate that despite the inclusion of the mitigation schemes identified, a number of junction across the model experience worsening in queueing conditions during the PM peak.

57. The inclusion of mitigation at the Marraway junction improves queue conditions here, but the release of vehicles here is likely to have a knock on impact on junctions downstream, as demonstrated by the queue length increases at the A46/Wildmoor and Stratford Gyratory junctions.

58. The queue analysis also indicates the key routes between the north and south of the model begin to become congested, despite a general improvement of traffic congestion on the A46. The results suggest that the Evesham Road/West of Shottery Relief Road/SWRR junction experiences queue increases, along with the Shipston Road/Trinity Way/Seven Meadows Road junction.

59. This analysis would suggest that, in light of the continued congestion during the PM peak following the inclusion of small scale mitigation measures within the model network, it is likely that in order to deliver all Core Strategy sites, along with the Reserve Sites, some significant grade separation junctions and/or additional link roads will need to be delivered within the model network, unless alternative demand reduction options can be derived.

Mode Shift Testing

60. Following on from the capacity constraints detailed above, a further set of tests have been developed which focus on the impact associated with a reduction in the volume of trips

generated by each of the Reserve Sites through the application of alternative mode shift assumptions.

61. As previously detailed within this note, a 10% car reduction has been applied to all demands associated with the Reserve Sites included within the 2031 Core Strategy model. The assessment so far has indicated that a further mode shift may need to be realised to enable the network to operate without significant congestion.

62. As such, testing has been undertaken which further reduces the car mode share from a 10% reduction in the original 2031 Core Strategy + Reserve Sites scenario, to a 20% and 30% car share adjustment.

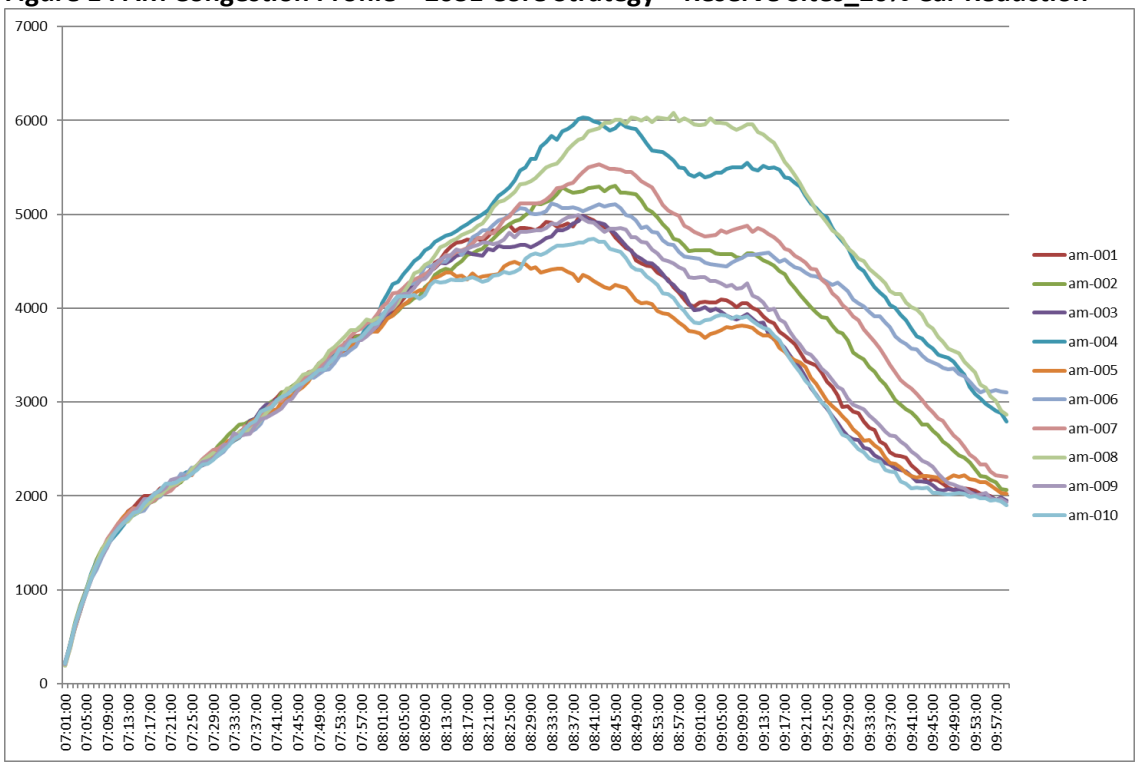
63. Accordingly the following scenarios have been run:

- 2031 Core Strategy + Reserve Sites_20% Car Mode Reduction
- 2031 Core Strategy + Reserve Sites_30% Car Mode Reduction

64. The intention of this testing is to determine the point at which the model congestion profile becomes stable, and the network wide delay is not significantly higher than the 2031 Core Strategy scenario.

65. The following section presents the congestion profiles from the two additional mode shift scenarios, along with a comparison of the network wide average journey times in each of the scenarios tested.

Figure 14 AM Congestion Profile – 2031 Core Strategy + Reserve Sites_20% Car Reduction

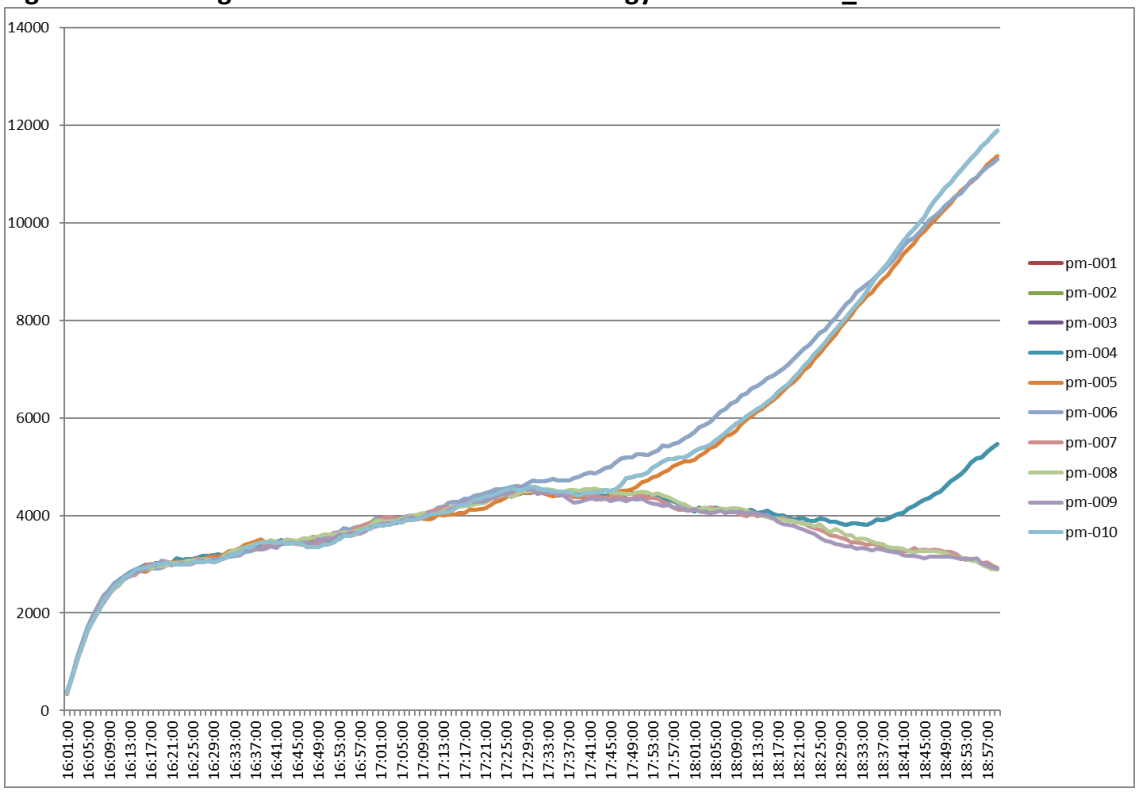


66. **Figure 14** presents the AM period congestion profile for the 20% car mode shift reduction scenario. The congestion profile indicates a much greater level of model stability when

compared to the original 2031 Core Strategy + Reserve Sites scenario, with a typical congestion profile modelled, and smaller variability between runs.

67. This would suggest that with a 20% car mode shift reduction from the Reserve Sites, the model network during the AM period is largely stable.

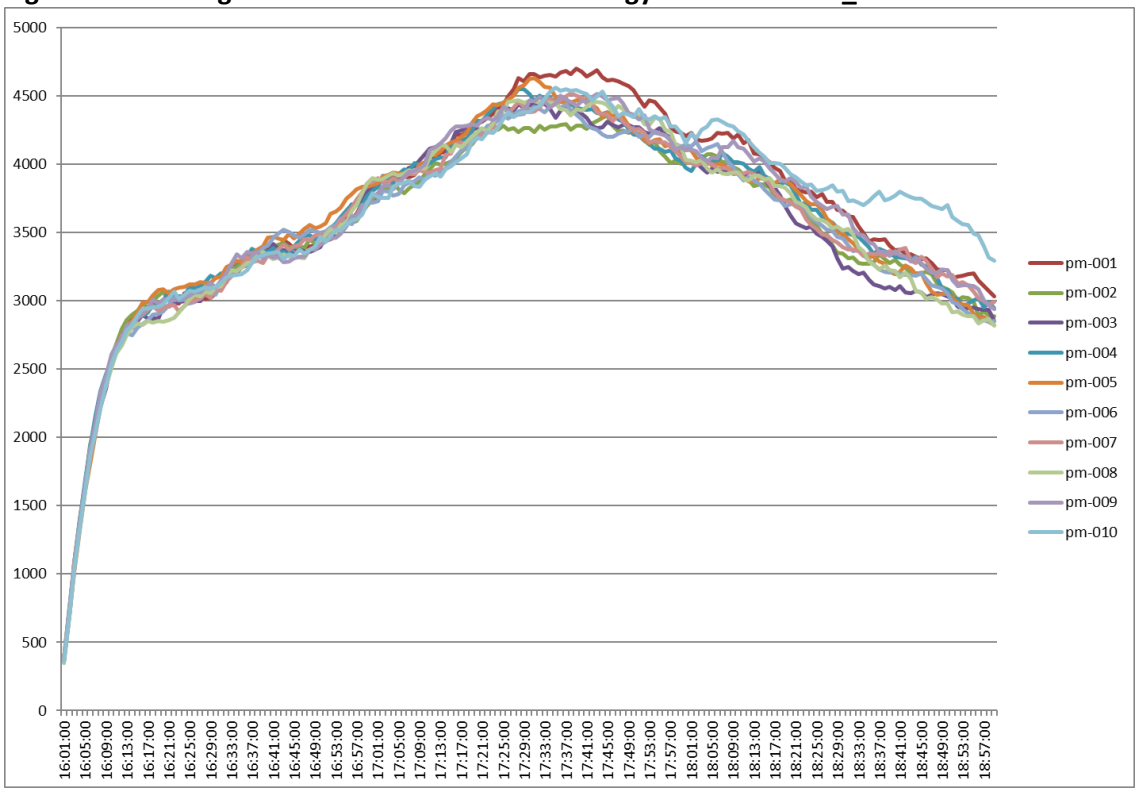
Figure 15 PM Congestion Profile – 2031 Core Strategy + Reserve Sites_20% Car Reduction



68. **Figure 15** presents the PM congestion profile for the 20% car mode shift reduction scenario. The congestion profile indicates that a high level of model instability continues to exist, with a number of 'failed' runs. This would suggest that with a 20% car mode shift reduction from the Reserve Sites, the model network continues to be unstable during the PM period.

69. Accordingly a 30% car mode shift has been applied, with the specific intention of investigating whether this level of mode shift would result in a more stable PM modelled network. **Figure 16** demonstrates the PM period congestion profile once this 30% car mode reduction has been applied to all Reserve Sites.

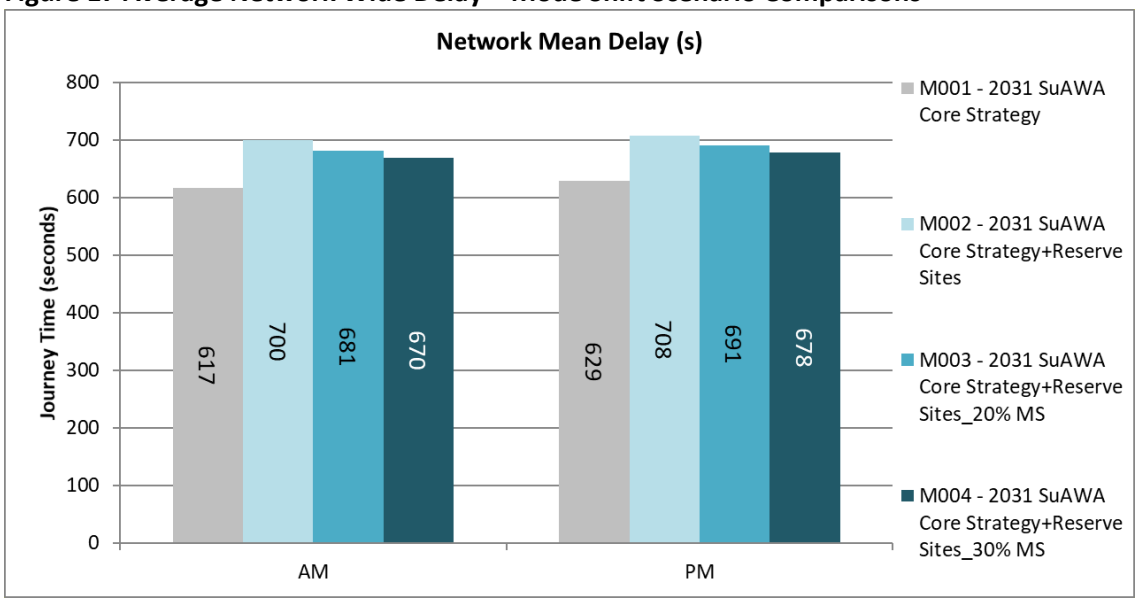
Figure 16 PM Congestion Profile – 2031 Core Strategy + Reserve Sites_30% Car Reduction



70. The congestion profile demonstrates that with this level of mode shift, the congestion on the network follows a more stable pattern, indicating that the network does not gridlock or become highly congested during this period, with the 30% car reduction applied to the Reserve Site demands.

71. In addition to the above congestion profile analysis, the network wide delay incurred in each of these scenarios is presented in **Figure 17**.

Figure 17 Average Network Wide Delay – Mode Shift Scenario Comparisons



72. The analysis presented in **Figure 17** demonstrates that with the addition of the Reserve Sites to the network, the average delay increases by around 83 seconds per journey in the AM period and 79 seconds per journey in the PM period, compared to the 2031 Core Strategy scenario.

73. The scenarios containing the adjusted mode shift assumptions reduce this level of delay, with the most significant reductions occurring during the AM period.

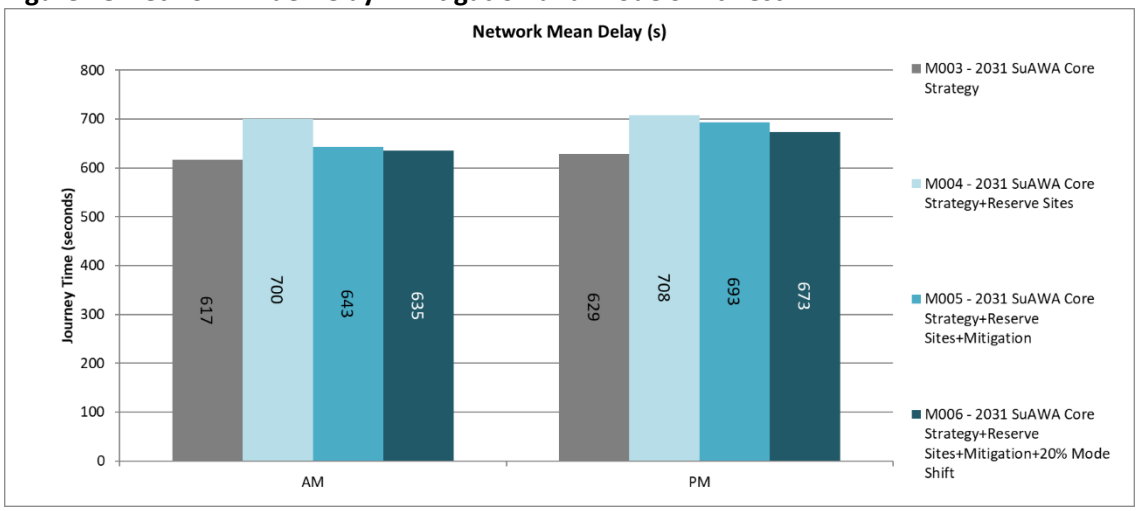
74. With a 30% car reduction from the Reserve Sites, the additional delay per journey is around 53 seconds per journey in the AM period, and 49 seconds per journey in the PM period, when compared to the 2031 Core Strategy scenario.

Mitigation + Mode Shift Test

75. Further to the assessment outlined above, it was determined that one final test would be undertaken, which focuses on the impact on the network of including the Reserve Sites, alongside the identified mitigation, and the application of a car mode shift reduction.

76. Accordingly the final test undertaken assesses a 20% car mode shift reduction, alongside the identified mitigation measures. This model has been run, and the network wide delay results presented alongside the previously tested scenarios in **Figure 18**.

Figure 18 Network Wide Delay – Mitigation and Mode Shift Test



77. The results presented in **Figure 18** demonstrate the impact of including the mitigation measures identified, alongside the 20% car mode shift for the Reserve Sites demands.

78. The resultant average journey times in this scenario is only 18 seconds higher than the average journey times in the 2031 Core Strategy scenario during the AM period. However, during the PM period, the journey times are 44 seconds per journey higher than the 2031 Core Strategy scenario.

79. These results suggest that during the PM the network is operating close to or at capacity despite the introduction of mitigation measures alongside a 20% car mode share reduction for Reserve Site demands.

Stage 1 Assessment Summary

80. This section has outlined that in order to deliver the Reserve Sites, and maintain a reasonable level of model stability, some mitigation would be required on the network (additional to the significant works included within the Core Strategy model) or at least a 30% car mode shift would have to be realised for all trips generated by Reserve Sites. This is in a scenario with no additional mitigation included within the network.

81. The resultant level of network wide delay in each of the scenarios assessed has been presented against the network wide delay for the 2031 Core Strategy scenario, as a further means of demonstrating the impact of including the Reserve Sites on the network in either the mitigated or each of the mode shift scenarios.

82. This analysis has indicated that the introduction of the 30% mode shift reduces delay significantly when compared to no additional mode shift, and also outlines that the introduction of the mode shift delivers greater benefits in network performance than those delivered with no mode shift but mitigation included.

83. Despite this, the levels of delay incurred are still notably higher than the 2031 Core Strategy Scenario, which would suggest that the inclusion of the Reserve Sites, even with a 30% mode shift applied, or in a scenario which combines the mitigation measures with a 20% car reduction, results in a network that is at or very close to capacity, particularly during the PM period.

84. This is largely a result of the traffic flows predicted to route between the South-East of the model network to the North of the model network in the AM period, and the reverse of this pattern in the PM period.

85. The results have indicated that despite the provision of the SWRR in its currently proposed form, and the A46 junction upgrades, along with the additional mitigation provided in this assessment, that both the A46 and alternative routes to enable these movements (Campden Road and routes through the town centre) are either at or reaching capacity, particularly during the PM period.

Stage 2 – 2023 Interim Year Core Strategy Assessment

Methodology

86. This second stage of the assessment centres around the assignment of trips predicted to be generated by the potential Reserve Sites into the 2023 Interim Year SuAWA Core Strategy Scenario network. Critically, this scenario does not contain the SWRR.

87. As per Stage 1, the Reserve Sites trips will be assigned based upon a trip generation and distribution agreed with WCC, and a review of resultant network conditions will then be undertaken in order to determine the impact that each additional reserve site will elicit on the network.

88. This stage of the assessment will establish what additional mitigation measures will be required to ensure the network will continue to operate satisfactorily when all sites are included.

Reserve Sites Inclusion

89. As per Stage 1, all of the previously identified potential Reserve Sites were included within the Interim Year modelling. SDC advised on the likely number of dwellings at each site in the Interim Year, the details of which are summarised in **Table 6**.

Table 6 Interim Assessment Year Reserve Sites Details

Site	Dwellings
Land North of Evesham Road	90
Land East of Banbury Road	70
Land South of Trinity Way	70
Land East of Kineton Road	90
Land West of Kineton Road	60
Land West of Walton Road	45
Land South of Loxley Road	45
Atherstone Airfield	70
Former Long Marston Depot	50
Adjacent to former Long Marston Depot	90
Land East of Shipston Road	70

90. The above sites have been included in the same format, with the same trip distribution applied as per Stage 1 of the assessment. As per Stage 1 a 10% car reduction has been applied to all Reserve Site demands.

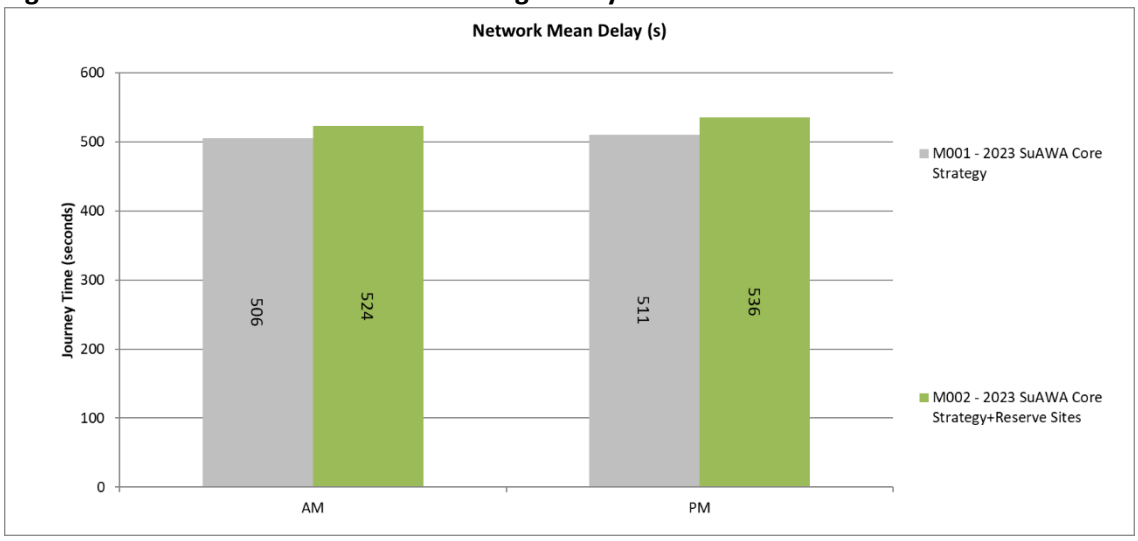
Model Review

91. Upon inclusion of the Reserve Site demands into the 2023 Interim Year Core Strategy model, the model has been run and the network performance reviewed.

92. A review of the network wide delay outputs from the model indicates that the mitigation schemes previously included within the Interim Year Core Strategy model provide sufficient capacity on the network once the Reserve Site demands are included.

93. This pattern is reflected in the network statistics analysis, which reveals only small increases in the average delay across the model, once the Reserve Site demands are included, as demonstrated by **Figure 19**.

Figure 19 Network Wide Statistics – Average Delay



94. A visual review of the model performance indicates that the network operates largely without significant congestion occurring, however during the AM period, queues begin to build on Campden Road, through Clifford Chambers, and on the Clifford Lane approach to the A3400/Clifford Lane roundabout.

95. The reverse of this pattern emerges in the PM period, with the majority of the network operating within capacity during the period, but with queues forming on the A3400 southbound approach to the A3400/Trinity Way/Seven Meadows Road junction, along with queues forming at the Evesham Road/Seven Meadows Road/Shottery Road junction.

96. Additional analysis of these queuing patterns indicates that the A3400/Trinity Way/Seven Meadows Road roundabout, and the A3400/Clifford Lane roundabout are operating close to capacity once additional demands are included at the Reserve Sites surrounding Long Marston Airfield.

97. It is likely that the introduction of the SWRR would alleviate the congestion issues modelled at these locations, providing an alternative route for traffic generated by these sites, rather than being forced to travel through the town centre when travelling to/from the north of the model network.

98. It is anticipated that the main barrier to growth in the Interim Year scenario would be the capacity constraints at the Clopton Bridge. Accordingly, a review of the change in traffic flows at this location in the 2023 Core Strategy vs the 2023 Core Strategy + Reserve Sites has been undertaken. The resultant AM and PM peak period changes in flows are presented in **Table 7**.

Table 7 Clopton Bridge Two Way Flows – Interim Year Assessment

	2023 Core Strategy	2023 Core Strategy + Reserve Sites	Difference
AM Peak Period (0700-1000)	5480	5735	+255
PM Peak Period (1600-1900)	5770	6098	+328

99. The analysis indicates that the inclusion of the Reserve Sites within the Interim Year Core Strategy model results in around 255 additional two way trips across the bridge during the AM period, and an additional 330 two way trips across the bridge during the PM period.

100. This volume of traffic appears relatively small in the context of the total two way trips across the bridge in each period.

101. In order to further demonstrate the impact that this increase in flows has on the bridge, queue lengths have been extracted and reported for the approaches to the bridge in the AM and PM peak hours (0800-0900 and 1700-1800). These queue lengths are reported in **Figure 20** and **Figure 21**.

Figure 20 Clopton Bridge AM Peak Hour Queue Analysis - Interim Year Assessment

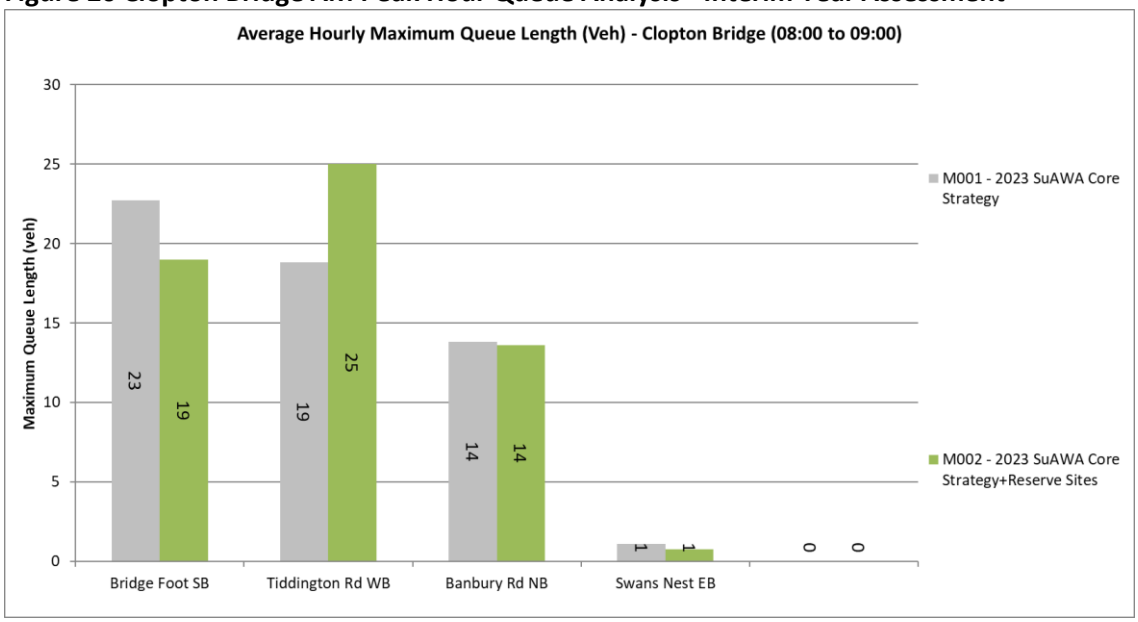
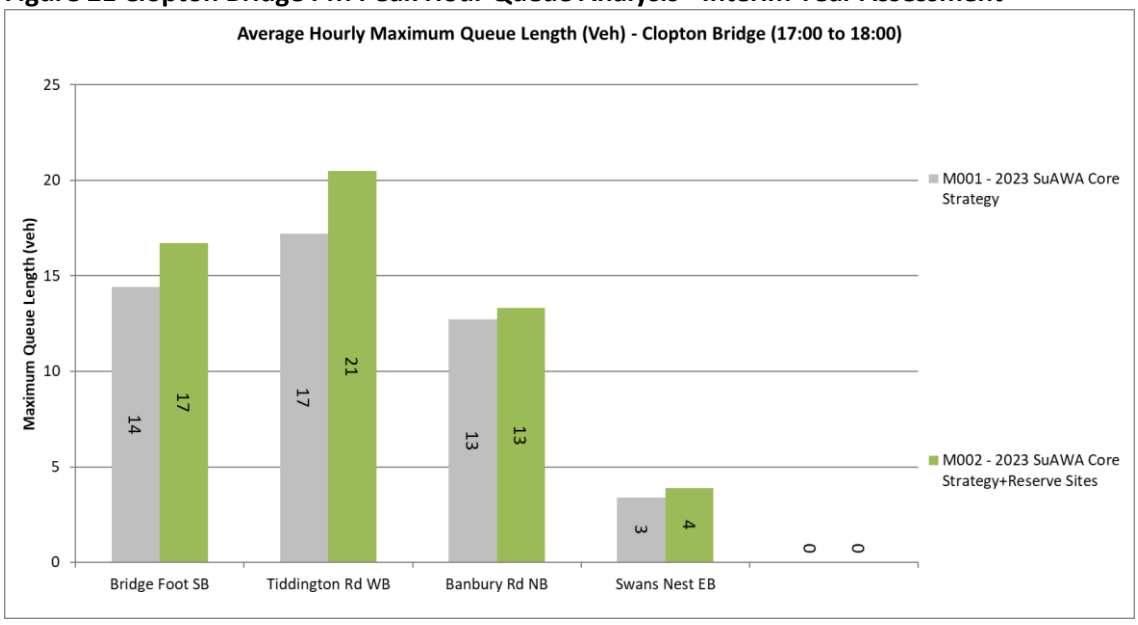


Figure 21 Clopton Bridge PM Peak Hour Queue Analysis - Interim Year Assessment



The queue length results indicate that there is a small impact on peak hour queues at the Clopton Bridge, and that it is likely that the inclusion of the Reserve Sites in the quantum applied in this 2023 assessment will not trigger the need for further mitigation at this location.

Stage 2 Assessment Summary

102. The analysis in this stage of the assessment has indicated that the inclusion of the Reserve Sites within the Interim Year scenario does not necessarily trigger the need for any additional mitigation including within the network (beyond that already included in the 2023 Core Strategy scenario).

103. The network appears to have capacity for the sites closer to the town centre, with the impact of including these sites within the model on Clopton Bridge being minimal.

104. The analysis does indicate that any additional development at the larger site at the former Long Marston Depot will trigger the need for the SWRR, largely as a result of queues on Campden Road and on the Clifford Lane approach to the A3400/Clifford Lane roundabout.

Summary and Conclusions

105. This Note forms part of a series produced by Vectos Microsim (VM) in response to a request from Stratford District Council (SDC) for assistance in assessing the potential implications of the delivery of a strategy for the allocation of Reserve Sites, which may be necessary to bridge any perceived shortfall that has arisen in the housing delivery profile for Stratford District, post adoption of the Core Strategy.

106. The primary objective of this assessment was to assess at a final point, and interim year, the impacts on the SuAWA network associated with the delivery of the potential Reserve Sites identified by SDC, and where possible to do so identify measures to overcome the impacts identified

107. The initial analysis has focused on the impact of the inclusion of the full build out of the Reserve Sites in the 2031 Core Strategy scenario. This stage outlined that in order to deliver the Reserve Sites, and maintain a reasonable level of model stability, some mitigation would be required on the network (additional to the significant works included within the Core Strategy model) or at least a 30% car mode shift would have to be realised for all trips generated by Reserve Sites.

108. Despite the application of a mode shift, or introduction of mitigation schemes, the levels of delay incurred are still notably higher than the 2031 Core Strategy Scenario, which would suggest that the inclusion of the Reserve Sites, even with a 30% mode shift applied, results in a network that is at or very close to capacity.

109. This is largely a result of the traffic flows predicted to route between the South-East of the model network to the North of the model network in the AM period, and the reverse of this pattern in the PM period.

110. The results have indicated that despite the provision of the SWRR and A46 junction upgrades, along with the additional mitigation provided in this assessment, that both the A46 and alternative routes to enable these movements (Campden Road and routes through the town centre) are either at or reaching capacity, particularly during the PM period.

111. Following on from this stage of the assessment, the potential Reserve Sites have been tested in a 2023 Interim Year scenario. SDC advised VM of the likely build out rate at each site by this assessment year, and the appropriate level of trips were included within the 2023 Interim Year Core Strategy model.

112. This model has been run and reviewed, and the results highlight that the inclusion of the potential Reserve Sites within the Interim Year scenario does not necessarily trigger the need for any additional mitigation within the network (beyond that already included in the 2023 Core Strategy scenario including the SWRR). The network appears to have capacity for the level of build out of each site by this assessment year, particularly for those sites closer to the town centre.

113. The analysis does indicate that any additional development beyond that included within the model at the sites adjacent to Long Marston will likely trigger the need for the SWRR.

SDC Reserve Housing Sites Assessment

Historic Data Review and Clopton Bridge Impact Assessment

April 2019

VM185174.TN001

Introduction

1. This Note forms part of a series produced by Vectos Microsim (VM) in response to a request from Stratford District Council (SDC) for assistance in assessing the potential implications for the delivery of a strategy for the identification of Reserve Sites which may be necessary to bridge any potential shortfall that has arisen in the housing delivery profile for Stratford District, post adoption of the Core Strategy.

2. This Note sets out the review of historic traffic count data around the Clopton Bridge area, before outlining the steps undertaken to ascertain the likely impact on the bridge of each of the potential Reserve Sites within the Stratford area.

Background

3. The original Stratford-upon-Avon Wide Area (SuAWA) model that was used to assess the impacts of the Core Strategy was developed from 2007 data. By 2013 the next model update had been scheduled which was completed by 2015. However, at that time the base model was still representative of a 2013 year and, as there were a number of large scale developments expected to come forward by 2018, it was decided the model should be subject to a further targeted update to ensure it is as reflective of current network conditions as possible. Accordingly, the model has been updated in 2017.

4. The updated model was also further extended to ensure Wellesbourne was included in more detail given its close functional relationship (and since this is an area previously promoted for potential development), and the network around Long Marston was also extended and calibrated to a higher level of detail.

5. Since the time of the original Core Strategy work, additional work has been undertaken on a number of sites which are allocated within the Strategy, this included the assumptions pertaining to Long Marston Airfield and Land South of Alcester Road (SUA2). Therefore, separate to this stage of the assessment, the Core Strategy Sensitivity test model has been update to reflect the latest assumptions related to these sites.

Objective

6. Through discussions between WCC and SDC, VM have identified a primary objective which is to be assessed by this stage of the work.

7. The assessment summarised within this note addresses the following objective:

    - To complete a review of the data pertaining to the housing cap applied on Long Marston Airfield (LMA) and other developments which prevent further development to the south of Stratford before the South Western Relief Road (SWRR) is delivered.

8. In order to address the above objective, the following stages of assessment have been undertaken, which are summarised within the remainder of this note.

    - Stage 1 –Data Review
    - Stage 2 – Reserve Sites Clopton Bridge Impact

Stage 1 –Data Review

Methodology

9. The focus of this assessment is based around the assumption that the development of housing to the south of Stratford is currently restricted until such time as the South Western Relief Road (SWRR) is in place. The Core Strategy Policy for the Long Marston Airfield site (LMA) stipulates that there is a specific requirement for:

    Completion of a south-western relief road before more than 400 dwellings can be occupied, unless a transport assessment demonstrates a higher threshold is appropriate.

10. As a result of this, there has been a position adopted by WCC which requires the SWRR to be delivered before any further development would be approved within the area. At the time of completing the Core Strategy assessment and subsequent to that this position has been considered reasonable based on the evidence available at the time.

11. However, it is important to note that this evidence was based on traffic forecasts derived from a series of counts which were collected between 2007 and 2015. Furthermore, the 2015 assessment was completed within a cordon model which focussed on the gyratory area in isolation, thus the potential for reassignment away from Clopton Bridge was omitted within the bespoke modelling of this area.

12. Therefore, this stage of the assessment involves a review of the traffic data and changes that have occurred in the area around Clopton Bridge. This analysis focuses on how the pattern of traffic growth between years has occurred and how this compares to what has previously been assumed within the modelling.

13. As part of this review the following data sources/models have been reviewed:

- Historic Cordon Count data for flows in and out of Stratford at Clopton Bridge
- 2031 Reference Tiddington Model
- 2031 Core Strategy Tiddington Model
- 2031 SuA Reference Case (following recent update)
- 2031 Core Strategy Model (following recent update)

14. It is anticipated that a review of the above data sources and modelled flows, will help establish any level of relief predicted to occur through the reassignment of traffic away from the development area.

Cordon Count Data Review

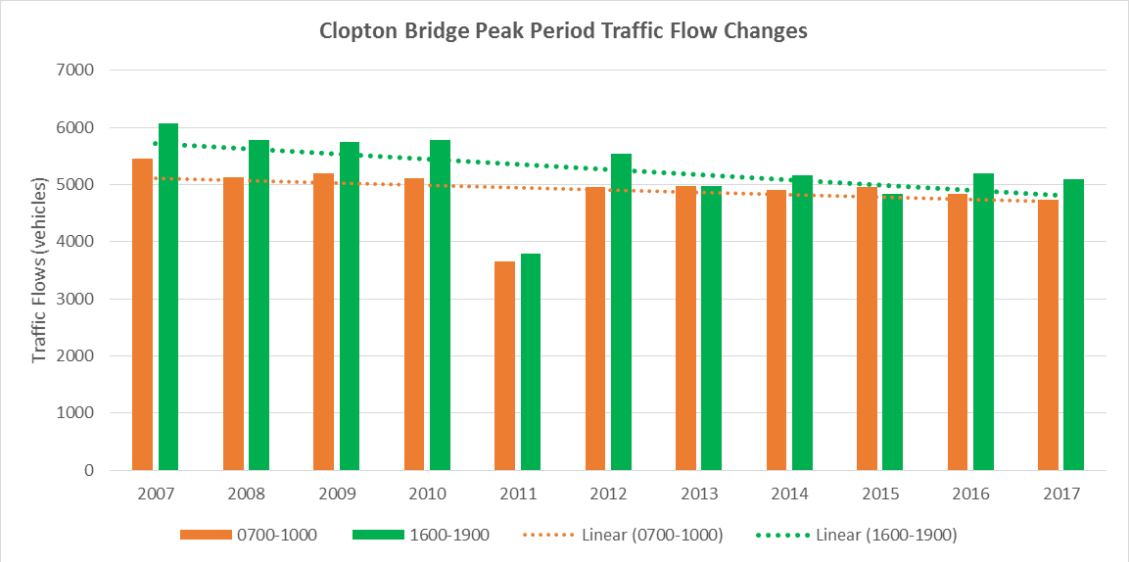
15. The first stage of the data review focuses on cordon count data provided to VM by WCC for the Clopton Bridge area. Historic ATC data has been provided for traffic flows both into and out of Stratford town centre, at the location highlighted in **Figure 1**.

Figure 1 Clopton Bridge Cordon Count Location

16. WCC have provided annual count data from 1998 up until 2017. However, for the purposes of this assessment it was deemed appropriate to review only 10 years' worth of data, from 2007 to 2017, on the basis that this volume of data should be sufficient to identify any underlying trends, but also the original SuA Base model was calibrated and validated to 2007 data.

17. The annual data has been reviewed, specifically focusing on the average Monday-Friday data. The inbound and outbound traffic flows have been combined to provide an average peak period (0700-1000 and 1600-1900) two way flow at the Clopton Bridge, for week day's data collected between 2007 and 2017. The resultant flows are presented in the following **Figure 2**.

Figure 2 Clopton Bridge Two Way Traffic Flows



18. The data presented within **Figure 2** demonstrates a general reduction in traffic using the Clopton Bridge year on year.

19. This pattern of reduced flows is most significant in the PM period, where two way flows have reduced by around 16% between 2007 and 2017. Across the AM peak period traffic flows have reduced by 13%.

Traffic Model Future Year Flow Review

20. The reduction in traffic flows reflected in the cordon count data would suggest that the conclusions of any previously modelling assessment undertaken may now be subject to adjustment, on the basis that the underlying data used in this modelling has been superseded by lower traffic flows in subsequent years.

21. The previous modelling assessments undertaken within Stratford, as detailed in this note, are based upon either 2007 or 2013 traffic count data. The 2007 and 2013 count data was used to develop the relevant Base models, which were then factored by TEMPro growth assumptions and the relevant housing trajectory information to derive agreed future year scenarios.

22. The previous growth cap identified as a restraint on growth within the study area was based upon flows extracted from the bespoke traffic model for the Clopton Bridge/Stratford Gyratory model, named the Tiddington model. This model was developed for a 2031 Reference Case (inclusive of all known committed developments at the time including 400 dwellings at Long Marston Airfield). This model was also developed to represent a 2031 Core

Strategy scenario which included the additional 3,100 dwellings at Long Marston, and an allowance for re-routing away from the bridge as a result of the delivery of the SWRR.

23. Each of the future year Tiddington models were based upon the 2015 Tiddington Base Model. On the basis that these future year scenarios were developed by factoring baseline data that has now been proven to have reduced in volume between current levels and those assumed in any previous modelling, then previous conclusions may now be subject to revision, and there may in fact be additional capacity at the bridge in the future year scenarios than previously thought.

24. It is therefore considered pertinent to review the future year traffic flows within these models at the Clopton Bridge, to review whether the latest models (which are based upon 2017 count data) suggest that capacity exists at this location on the network, which the previous modelling predicted would not be available.

25. The following table demonstrates the changes in predicted traffic flows between the previously developed Tiddington models, and the most recent SuAWA models, developed using 2017 traffic count data. The data presented compares traffic flows travelling towards the town centre during the AM peak period, and traffic flows travelling away from the town centre during the PM peak period.

Figure 3 Clopton Bridge Flow Analysis - Model Differences

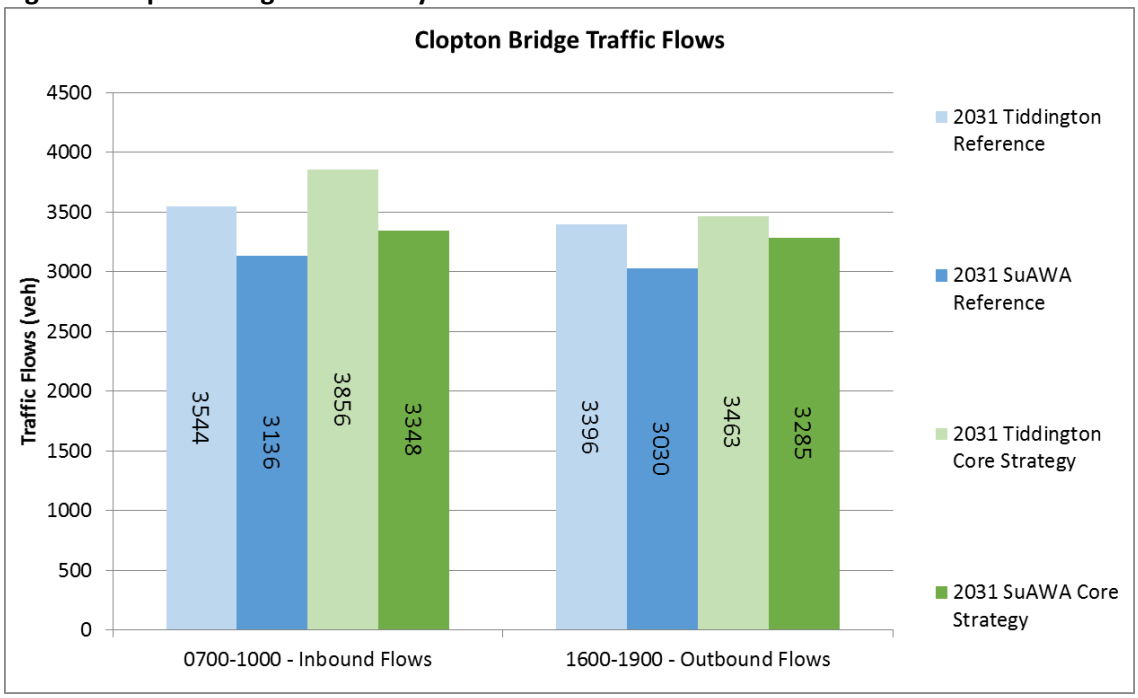


Table 1 Clopton Bridge Flow Analysis

	2031 Tiddington Ref	2031 SuAWA Ref	Difference
0700-1000	3544	3136	-408
1600-1900	3396	3030	-366
	2031 Tiddington Core Strategy	**2031 SuAWA Core Strategy**	**Difference**
0700-1000	3856	3348	-508
1600-1900	3463	3285	-178

26. The analysis presented in **Figure 3** and **Table 1** demonstrates that the flows extracted from the 2031 Reference and 2031 Core Strategy Tiddington models, for the AM and PM peak periods, are consistently higher than those extracted from the recently updated 2031 SuAWA Reference and 2031 SuAWA Core Strategy scenarios.

27. The analysis highlights the large differences being between the 2031 Reference Case scenarios, with the most recent SuAWA model predicting around 408 fewer inbound trips across the Clopton Bridge than previously predicted by the 2031 Reference Tiddington model during the AM period.

28. A reduction in flows is also modelled in the Core Strategy scenarios, with this reduction in the region of 500 inbound trips during the AM peak periods, and 200 outbound trips in the Pm.

29. It is likely that this reduction in flows is a result of the lower baseline flows used to develop the update SuAWA models, but also due to the ability of the SuAWA model to capture any reassignment of traffic away from the bridge.

30. This analysis demonstrates that the previously predicted cap on development to the south of Stratford, which was based upon capacity constraints highlighted by the Tiddington models, may be subject to adjustment, as the more recently updated models predicted less traffic to be routing via the bridge.

31. This analysis has indicated that there may in fact be more capacity available at the Clopton Bridge, in the future year scenarios, than has previously been predicted.

Stage 2 – Reserve Sites Clopton Bridge Impact

Methodology

32. Following the analysis of traffic data for the Clopton Bridge area outlined in Stage 1 of this assessment, along with an identification that the growth in traffic flows previously predicted is not currently being realised, it is now considered pertinent to assess the relative impact that each of the potential Reserve Sites would have on the Clopton Bridge area of the Stratford-upon-Avon road network.

33. In order to achieve this, the demand equivalent to 100 dwellings have been assigned to each of the sites within the 2023 Interim Core Strategy Sensitivity Test Scenario (i.e. the scenario without the SWRR).

34. The purpose of assigning 100 dwellings to each area is that it enables equivalent values to be derived. This means that the assessment identifies the equivalent number of houses in each area that will elicit the same impact on Clopton Bridge.

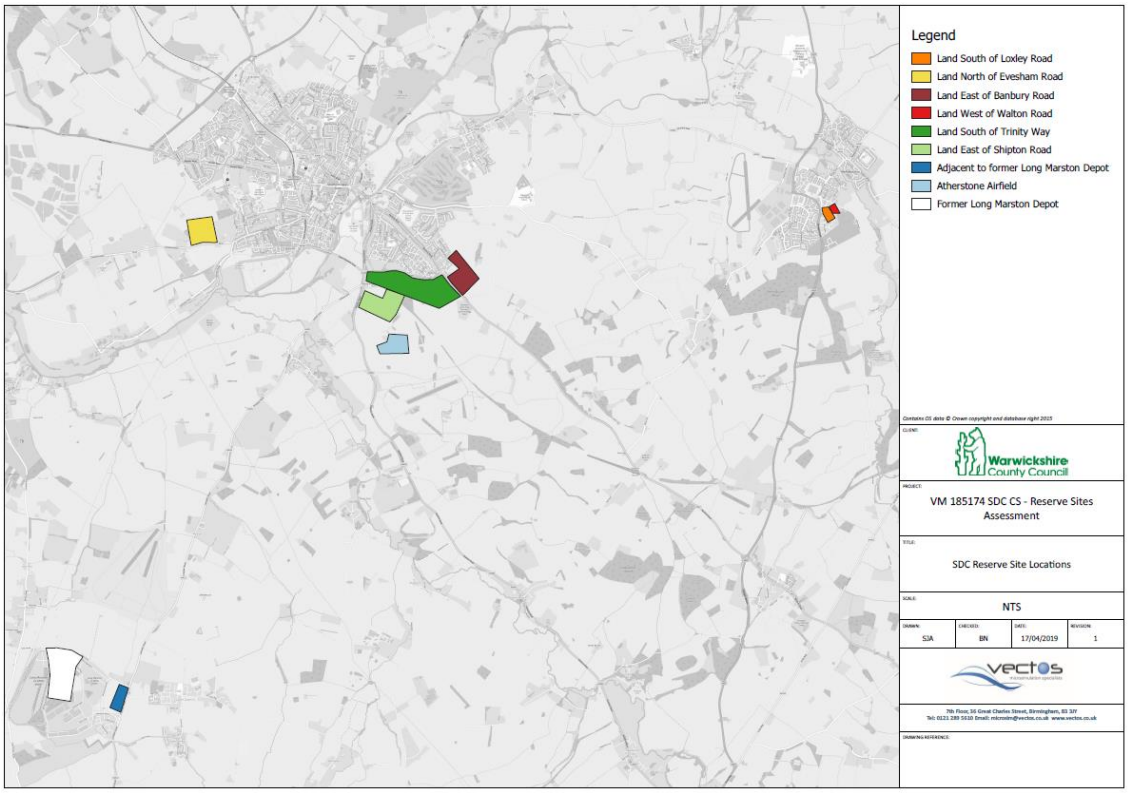
35. The analysis will then determine the areas where it is preferential for potential Reserve Sites to be prioritised before delivery of a SWRR, on the basis that they are least likely to affect the operation of the network in the area of Clopton Bridge.

36. The model scenario containing the sites has been run for the AM and PM peak periods and an assessment of proportion of trips generated by each site which will impact on the Clopton Bridge area has been undertaken.

SDC Reserve Sites for Modelling

37. Following discussions between VM, WCC and SDC a list of potential Reserve Sites was provided for inclusion within the model. These sites are outlined in **Figure 4**.

Figure 4 Reserve Site Locations



38. Two additional potential Reserve Sites at Wellesbourne have been included within the modelling. However, these sites, Land East of Kineton Road and Land West of Kineton Road, lie outside of the model extent. Any trips predicted to enter the model from these zones have been assigned to the closest external zone to these sites, which in this case is Zone 923.

39. As detailed above, for the purposes of the impact on the bridge assessment, the trips equivalent to 100 dwellings were included within each of the sites. These trips were then distributed using the WCC mobile network database distribution which have been derived for each site.

40. These trips have been included within the 2023 Interim Year Core Strategy model, which does not contain the SWRR, with the intention of capturing the likely impact on the bridge of each site.

41. The following section sets out the proportion of trips generated by each site which will travel across the Clopton Bridge. Alongside this the following categories have been applied to each development site, dependant on the likely impact:

- Category 1 – 0-10% of trips generated to route via Clopton Bridge
- Category 2 – 11-20% of trips generated to route via Clopton Bridge
- Category 3 – 21-30% of trips generated to route via Clopton Bridge
- Category 4 – 30% + of trips generated to route via Clopton Bridge

Table 2 Reserve Sites Predicted Impact on Clopton Bridge

Reserve Site Location	% of Trips Generated to travel via Bridge	Category
Land North of Evesham Road	3%	1
Land East of Banbury Road	39%	4
Land South of Trinity Way	31%	4
Land West of Walton Road	13%	2
Land South of Loxley Road	13%	2
Atherstone Airfield	28%	3
Former Long Marston Depot	28%	3
Adjacent to former Long Marston Depot	29%	3
Land East of Shipston Road	30%	4

* The reserve sites at the Land East of Kineton Road and Land West of Kineton Road sites have been included within the modelling. However, no trips related to these sites were predicted to route via the bridge

42. The analysis presented above demonstrates that the modelling predicts that prior to the delivery of the SWRR, the Land East of Banbury Road, Land South of Trinity Way and Land East of Shipston Road sites will have the most significant impact on the Clopton Bridge, with over 30% of development trips generated by these sites predicted to route via the bridge. The analysis also demonstrates that the two sites adjacent to the Long Marston Airfield will also result in almost 30% of all trips generated travelling via the bridge.

43. Conversely the Land North of Evesham Road, along with the Land West of Walton Road and Land South of Loxley Road sites are predicted to have the smallest impact on the bridge.

44. As this Note has detailed that there may be some additional capacity at the Clopton Bridge compared to that predicted in previous modelling assessments, then the results from **Table 2** outline that the Land North of Evesham Road would be the site within Stratford upon Avon least likely to impact on this additional capacity at the bridge.

Summary and Conclusions

45. This Note forms part of a series produced by Vectos Microsim (VM) in response to a request from Stratford District Council (SDC) for assistance in assessing the potential implications for the delivery of a strategy for the allocation of Reserve Sites, which may be necessary to bridge any shortfall that has arisen in the housing delivery profile for Stratford District, post adoption of the Core Strategy.

46. This Note sets out the review of historic traffic count data around the Clopton Bridge area, before outlining the steps undertaken to ascertain the likely impact on the bridge of each of the proposed reserve sites within the Stratford area.

47. The historic traffic count data has revealed that over the last 10 years, traffic flows at the Clopton Bridge have actually reduced year on year, particularly in the PM period, whereby weekday flows between 1600-1900 were around 16% lower in 2017 than those for the same period in 2007, whilst AM flows were around 13% lower in 2017 compared to 2007.

48. This pattern indicates that the previously predicted cap on development related to the Bridge capacity may have potential to be altered, on the basis that previously predicted growth is unlikely to have been realised due to lower underlying base flows at the bridge than previous modelling assessments have assumed.

49. The second stage of the assessment focuses on the inclusion of the identified potential Reserve Sites on the network, and a review of the potential impact on the Clopton Bridge. This part of the assessment ranked the sites in order of the predicted impact on the bridge, and indicated which sites would be least likely to impact the bridge, and thus least likely to take away from any existing capacity at this location.

SDC Reserve Housing Sites Assessment

Long Marston Area Additional Dwellings Assessment

April 2019

VM185182.TN001

Introduction

1. This Note forms part of a series produced by Vectos Microsim (VM) in response to a request from Stratford District Council (SDC) for assistance in assessing the potential implications of the delivery of a strategy for the identification of Reserve Sites which may be necessary to bridge any potential shortfall that has arisen in the housing delivery profile for Stratford District, post adoption of the Core Strategy.

2. This Note sets out the testing that has been undertaken to identify the impact of additional large-scale development in the vicinity of Long Marston Airfield. VM understand that the assessment is necessary to establish what potential capacity exists to enable more housing to be unlocked in the area by the delivery of the SWRR.

Background

3. During the original Core Strategy work, VM undertook an assessment to establish the reserve capacity of the mitigated network post assignment of the 3500 dwellings at LMA alongside all other Core Strategy allocations.

4. This test comprised the inclusion of a further 1000 dwellings within the model area. This work concluded that further mitigation, as yet unidentified, would need to be determined before it was likely that the network capacity could accommodate a further 1000 dwellings.

5. Testing is now intended to consider an additional 4300 dwellings in the same area, based on various development aspirations known at this time. As such, it is inevitable that further mitigation will be required to accommodate the additional development.

Model Scenario

6. The testing documented within this note is has been undertaken within the latest SuAWA 2031 Core Strategy model.

7. These models have been developed by VM in compliance with WebTAG, based upon the calibrated and validated 2017 SuAWA Base model.

8. The model has been developed to be inclusive of all committed developments and infrastructure, and subsequently all Core Strategy aspirations up to 2031, which comprises of the following Core Strategy development sites:

- Long Marston Airfield (3100 dwellings + Employment and Education land uses)
- SuA2 Alcester Road (105,000m^2 B1, B2 and B8 Employment land use)
- SuA1 Canal Quarter Regeneration Zone (1,000 dwellings + 9,000m^2 B1 Employment land use)
- SuA4 Atherstone Airfield (40,000m^2 B1, B2 and B8 Employment land use)

9. The Core Strategy scenario also contains the South Western Relief Road (SWRR) in its currently proposed format.

Objective

10. Through discussions between WCC, SDC and VM the following primary objective of this study has been identified:

    - To assess the implications on the Stratford upon Avon model network of delivering additional dwellings at the Long Marston Airfield (LMA) development area above the already identified 3,500 dwellings in the Core Strategy, and where appropriate, identify highway network mitigation measures.

Methodology

11. This assessment centres on the assignment of trips predicted to be generated by the additional development within the LMA area. The trips have been assigned to two separate land parcels, one to the north of the currently proposed LMA site, and one to the south, with an equal split of development across each new site.

12. The trips will be assigned based upon a trip generation and distribution agreed with WCC, and a review of resultant network conditions will then be undertaken in light of the inclusion of the development, in a range of development quantum's, with a focus on the impact that the associated increase in trips will elicit on the network.

13. The assessment will be undertaken within the recently created 2031 SuA Core Strategy model, which is inclusive of all current Core Strategy sites, along with the South Western Relief Road[1].

14. The assessment will focus on the impact of including a range of different development quantum at the two land parcels, and will initially focus on the quantum of development that can be included alongside smaller mitigation schemes.

15. Following this, the assessment will focus on the development quantum that could be delivered alongside more significant mitigation measures.

[1] VM185176.TN001 SuAWA Core Strategy Model Development Note

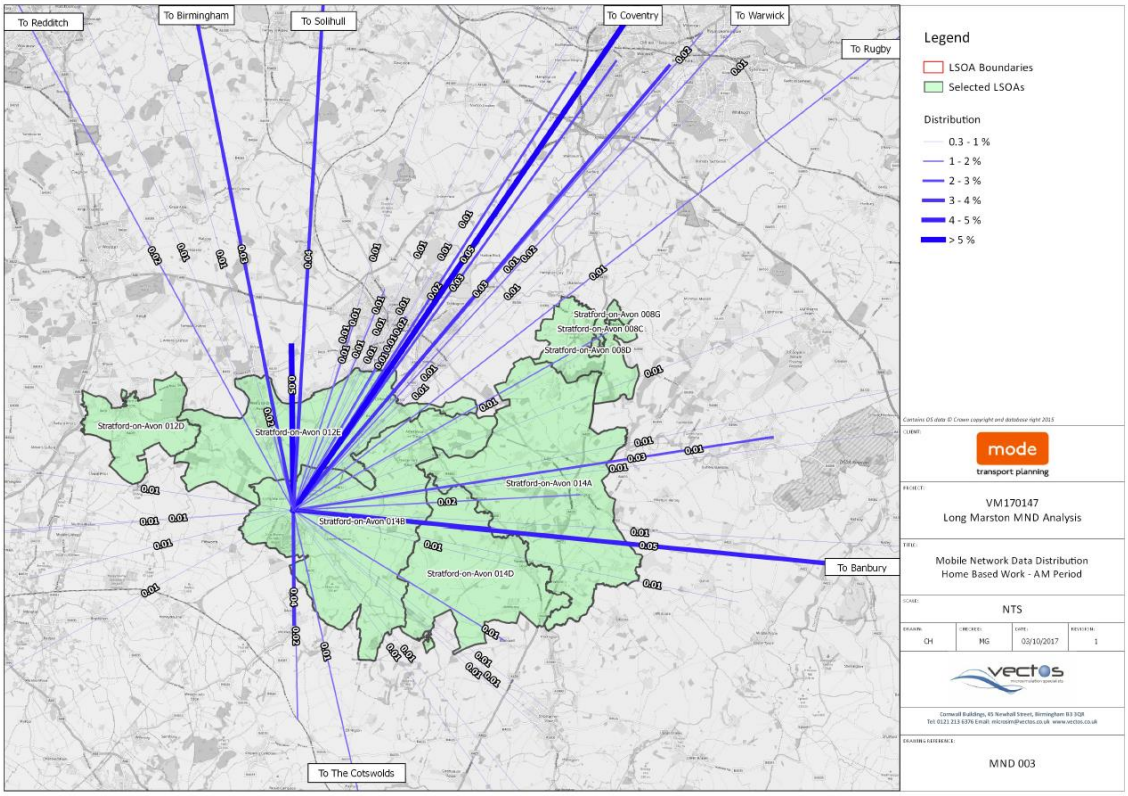
Development Details

16. WCC have advised on the appropriate trip rates to assign to the additional development at the LMA area, which are the WCC Strategic Transport Assessment Residential trip rates.

17. The two land parcels have been coded into the 2031 Core Strategy model, with access arrangements based upon concept schemes, which are designed to ensure that all traffic leaving each site gets onto the network where possible, rather than queuing within the site attempting to access the network. In all instances, accesses have been included as roundabouts.

18. The trips generated by each land parcel have been distributed using the same WCC mobile network database (MND) distribution as applied to the LMA trips within the Core Strategy modelling. The resultant MND applied is demonstrated in **Figure 1**.

Figure 1 LMA Distribution



19. The additional LMA development land parcels have been included within the 2031 Core Strategy network using the trip rates and distribution outlined above, along with their associated access arrangements.

20. Once the demands had been derived, and in line with STA testing undertaken elsewhere within the county, a modal shift allowance was made for all trips generated by these land parcels of a 20% car reduction.

21. The mode shift factor has been applied on the basis that site promoters will be tasked with achieving this target through the delivery process, and therefore this is considered an appropriate assumption for this stage of testing.

22. These adjustments have been applied only to the new LMA trips generated and included within this stage of the assessment. No demand adjustments have been applied to account for the potential shift in background traffic in response to the delivery of enhancements to existing and provision of new sustainable transport services.

Stage 1 – Small Scale Mitigation Assessment

23. Following the inclusion of the LMA additional land parcels and associated access strategies within the 2031 Core Strategy model, assessments have been undertaken to investigate the potential development quantum that could be included at the LMA area, alongside small scale mitigation measures, before the network reaches capacity.

24. In order to assess the potential of the network, the development quantum at the LMA area has been built up in 250 dwelling increments, beginning with 500 dwellings.

25. The models have been assessed, by means of a visual review of the model performance, and an extraction of network wide statistics and queue length data. The queue length data has been presented in the form of queue plots, which identify the average hourly maximum queue lengths across each junction within the model, once the additional LMA demands are added to the 2031 Core Strategy network.

Model Review

26. Upon inclusion of the demands generated by 500 additional dwellings at the LMA area, it was established that some small scale mitigation would be required along the A46, to facilitate a reasonable level of network performance.

27. As there are significant mitigation schemes included at the major junctions along the A46 within the Core Strategy network, it has been determined that no additional changes to these junctions would be made at this stage.

28. In an attempt to improve the throughput on the A46 however, dualling has been included in the network at the following locations:

- A46 EB approach to the Wildmoor roundabout - 100 metres of dualling prior to segregated left turn lane;
- A46 NB exit from Wildmoor roundabout - 200 metres of dualling on exit from the junction, to improve merge from segregated left turn lane and mainline; and

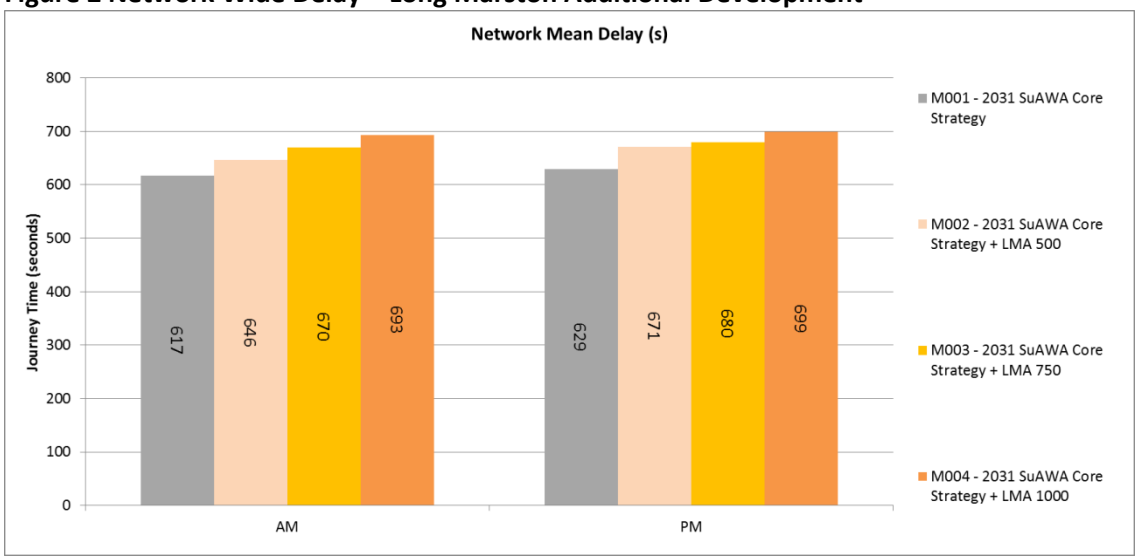
- A46 SB exit from Marraway Junction – 200 metres of dualling beyond previously modelled merge from two lanes back to one, to reduce blocking back through the signal junction.

29. Once this mitigation had been included, the following development quantum was tested at the LMA site within this model network:

- 2031 Core Strategy + 500 Additional Dwellings at LMA
- 2031 Core Strategy + 750 Additional Dwellings at LMA
- 2031 Core Strategy + 1000 Additional Dwellings at LMA

30. The impact of each of these scenarios on the model network wide delay statistics are presented within the following **Figure 2**:

Figure 2 Network Wide Delay – Long Marston Additional Development



31. **Figure 2** demonstrates the impact on network wide delay of the inclusion of additional dwellings within the LMA area. The results indicate that the inclusion of 500 additional dwellings, alongside the previously identified small scale mitigation measures, results in relatively small increases in network wide delay when compared to the 2031 Core Strategy scenario, with around 29 second increases in average journey times during the AM period. This increases to around 42 second average increases in journey times during the PM period.

32. Upon inclusion of 750 dwellings at the LMA area, the delay further increases, with 53 second increases during the AM period, and 52 second increases during the PM period.

33. With the inclusion of 1000 dwellings, the network wide statistics suggest that the level of delay increases significantly when compared the 2031 Core Strategy network delay, with around 76 second increases in average journey times in the AM period, and 70 second increases during the PM period.

34. Upon a visual review of the model performance, the 750 and 1000 additional dwelling scenarios result in significant congestion occurring in the Clifford Chambers area of the model during the AM period. This congestion at Clifford Chambers results in queues blocking back to the LMA site access junctions, restricting the amount of new development trips that can get onto the network during the AM peak hour.

Campden Road Journey Time Analysis

35. In order to quantify the impacts described above, with a particular focus on the network between the LMA development area, and the junction of the A3400 Shipston Road/Clifford Lane, which captures the Campden Road route through Clifford Chambers, it was determined that a journey time analysis would be undertaken.

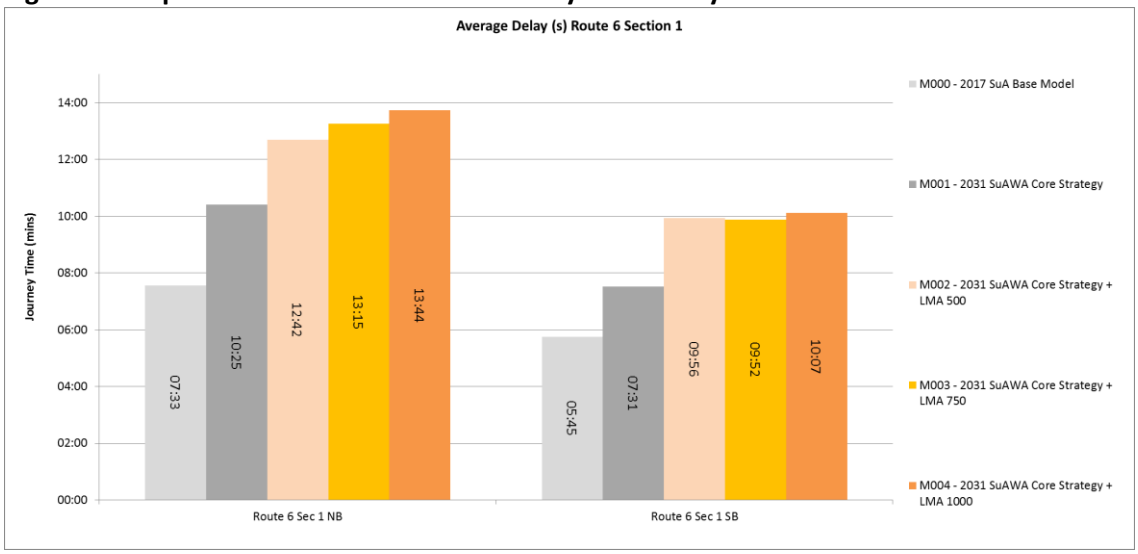
36. Journey times were recorded from each model scenario on Campden Road, between the junction of Station Road/Campden Road and the A3400 Shipston Road/Seven Meadow Road/Trinity Way. This route is demonstrated in **Figure 3**.

Figure 3 Campden Road Journey Time Route Analysed

37. Journey times between each scenario have been collected for comparison, to demonstrate the impact of additional trips at LMA on journey times along this route. Campden Road will be used by the vast majority of development trips from the LMA area, as vehicles route along this road, through Clifford Chambers, to travel on the SWRR, or towards Stratford upon Avon town centre.

38. As the visual review of the model flagged the most significant impact as being in the AM period, the northbound and southbound journey times for the morning peak hour (0800-0900) have been presented along this route, which are shown in **Figure 4**.

Figure 4 Campden Road AM Peak Hour Journey Time Analysis



39. **Figure 4** presents the journey times on Campden Road (as per the route outlined in **Figure 3**), in each of the scenarios tested. The 2017 Base model journey times have also been included for comparative purposes.

40. The results demonstrate that once 500 additional dwellings are included at Long Marston journey times increase in a northbound direction on Campden Road by around 2 minutes 20 seconds when compared to the 2031 Core Strategy scenario. Southbound journey times on this route also increase by around 2 minutes 30 seconds.

41. With an additional 750 dwellings at the LMA development area, journey times further increase when compared to the 2031 Core Strategy scenario, with around a 3 minute increase in the northbound direction, and 2 minute 30 increase in the southbound direction.

42. The results from the 1000 additional dwellings scenario again demonstrate large increases in the northbound journey times, of around 3 minutes 20, whilst the southbound journey times are consistent with the previously reported scenarios with around 2 minute 30 journey time increase.

43. The results presented above demonstrate the impact on Campden Road of including the additional development at the LMA development area. The focus of the impact appears to be on the northbound route through Clifford Chambers, during the AM period. These results present further evidence that Campden Road begins to become congested and reaches capacity once any additional growth beyond that outlined in the 2031 Core Strategy scenario is delivered within this area.

Queue Length Analysis

44. The network wide delay and journey time analysis above has identified that any development quantum around 1000 additional dwellings is unlikely to be deliverable without significant infrastructure changes within the SuA network, given the impact on journey times on Campden Road and congestion in this area. The results do indicate that up to around 750 dwellings could potentially be delivered alongside only minor changes to the network.

45. To further support the network wide delay analysis outlined above, queue analysis has been undertaken for the 500 and 750 dwelling LMA scenarios, to present the impact of these scenarios on the wider model network, with queue lengths compared to those reported in the 2031 Core Strategy scenario.

46. Junctions where queue differences have not been presented on the maps simply represent junctions which did not trigger any of the assessment criteria across any one approach.

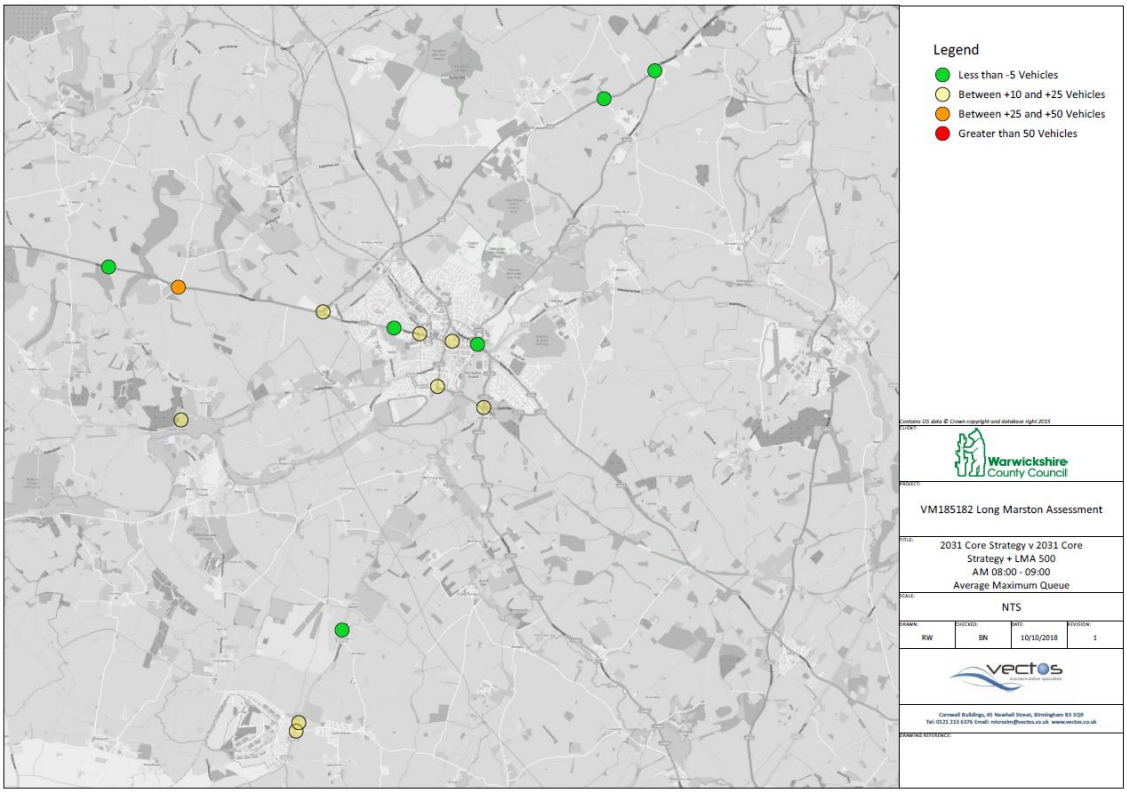
47. The classifications for the queue length analysis within these plots are outlined as follows:

- **Queue Reduction** (a reduction in queue lengths of greater than 5 vehicles)
- **Moderate Increase** (an increase in queue lengths of between 10 and 25 vehicles)
- **Significant Increase** (an increase in queue lengths of between 25 and 50 vehicles)
- **Very Significant Increase** (an increase in queue length of over 50 vehicles)

48. The classifications detailed above are based upon best practice and the approach adopted in similar studies elsewhere within the county.

49. **Figure 5** and **Figure 6** present the queueing impact of the LMA 500 Additional dwelling scenario.

Figure 5 AM Queue Length Analysis – 2031 Core Strategy vs 2031 Core Strategy + LMA 500

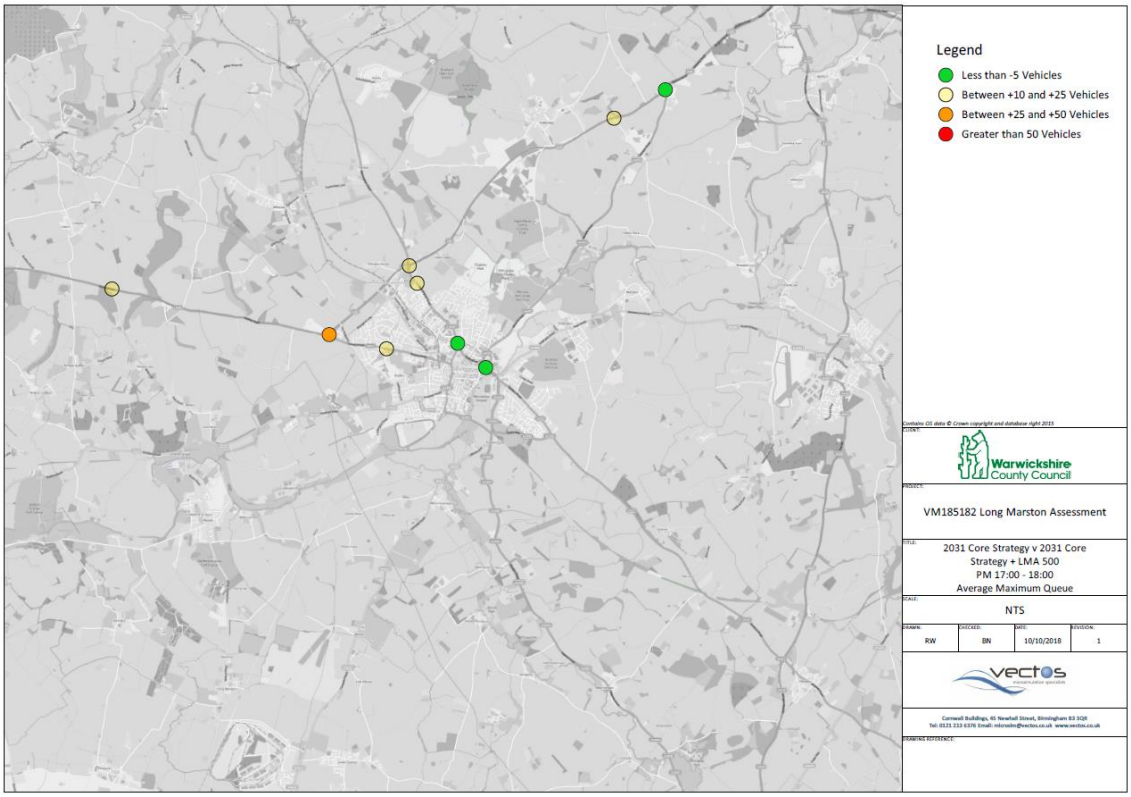


50. The queue results presented in **Figure 5** demonstrate the impact of including an additional 500 dwellings at the LMA development area alongside some minor mitigation measures on the A46, during the AM peak hour.

51. The AM queue results suggest that the impact of including these additional dwellings is minor, with only one instance of queue increases of over 25 vehicles, which occurs at the Billesley Crossroads.

52. These results indicate that the AM network performs within capacity once the demands equivalent to an additional 500 dwellings at the LMA development area are included within the model network.

Figure 6 PM Queue Length Analysis – 2031 Core Strategy vs 2031 Core Strategy + LMA 500



53. The queue results presented in **Figure 6** demonstrate the impact of including an additional 500 dwellings at the LMA development area alongside some minor mitigation measures on the A46 during the PM peak hour.

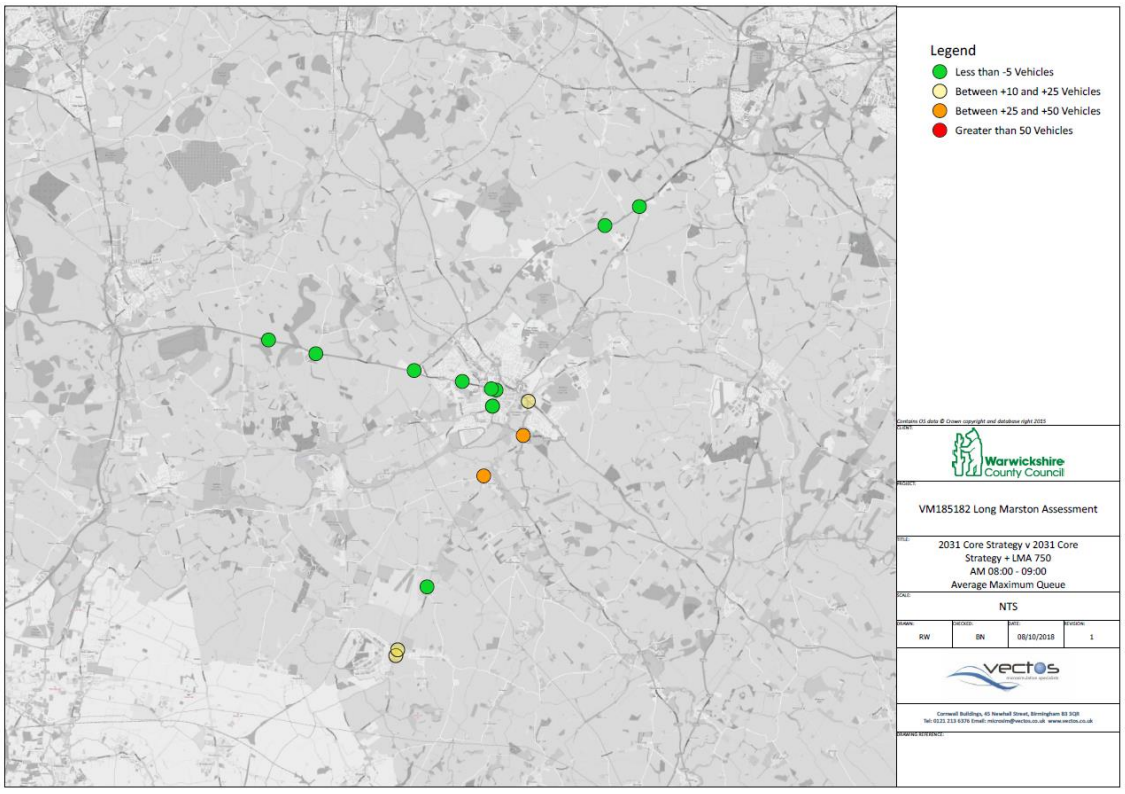
54. The PM queue results suggest that the impact of including these additional dwellings is again relatively minor. There is one instances of queue increases of over 25 vehicles, which occurs at the A46/Wildmoor junction, on the A46 southbound approach.

55. This is a result of additional traffic traveling through this junction onto the WRR and eventually SWRR when travelling from the north of the model network towards the LMA area during the PM period.

56. The queue results presented in **Figure 6** suggest that the model has capacity for the demands associated with the delivery of 500 additional dwellings at the LMA development area during the PM period without any significant queues forming in the model above those previously modelled in the 2031 Core Strategy model.

57. Following the queue results presented in **Figure 5** and **Figure 6**, the results for the 2031 Core Strategy + LMA 750 have been extracted, and compared to the 2031 Core Strategy results in the following queue plots.

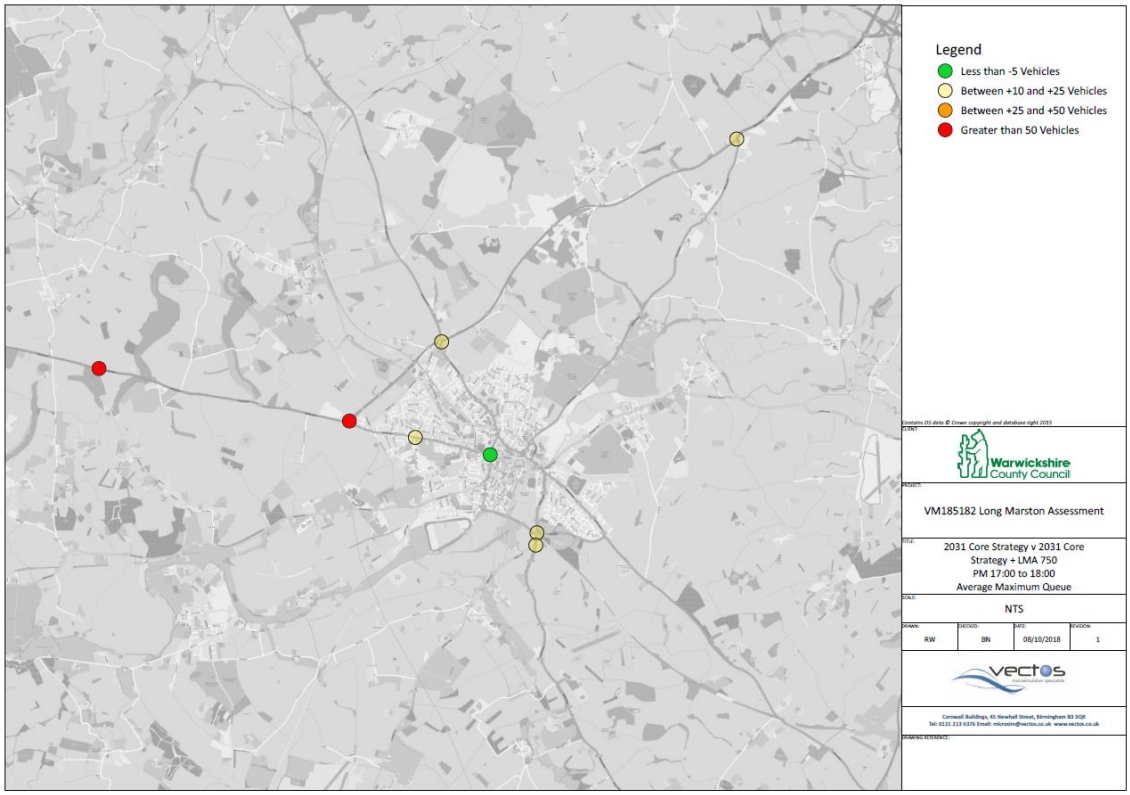
Figure 7 AM Queue Length Analysis – 2031 Core Strategy vs 2031 Core Strategy + LMA 750



58. The queue results presented in **Figure 7** demonstrate the impact of including an additional 750 dwellings at the LMA development area alongside some minor mitigation measures on the A46, during the AM peak hour.

59. The AM queue results suggest that the impact of including these additional dwellings is minor, with only two instances of queue increases of over 25 vehicles, which occurs on Campden Road at Clifford Chambers, and also at the A3400 Shipston Road/Clifford Lane junction.

Figure 8 PM Queue Length Analysis – 2031 Core Strategy vs 2031 Core Strategy + LMA 750



60. The queue results presented in **Figure 8** demonstrate the impact of including an additional 750 dwellings at the LMA development area alongside some minor mitigation measures on the A46 during the PM peak hour.

61. The PM queue results suggest that the impact of including these additional dwellings becomes more significant than modelled during the AM period. There are two instances of queue increases of over 50 vehicles, which occur on the A46. The most significant of these increases occurs on the A46 southbound approach to the A46/Wildmoor junction.

62. This is a result of additional traffic traveling through this junction onto the WRR and eventually SWRR when travelling from the north of the model network towards the LMA area during the PM period. Alongside this, the inclusion of mitigation measures at the A46/Marraway junction releases previously queued traffic at this location, resulting in additional traffic reaching the A46/Wildmoor junction, and therefore contributing to increased queues at this location.

Stage 1 Assessment Summary

63. The results presented in this section assess the impact of including 500, 750 and 1000 additional dwellings at the LMA development area, alongside some small scale mitigation measures.

64. The analysis has identified that with an additional 1000 dwellings at the LMA area, the network in close proximity to the site, particularly on Campden Road, becomes over capacity

during the AM period, with queues forming which block back from Clifford Chambers to the LMA site access junctions, restricting the volume of development traffic that can access the network.

65. It has been identified that around 500 additional dwellings could be accommodated within the network without Campden Road becoming over capacity, and with this level of additional development, the impact on the wider highway network is relatively minor.

66. Once the trips associated with 750 additional dwellings at the LMA area are assigned to the network, capacity issues begin to occur during the PM period, with significant queues forming on the A46 southbound at the A46/Wildmoor junction.

67. This analysis has determined that the network in its current form, with some minor additional mitigation measures as identified in this note, along with the currently proposed alignment for the SWRR, is likely to provide capacity for a further 500 additional dwellings at the LMA area, above the 3500 already included within the 2031 Core Strategy assessment, before significant capacity issues begin to occur.

Stage 2 – Large Scale Mitigation Assessment

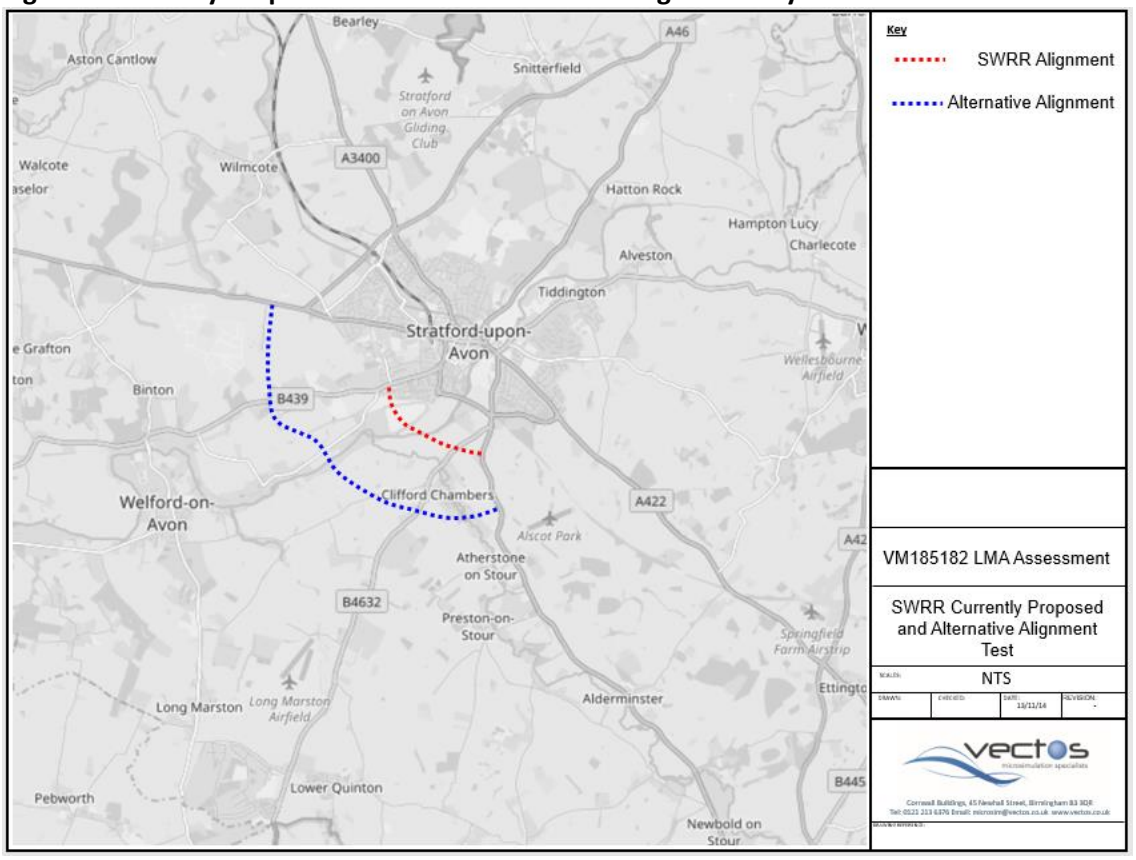
68. The assessment completed as part of Stage 1 has highlighted that around 500 additional dwellings could be accommodated within the LMA development area (in addition to the 3500 included in the 2031 Core Strategy scenario), with only minor mitigation measures included within the network. This network includes the South Western Relief Road in its currently proposed form.

69. Beyond this level of development, significant congestion occurs around the Clifford Chambers area of the network, as development traffic travels between the LMA area and the SWRR/Stratford town centre. Accordingly, to test the impact of more than 500 dwellings at the LMA area, alternative mitigation options are required.

70. Based upon the findings of Stage 1 of this assessment, the initial objective of this second stage of the assessment is to enable development traffic to avoid the Clifford Chambers part of the network. In an attempt to avoid the congestion and delay occurring at Clifford Chambers, an alternative alignment for the SWRR has been included within the model network, which is as per the indicative layout provided in **Figure 9**.

71. This layout enables development trips to route directly between the LMA area and the A46, without having to travel the constrained parts of the network at Clifford Chambers. The alternative route runs to the south of Clifford Chambers and meets the A46 at the proposed access for the SuA2 Employment site.

Figure 9 Currently Proposed SWRR and Alternative Alignment Layout



72. Further to this, large scale mitigation has also been included within the model along the A46. The following measures have been included:

- Grade separated junction at the A46/Wildmoor junction;
- Grade separated junction at the A46/Bishopton Island junction; and
- Dualling of the A46 provided between the junctions at which the revised SWRR joins the A46, and the A46/Bishopton Island junction.

73. The indicative layout of the grade separated junctions is provided in **Figure 10** and **Figure 11**.

Figure 10 Indicative Grade Separation Scheme – A46/Wildmoor Junction

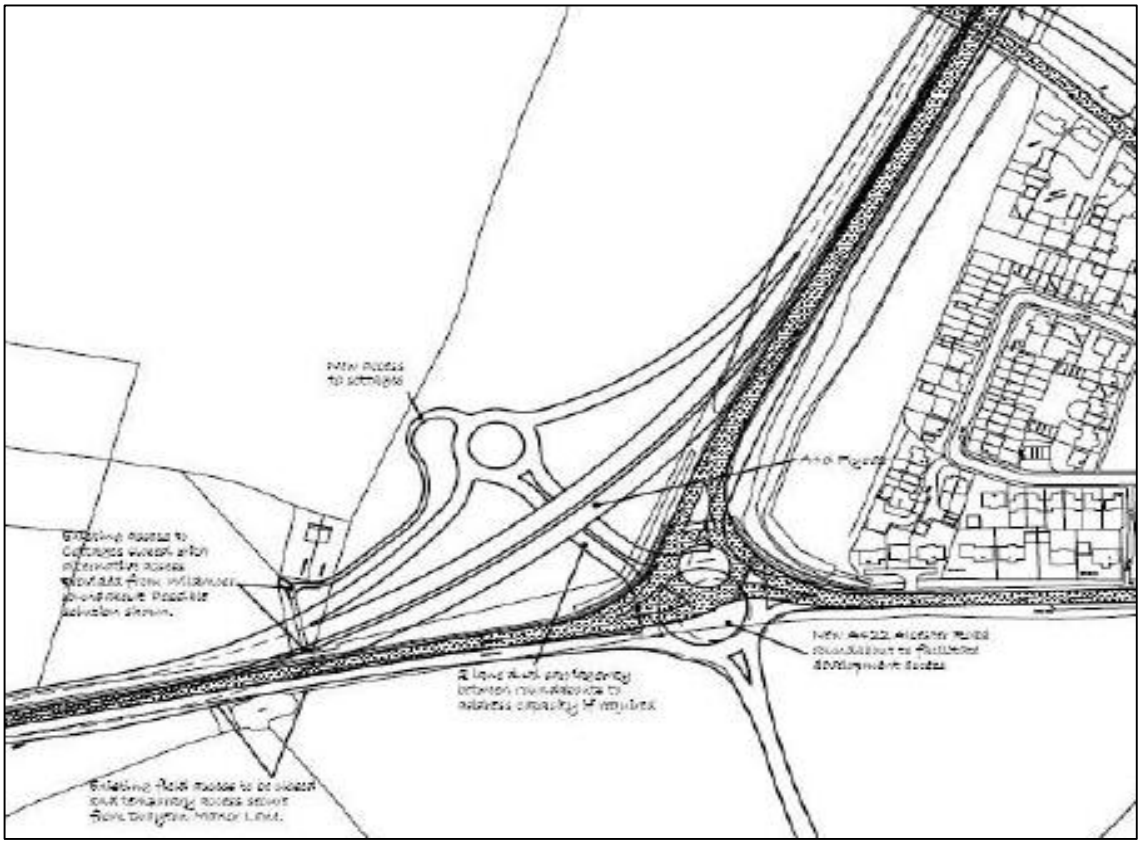
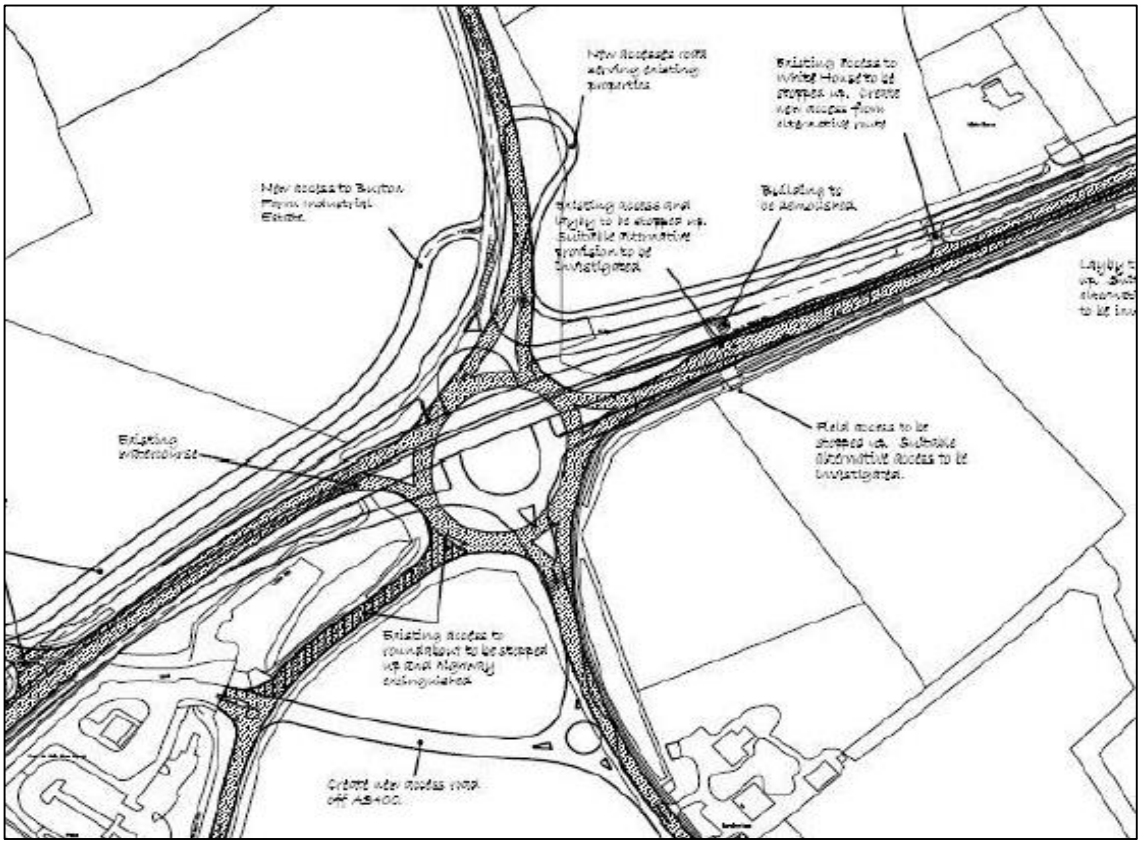


Figure 11 Indicative Grade Separation Scheme – A46/Bishopton Island Junction



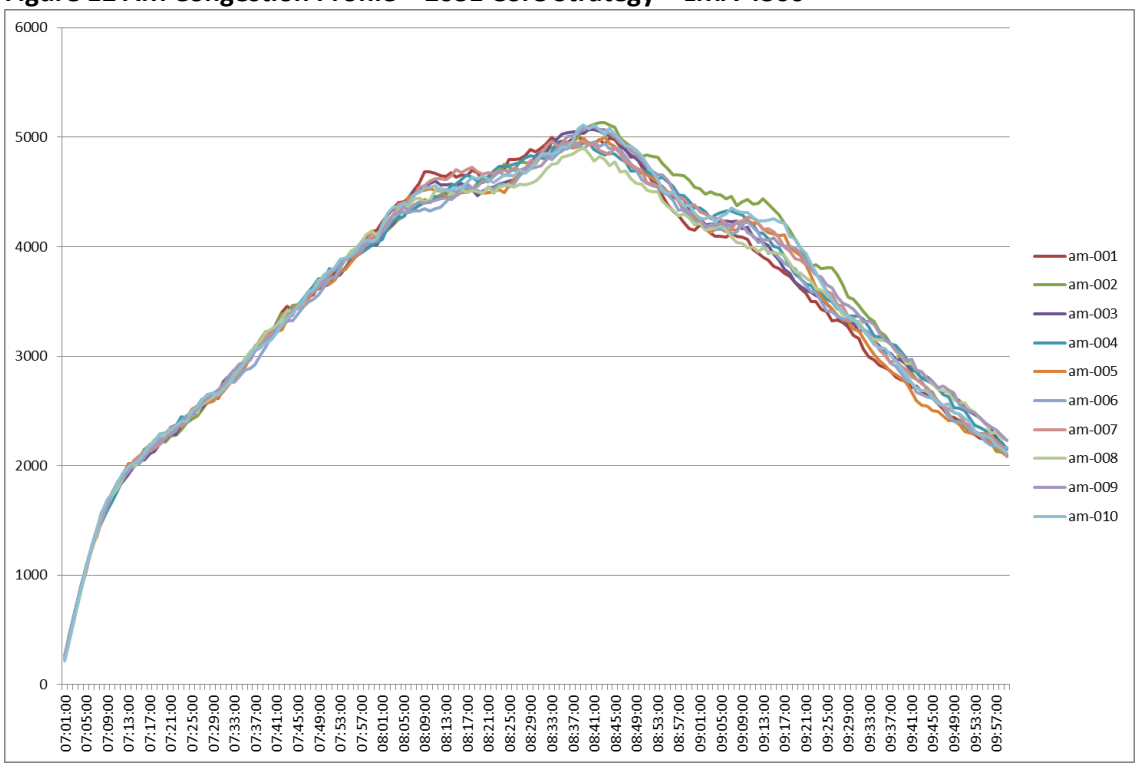
74. A review of the model at this stage indicated that the revised SWRR alignment, and A46 junction upgrades enables the delivery of a larger number of dwellings at the LMA area than tested so far in this assessment.

75. Based upon development aspirations as advised by SDC, there was the requirement to test the impact of a further 4,300 dwellings at the LMA development area. The development trips generated by this number of dwellings have been included within the SuA model network, alongside the revised link road alignment, and grade separated junctions outlined above.

76. In order to review the model stability and performance in this scenario, the congestion profile of the model simulation has been assessed, along with a visual review of the model operation. A typical congestion profile would indicate a build-up of traffic towards the peak hour, before traffic dissipates away in the final hour of the simulation. A run is considered 'failed' if this build-up of traffic constantly grows throughout the modelled period.

77. The congestion profile of the 2031 Core Strategy + LMA 4300 model has been provided in **Figure 12** and **Figure 13** for the AM and PM simulation periods respectively, based upon 10 AM and 10 PM model runs.

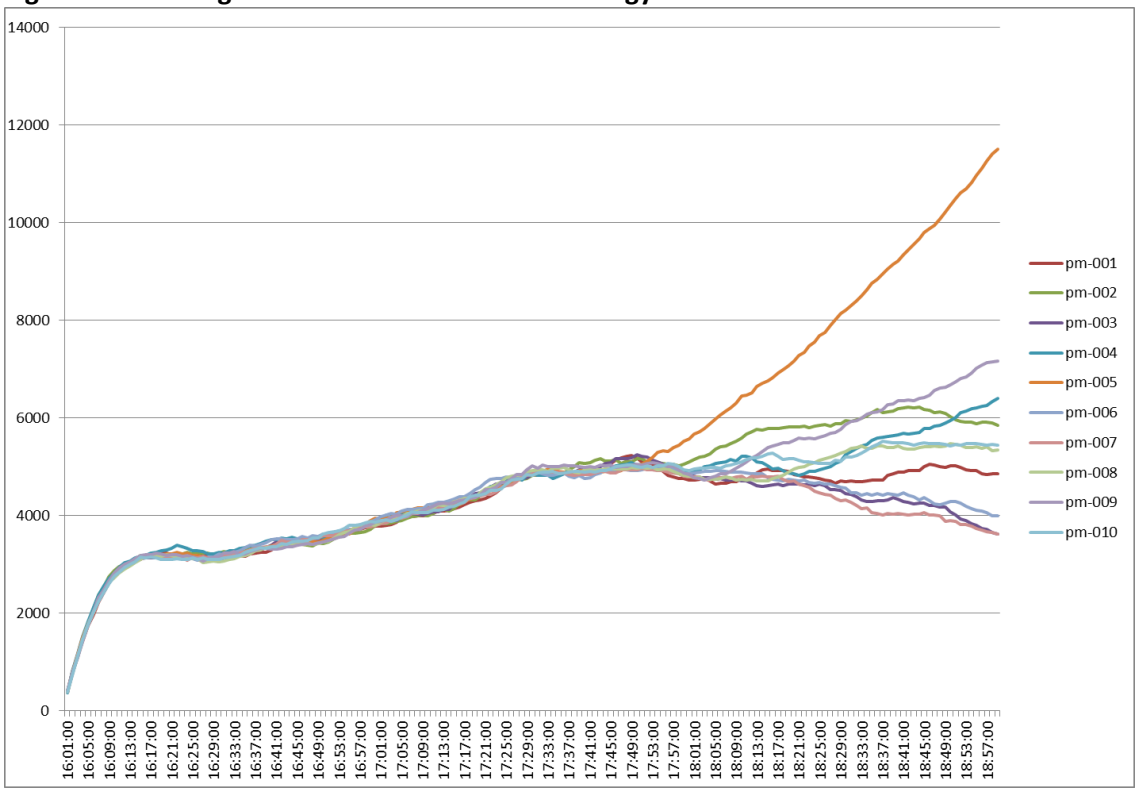
Figure 12 AM Congestion Profile – 2031 Core Strategy + LMA 4300



78. The AM period congestion profile outlined in **Figure 12** indicates a stable model performance, with traffic building towards the peak hour, and dissipating away in the post peak hour.

79. A visual review of the model supports this, and although the network is congested during the AM peak hour, traffic does dissipate away beyond this point.

Figure 13 PM Congestion Profile – 2031 Core Strategy + LMA 4300



80. The congestion profile presented in **Figure 13** demonstrates the model performance during the PM period. The analysis presented demonstrates a highly unstable model performance, with a high proportion of the model runs indicating that the number of vehicles on the network increases throughout the period, suggesting that the model is grid-locking, causing vehicles to be trapped on the network and unable to reach their destination.

81. This has been supported by a visual analysis of the model operation, which indicates significant congestion and delay occurring along the A46, along with routes through the town centre.

82. It is clear from this analysis that the model network is unable to provide capacity for the additional volume of trips included on the network as a result of the delivery of a further 4,300 dwellings at the LMA area, despite the introduction of the revised link road, and large scale mitigation along the A46.

83. Accordingly it has been determined that two further tests will be undertaken. The first of these will seek to identify the likely mode shift that the LMA additional dwellings will be required to achieve in order to result in a stable model network, whilst the second test will focus on the quantum of development that could be delivered before the network becomes unstable, with the mode shift consistent with the previous round of testing.

Revised Mode Shift Assessment

84. As detailed above the inclusion of 4,300 additional dwellings at the LMA development area, results in a highly unstable and congested PM period model network. This is with a 20% car

reduction applied to the LMA additional trips (to account for likely internalisation of trips and mode shift targets the developer will be tasked with achieving).

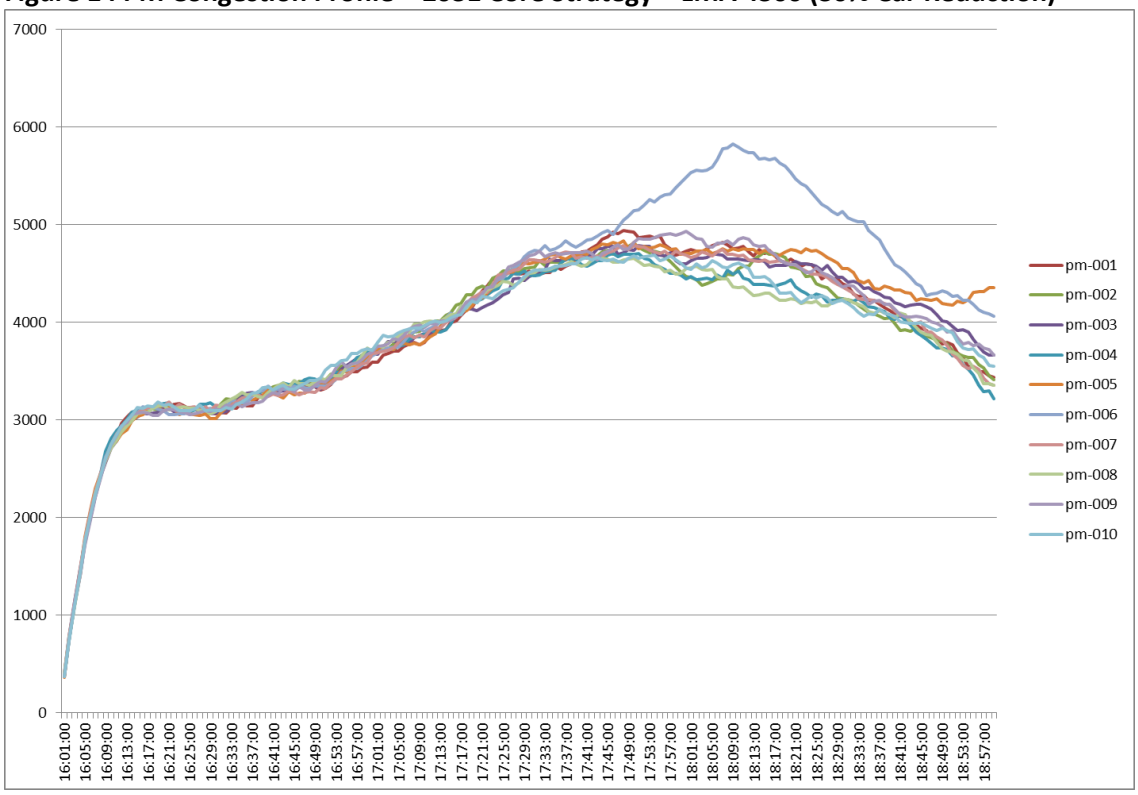
85. Following on from this it has been determined that a series of tests should be undertaken to ascertain what level of mode shift would need to be achieved by the LMA additional development, to ensure a reasonable level of model stability.

86. As such the following scenarios have been run, with the analysis focused on the PM model stability:

- 2031 Core Strategy + 4300 Additional Dwellings at LMA – 30% Car Reduction
- 2031 Core Strategy + 4300 Additional Dwellings at LMA – 40% Car Reduction

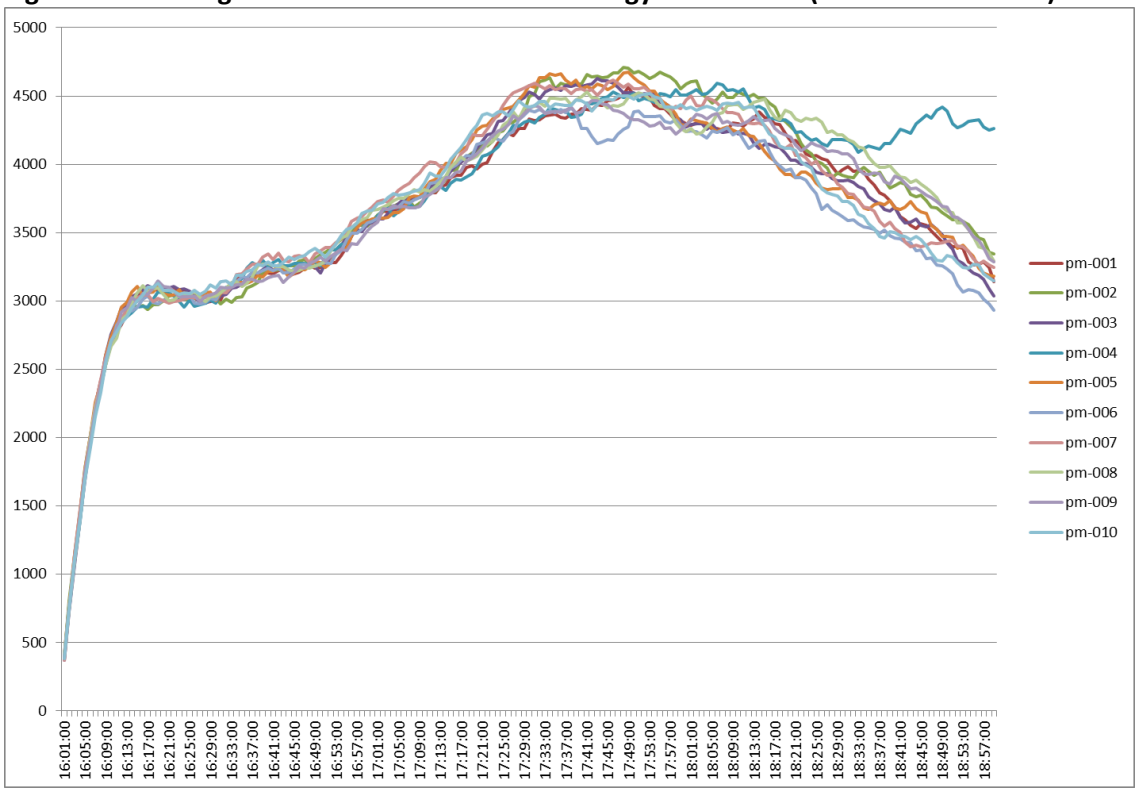
87. The model stability analysis for the 30% car reduction scenario is presented within **Figure 14** and the analysis for the 40% car reduction scenario presented within **Figure 15**.

Figure 14 PM Congestion Profile – 2031 Core Strategy + LMA 4300 (30% Car Reduction)



88. The stability analysis presented within **Figure 14** demonstrates the congestion profile in the 2031 Core Strategy + LMA 4300 once a 30% car reduction has been applied. The analysis demonstrates a far greater level of model stability than demonstrated in **Figure 13**, suggesting that this additional car reduction has the potential to significantly improve the network performance. Of the 10 runs undertaken, only 2 appear to have 'failed', demonstrating the potential for this scenario to be assessed in a greater level of detail.

Figure 15 PM Congestion Profile – 2031 Core Strategy + LMA 4300 (40% Car Reduction)

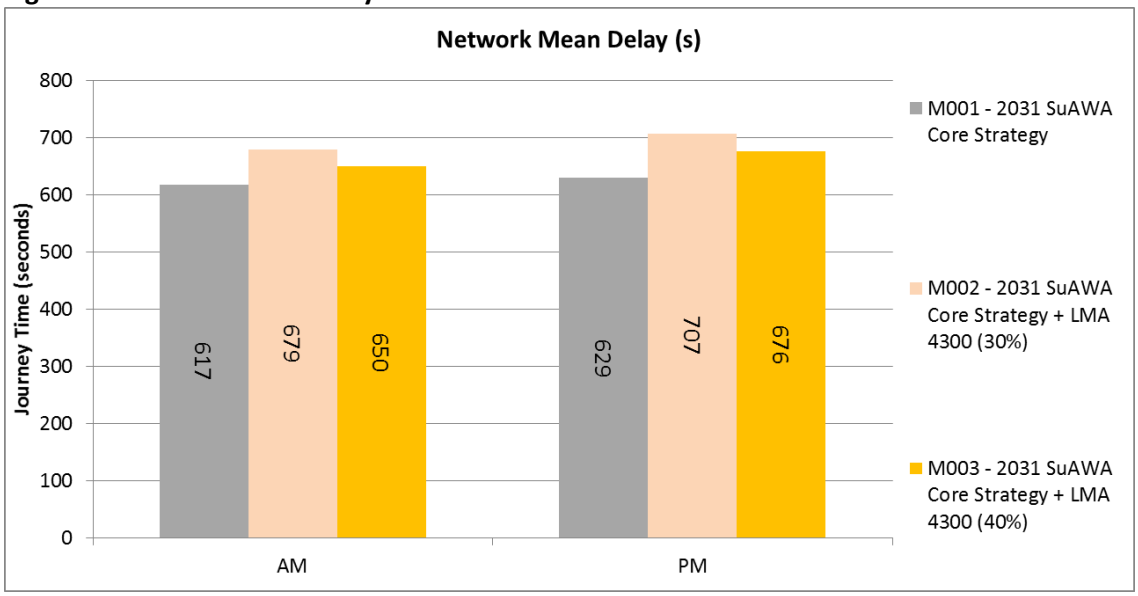


89. The stability analysis presented within **Figure 15** demonstrates the congestion profile in the 2031 Core Strategy + LMA 4300 once a 40% car reduction has been applied. As in **Figure 14**, the analysis demonstrates high level of model stability, suggesting that this additional car mode share reduction has the potential to even further improve the network performance. Of the 10 runs undertaken, only 1 appears to have 'failed', demonstrating the potential for this scenario to be assessed in a greater level of detail.

90. The model stability analysis presented demonstrates that in order to deliver the outlined 4,300 dwellings at the LMA area, at least a 30% car mode reduction would be required in order to achieve a stable model network in the PM period. This assessment has run two additional scenarios, one with a 30% and one with a 40% car mode reduction, both of which largely maintain a stable model performance, allowing for results to be extracted.

91. Accordingly the network wide delay statistics have been extracted from these scenarios for the AM and PM periods, to indicate the high level impact on modelled journey times once the additional 4,300 dwellings at the LMA area are included, when compared to the 2031 Core Strategy scenario.

Figure 16 Network Wide Delay – Mode Shift Assessment



92. The results presented on **Figure 16** outline the impact on network wide delay once the car mode shift reduction has been applied to the LMA additional development trips. The results demonstrate that in the 30% car reduction scenario, average journey times increase significantly when compared to the 2031 Core Strategy scenario, in both the AM period (62 seconds) and most noticeably in the PM period (78 seconds).

93. The results for the 40% car reduction scenario demonstrate significantly lower levels of delay increases, with average journey times increasing by only 33 seconds during the AM period, and 47 seconds in the PM period. This is supported by a visual review of the model performance, which demonstrates that in the 30% car reduction scenario, congestion is still significant during the PM period across the town centre, and in particular at the A3400 Shipston Road/Clifford Lane roundabout.

94. The 40% car reduction scenario shows a much less noticeable impact on queues across the town centre. In this scenario, queues are also less noticeable on the A46, which results in more traffic using this route, rather than re-routing through the town centre when travelling between the north of the model network and the LMA area.

95. The results presented in this section highlight that by achieving a 30% car mode reduction for all additional LMA area trips, the model stability is significantly improved when compared to the original 20% car reduction test. A more detailed review of the model results however has highlighted than not until a 40% car mode shift is achieved is it likely that the network, which includes a revised link road alignment and grade separated junctions on the A46, can provide capacity for the predicted volume of additional trips on the network.

Revised Development Quantum Assessment

96. Additional to the mode shift analysis presented above, it has also been necessary to test a range of scenarios which ascertain the quantum of additional development that could be

included at the LMA development area, should no additional mode shift beyond the 20% already assumed be achieved.

97. The assessment undertaken thus far has highlighted that the model network is unlikely to have capacity to accommodate the trips associated with an additional 4,300 dwellings at the LMA area, despite the inclusion of a revised link road alignment and grade separation on the A46.

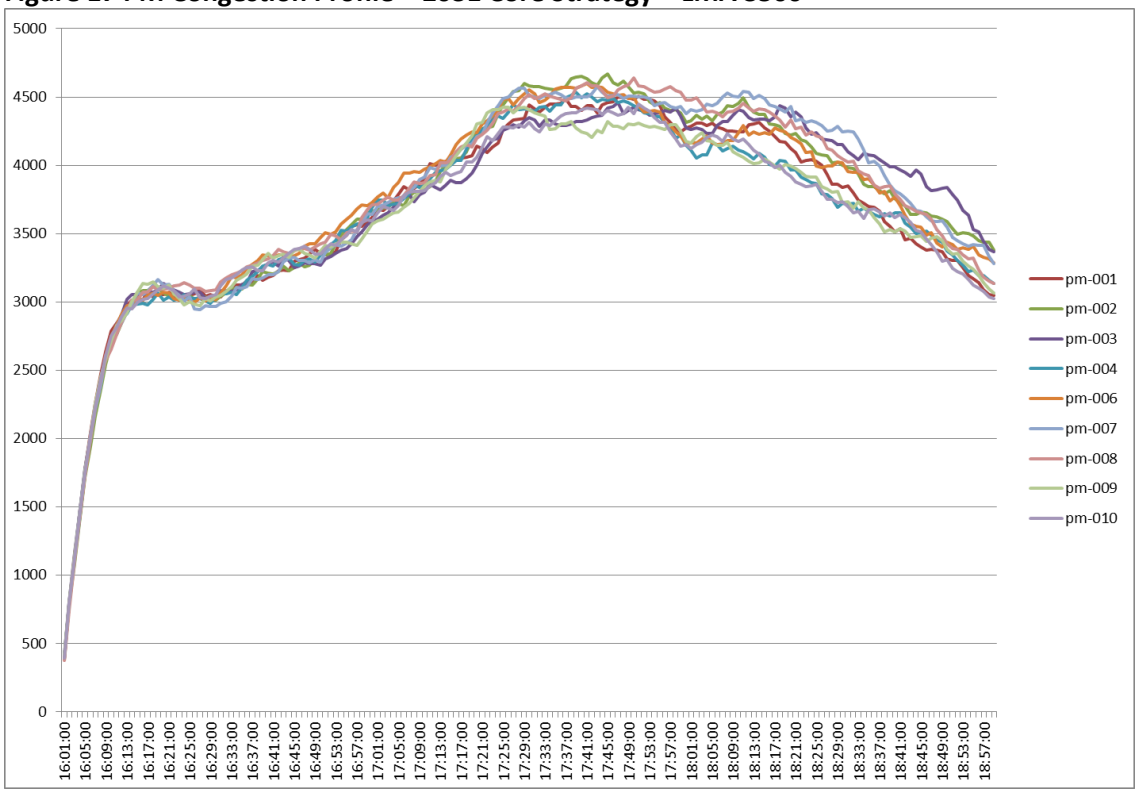
98. Accordingly the following scenarios were developed for assessment, to ascertain the quantum of development that could likely be delivered:

- 2031 Core Strategy + 2150 Additional Dwellings at LMA area
- 2031 Core Strategy + 3000 Additional Dwellings at LMA area
- 2031 Core Strategy + 3500 Additional Dwellings at LMA area

99. As previously, in order to determine the impact of each scenario, a visual review of the model operation has been undertaken, and once the model stability confirmed, the network statistics presented.

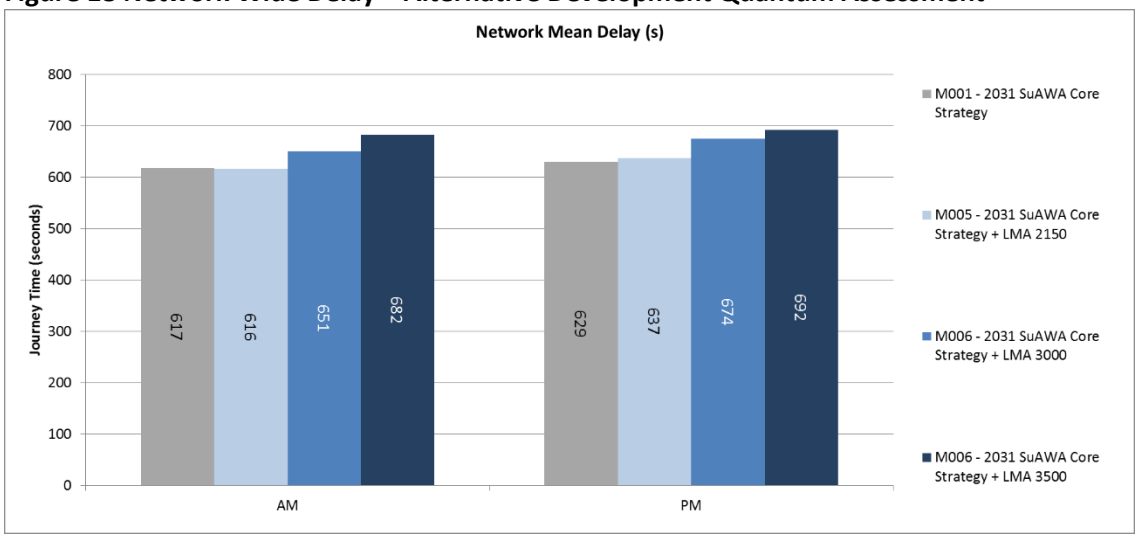
100. Given that the results in **Figure 13** demonstrated that with the inclusion of the demands generated by the additional 4300 dwellings at LMA, the PM period became unstable, the initial test undertaken at this stage was to review whether the inclusion of 3500 dwellings would deliver a more stable PM model network. The resultant model stability from the 2031 Core Strategy + LMA 3500 is presented in **Figure 17**.

Figure 17 PM Congestion Profile – 2031 Core Strategy + LMA 3500



101. **Figure 17** demonstrates that with 3,500 additional dwellings included at the LMA area, the PM model network is now considered stable. It is therefore possible to extract additional results from the model. As such the network statistics for this scenario, along with for the 3,000 dwelling and 2,150 dwelling scenario have been presented in **Figure 18**.

Figure 18 Network Wide Delay – Alternative Development Quantum Assessment



102. **Figure 18** demonstrates the network wide delay that occurs in each of the revised development quantum scenarios tested. The results for the 2,150 additional dwellings at the LMA area indicate that this volume of additional trips, when included alongside the revised link road alignment and grade separating on the A46, will result in lower levels of network wide delay during the AM period, when compared to the 2031 Core Strategy scenario, and only an average of 8 seconds per journey additional delay during the PM period.

103. The results from the 3,000 dwelling scenario indicate that the average journey time will increase by around 30 seconds per journey during the AM period, and around 45 seconds per journey during the PM period. With the inclusion of 3,500 dwellings, the network delay increases by 65 seconds during the AM period, when compared to the 2031 Core Strategy scenario, and around 60 seconds during the PM period.

104. A visual review of the performance of each model has also been undertaken, which demonstrates that although the revised alignment of the link road, and grade separation does result in the majority of LMA area trips routing via the link road and the A46, the town centre does continue to suffer from congestion, particularly during the PM period. As delay inevitably increases along the A46, due to the volume of additional trips on this part of the network, some trips will re-route through the town centre, causing long delays at the Gyratory, and most noticeably at the A3400 Shipston Road/Clifford Lane roundabout.

105. The revised link road alignment has noticeably improved previously modelled delay along Campden Road, particularly through Clifford Chambers.

106. A review of the 2,150 dwelling scenario indicates a network operating well, with little in the way of significant queues and delay forming. The 3,000 dwelling scenario does indicate some

delay beginning to form on the A46 during the PM period, which results in LMA area traffic routing through the town centre to avoid this delay, exacerbating issues here. This is further magnified in the 3,500 dwelling scenario.

Stage 2 Assessment Summary

107. The results presented in this section assess the impact of including 4,300 additional dwellings at the LMA area, alongside some large scale mitigation measures, in the form of a revised link road alignment which replaces the currently proposed SWRR, along with grade separation at the A46/Wildmoor and A46/Bishopton Island junctions.

108. The analysis has identified that with an additional 4,300 dwellings at the LMA area, the network (inclusive of the large scale mitigation outlined above), operates over capacity during the PM period, with the model runs being highly unstable.

109. Accordingly, analysis has been undertaken to establish the level of car mode reduction required at the additional LMA area development, to achieve a stable model network once 4,300 dwellings are assigned. This analysis has tested a 30% and 40% car mode reduction, and indicated, that although both scenarios result in increased levels of model stability when compared to the original 4,300 dwelling scenario, it is not until the 40% car mode shift is realised that the level of congestion and delay on the network is at similar levels to those modelled in the 2031 Core Strategy scenario.

110. Following this, an additional assessment has been undertaken which reviews the quantum of additional development at the LMA area that could be accommodated if no additional mode shift was to be achieved. This assessment has tested scenarios with 3,500, 3,000 and 2,150 additional dwellings at LMA. The resultant analysis has highlighted that 2,150 additional dwellings could be delivered at the LMA area (alongside the mitigation measures outlined above), with no worsening of the model network compared to the 2031 Core Strategy scenario. The 3,000 dwelling scenario begins to result in increased congestion in the town centre, whilst the 3,500 dwelling scenario indicates significant delay both within the town centre and at the A3400 Shipston Road/Clifford Lane junction.

Summary and Conclusions

Summary

111. The results presented in this Note provide a high level analysis of this impact of including a range of additional housing numbers at the LMA area. The assessment has initially focused upon the number of additional dwellings that could be accommodated on the currently proposed Stratford-upon-Avon model network, with only small scale additional mitigation measures included.

112. This analysis has determined that the network in its current form, along with the currently proposed alignment for the SWRR, is likely to provide capacity for around 500 additional dwellings at the LMA area, above the 3500 already included within the 2031 Core Strategy assessment, before becoming over capacity.

113. Following on from this, a second stage of the assessment has been undertaken, which focuses on the impact of including 4,300 additional dwellings at the LMA area. This quantum is the level advised for the area by SDC. Trips equating to this quantum of development have been included within the model network, alongside some large scale mitigation, in the form of a revised link road alignment, which enables LMA area trips to travel from the site towards the A46 without having to route through Clifford Chambers, alongside dualling and grade separation along the A46.

114. The resultant model performance indicates that during the PM period, this level of development cannot be accommodated within the SuA model network, despite the large scale mitigation provided. Accordingly, a series of further tests have been adopted to investigate the required mode shift from this additional development, or the revised quantum of development that could be delivered, without causing the model to become unstable.

115. This analysis has indicated that a 40% car reduction for trips generated by the LMA additional development will deliver a stable model network, without significant congestion and delays occurring.

116. The revised development quantum testing has indicated that with around 2,150 dwellings at the LMA area, the model performance is comparable with the level of delay incurred in the 2031 Core Strategy scenario, whilst up to 3,000 additional dwellings could be accommodated before significant delay begins to occur.

Conclusions

117. This assessment has identified that with the network in the currently proposed form for the 2031 Core Strategy scenario, only 500 additional dwellings could be accommodated at the LMA area, alongside some small scale mitigation, before the model network becomes over capacity, most noticeably in the Clifford Chambers and Campden Road areas.

118. The assessment has identified that to incorporate development beyond this level, there is a requirement for a revised alignment link road, to replace the currently proposed SWRR, which removes the need for LMA trips to route through Clifford Chambers. Once this link road is delivered, alongside grade separation on the A46, up to 3,000 additional dwellings can be accommodated at the LMA area before the model becomes unstable.

119. The analysis has also identified that 4,300 additional dwellings could be accommodated at the LMA area, should a 40% car mode reduction be realised for all new development trips tested within this assessment, together with a realigned link road and A46 junction improvements.

Southam Town Paramics Model

2031 Core Strategy Model Development

April 2019

VM185174.TN003

Introduction

1. At the request of Warwickshire County Council (WCC), Vectos Microsim (VM) has recently undertaken the development of a 2017 Southam Town Paramics Base model.

2. Following the development of the Base model, two forecast year models were developed, the 2023 and 2031 Reference Case models. Detail behind the development of these models is provided in a supporting technical note, which should be read in conjunction with this Note[1].

3. Subsequently WCC and Stratford District Council (SDC) have requested a further model, which is to reflect the current understanding of the Local Plan (Core Strategy) assumptions. Accordingly, a 2031 Core Strategy model has been created. The Core Strategy model is based upon the recently created 2031 Reference Model. The Core Strategy model contains the Core Strategy allocations and commitments in terms of developments and infrastructure.

Objectives

4. The objective of this exercise is to produce a future year (2031) Paramics model of the Southam Town Paramics model, which reflects the Core Strategy allocations and infrastructure.

5. Through this process, VM will seek to optimise the network which will include the introduction of any other measures deemed appropriate by VM or WCC. The schemes will be included on the basis of what is most desirable in each area.

6. This modelling assessment will not replace the site specific transport assessment work produced by each of the site promoters and the schemes that VM include within the model should be treated as such (i.e. they are concept schemes, included in a similar level of detail to the Stratford Transport Package (STP) in the SuA models).

[1] VM175107.TN001 - Southam Model Forecasting Note

Development Assumptions

7. It is understood that the following development sites are valid for inclusion within the Core Strategy Model:

- West of Banbury Road – 236 dwelling residential site
- West of Coventry Road – 165 dwelling residential site
- South of Daventry Road – 535 dwelling residential site
- CEG/Bird Group (GLH) – 2,000 dwelling residential site
- IM Properties (GLH) – 1,000 dwelling residential site
- JLR - 100 hectares of employment land
- AML – 4.5 hectares of employment land

8. It is understood that these site specific demands for these trips require inclusion within the existing 2031 Reference Case to form the 2031 Core Strategy scenario.

9. Three of the sites listed above exist within the 2031 Reference Case already, albeit the development quantum is lower than that outlined within the Core Strategy. Accordingly, these development trips can be included within the relevant existing model zones.

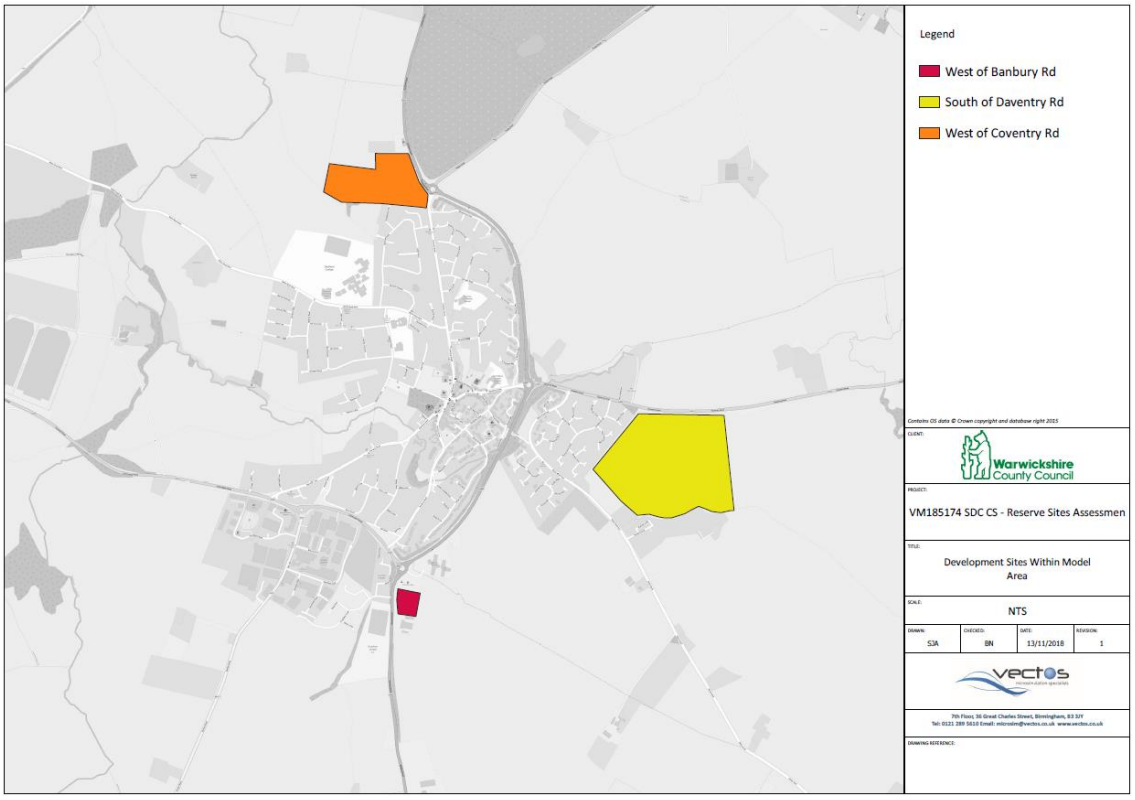
10. The remaining sites lie outside of the model extent and therefore any trips deemed to be travelling through the Southam model network will be loaded onto the network at the relevant external model zones The external/internal classification of the Core Strategy development sites is shown in **Table 1**.

Table 1: Site Classification

Internal Sites	External Sites
West of Banbury Rd	CEG/Bird Group (GLH)
South of Daventry Rd	IM Properties (GLH)
West of Coventry Rd	JLR
	AML

11. The locations of the Core Strategy internal sites that lie within the Southam model extent, are displayed in **Figure 1**.

Figure 1 Development Site Locations within Model Extent



Internal Sites Inclusions

12. The 2031 Southam Reference Case already contained some of the development sites outlined by WCC for inclusion within the 2031 Core Strategy model.

13. The following sites, and number of dwellings included at each of these sites have already been accounted for within the 2031 Reference Case

- West of Banbury Rd – 173 dwellings
- West of Coventry Rd – 165 dwellings
- South of Daventry Rd – 535 dwellings

14. As a result of these sites already having been included within the Reference Case, the West of Coventry Road and South of Daventry Road sites require no further additional trips including within the Core Strategy model.

15. The West of Banbury Road site required the number of dwellings uplifting by 63 to the required 236 dwellings in the 2031 Core Strategy model. The trip generation and output demands for this site have been adjusted accordingly.

CEG/Bird Group & IM Properties (GLH)

16. Although CEG/Bird Group and IM Properties are separate developments they are part of the same land allocation. This means that for the purposes of modelling the two developments

can be handled as a single development, consequently they are included in the 2031 Reference Case in the same matrix level and share a demand distribution.

17. The CEG/Bird Group development is included in the 2031 Reference Case with the assumption that there will be 1,720 dwellings completed by the 2031 forecast year. The Core strategy trajectories indicate that this needs to be increased to 2,000 dwellings.

18. The IM Properties development is also included in the 2031 Reference Case. The development assumption used in the Reference Case is that 860 dwelling will be completed by 2031. This figure will need to be revised in the Core Strategy model to align with the Core Strategy assumption of 1,000 completed dwellings.

19. As all these elements could be isolated by vehicle type it was possible to cordon out these trips from the 2031 Extended M40 Reference model and then utilise them within the Southam Core Strategy models.

20. The link references within the M40 model that correspond to the links that connect to the zones within the Southam cordon model were defined. Where possible, each zone within the Southam model was allocated a link reference for the inbound and outbound movements based on the M40 model's structure.

21. No cordon points were available within the M40 model for the Southam zones to the north of A423/Daventry Road roundabout as the M40 model does not include this section of the network. Therefore, a cordon point on the A423 Southam Bypass was used and the resulting cordoned OD counts extrapolated using the observed turn proportions from the survey at A423/A426/Southam Bypass/Coventry Road roundabout. This was done for each of the cordoned elements to ensure they were distributed to the northern zones of the Southam model.

22. The M40 model was then run with 50% demand levels and the Vehicle Routes file collected. The Vehicle Route files, and the link references, were then used to produce cordon matrices for each AM and PM hour (factored back to 100% demand levels) in the cordon model's zoning format.

23. Subsequently, the GLH demands and the IM Properties demands were cordoned out separately. The result of this exercise was a set of demand matrices representing the trips related to these two development sites in the zone format compatible with the Southam model.

JLR & AML – Employment Sites

24. The 2031 M40 S-Paramics model has again been utilised to derive the appropriate employment site demands for inclusion in the 2031 Southam Core Strategy model.

25. For the JLR employment site, the relevant demands have been cordoned out from the M40 model, by isolating the vehicle type associated with JLR. Via the cordoning of these demands, the employment trips can then be appropriately distributed throughout the 2031 Southam Core Strategy model network.

26. The AML site is not explicitly included in the 2031 M40 S-Paramics model. For the purposes of the Southam Core Strategy model the AML site is considered to be very similar to the JLR site with regards to the trip generation and distribution. As such, the JRL demands cordoned from the 2031 M40 S-Paramics model can be utilised for the purpose of including AML into the Core Strategy model.

27. Given that the AML development site is 4.5 hectares in size, whilst the JLR site is 100 hectares in size, the JLR demands cordoned have then been factored by 4.5% to reflect AML demand levels.

Core Strategy Development - Demand Inclusions

28. As outlined above, each of the development sites listed have been added to the 2031 Reference Case network to form the 2031 Southam Core Strategy model. This has resulted in eight demand matrix levels within the model.

29. The status of each matrix level is either 'original' (as seen in 2031 Reference Case), 'updated', (to match the Core Strategy Trajectories), or are 'new additions' for the Core Strategy model. The matrix levels are described in **Table 2**.

Table 2 - 2031 Southam Core Strategy Matrix Levels

Matrix Level	Matrix Description	Status
1	Background Traffic (Lights)	Original
2	HGV	Original
3	Committed Developments	Original
4	Growth (2018 – 2031)	Original
5	GLH	Updated
6	Internal Core Strategy	New
7	JLR	New
8	AML	New

GLH Demands

30. The update applied to Matrix Level 5 consisted of factoring the demands that were previously included for the CEG/Bird Group and IM Properties sites within the Reference Case, to match the Core Strategy trajectories.

31. The resulting demand totals are shown in **Table 3**.

Table 3 – GLH Matrix Level Demand Totals

Direction	0700-0800	0800-0900	0900-1000	1600-1700	1700-1800	1800-1900
In	183	306	97	153	326	225
Out	170	166	43	178	271	162
Total	353	472	140	331	597	387

Core Strategy Internal Sites Demands

32. Matrix level 6 contains the demands related to the internal model network residential sites. As detailed earlier in this note, the demands in this matrix level are only required to provide an uplift to the demands included within the 2031 Reference Case for the West of Banbury Road site. The trip generation used to build demands for matrix 6 is shown in **Table 4**.

Table 4 – Matrix Level 6 Demand Totals

Direction	0700-0800	0800-0900	0900-1000	1600-1700	1700-1800	1800-1900
In	5	10	11	21	25	17
Out	18	26	13	13	15	14
Total	23	36	24	34	40	31

JLR Demands

33. Using the same method used to capture the CEG/Bird Group and IM Properties demands, the demands relating to the JLR employment site were cordoned from this M40 model to produce cordon matrices for each AM and PM hour in the Southam model's zone format. The demand totals for Matrix 7 are visible in **Table 5**.

Table 5 – Matrix Level 7 Demand totals

Direction	0700-0800	0800-0900	0900-1000	1600-1700	1700-1800	1800-1900
In	40	16	10	134	116	12
Out	82	28	14	6	4	0
Total	122	44	24	140	120	12

AML Demands

34. Matrix level 8 represents the AML employment site demands. This development is considered to be similar to the JLR site in terms of the land use and distribution. The AML site is 4.5 hectares in size. As the JLR site is 100 hectares in size, it has been deemed appropriate to factor the JLR employment demands in Matrix 7 by 4.5% to derive suitable demands for the AML site. **Table 6** contains the demand totals Matrix Level 8.

Table 6 – Matrix Level 8 Demand Totals

Direction	0700-0800	0800-0900	0900-1000	1600-1700	1700-1800	1800-1900
In	2	1	0	6	5	1
Out	4	1	1	0	0	0
Total	5	2	1	6	5	1

35. The resultant total trip generation for both each Core Strategy site is demonstrated in the following **Tables 7-9**.

Core Strategy (2031) Development Trip Generation

Table 7 2031 Core Strategy - AM Development Site Trip Generation Totals

Development	0700-0800		0800-0900		0900-1000	
	In	Out	In	Out	In	Out
GLH (Housing)	183	170	306	166	97	43
Southam Internal Sites	5	18	10	26	11	13
JLR Employment	40	82	16	28	10	14
AML Employment	2	4	1	1	0	1

Table 8 2031 Core Strategy - PM Development Site Trip Generation

Development	1600-1700		1700-1800		1800-1900	
	In	Out	In	Out	In	Out
GLH (Housing)	153	178	326	271	225	162
Southam Internal Sites	21	13	25	15	17	14
JLR Employment	134	6	116	4	12	0
AML Employment	6	0	5	0	1	0

36. The cumulative hourly trip generation assigned to the 2031 Core Strategy model, based on the above development trips is summarised in **Table 9**.

Table 9 2031 Core Strategy Development Sites - Net Trip Generation

Hour	Total Trips	Periodic
0700-0800	504	1247
0800-0900	554	
0900-1000	189	
1600-1700	511	1704
1700-1800	762	
1800-1900	431	

Development Release Profiles

37. The release of Core Strategy development trips has been controlled via specific profiles. Since all demands associated with the Core Strategy developments are assigned to existing zones, the profiles already applied to these zones are being utilised and no new profiles have been derived.

38. This is applicable also for the external Core Strategy development sites, whereby the profile applied to the relevant external zone has been applied to the trips entering the model from each external Core Strategy site.

Vehicle Type Proportions

39. As each of the Core Strategy development sites have been included in isolated matrix levels, it was necessary within the modelling to assign a specific vehicle type to each matrix level and therefore each development.

40. Each of the developments have only ‘car’ type vehicles assigned to their matrix level. All ‘car’ vehicle types have been assigned using the same familiarity and perturbation settings as assigned to the ‘car’ vehicle type within the Base model.

2031 Core Strategy Network Mitigation

41. Following the inclusion of the vehicle trip generation within the 2031 model network, it was clear that some highway intervention measures would be required to enable the network to function without significant congestion and gridlocking.

42. The following section of the note details the schemes that were included within the 2031 Core Strategy model network.

A425 Southam Road/Fosse Way Roundabout Scheme

43. Upon a review of the model operation following the inclusion of the Core Strategy sites, the A425 Southam Road/Fosse Way roundabout began to experience significant congestion issues. This appears to be due to an increase in the amount of traffic attempting to enter and leave the model from the direction of Fosse Way S and Southam Road W. The roundabout does not appear to have the capacity to accommodate the projected increase in flows travelling across the roundabout to and from the Southam Road E and Southam Road W approaches.

44. To mitigate this, network changes were applied to this junction within the model, in an attempt to increase capacity between the Southam Road E and Southam Road W arms. The changes made to this junction were as follows:

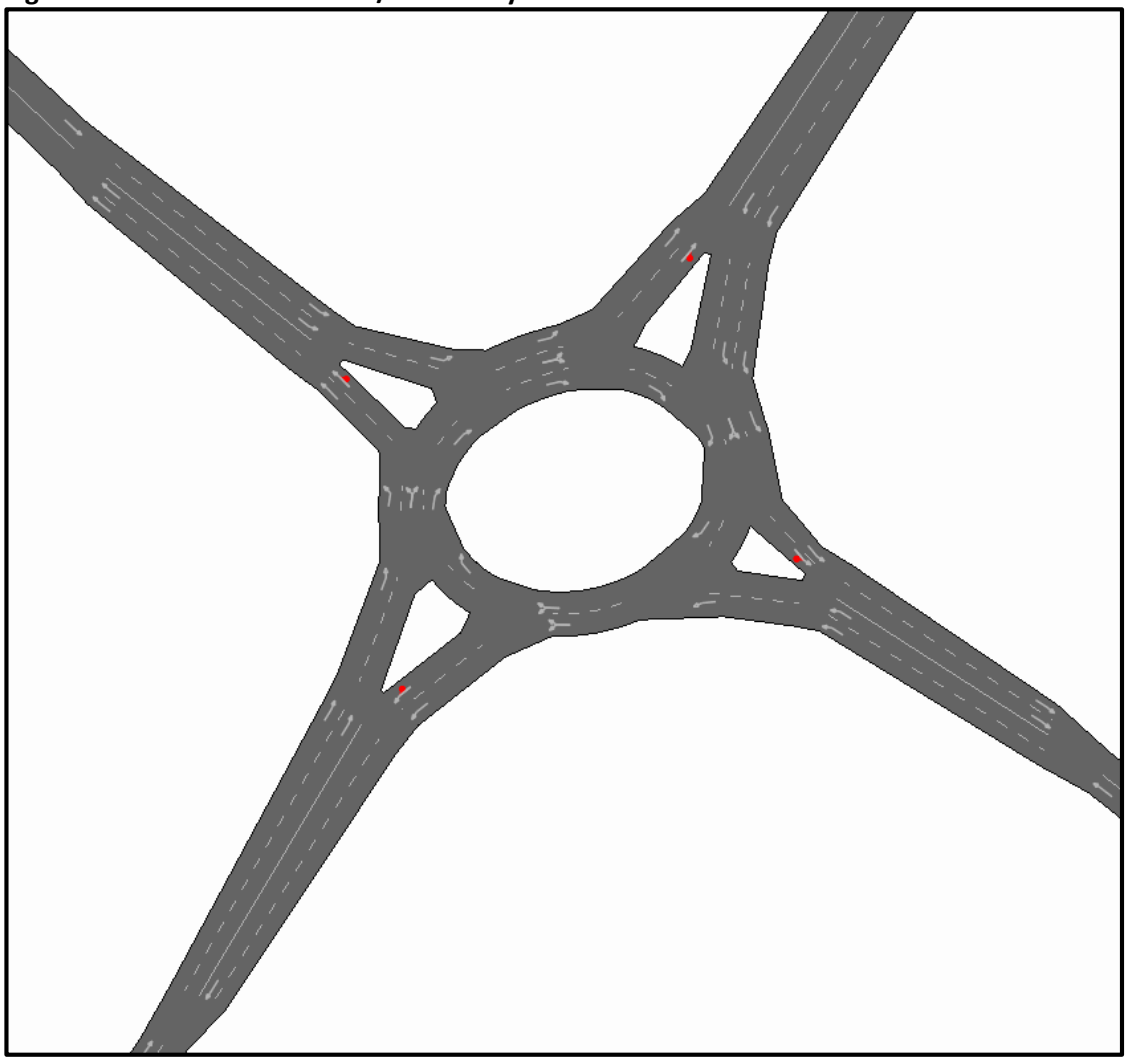
- A425 Southam Road E and A425 Southam Road W exit arms have been widened to two lanes.
- Circulatory links widened to two lanes around the entire roundabout

45. This would enable vehicles travelling between the Southam Road E and Southam Road W arms to make the movement in two lanes, thus increasing the vehicle throughput.

46. Based on visual inspection these changes have significantly reduced the queue lengths at this location in the model, with a large increase in junction throughput.

47. **Figure 2** shows the A425 Southam Rd/Fosse Way roundabout layout with the above changes implemented.

Figure 2 – A425 Southam Road/Fosse Way Roundabout Scheme



A425/A423 Roundabout Scheme

48. Additional to the A425/Fosse Way detailed above, the review of the model operation also indicated that the A425/A423 junction experiences significant congestion, particularly on the A423 SB approach arm, once the Core Strategy demands are included within the network.

49. A further review of the traffic flow patterns at this junction revealed that a large volume of the traffic arriving at the roundabout from the A423 SB approach arm was attempting to turn right, around the roundabout, to continue onwards onto the A425 WB. Due to the volume of traffic already on the roundabout, there are limited gaps available for vehicles attempting to enter the roundabout from the A423 SB, subsequently causing queues on this approach.

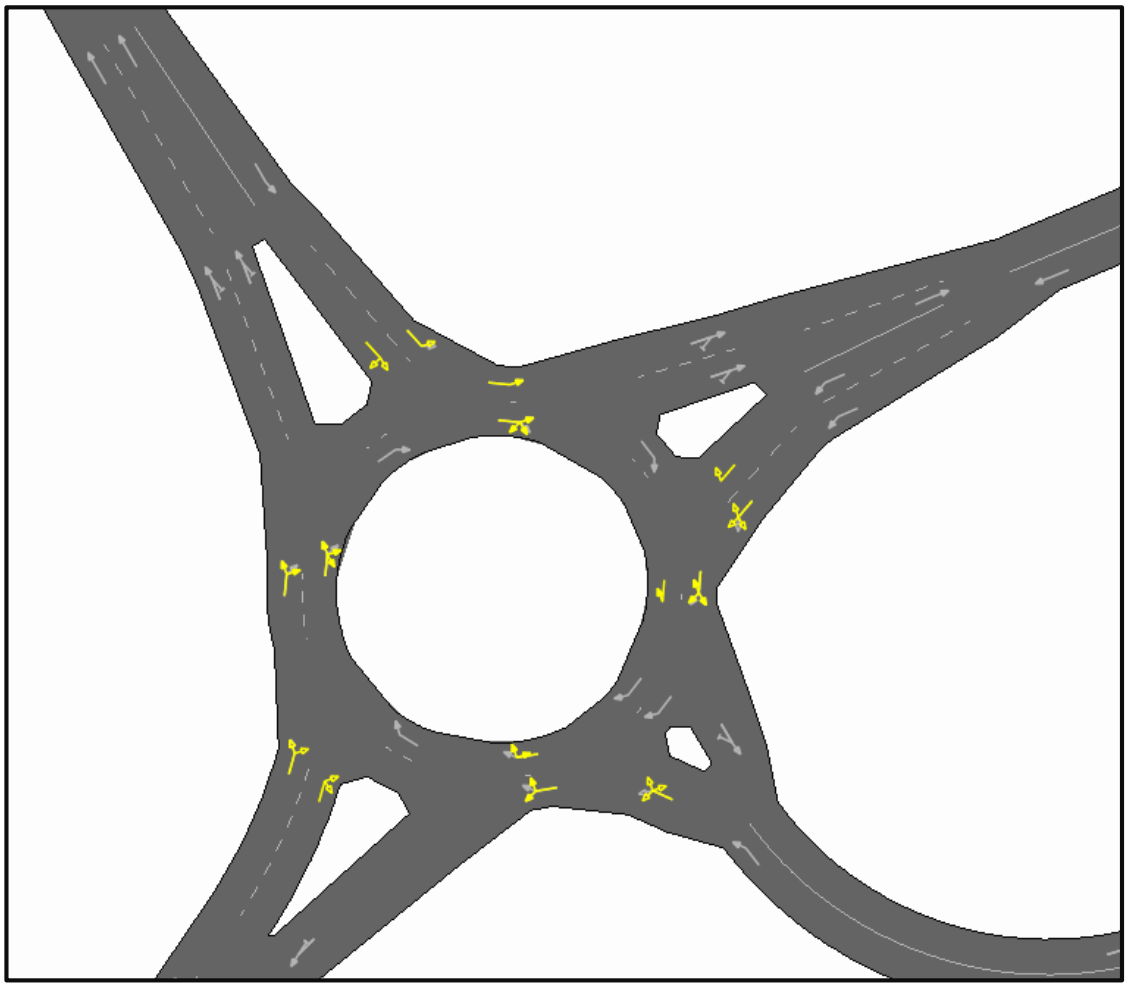
50. To mitigate the impacts modelled, the following changes were made to the:

- Widening of the A425 WB exit to two lanes.
- Widening of the circulatory links to two lanes around the entire roundabout

51. This would enable vehicles travelling from the A423 SB to the A425 WB to make the movement in two lanes, thus increasing the vehicle throughput for this movement.

52. A visual inspection revealed that the changes listed improved the situation at the roundabout. The revised junction layout at the A425/A423 roundabout, is demonstrated in **Figure 3.**

Figure 3 - A423/Banbury Rd roundabout with Mitigation



2031 Core Strategy Mitigation Measures

53. Upon inclusion of the 2031 Core Strategy demands within the model, a network review was undertaken, and appropriate levels of mitigation identified for inclusion within the network.

54. The mitigation included consists of two schemes both of which consisted of widening of roundabout circulatory and exit arms.

Summary and Conclusions

55. This Note details the steps undertaken in the development of a 2031 Southam Core Strategy model.

56. The relevant Core Strategy development trips have been added to the existing 2031 Southam Reference Case networks as advised by WCC and SDC.

57. The demands have been added on top of the existing reference case demands, with no further adjustment in growth levels of peak spreading applied.

58. Upon inclusion of the relevant demands within the Core Strategy models, a review of the model operation was undertaken, and appropriate schemes included.

59. The 2031 Core Strategy mitigation consists of the delivery of the two roundabout enhancement schemes, with widening included on exit and circulatory arms of the A425 Southam Road/Fosse Way roundabout and the A425/A423 roundabout.

SDC Reserve Housing Sites Assessment

Southam Area Reserve Sites

April 2019

VM185174.TN004

Introduction

1. This Note forms part of a series produced by Vectos Microsim (VM) in response to a request from Stratford District Council (SDC) for assistance in assessing the potential implications of the delivery of a strategy for the identification of Reserve Sites, which may be necessary to bridge any potential shortfall that has arisen in the housing delivery profile for Stratford District, post adoption of the Core Strategy.

2. This Note sets out the assessment undertaken to ascertain the likely impact on the Southam modelled network of the potential Reserve Sites within the Southam area.

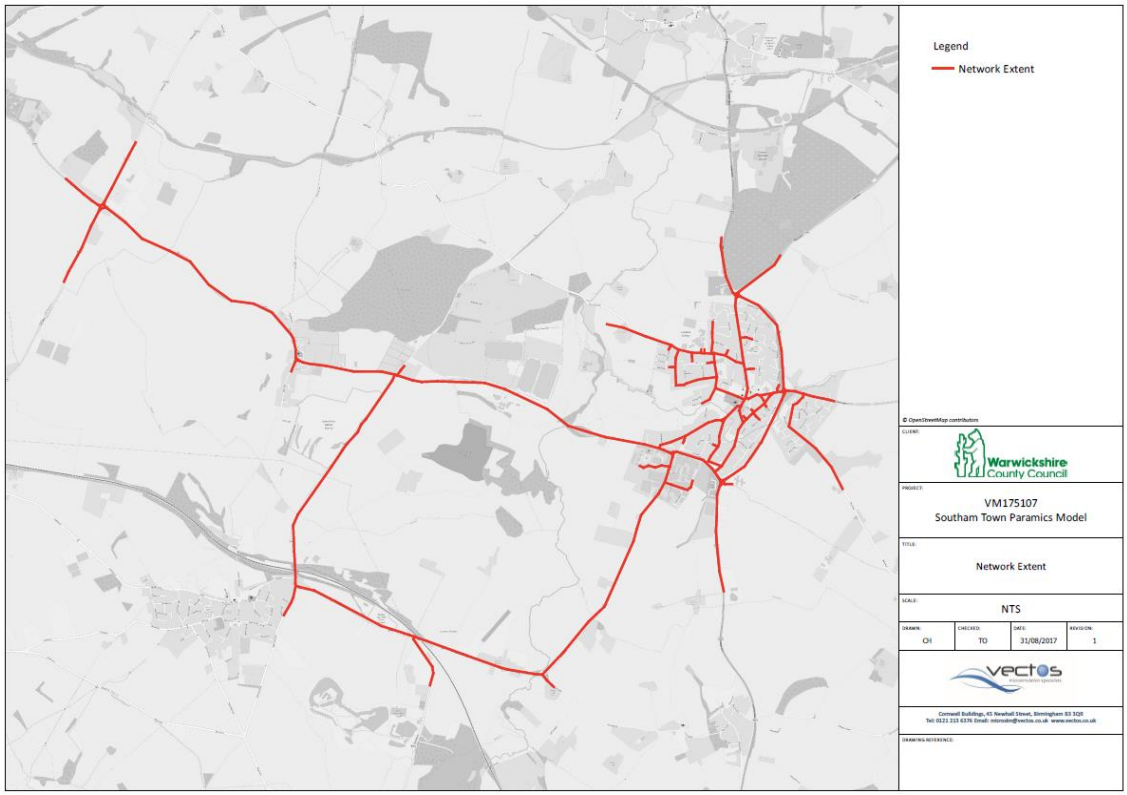
Background

3. Originally, in 2015, VM were commissioned by WCC to develop the S-Paramics 2031 Base Model of Southam, including the A423 bypass, the A425 from Southam to west of Radford Semele, adjacent sections of the Fosse Way and Deppers Bridge. The Base Model was calibrated using existing observed data, collected between the years 2010 and 2013. The calibrated and validated 2013 Base Model was then utilised to develop forecast scenarios for the future years 2021 and 2031.

4. Following on from this, in 2017 VM were commissioned by WCC to update the 2013 Southam Base Model to 2017 traffic levels. New survey data was collected in 2017 to inform this update. At this point the model was also converted to Paramics Discovery, and the model was extended to include Southam town centre. The latest Southam model extent is shown in **Figure 1**. The 2017 Southam Base Model, once validated, was used to develop future year scenarios. The years forecasted were 2023 and 2031.

5. Since updating the original Southam model, WCC and Stratford District Council (SDC) requested a further model, which is to reflect the current understanding of the Local Plan (Core Strategy) assumptions. All known Core Strategy aspirations within the study area were included within the 2031 Southam Reference Model, to form the 2031 Core Strategy model. This Core Strategy model contains the known Core Strategy aspirations in terms of developments and infrastructure.

Figure 1 Southam Model Extent



Objectives

6. Through discussions between WCC and SDC, VM have identified primary objectives which are to be assessed by this stage of the study. Accordingly, the assessment summarised within this note addresses the following objectives:

- To assess, at a final point, the impacts on the Southam model network associated with the delivery of the potential Reserve Sites identified by SDC, and where possible to do so, identify measures to overcome the impacts identified
- Determine the appropriate level of mitigation to be delivered within the Warwick District transport network in response to issues observed to occur as a result of potential housing development identified by SDC for delivery in the Southam area.

7. In order to assess the second objective, the South Leamington model will also be used in the assessment of the impacts of housing sites in the Southam area. It is proposed that the 2025 Reference Case would be used for this assessment as this year is already available

Methodology

8. This first stage of the assessment centres on the assignment of trips predicted to be generated by the potential Reserve Sites into the 2031 Southam Core Strategy Scenario network. The trips will be assigned based upon a trip generation and distribution agreed with WCC, and a review of resultant network conditions will then be undertaken in light of the

inclusion of these sites, with a focus on the impact that each additional Reserve Site will elicit on the network.

9. The second stage of the assessment will establish what additional mitigation measures or mode shift assumptions will be required to ensure the network will continue to operate satisfactorily when all sites are included.

2031 Core Strategy Assessment

Reserve Sites Inclusion

10. Following discussions between VM, WCC and SDC a list of potential Reserve Sites was provided, along with the predicted number of dwellings at each site, for inclusion within the 2031 Core Strategy model. These Reserve Sites are outlined in **Table 1** and **Figure 2**.

Table 1 Reserve Site Details

Site	Dwellings	Trip Rates to Assign	Model Zone
Site Adjacent to A423	240	STA Trip Rates	202
Site Adjacent to Banbury Road	240	STA Trip Rates	201
Lower Farm Stoneythorpe	800	STA Trip Rates	203
Former Southam Cement Works	350	STA Trip Rates	*1
North of Former Harbury Cement Works	200	STA Trip Rates	200
Site east of A423/North of Daventry Road	300	STA Trip Rates	204
Site West of Banbury Road	75	STA Trips Rates	205

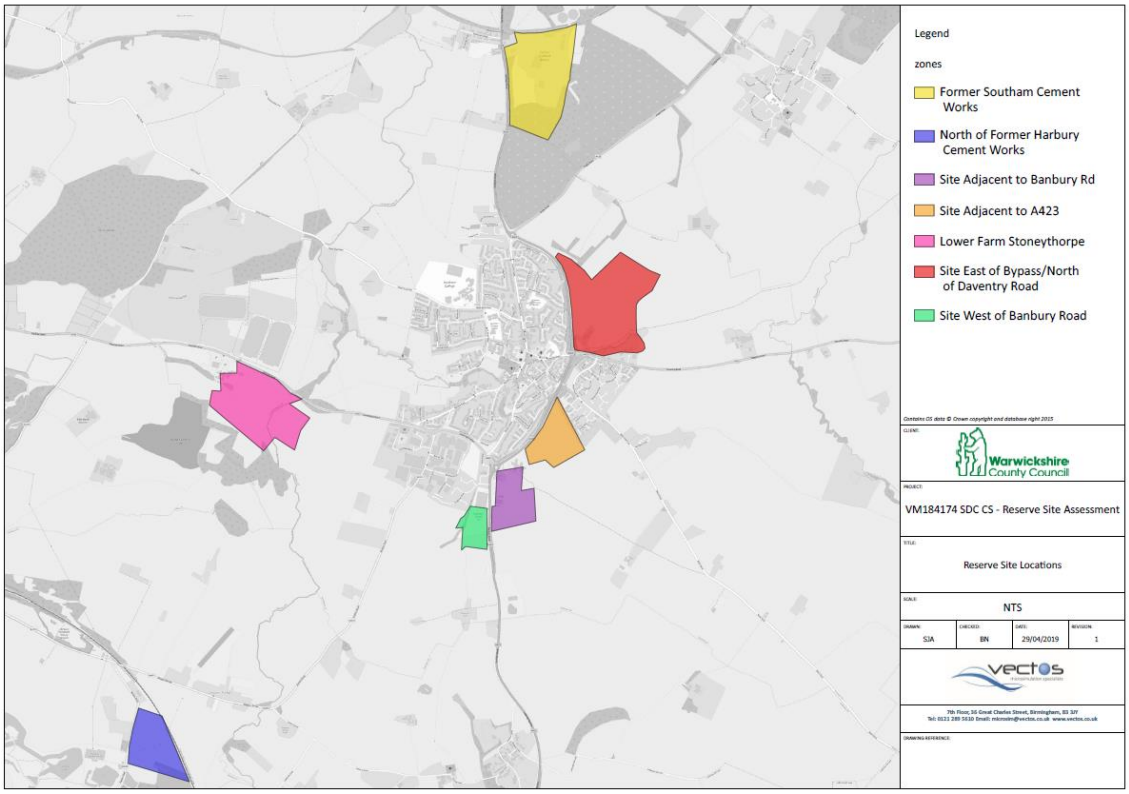
***** The Former Southam Cement Works site lies outside of the model extent. Any trips predicted to enter the model from this site has been assigned to the closest external zone to these site, which in this case is Zone 1.

11. WCC have advised on the appropriate trip rate to assign to all of the reserve sites is the WCC Strategic Transport Assessment Residential trip rates.

12. Each of the above sites have been coded into the 2031 Core Strategy model, with access arrangements based upon concept schemes, which are designed to ensure that all traffic leaving each site gets onto the network, rather than queuing within the site attempting to access the network.

13. In all instances, accesses have been included as either priority junctions (with ghost island right turn bays) or roundabouts.

Figure 2 Reserve Site Locations



14. The trips generated by each site have been distributed using the WCC mobile network database (MND). The MND has been interrogated, with a distribution being derived using a residential LSOA (Lower Super Output Area) that each site lies within.

15. The MND distribution was altered before application to the site at the Former Southam Cement Works, since this site lies outside of the model network. The alterations were implemented to better reflect likely route choices through the Southam model network.

16. **Figure 3** shows the generic zonal distribution used for all Reserve Sites except the Former Southam Cement Works Site. The altered distribution created for the Former Southam Cement Works Site is shown in **Figure 4.**

Figure 3 Distribution Applied to Southam Reserve Sites

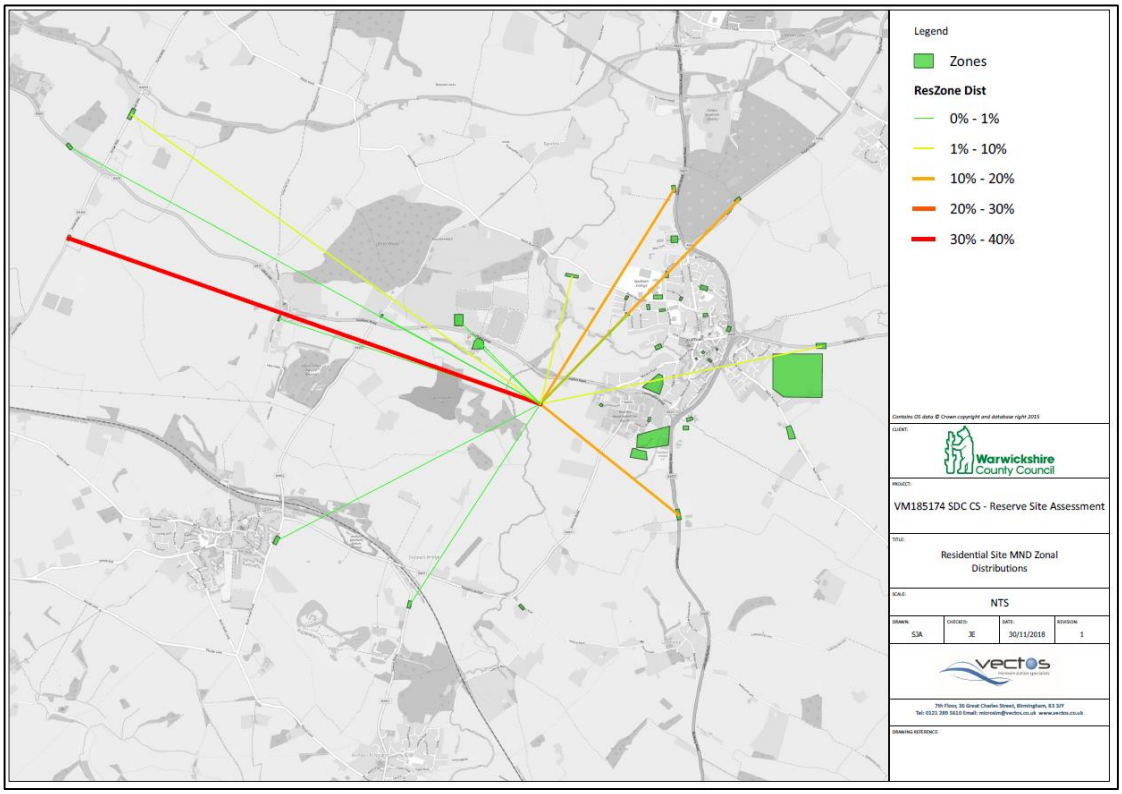
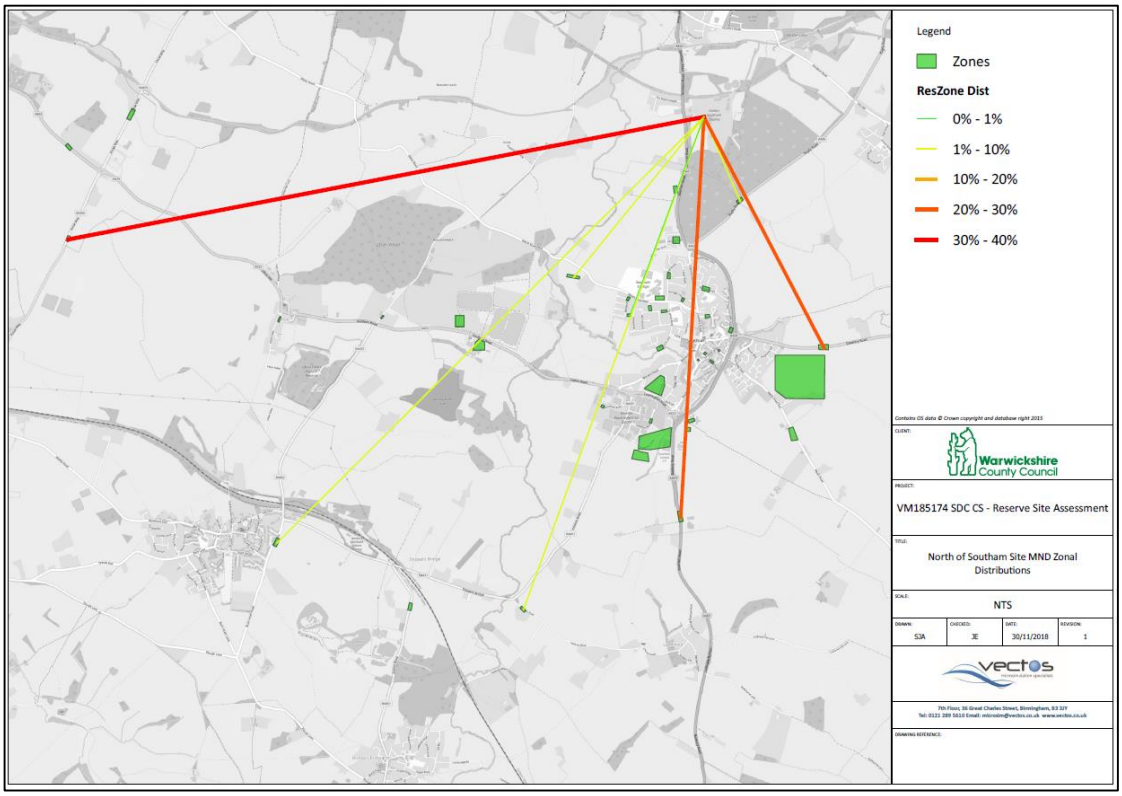


Figure 4 Distribution Applied to Former Cement Works Site



17. Each of the sites detailed have been included within the 2031 Core Strategy network using the trip rates and distribution outlined above, along with their associated access arrangements.

18. When adjusting the distribution for the Former Southam Cement Works Site it was discovered that only 34.43% of the total trips associated with this site would travel via the model network. The trips generated by the site have been factored to ensure that only this proportion of the trips will enter the model network.

19. The resultant trips generated by each of the sites are presented for the AM and PM modelled hours in **Table 2** and **Table 3**.

Table 2 Reserve Sites Trip Generation (AM Period)

Development	0700-0800		0800-0900		0900-1000	
	In	Out	In	Out	In	Out
Site Adjacent to A423	17	107	38	132	29	47
Site Adjacent to Banbury Road	17	107	38	132	29	47
Lower Farm Stoneythorpe	56	356	126	442	97	158
Former Southam Cement Works	8	54	19	67	15	24
North of Former Harbury Cement Works	14	89	32	110	24	39
Site east of A423/North of Daventry Road	21	134	47	166	36	59
Site West of Banbury Road	5	33	12	41	9	15

Table 3 Reserve Sites Trip Generation (PM Period)

Development	1600-1700		1700-1800		1800-1900	
	In	Out	In	Out	In	Out
Site Adjacent to A423	78	41	116	44	94	47
Site Adjacent to Banbury Road	78	41	116	44	94	47
Lower Farm Stoneythorpe	261	136	387	146	312	158
Former Southam Cement Works	39	20	58	22	47	24
North of Former Harbury Cement Works	65	34	97	36	78	39
Site east of A423/North of Daventry Road	98	51	145	55	117	59
Site West of Banbury Road	24	13	36	14	29	15

20. The cumulative hourly trip generation for the Reserve Site demands is summarised in **Table 4**.

Table 4 Reserve Sites Net Trip Generation

Hour	Total Trips	Periodic
0700-0800	1017	3048
0800-0900	1403	
0900-1000	628	
1600-1700	980	3455
1700-1800	1316	
1800-1900	1160	

21. Once the demands had been derived, and in line with STA testing undertaken elsewhere within the county, a modal shift allowance was made for all Reserve Sites of a 10% car reduction. The mode shift factor has been applied on the basis that site promoters will be

tasked with achieving this target through the delivery process, and, on that basis, was considered an appropriate assumption for this stage of testing. These adjustments have been applied only to the Reserve Sites included within the modelling.

22. No assumptions have been applied to account for the potential shift in background traffic in response to the delivery of enhancements to existing and provision of new sustainable transport services and, as a result, when assessed in the context of the overall demands assigned within the model, these adjustments affect less than 1% of the assigned demand totals within the model.

Model Review

23. Following the inclusion of the Reserve Site demands within the 2031 Core Strategy model network, a visual review of the model operation was undertaken, in order to ascertain the areas of impact, and the model stability.

24. The review revealed that across the model congestion has been significantly worsened as a results of the introduction of the Reserve Site traffic. The impacts of the congestion were not observed to cause the model to lock up. However, there are areas where many unreleased vehicles cannot enter the model as a results of the congestion.

25. There were four main areas where significant congestion issues occurred. Although the impacts are not exclusive to these areas, they are the most noticeably effected locations. These locations are:

- Welsh Rd E/Daventry Rd & A423/Daventry Rd Junctions
- Fosse Way/Southam Rd Roundabout
- A425/Banbury Rd & Leamington Rd/Kineton Rd Junctions
- Warwick Rd/Leamington Rd Priority Junction

26. The following figures show screen captures taken from the model to display the areas of congestion described above.

Welsh Rd E/Daventry Rd & A423/Daventry Rd Junctions

27. **Figure 5** shows a large build-up of northbound traffic along Welsh Rd East. The extent the queueing at this junction is often observed to reach back far enough to prevent vehicles from exiting the development site accessed off Welsh Road East. The queueing appears to be caused by the traffic travelling from Welsh Rd E not having opportunity to get out of the junction, due to constant traffic flows on the main line. The northbound queueing is not observed to the same extent in the PM period.

28. As well as this A423/Daventry Rd roundabout experiences traffic build ups on the eastbound and the southbound arms, due to high volumes of traffic attempting to cross the roundabout. The queueing described is also seen in the PM hour where it reaches even more significant levels and causes unreleased vehicles from the Site east of Bypass/North of Daventry Road, shown in **Figure 6**.

Figure 5 Welsh Rd E/Daventry Rd & A423/Daventry Rd Junctions Congestion – AM Peak

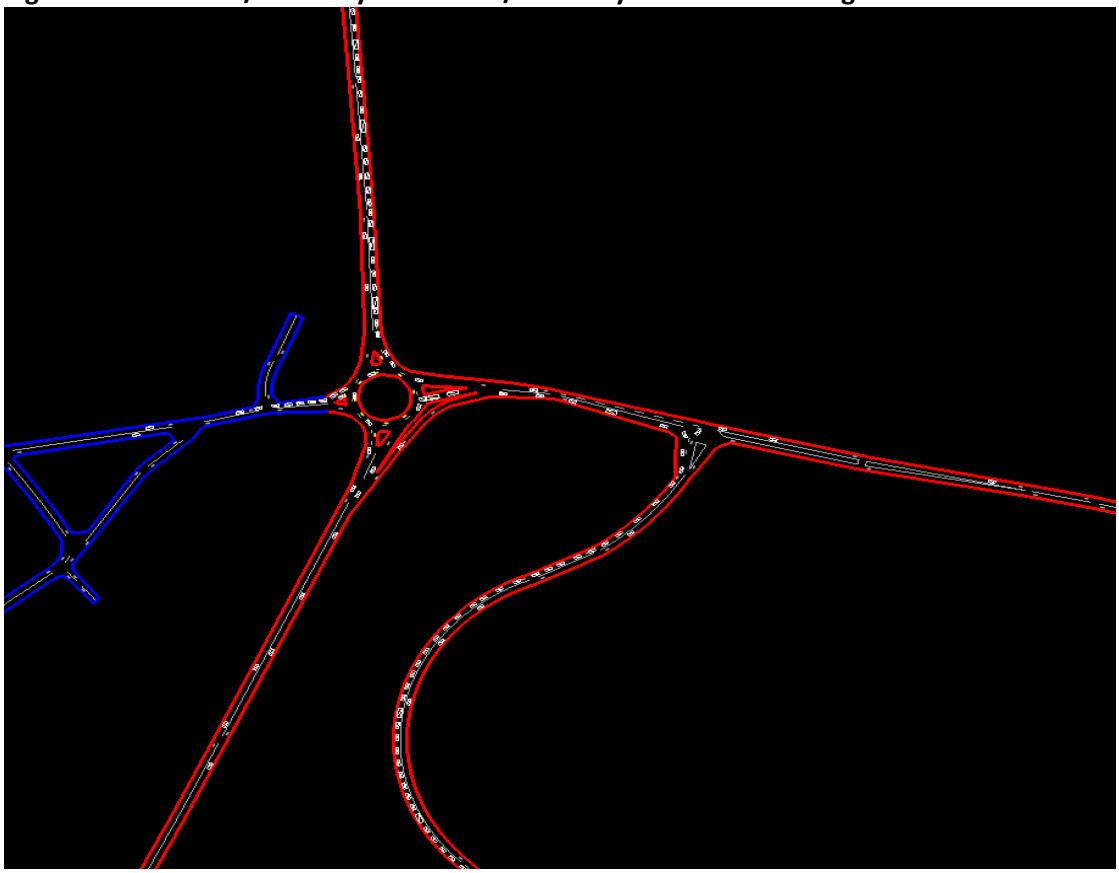
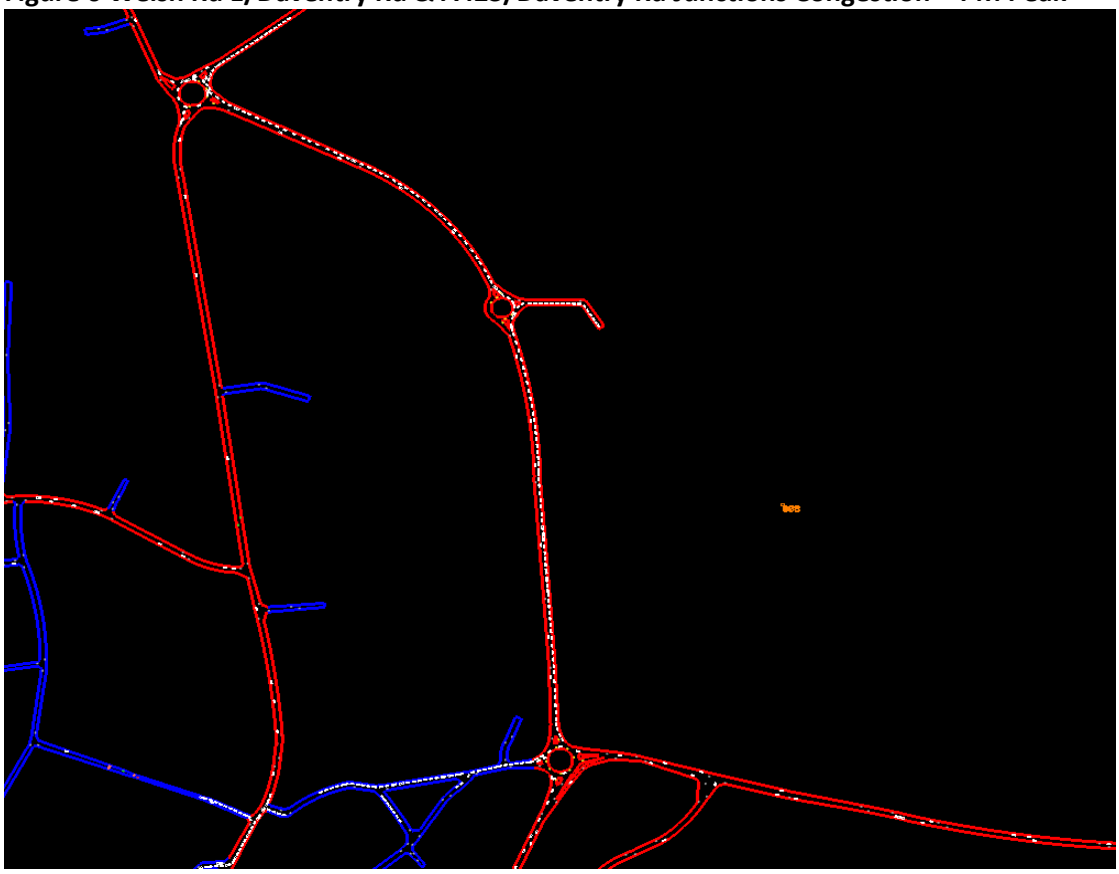


Figure 6 Welsh Rd E/Daventry Rd & A423/Daventry Rd Junctions Congestion - PM Peak

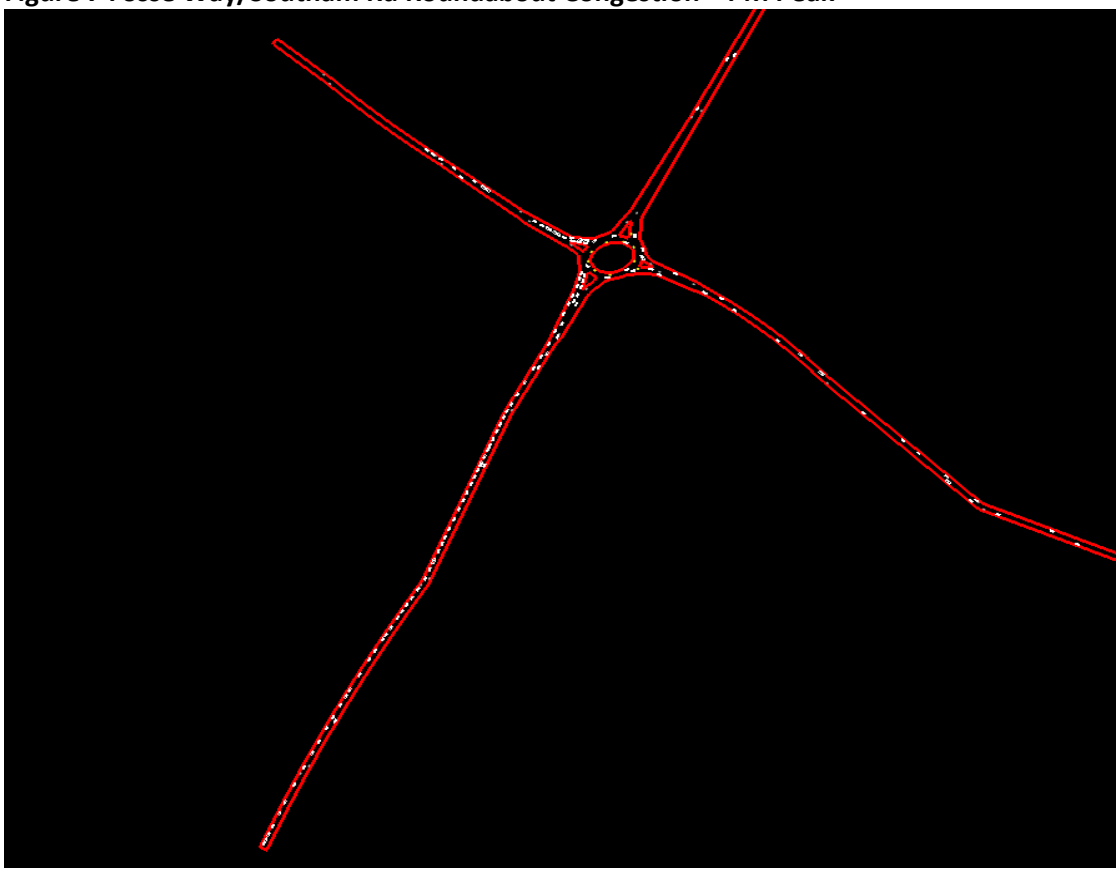


Fosse Way/Southam Rd Roundabout

29. The congestion at the Fosse Way/Southam Rd, shown in **Figure 7** below, is most prominent in the PM period, though there are still high levels of queueing in the AM period from the southbound arm of the roundabout.

30. The increase in queueing levels is caused by higher volumes of traffic using the junction once the Reserve Sites demands are included within the model. More specifically there is a large increase in trips travelling to and from the Fosse Way South approach.

Figure 7 Fosse Way/Southam Rd Roundabout Congestion – PM Peak



A425/Banbury Rd & Leamington Rd/Kineton Rd Junctions

31. The congestion seen in **Figure 8** is consistent throughout the model run times, the congestion reaches its peak in the AM and PM peak hours. High levels of congestion can often be observed from the Tesco junction on Kineton Rd and blocking right back along Banbury Road.

32. As a central point to the model, high volumes of traffic travel through the area shown in **Figure 8**. The current network does not have the capacity to handle the increased volumes of traffic, causing increased levels of queueing. Much of the issues in the area are a consequence of vehicles not having opportunity to make a turn at a junction, which results congestion blocking back into nearby junctions.

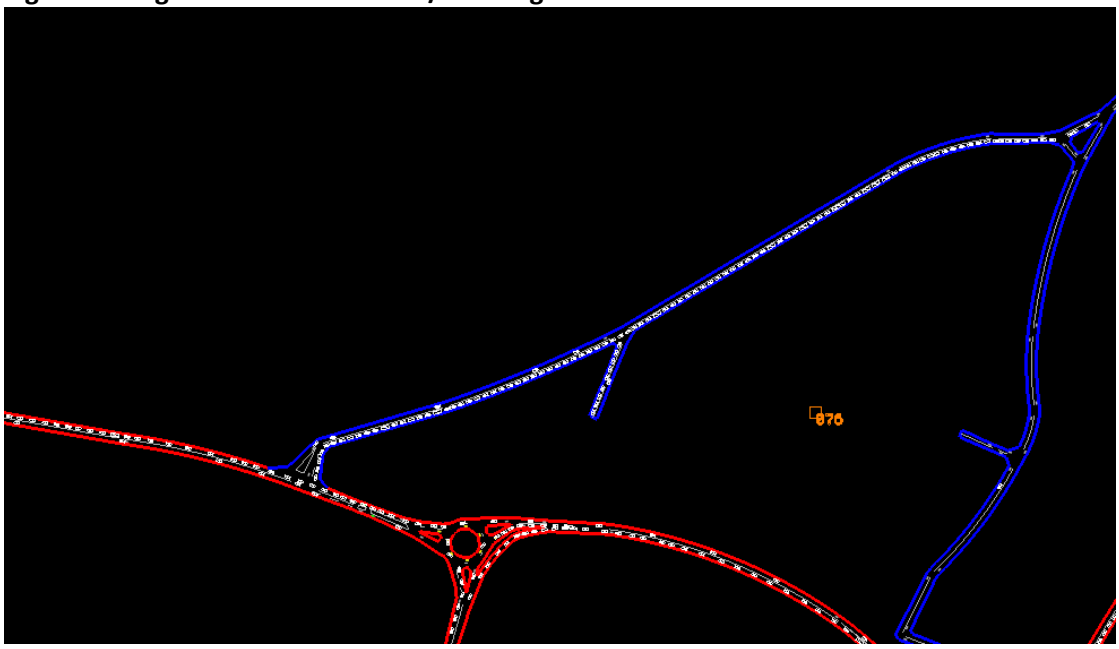
Figure 8 Congestion A425/Banbury Rd & Leamington Rd/Kineton Rd Junctions –PM Peak

Warwick Rd/Leamington Rd Priority Junction

33. At the Warwick Rd/Leamington Rd Priority Junction an extremely long queue forms from the junction and can often be seen to occupy the entirety of Warwick Rd and reach to as far back as Warwick St. This queue along Warwick Rd causes unreleased vehicles in Zone 33, preventing vehicles from this zone from entering the network.

34. The queue appears to be a result of traffic queueing from the nearby Leamington Rd/A425 Roundabout, the queues from this junction prevent traffic from moving from Warwick Rd on to Leamington Rd. The congestion, shown in **Figure 9**, is most severe in the PM period.

Figure 9 Congestion at Warwick Rd/Leamington Rd Junction –PM Peak



Queue Length Analysis

35. In order to further quantify the impact of including the Reserve Sites within the network, this section presents the findings from an average maximum queue difference analysis which compares the outputs of the 2031 Core Strategy model with the 2031 Core Strategy + Reserve Sites model.

36. The average maximum queue length is a statistic extracted from the model outputs, which describes the longest average queue occurring at a junction throughout a given time period. By comparing the average maximum queue lengths any improvement or worsening in the congestion between models can be quantified.

37. The classifications for the queue length analysis within these plots are outlined as follows:

- **Queue Reduction** (a reduction in queue lengths of greater than 5 vehicles)
- **Moderate Increase** (an increase in queue lengths of between 10 and 25 vehicles)
- **Significant Increase** (an increase in queue lengths of between 25 and 50 vehicles)
- **Very Significant Increase** (an increase in queue length of over 50 vehicles)

38. The classifications detailed above are based upon best practice and the approach adopted in similar studies elsewhere within the county. The queue comparison results are shown below in **Figure 10** & **Figure 11**.

Figure 10 Queue Analysis - 2031 Core Strategy Vs 2031 Core Strategy + Reserve Sites – AM Period

Figure 11 Queue Analysis - 2031 Core Strategy Vs 2031 Core Strategy + Reserve Sites – PM Period

39. The queue analysis presented in **Figure 10** and **Figure 11** quantifies the increases in queue lengths in the areas of the model previously noted to be in need of mitigation.

40. The AM peak hour analysis in **Figure 10** demonstrates queue length increases of between 25 and 50 vehicles at the A423/Daventry Road junction and A423/A425 roundabout.

41. The PM peak hour analysis in **Figure 11** demonstrates severe queue length increases (over 50 vehicles) at the A423/Daventry Road roundabout, the A423/A426 roundabout and A425/B4452 junction. The Fosse Way/Southam Rd roundabout does not flag in this analysis, although visual observations of the model operation have demonstrated a congestion issue at this location.

42. An area not previously discussed that has been highlighted in the queue analysis is the A425/B4452 Junction. This junction is experiencing an increased number of vehicles travelling northbound along the B4452, caused by the Reserve Site development at the 'North of Former Harbury Cement Works' site. Traffic builds up on the B4452 arm of the junction as vehicles are unable to find sufficient gaps in the traffic flow on the A425 to pull out of the junction.

Mitigation Testing

43. As detailed above, significant congestion issues have been identified once the potential Reserve Sites demands have been included within the Core Strategy model network. This is considered to be a result of the cumulative impact of all Reserve Sites, since the Core Strategy model already includes mitigation to address congestion caused by the Core Strategy generated traffic.

44. The areas of the model detailed in this Note provided the focus for the mitigation testing, as these areas experience the most severe congestion.

Mitigation Scheme Details

45. The following section describe the mitigation measures that have been implemented into 2031 Core Strategy + Reserve Sites model.

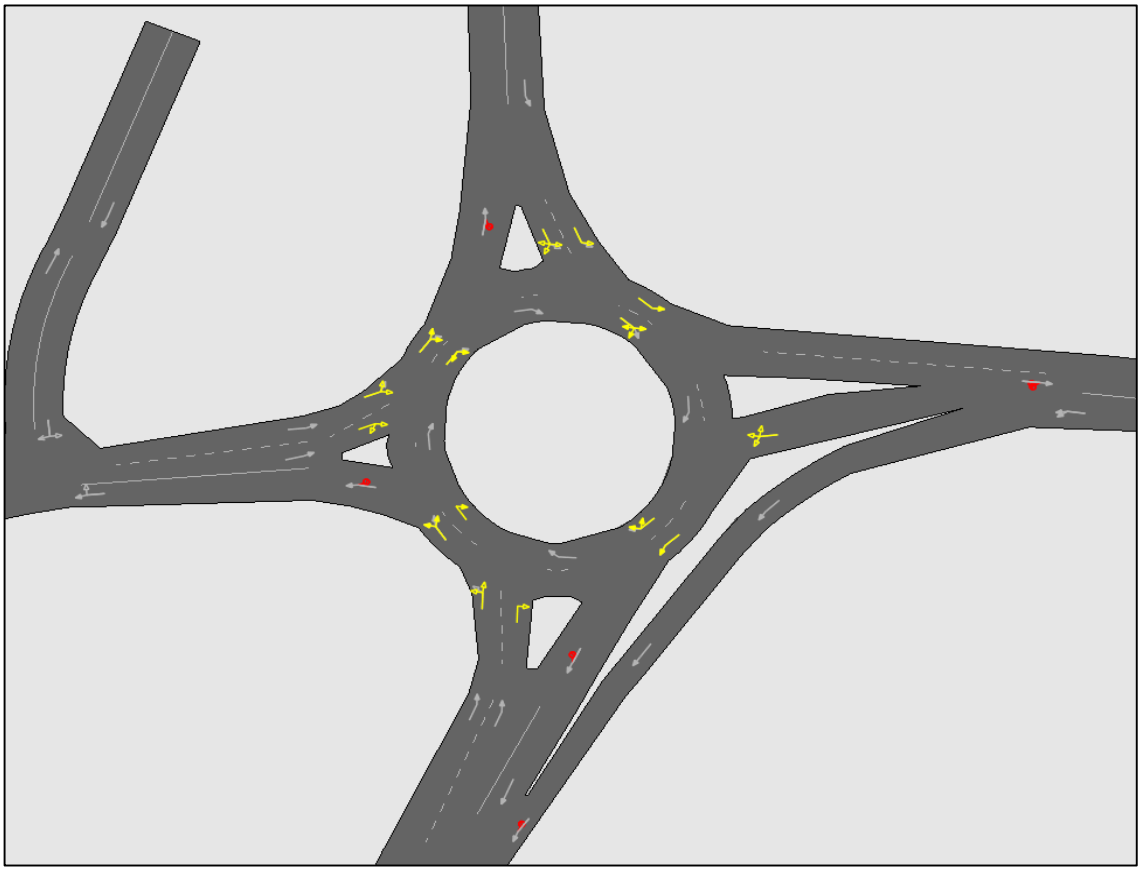
A423/Daventry Rd Roundabout

46. The primary focus of mitigation in this area was the A423/Daventry Rd roundabout, due to the extensive queueing here during both the AM and PM period. Accordingly, mitigation has been added to the A423/Daventry Rd roundabout as follows:

- Daventry Road W entry arm has been widened to two lanes
- Daventry Road E exit has been widened to two lanes

47. The resultant roundabout layout is shown in **Figure 12**.

Figure 12 A423/Daventry Rd Roundabout with Mitigation



48. A visual review of the model operation prior to the inclusion of the mitigation revealed that a high volume of traffic exits the roundabout at the Daventry Rd east arm as well as travel southbound on the A423, from the northern arm of the roundabout.

49. Increasing the lane numbers on the Daventry Road E exit arm allows traffic travelling towards this exit to do so in two lanes, thus increasing the junction throughput.

50. A review of the model operation also revealed high levels of delay on the Daventry Road W entry arm, which is a result of the high volumes of traffic on the circulatory links, particularly a high volume of trips from the A423 S to Daventry Road during the PM period. Accordingly, mitigation has been included in the form of two lanes on the entry to the roundabout from the Daventry Road W approach, to improve capacity for traffic entering the junction from this approach arm.

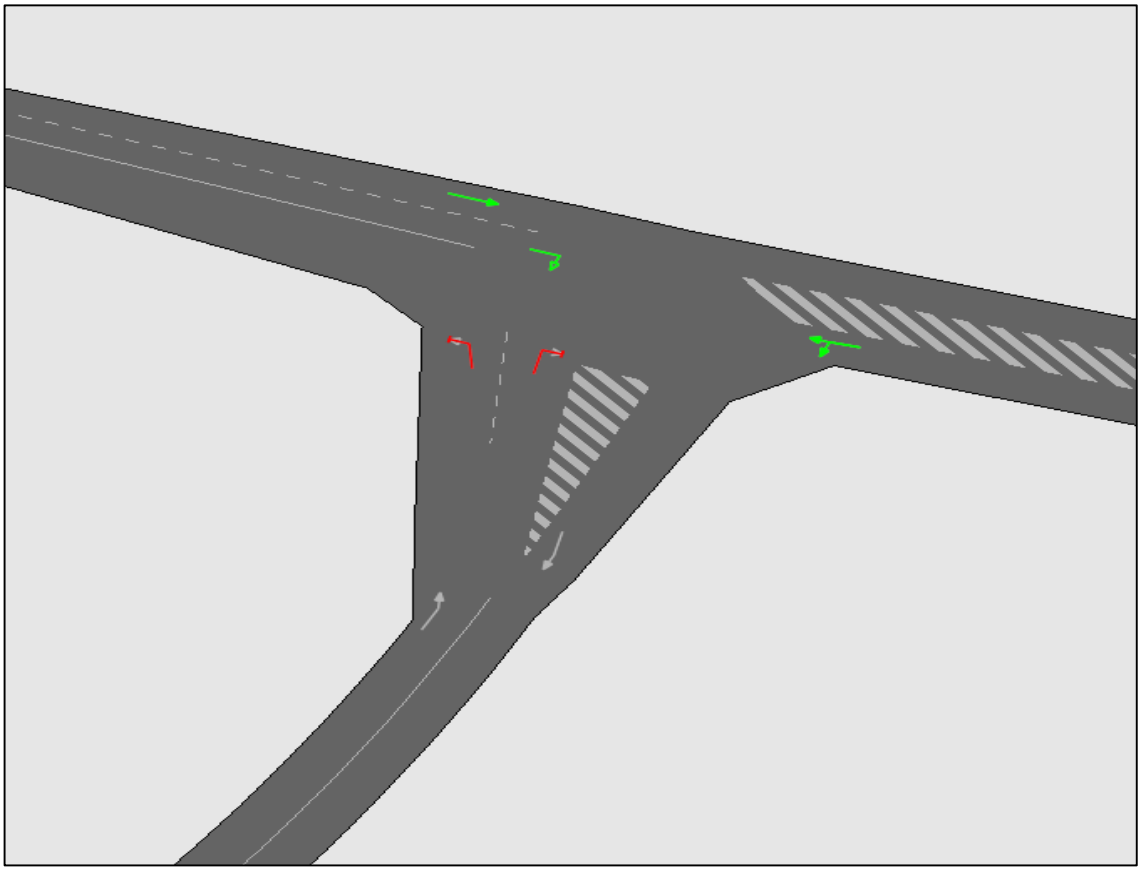
Daventry Road/Welsh Road East Junction

51. To mitigate the large queues that occur on the Welsh Rd East arm of the Daventry Road/Welsh Road East junction, the existing priority junction has been upgraded to a signalised junction.

52. The signal times have been optimised so that in the AM period the northbound arm is allowed enough time to prevent the levels of traffic build up seen prior to the mitigation inclusion. The PM period does not offer as much time to the northbound movements since there is not the same level of congestion here at that time.

53. The Daventry Road/Welsh Road East signalised junction is pictured below in **Figure 13**.

Figure 13 Daventry Road/Welsh Road East Junction with Mitigation



Fosse Way/Southam Rd Roundabout

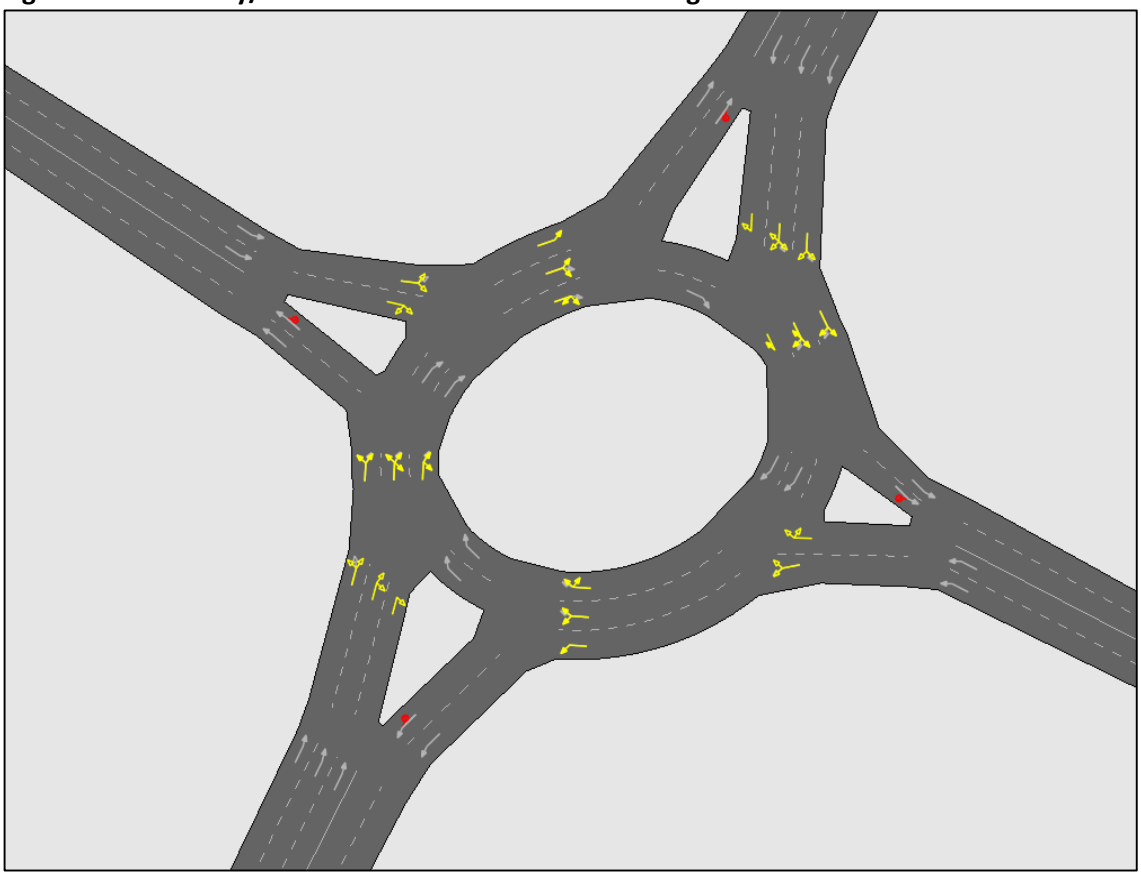
54. Observations of the model operation has revealed that in both AM and PM periods there are increased queue levels at this junction. This is most noticeable on the southbound and the northbound arms.

55. In an attempt to increase the capacity at the roundabout to a level where traffic can move through the junction without causing high levels of queueing, the following mitigation has been added to the Fosse Way/Southam Rd Roundabout.

- Fosse Way S entry arm widened to three lanes
- Circulatory links widened to three lanes

56. The mitigation added accommodates the Fosse Way S to Fosse Way N and Fosse Way S to Southam Road E movements within two lanes, thus increasing junction throughput. The proposed layout is shown in **Figure 14**.

Figure 14 Fosse Way/Southam Rd Roundabout with Mitigation

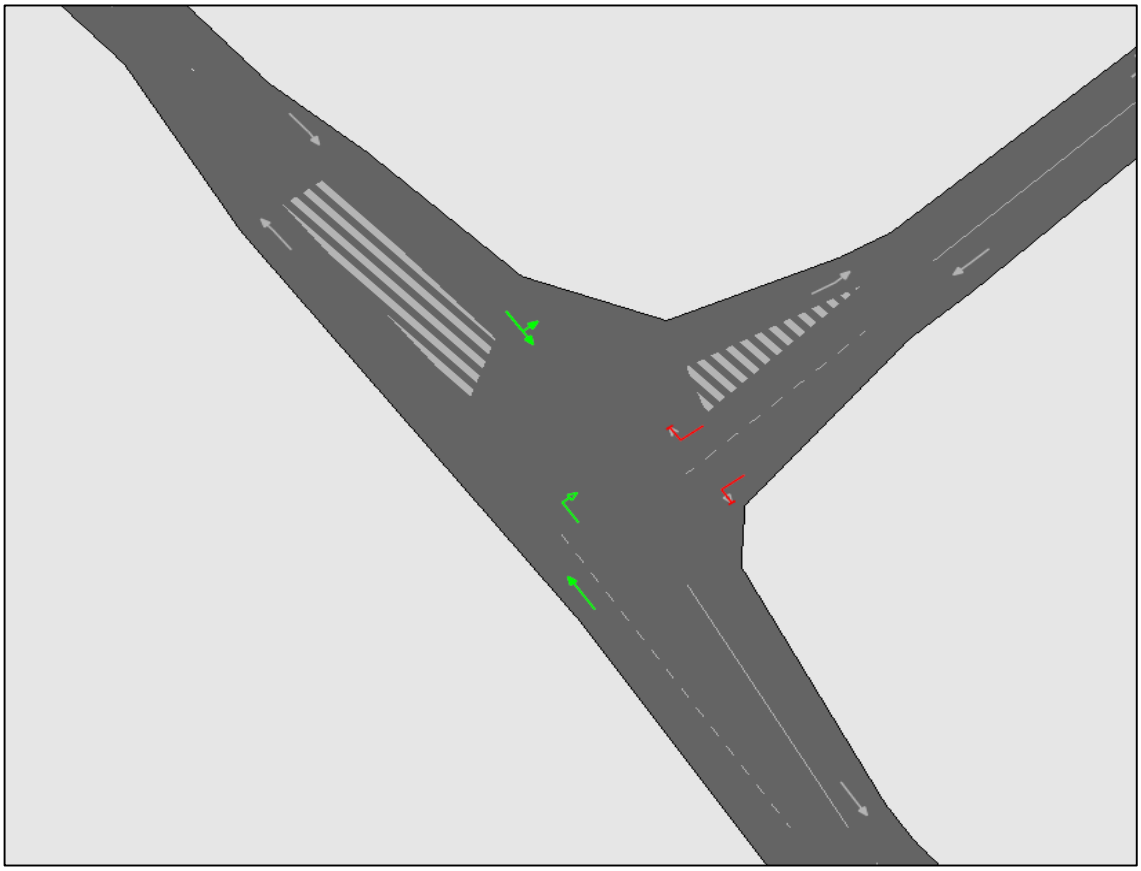


A425/Banbury Road & A425/B4451 Junctions

57. A visual observation of the model operation in this area has indicated that the A425/Banbury Road priority junction is the cause of much of the queueing in this area. There are large queues southbound on Banbury Road leading up to the junction that are unable to find gaps in traffic to travel through the junction. As well as this, despite the right turn bay that is already in place, there is a build-up of traffic attempting to turn right onto Banbury Rd; this blocks traffic back through the A423/A425 roundabout.

58. In an attempt to alleviate the queues caused at the A425/Banbury Rd junction, signals have been added at this location. The signals have been optimised to enable vehicles to exit Banbury Road without causing significant queues to form at this locations, and also to ensure that right turning vehicles from the A425 into Banbury Road do not block the A425 mainline flows. The layout of the mitigation coded within the model is demonstrated in **Figure 15**.

Figure 15 A425/Banbury Rd Signalised Junction



A423 Dualling

59. The mitigation measures introduced at both the A425/Banbury Rd and Welsh Rd E/Daventry Rd junctions resulted in less queueing vehicles at both locations, and accordingly more traffic travelling along the A423 between the A423/A425 roundabout and the A423/Daventry Rd roundabout.

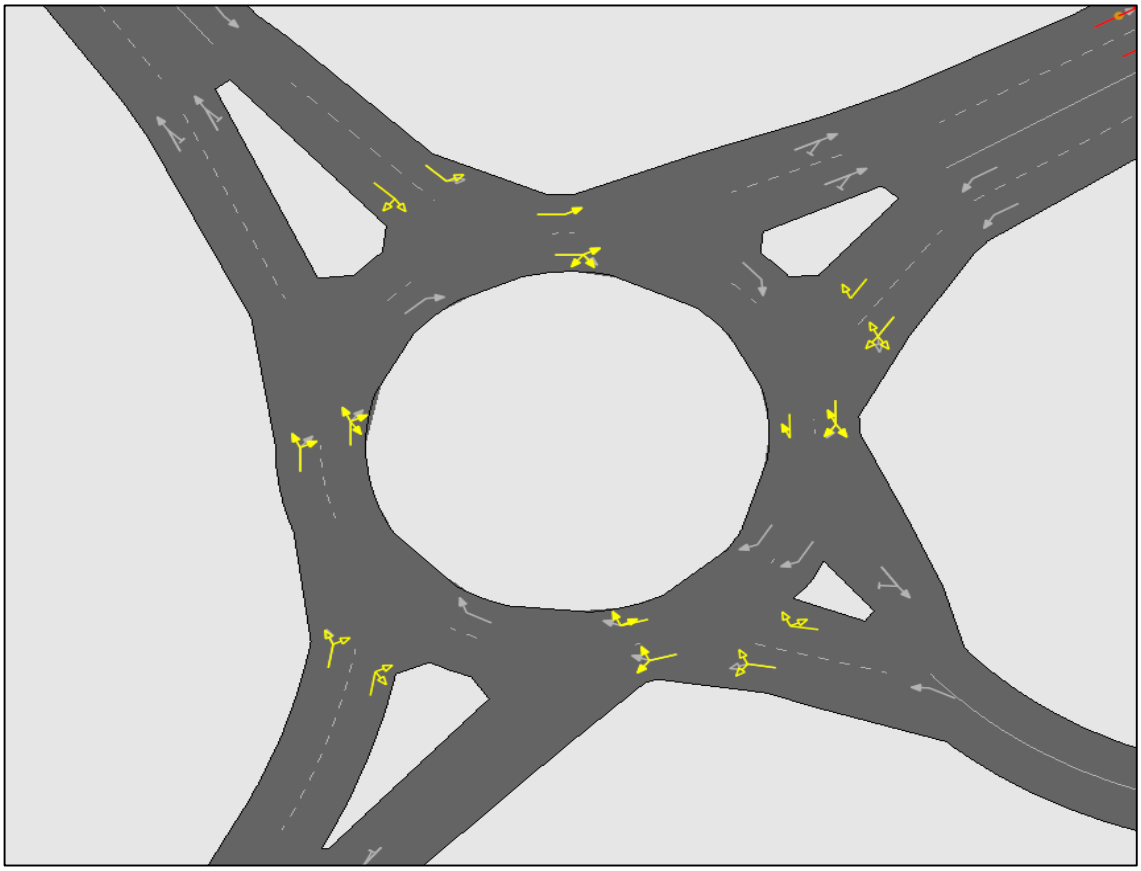
60. A review of the model at this location has revealed that dualling should be included, in both directions, on this section of the A423, to increase capacity and improve traffic flows in this area.

A423/A425 Roundabout

61. As a result of upstream mitigation the traffic flow through the A423/A425 roundabout was improved, with increased throughput. An effect of this was to restrict gaps in the vehicle flow for trips from the Galanos House arm to get onto the network, which highlighted the need for mitigation at this location to accommodate the flows from the Site Adjacent to Banbury Rd development, which enters the junction from the Galanos House arm.

62. Accordingly, this entry arm has been upgraded to two lanes, as shown in **Figure 16**.

Figure 16 A423/A425 Roundabout with Mitigation

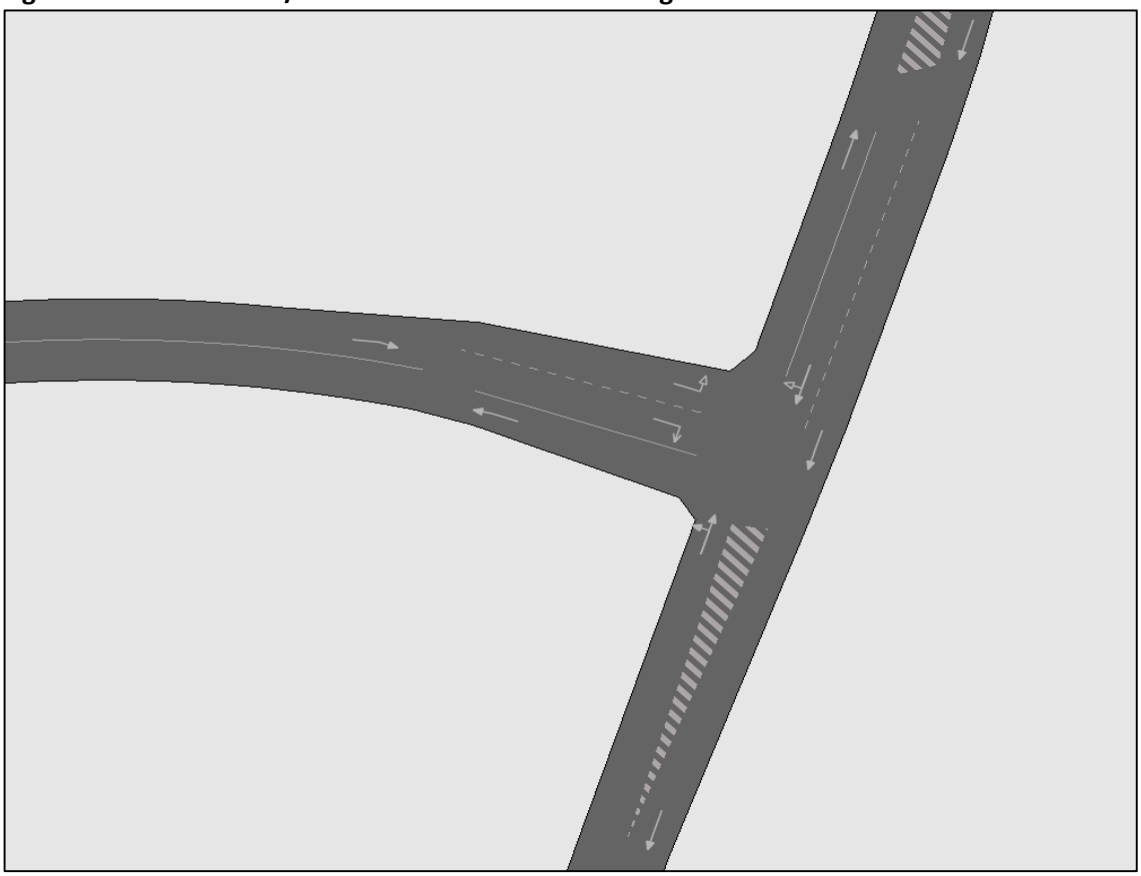


B4451/Northfield Road Junction

63. The model review identified congestion issues occurring at the A425/B4451 junction, which on closer inspection was a direct result of the queues that form on the B4451 southbound approach to the B4451/Northfield Road junction. The queues are seen building on the B4451 southbound, as a result of traffic attempting to turn right blocking back on the B4451 mainline.

64. As a mitigation measure a right turn bay has been introduced so that vehicles waiting for a gap in traffic to turn right into Northfield Rd do not block vehicles travelling southbound through the junction. Additional to this, Northfield Rd has been widened to two lanes, with separate lanes for left and right turning vehicles exiting Northfield Rd. **Figure 17** shows the improved Northfield Rd/Kineton Rd junction.

Figure 17 Northfield Rd/Kineton Rd Junction with Mitigation



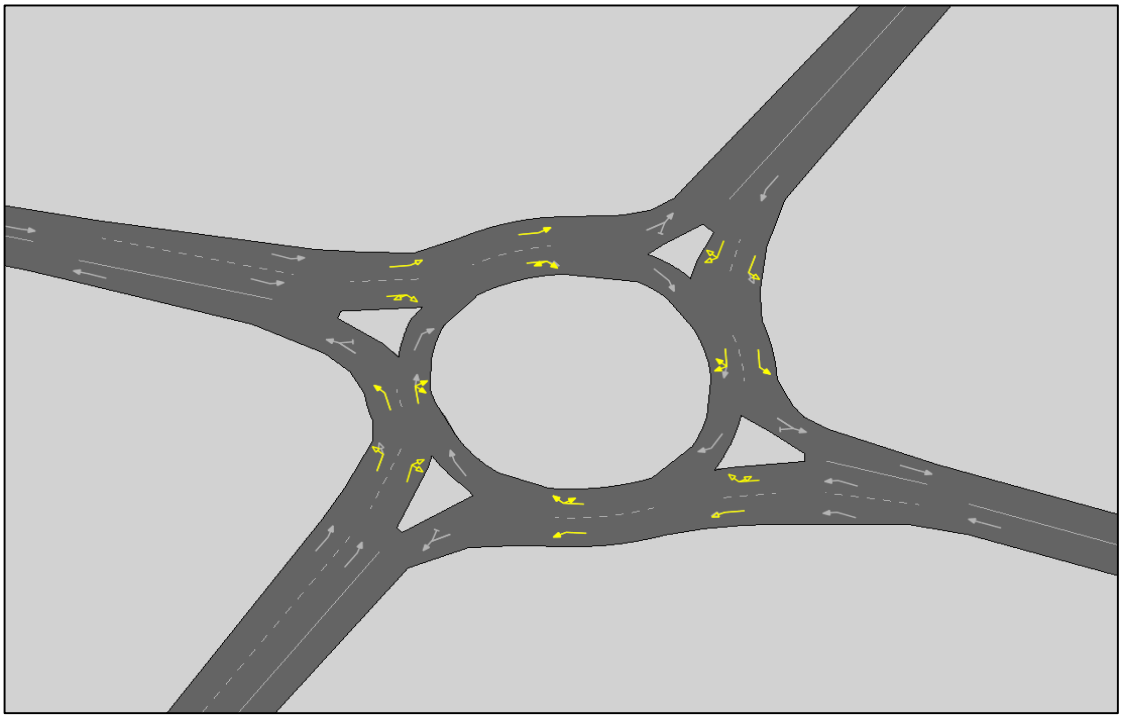
A425/B4452 Junction

65. The queueing impact observed at this junction was directly related to traffic being unable to find sufficient gaps in flow on the A425 to exit the B4452 approach arm. Accordingly queues form on the B4452. Also traffic turning right from the A425 western arm cause the mainline flow on the A425 to block whilst waiting for a gap in the westbound traffic, despite the inclusion of a right turn lane on this approach.

66. As a result, mitigation has been included in the form of a new roundabout in this location. The roundabout incorporates the nearby A425/Bascote Rd junction to form a four arm roundabout. This roundabout will allow vehicles entering the A425 from the B4452, as well as traffic turning from the A425 to the B4452 to do so without restricting traffic flows as previously observed.

67. The roundabout mitigation scheme configuration is shown in **Figure 18**.

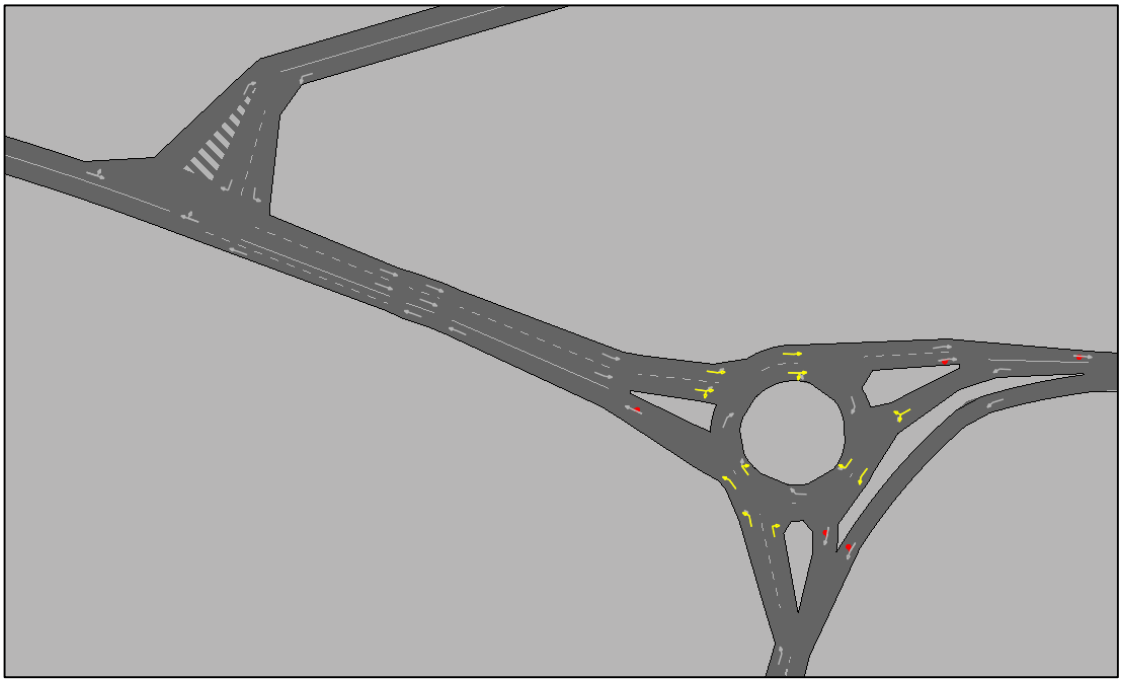
Figure 18 A425/B4452 Roundabout Mitigation



Warwick Rd/Leamington Rd Priority Junction

68. To improve the traffic flow at the Warwick Rd/Leamington Rd priority junction the eastbound exit of the Leamington Rd/A425 has been increased to two lanes, and some of the roundabout lanes have been revised. Additionally, Leamington Rd has been increased to two lanes eastbound between Warwick Rd and the Leamington Rd/A425 roundabout to accommodate the high levels of traffic flow thought this area and to allow space traffic turning left from Warwick Rd to Leamington Rd.

Figure 19 – Warwick Rd/Leamington Rd Mitigation



Mitigation Summary

69. To accommodate the additional Reserve Sites demands within the 2031 Core Strategy model requires a range of mitigation measures to enable the network to operate at a satisfactory level.

70. The following list and plot summarises all infrastructure alterations that have been included in order to improve the conditions in the network.

Scheme 1 - A423/Daventry Road Roundabout - Daventry Road W entry arm widened to two lanes, Daventry Road E exit arm widened to two lanes.

Scheme 2 - Daventry Road/Welsh Road East Junction - Priority junction altered to a signalised junction.

Scheme 3 - Fosse Way/Southam Rd Roundabout – Fosse Way S entry arm widened to three lanes, along with sections of the circulatory.

Scheme 4 - A425/Banbury Road Junction – Priority junction altered to a signalised junction

Scheme 5 - A423 – Dualling on both northbound and southbound carriageways between A423/A425 roundabout and A423/Daventry Road junction.

Scheme 6 - A423/A425 Roundabout – Galanos House entry arm widened to two lanes.

Scheme 7 - B4451/Northfield Road Junction – Right turn bay introduced on B4451 N arm, Northfield Rd widened to two lanes.

Scheme 8 - A425/B4452 Junction – Junction upgraded to a four arm roundabout.

Scheme 9 – Leamington Rd/A425 – Leamington Road approach increased to two lanes and A425 Exit increased to two lanes

Figure 20 Identified Mitigation Scheme Locations

Mitigation Impacts

71. In order to quantify the benefits of the mitigation measures introduced within the model network, headline statistics have been extracted and presented for comparison from the following models:

- Southam 2031 Core Strategy
- Southam 2031 Core Strategy + Reserve sites with 10% Mode Shift
- Southam 2031 Core Strategy + Reserve sites with 10% Mode Shift + Mitigation

72. The following figures compare key aspects of the network wide statistics, extracted from the models listed above.

Figure 21 Network Statistics: Average Journey Time

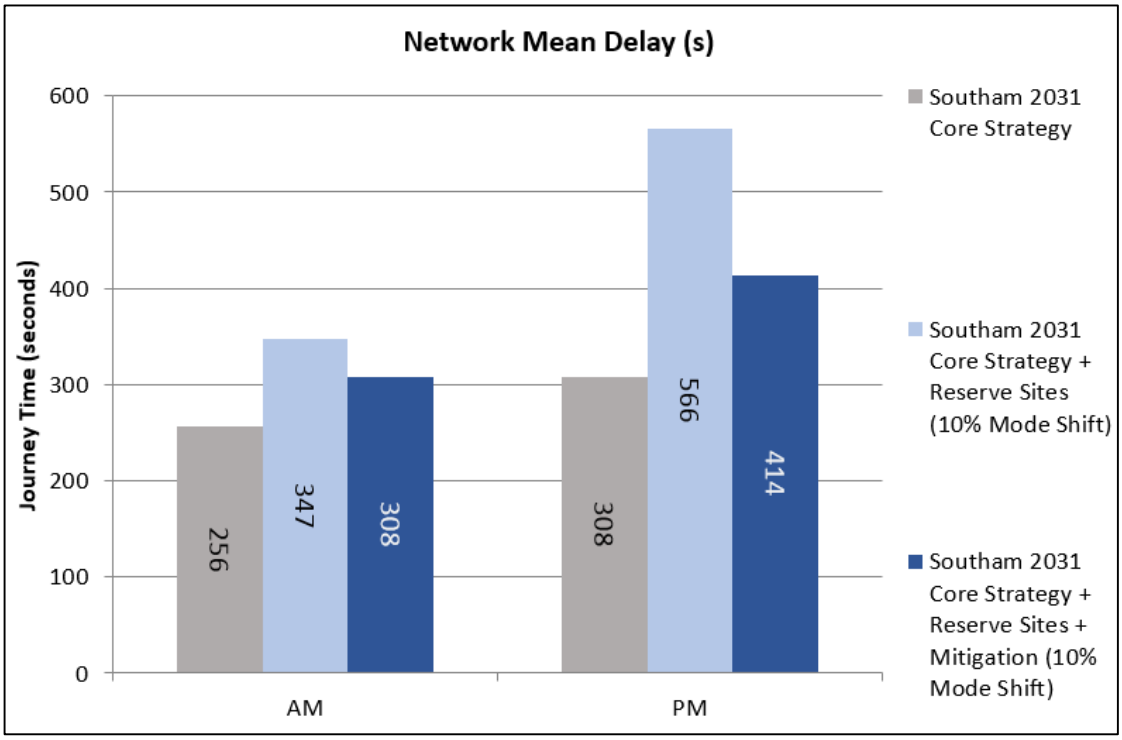
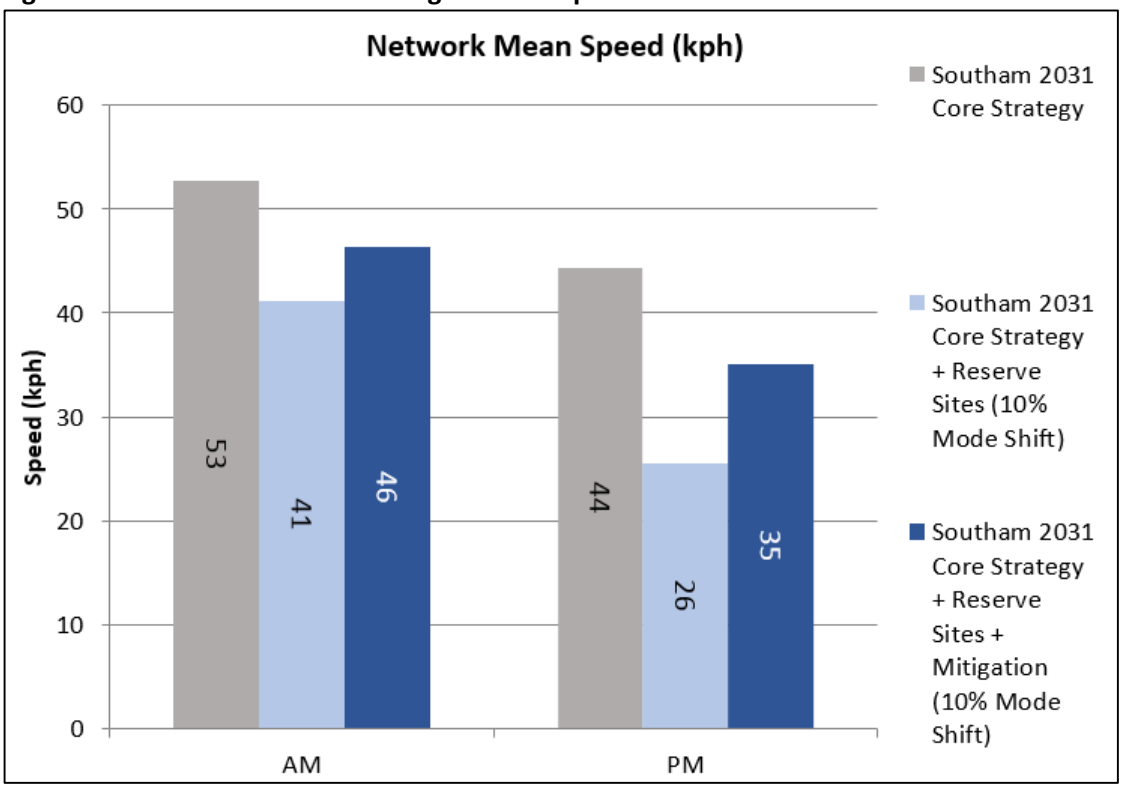


Figure 22 Network Statistics: Average Vehicle Speed



73. The network statistics shown in **Figure 21** and **Figure 22** demonstrate that the introduction of the Reserve Sites significantly worsened network delay and speed conditions across the AM and PM period.

74. The results demonstrate that, with the introduction of the Reserve Sites, the average journey time increases by 91 seconds in the AM period and 258 seconds in the PM period (more than 4 minutes).

75. Introducing the mitigation measures has improved network delay conditions, when compared against the no mitigation scenario. With the mitigation included, the effect of the Reserve Sites upon the average journey time is a 52 second increase in the AM period and a 106 second (less than 2 minutes) increase in the PM period, when compared to Core Strategy conditions.

76. Further to this comparison of network wide delay and speeds, analysis has been undertaken of the queueing impact in the Reserve Sites + Mitigation scenario. The impact on queue lengths across the model have been compared with those in the 2031 Core Strategy scenario, in **Figure 23** and **Figure 24**.

Figure 23 Average Maximum Queue Difference Plots 2031 Core Strategy Vs 2031 Core Strategy + Reserve Sites + Mitigation – AM Period

Figure 24 Average Maximum Queue Difference Plots 2031 Core Strategy Vs 2031 Core Strategy + Reserve Sites + Mitigation – PM Period

77. Although it appears that there are still some areas where there is a moderate increase in queue lengths, the queue analysis shown in **Figure 23** and **Figure 24** indicates that the mitigation measures are beneficial to the operation of the network when compared to the queue analysis conducted prior to the introduction of mitigation (**Figure 9** and **Figure 10**). The results suggest that once the mitigation is included on the network, there are no instances of queue increases above 50 vehicles when compared to 2031 Core Strategy conditions.

78. This analysis indicates that the mitigation included goes a long way to mitigating the impact of the Reserve Sites within the 2031 Core Strategy network. Although delay and queueing increases continue to occur, the impact is moderate across the AM and PM period.

Mode Shift Testing

79. Following on from the capacity constraints detailed above, a further set of tests have been developed, which focus on the impact associated with a further reduction in the volume of trips generated by each of the Reserve Sites, through the application of alternative mode shift assumptions. This is to ascertain whether a reduction in the car mode share could negate the requirement for the mitigations schemes detailed within this Note.

80. As previously detailed within this Note, a 10% car reduction has been applied to all demands associated with the Reserve Sites included within the 2031 Core Strategy model. The assessment so far has indicated a further mode shift may need to be realised, to enable the network to operate without significant congestion.

81. As such testing has been undertaken, which further reduces the car mode share from a 10% reduction in the original 2031 Core Strategy + Reserve Sites scenario, to a 20% and 30% car share adjustment.

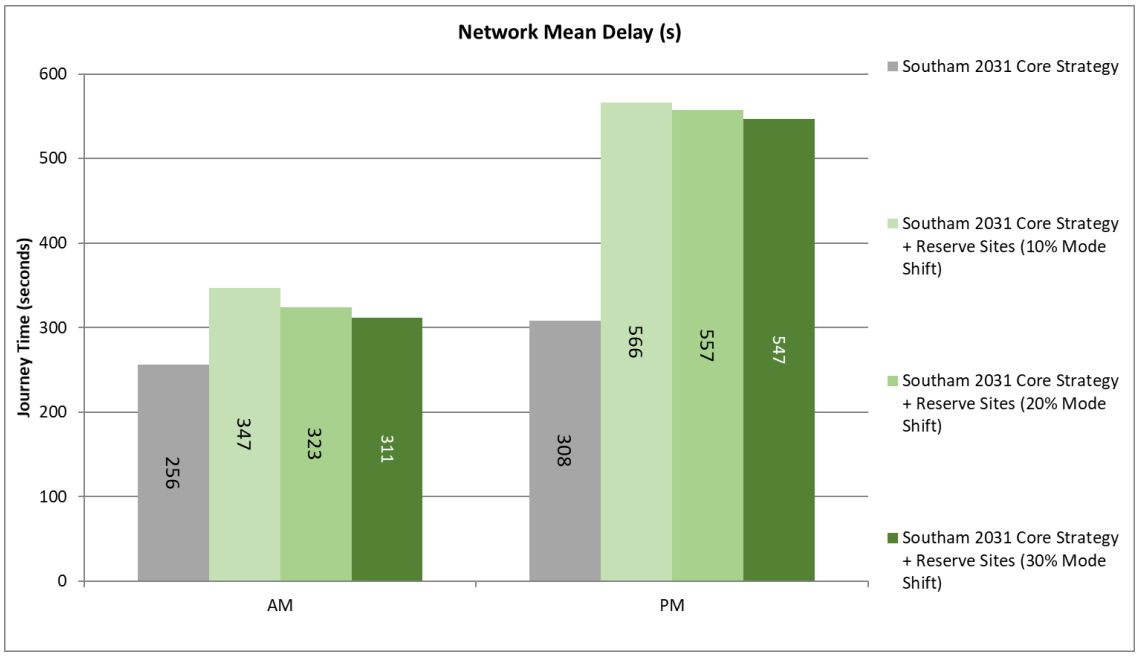
82. Accordingly, the following scenarios have been run:

- 2031 Core Strategy + Reserve Sites 20% Car Mode Reduction
- 2031 Core Strategy + Reserve Sites 30% Car Mode Reduction

83. The intention of this testing is to determine the point at which the model congestion profile becomes stable, and the network wide delay is not significantly higher than the 2031 Core Strategy scenario.

84. The following section presents the network wide average journey times in each of the scenarios tested:

Figure 25 Network Statistics: Average Journey Time with Mode Shift



85. The analysis presented in **Figure 25** demonstrates that with the addition of the Reserve Sites to the network, the average delay increases by 91 seconds per journey in the AM period and 258 seconds per journey in the PM period, compared to the 2031 Core Strategy scenario.

86. The scenarios containing the adjusted mode shift assumptions reduce this level of delay, however, these reductions in delay are very minor. With a 30% car reduction from the Reserve Sites, the additional delay per journey is around 55 seconds per journey in the AM period, and 239 seconds per journey in the PM period, when compared to the 2031 Core Strategy scenario.

87. The results clearly demonstrate that despite as high as a 30% car mode shift reduction, the impact on the modelled network of including the Reserve Sites demands is significant in

terms of the increase in delays. The analysis indicates that the mitigation previously identified is likely to be critical for achieving the delivery of the identified Reserve Sites.

South Leamington Model Assessment

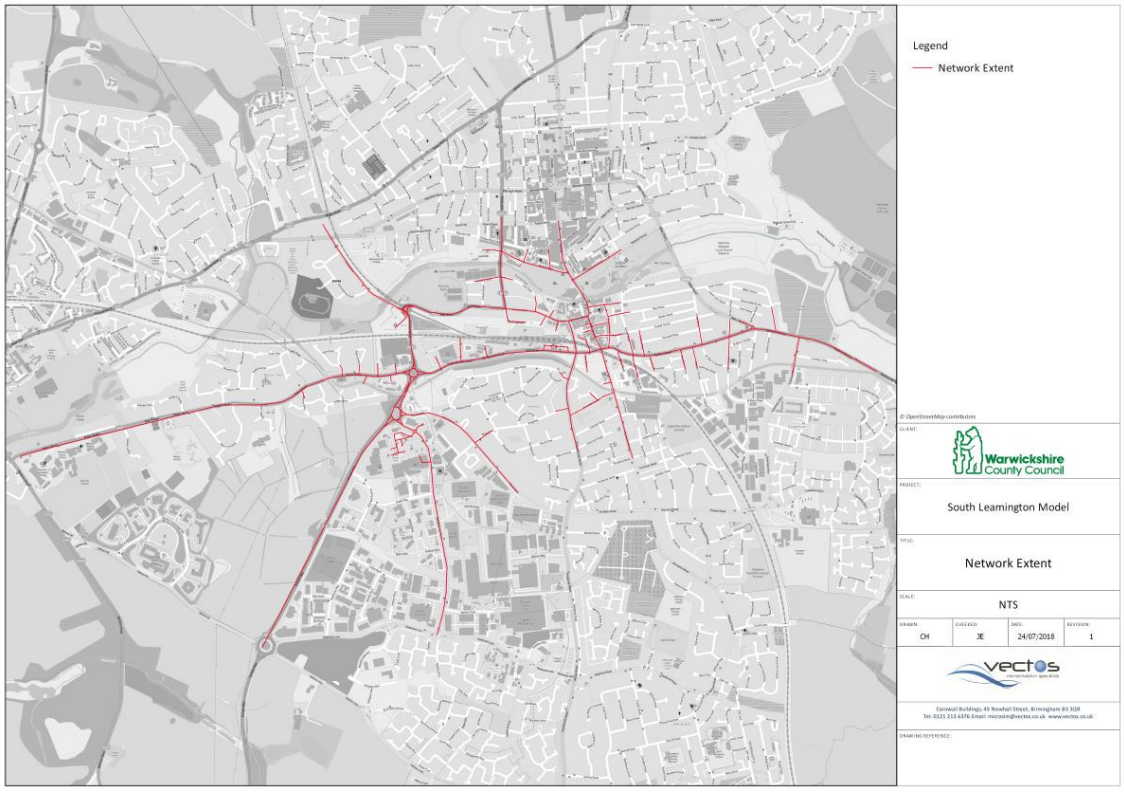
88. Previously, when Southam developments were considered in the lead-up to the Core Strategy Examination hearings, it was considered appropriate to test the development impacts within the South Leamington model, with particular attention afforded to the network performance around Sydenham Drive and also the Bath Street area.

89. It is expected that the performance of the network in these areas, once the Reserve Sites are included within the Southam model, will again require assessment, with the objective of determining the appropriate level of mitigation to be delivered within the Warwick District transport network.

90. The extent of the South Leamington model is illustrated within **Figure 26**. The 2025 South Leamington Reference Case has been used for this assessment, as this year is already available.

91. The Reserve Sites and Core Strategy demands developed in the Southam model assessment, which enter and exit the Southam model from the Leamington direction have been fed into the South Leamington model.

Figure 26 South Leamington Model Extent



92. Mobile Network Data, used to advise trip distribution for the Reserve Site demands, indicates that around 15% of the Reserve Site and 15% of the Core Strategy traffic generated

within the Southam modelling will travel to or from Leamington Spa via routes covered in the South Leamington model network.

93. To assess the impacts that the delivery of the Southam Reserve Sites on the South Leamington Spa network 15% of the Reserve Sites and Core Strategy demands from within the Southam modelling have been fed into the 2025 South Leamington model.

94. Accordingly, the following tests have been undertaken.

- 2025 South Leamington Model
- 2025 South Leamington Model + Core Strategy + Reserve Sites
- 2025 South Leamington Model + Core Strategy + Reserve Sites + Mitigation

95. The following tables detail the number of either Reserve Sites, or Core Strategy trips that have been included within the South Leamington model.

Table 5 – Reserve Site Trips applied to South Leamington model

Time	Entering Model	Exiting Model	Total
07:00-08:00	15	92	107
08:00-09:00	33	114	147
09:00-10:00	25	41	66
16:00-17:00	68	35	103
17:00-18:00	100	38	138
18:00-19:00	81	41	122

Table 6 – Core Strategy Trips applied to South Leamington model

Time	Entering Model	Exiting Model	Total
07:00-08:00	35	41	76
08:00-09:00	50	33	83
09:00-10:00	18	11	28
16:00-17:00	47	30	77
17:00-18:00	71	44	114
18:00-19:00	38	26	65

Table 7 – Combined Trips applied to South Leamington model

Time	Entering Model	Exiting Model	Total
07:00-08:00	49	133	182
08:00-09:00	83	148	230
09:00-10:00	43	52	94
16:00-17:00	115	65	180
17:00-18:00	171	81	252
18:00-19:00	119	67	186

96. It has been determined that the most suitable zone to assign the Reserve Site trips to, within the South Leamington model is Zone 41. This is an external zone on Radford Road, which represents the most likely route that would be used when travelling between South Leamington and Southam.

97. The demands assigned to Zone 41 have been distributed within the South Leamington network based on the existing zone to zone distribution patterns applied within this model.

Network Impacts

98. Following the inclusion of the Reserve Site demands within the 2025 South Leamington network, a review of the model operation was undertaken in order to ascertain the areas of impact, and the model stability.

99. In order to review the model stability the congestion profile of the model simulation has been assessed, along with a visual review of the model operation. A typical congestion profile would indicate a build-up of traffic toward the peak hour, before traffic dissipates away in the final hour of the simulation. A run is considered 'failed' if this build-up of traffic constantly grows throughout the modelled period.

100. The congestion profile of the 2025 South Leamington + Reserve Sites model has been provided in **Figure 27** and **Figure 28** for the AM and PM simulation periods respectively, based upon 10 AM and 10 PM model runs.

Figure 27 AM Congestion Profile – 2025 South Leamington + Reserve Sites

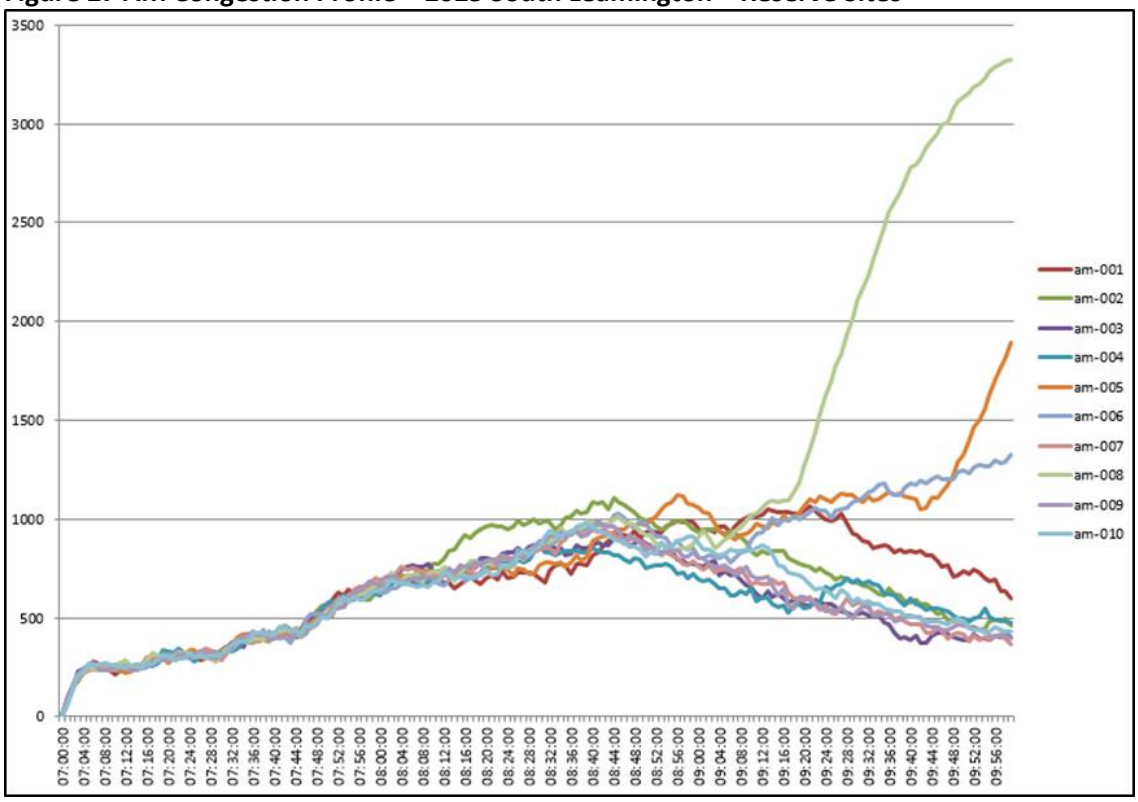
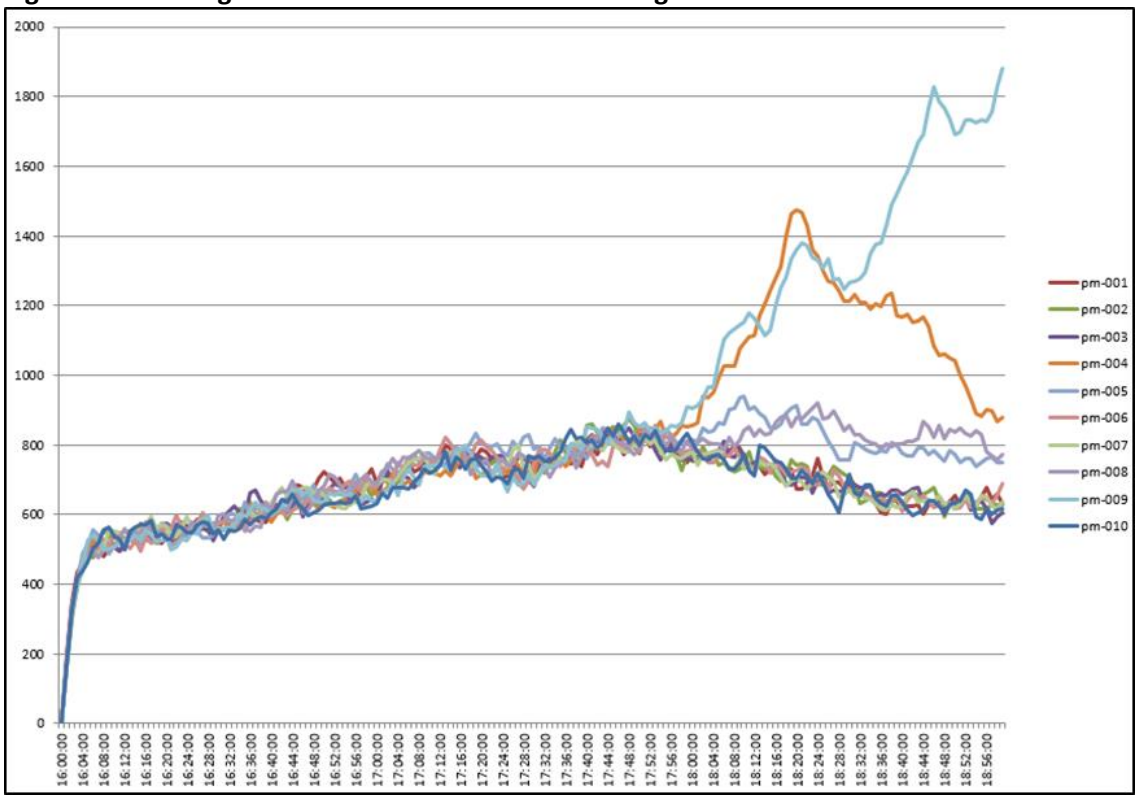


Figure 28 PM Congestion Profile – 2025 South Leamington + Reserve sites



101. A review of the congestion profiles, along with a visual review of the model operation, indicates that the model is unstable in both the AM and PM period once the Reserve Sites demands are included. In both periods there are multiple failed runs, indicating that the introduction of the Reserve Site demands results in increased model instability.

102. A visual review of the model operation highlighted that there are two areas of significant congestion during the AM and PM peak hours. The impact modelled is shown in **Figure 29** and **Figure 30**.

Figure 29 Network Congestion, AM Peak Hour

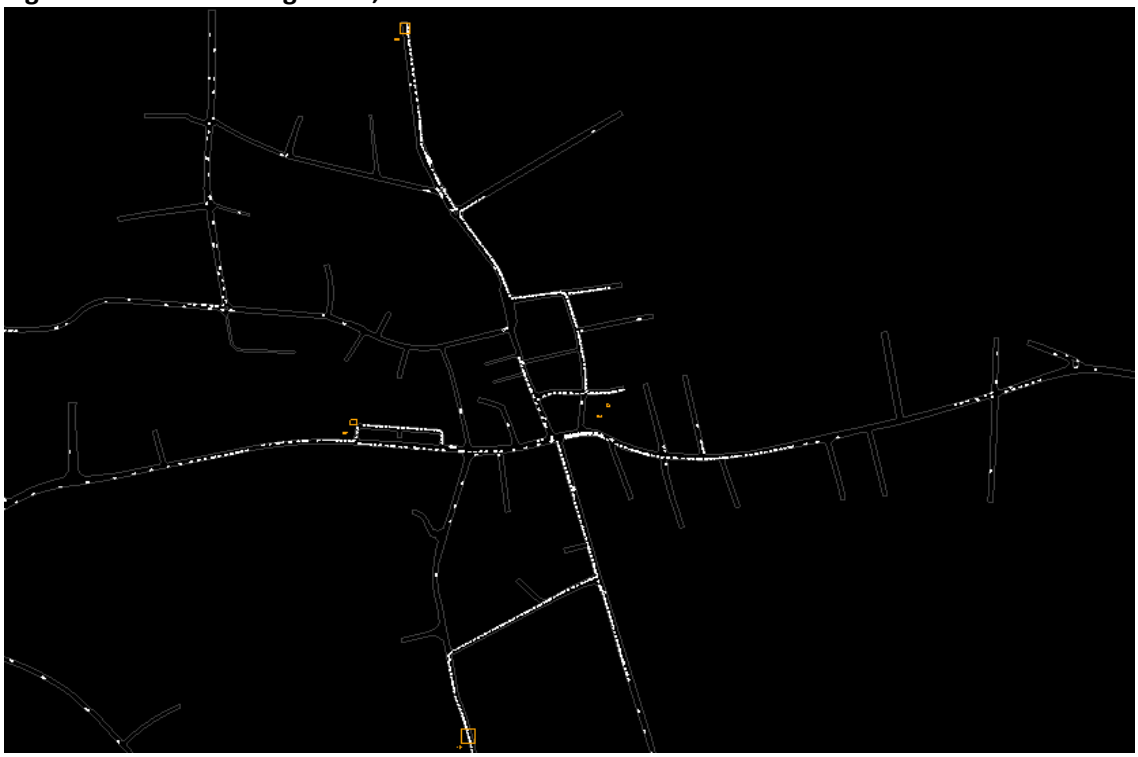


Figure 30 Network Congestion, PM Peak Hour

103. The AM model review indicates significant congestion issues are predicted to occur around the Bath Street Gyratory, whilst the PM review suggests significant congestion at A425/A452 Foundry roundabout and Shires (now known as Leamington) Retail Park roundabout.

104. Existing mitigation scheme designs within the South Leamington area are available to be utilised in the areas shown in **Figure 29** and **Figure 30.** Details on these schemes are provided within the following:

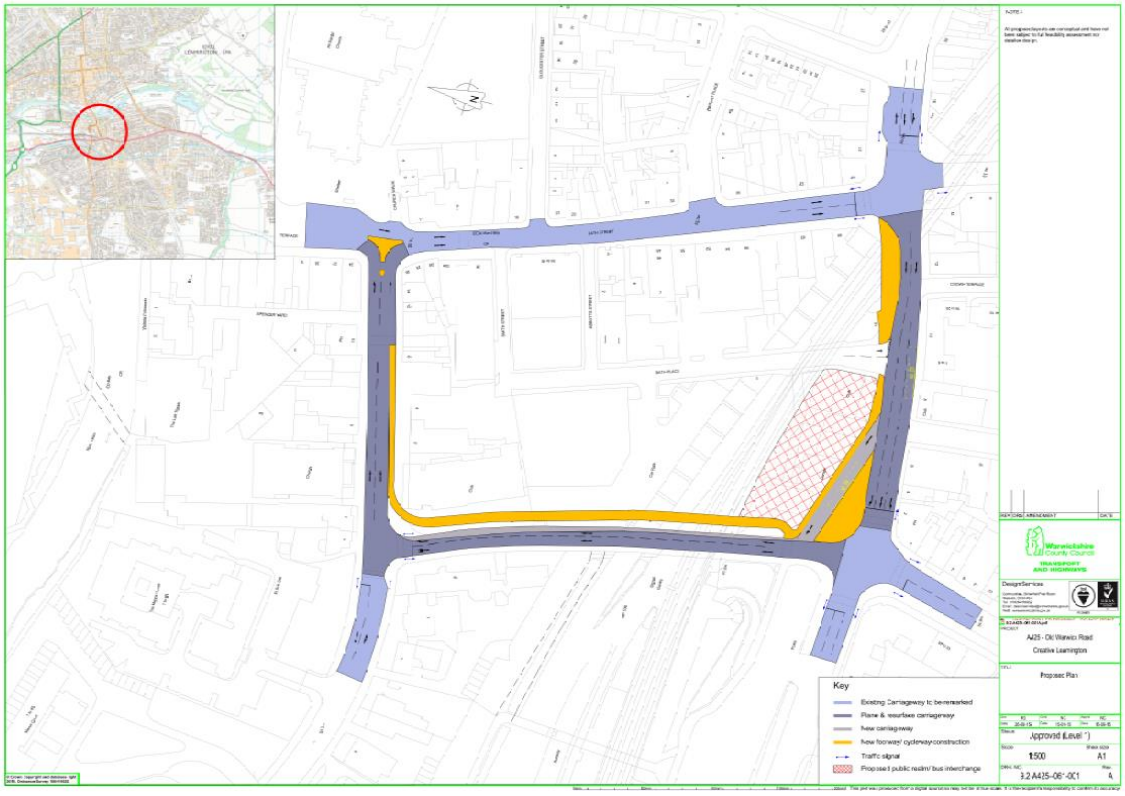
Bath St Gyratory Scheme Details

105. The Bath St Gyratory scheme contains the following network changes around the Gyratory:

- Part of Spencer St converted to one way westbound
- Part of High St converted to one way eastbound
- Segregated bus lane from High St to Lower Ave
- High St eastbound upgraded to three lanes

106. The revised Bath Street Gyratory is shown below, in **Figure 31**.

Figure 31 Bath St Gyratory



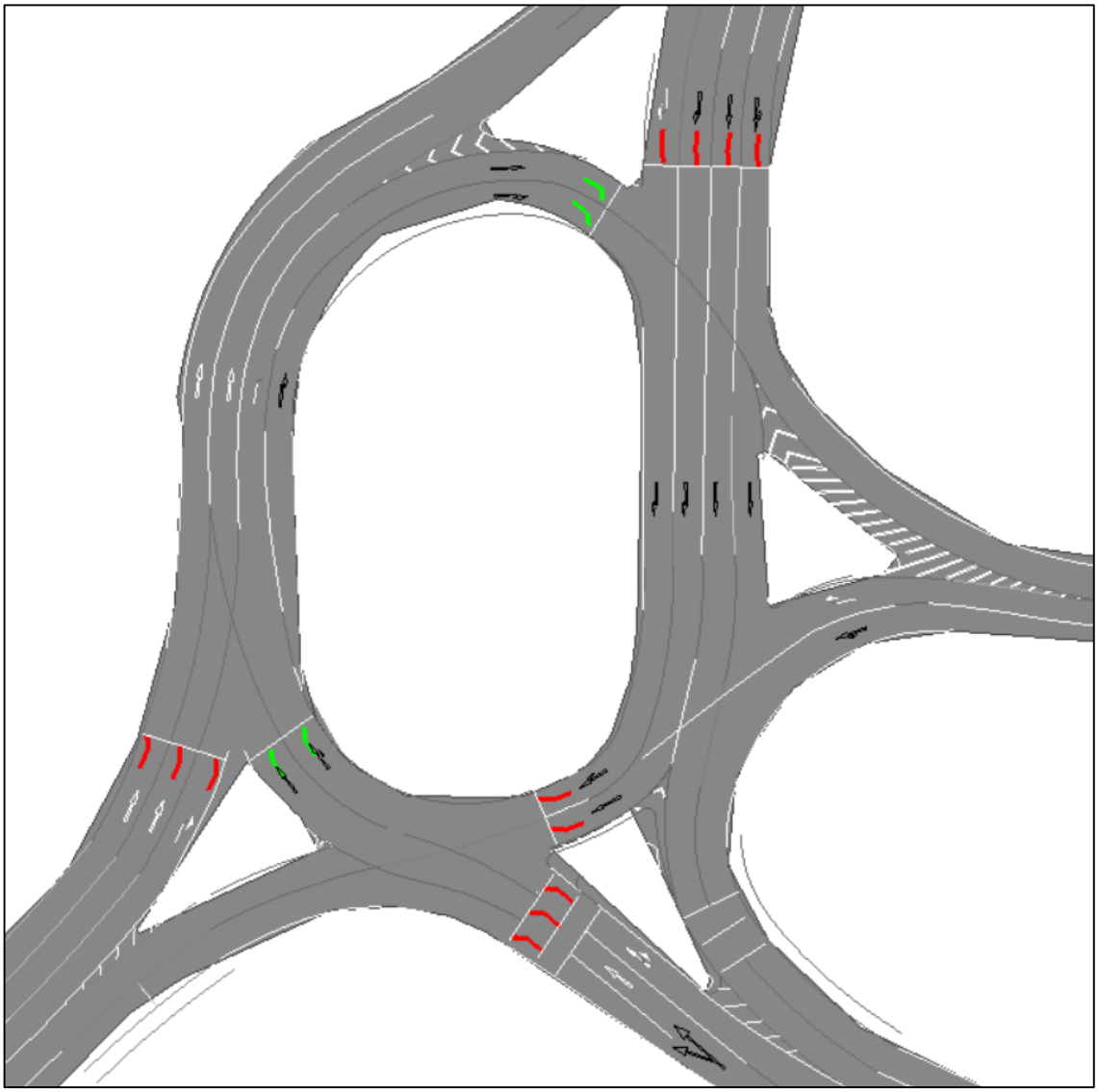
Shires Retail Park Roundabout Scheme Details

107. The mitigation at the Shires Retail Park consists of the following network changes:

- Europa Way NB arm upgraded to three lanes entry and two lanes exit
- Parts of the circulatory upgraded to 4 lanes, where needed
- Europa Way SB entry arm upgraded to four lane entry
- Major arms signalised

108. The Shires Roundabout Scheme is visualised in **Figure 32**, below.

Figure 32 Shires Roundabout



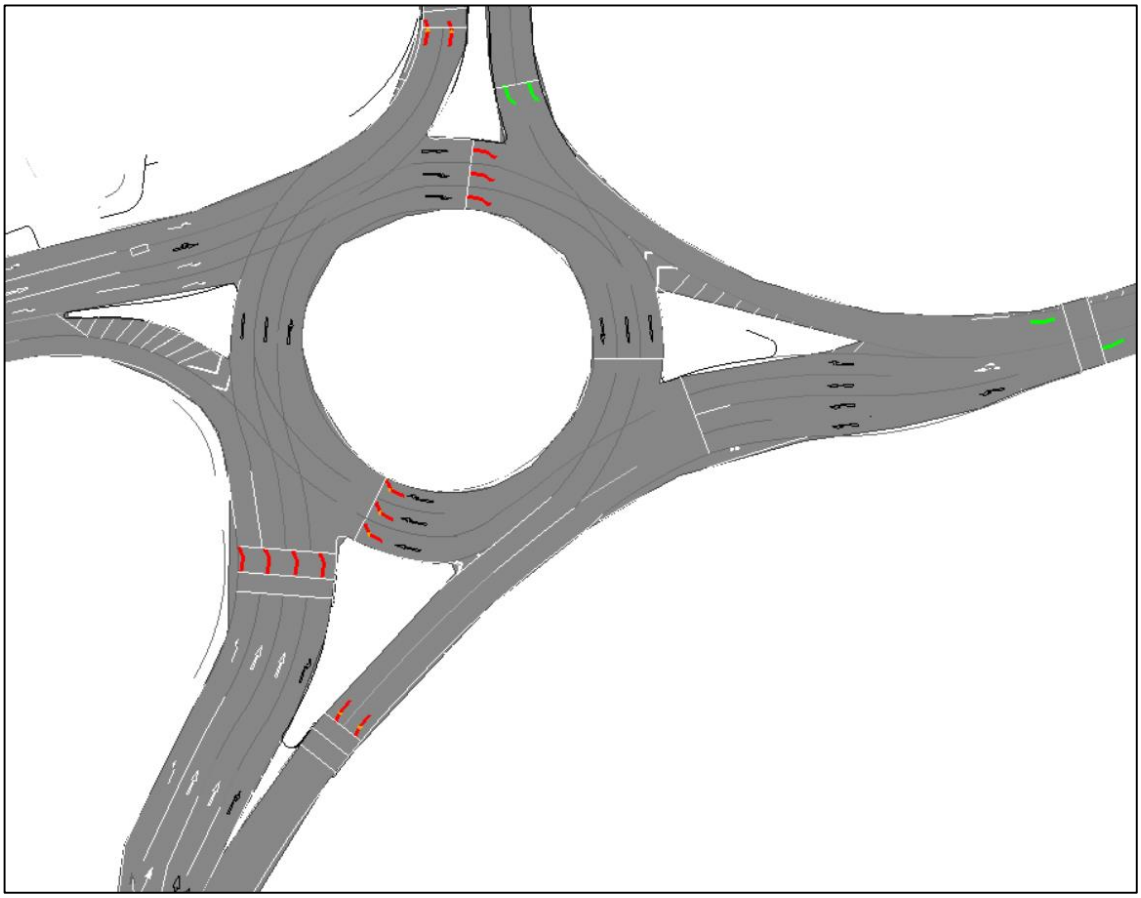
Foundry Roundabout Scheme Details

109. Foundry Roundabout mitigation scheme involves the following newtwork changes:

- Europa Way NB entry arm widened to four arms
- Myton Road EB entry arm widened to four arms
- Old Warwick Rd entry arm widened to four arms
- Additional lane on circulatory
- Major arms signalised

110. The mitigation described regarding the Foundary Roundabout is shown in **Figure 33**.

Figure 33 Foundry Roundabout



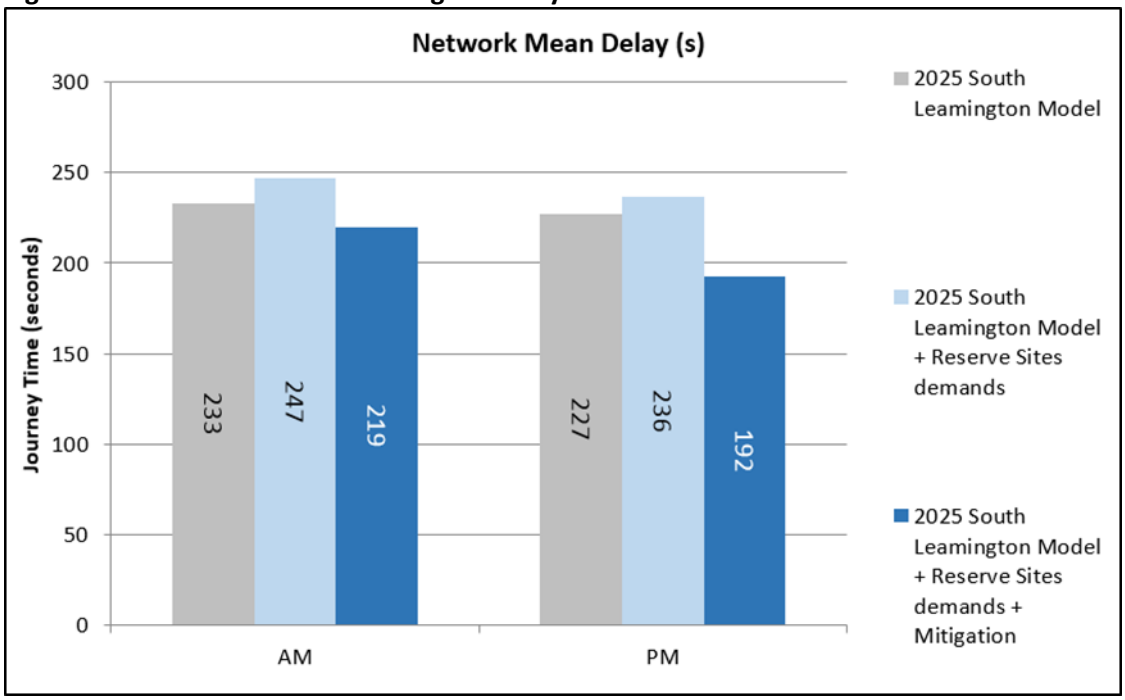
Network Mitigation Impacts

111. In order to quantify the benefits of the mitigation measures introduced within the South Leamington model network, queue analysis and headline statistics have been extracted and presented for comparison from the following models:

- 2025 South Leamington Model
- 2025 South Leamington Model + Reserve Sites
- 2025 South Leamington Model + Reserve Sites + Mitigation

112. The following network wide average delay results have been extracted from the models listed above.

Figure 34 Network Statistics: Average Journey Time



113. The network statistics shown in **Figure 34** demonstrate that the introduction of the potential Reserve Sites worsens network delay conditions across the AM and PM period.

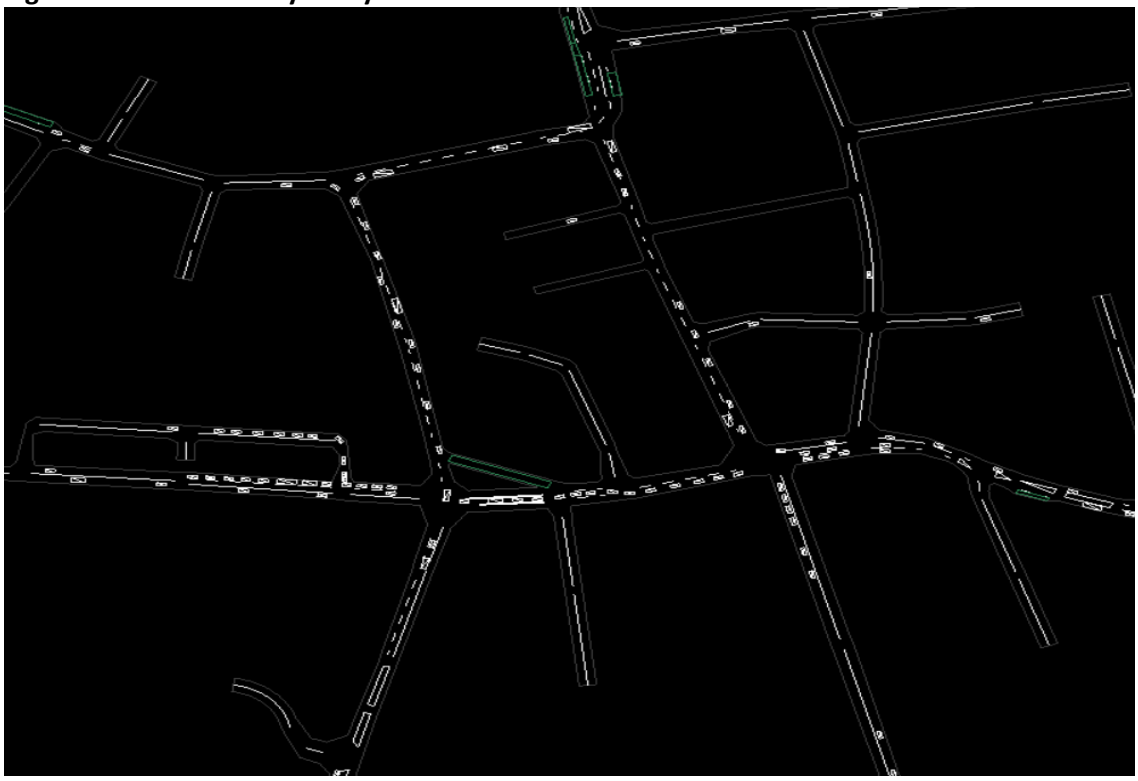
114. The results demonstrate that, with the introduction of the Reserve Sites, the average journey time increases by 13 seconds in the AM period and 5 seconds in the PM period.

115. Introducing the mitigation measures has improved network delay conditions, when compared against the no mitigation scenario, and Reference Case conditions. With the mitigation included, average journey times reduced by around 20 seconds during the AM period when compared to the Reference Case conditions, and approx. a 40 second reduction in the PM period.

116. Further to this comparison of network wide delay, a visual review of the 2025 South Leamington Model + Reserve Sites + Mitigation has been undertaken, with a particular focus on the parts of the network where mitigation has been applied.

117. The following figures provide snapshots from the model in the areas where congestion was most noticeable prior to any mitigation being included.

Figure 35 Bath Street Gyratory – AM Peak Hour



118. The snapshot provided in **Figure 35** demonstrates the model performance in the Bath Street Gyratory area of the network, once the mitigation has been included, during the previously congested AM period. The model operates with significantly reduced levels of congestion within this area, with the scheme mitigating the delay and model instability previously commented upon.

Figure 36 Shire Retail Park and Foundry Roundabouts – PM Peak Hour

119. The snapshot provided in **Figure 36** demonstrates the model performance in the Shires Retail Park and Foundry roundabout area of the network, once the mitigation has been included, during the previously congested PM period. The model operates with significantly reduced levels of congestion within this area, with the scheme mitigating the delay and model instability previously demonstrated in this part of the network.

South Leamington Assessment Summary

120. This part of the assessment has focused upon the impact of including the Southam Reserve Sites and Core Strategy trips within the South Leamington model network, in order to ascertain any traffic impacts arising as a result of the testing undertaken within Southam.

121. The assessment has highlighted that the inclusion of these demands results in significant levels of delay occurring during the AM period at the Bath Street Gyratory, and PM period at the Shires Retail Park and Foundry roundabouts. Mitigation has been included at these locations, and the subsequent model performance has demonstrated large reductions in the congestion previously modelled.

Summary and Conclusions

122. This Note forms part of a series produced by Vectos Microsim (VM) in response to a request from Stratford District Council (SDC) for assistance in assessing the potential implications of the delivery of a strategy for the identification of Reserve Sites, which may be necessary to bridge any potential shortfall that has arisen in the housing delivery profile for Stratford District, post adoption of the Core Strategy.

123. It has been assumed throughout this study that a minimum of 10% car mode reduction will be delivered as part of each Reserve Site development.

124. The primary objective of this Note was to assess at a final point the impacts on the Southam town network associated with the delivery of the potential Reserve Sites identified by SDC, and where possible to do so, identify measures to overcome the impacts identified

125. The initial analysis has focused on the impact of the inclusion of the full build out of the potential Reserve Sites in the 2031 Core Strategy scenario. This stage outlined that in order to deliver these Sites, and maintain a reasonable level of model stability, considerable mitigation would be required on the network (additional to the significant works included within the Core Strategy model). Additionally, some further mode shift considerations would be beneficial, although it would not be effective in reducing the need for highway mitigation.

126. The mitigation is required largely due to the capacity of the 2031 Core Strategy network not being sufficient enough accommodate the additional traffic associated with the potential Reserve Sites. This is particularly prominent during the PM period.

127. The Reserve Sites demands have also been included within the South Leamington model network, where this analysis has demonstrated that the inclusion of the demands triggers the requirement for the Bath Street Gyratory, Foundry roundabout and Shires Retail Park roundabout mitigation schemes to be in place.

SDC Reserve Housing Sites Assessment

Southam Area Reserve Sites Mitigation Requirements

April 2019

VM185174.TN005

Introduction

1. This Note forms part of a series produced by Vectos Microsim (VM) in response to a request from Stratford District Council (SDC) for assistance in assessing the potential implications of the delivery of a strategy for the identification of Reserve Sites, which may be necessary to bridge any potential shortfall that has arisen in the housing delivery profile for Stratford District, post adoption of the Core Strategy.

2. This Note explores the level of impact that each of the potential Reserve Sites in the Southam area will potentially have upon each of the junctions where the requirement for mitigation has been identified.

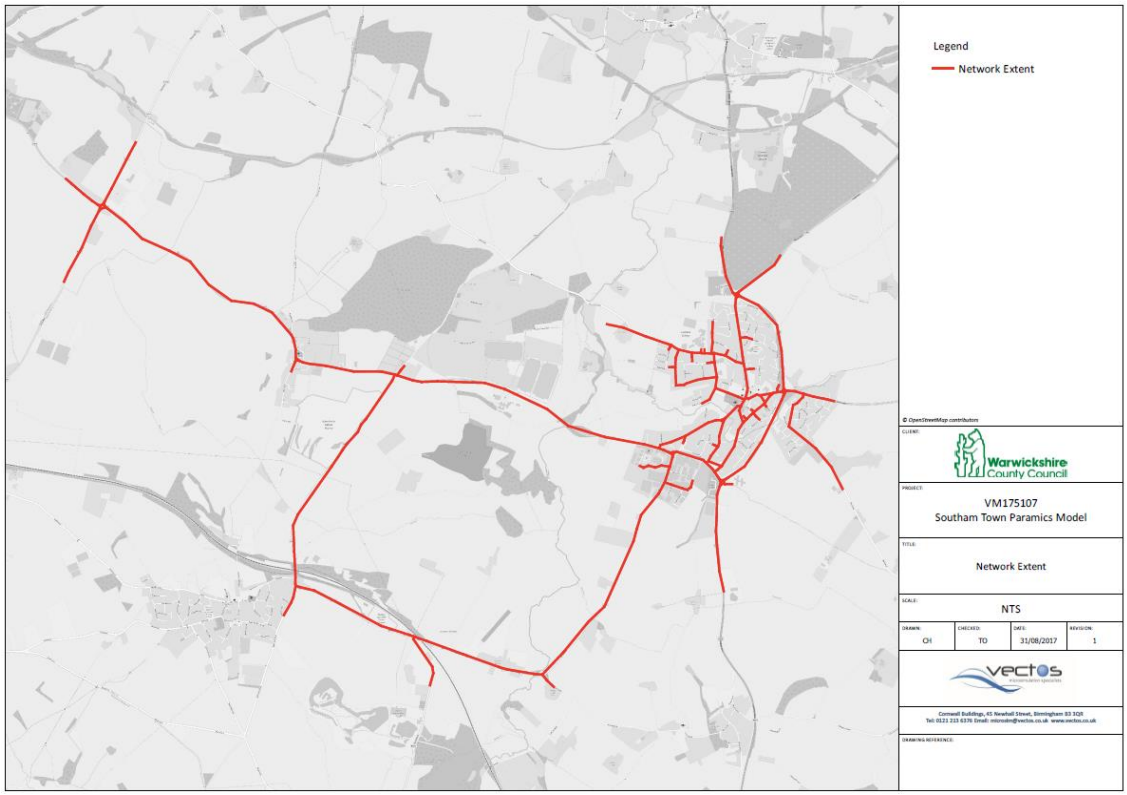
Background

3. Originally, in 2015, VM were commissioned by WCC to develop the S-Paramics 2031 Base Model of Southam, including the A423 bypass, the A425 from Southam to west of Radford Semele, adjacent sections of the Fosse Way and Deppers Bridge. The Base Model was calibrated using existing observed data, collected between the years 2010 and 2013. The calibrated and validated 2013 Base Model was then utilised to develop forecast scenarios for the future years 2021 and 2031.

4. Following on from this, in 2017 VM were commissioned by WCC to update the 2013 Southam Base Model to 2017 traffic levels. New survey data was collected in 2017 to inform this update. At this point the model was also converted to Paramics Discovery, and the model was extended to include Southam town centre. The latest Southam model extent is shown in **Figure 1**. The 2017 Southam Base Model, once validated, was used to develop future year scenarios. The years forecasted were 2023 and 2031.

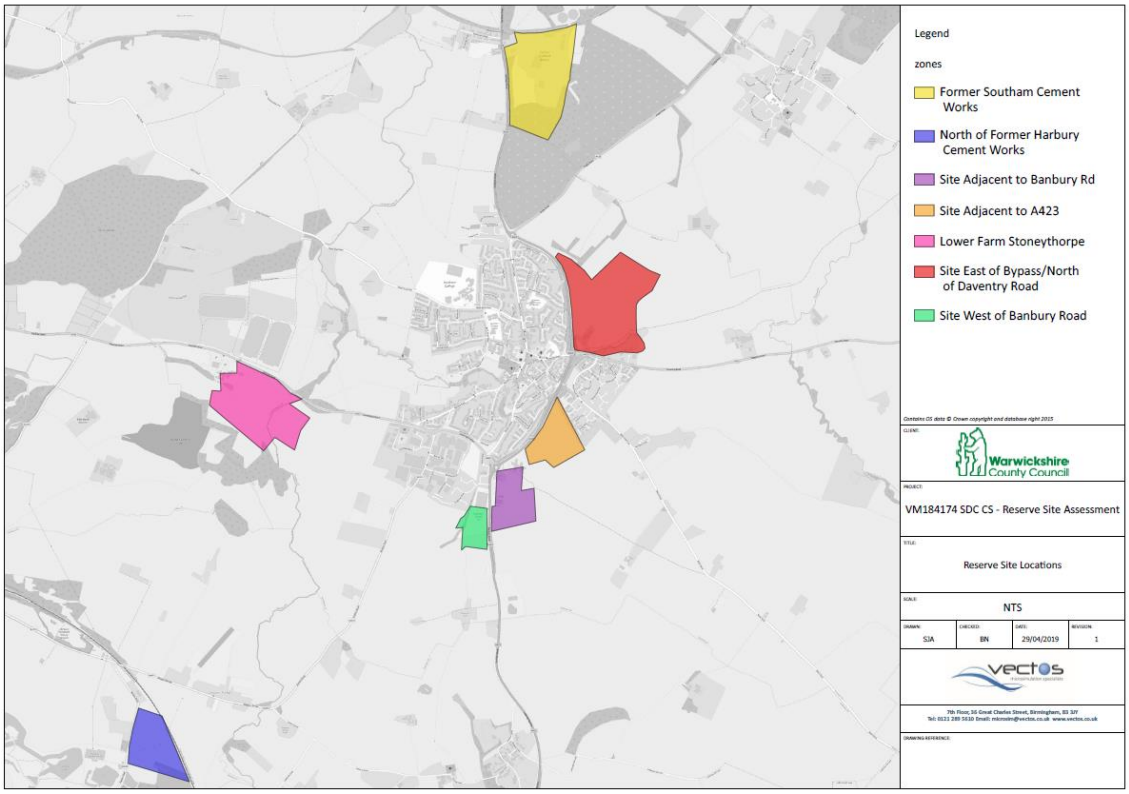
5. Since updating the original Southam model, WCC and Stratford District Council (SDC) requested a further model, which is to reflect the current understanding of the Local Plan (Core Strategy) assumptions. All known Core Strategy aspirations within the study area were included within the 2031 Southam Reference Model, to form the 2031 Core Strategy model. This Core Strategy model contains the known Core Strategy aspirations in terms of developments and infrastructure.

Figure 1 Southam Model Extent



6. The Southam 2031 Core Strategy model has since been utilised to assess the impact of the inclusion of potential Reserves Sites which fall within the Southam model network extent. The location of the Southam potential Reserve Sites is shown in **Figure 2**.

Figure 2 Reserve Site Locations



7. This assessment highlighted the need for significant network mitigation in order to accommodate the additional traffic as a result of the inclusion of the Reserve Sites

8. Following on from this, the assessment also reviewed the impact of the Southam area Reserve Sites on the South Leamington model network. This identified the requirement for three mitigation schemes within the Leamington area as a result of delivering the Southam Reserve Sites. The mitigation schemes were identified at the following locations:

    - Bath Street Gyratory
    - Shires Retail Park Roundabout
    - A452/Foundry Roundabout

Objectives

9. Through discussions between SDC and VM, the objectives which are to be assessed by this stage of the study have been identified. Accordingly, the assessment summarised within this note addresses the following objectives:

    - To identify which of the Reserve Sites could be developed without the need for any significant highway mitigation
    - To identify which sites could be developed before the need for highway mitigation at junctions outside of the immediate Southam area are required
    - To identify the sites that could be developed before the need for highway mitigation within South Leamington is required

Mitigation Summary

10. In order to accommodate the trips predicted to be generated by each of the potential Reserve Sites within the 2031 Core Strategy model, a range of mitigation measures have been identified. **Figure 3** and the following list summarises all mitigation schemes that have been identified.

Figure 3 Identified Mitigation Scheme Locations

- **Scheme 1 - A423/Daventry Road Roundabout** - Daventry Road W entry arm widened to two lanes, Daventry Road E exit arm widened to two lanes.
- **Scheme 2 - Daventry Road/Welsh Road East Junction** - Priority junction altered to a signalised junction.
- **Scheme 3 - Fosse Way/Southam Rd Roundabout** – Fosse Way S entry arm widened to three lanes, along with sections of the circulatory.
- **Scheme 4 - A425/Banbury Road Junction –** Priority junction altered to a signalised junction
- **Scheme 5 - A423** – Dualling on both northbound and southbound carriageways between A423/A425 roundabout and A423/Daventry Road junction.
- **Scheme 6 - A423/A425 Roundabout** – Galanos House entry arm widened to two lanes.
- **Scheme 7 - B4451/Northfield Road Junction** – Right turn bay introduced on B4451 N arm, Northfield Rd widened to two lanes.
- **Scheme 8 - A425/B4452 Junction** – Junction upgraded to a four arm roundabout.
- **Scheme 9 – Leamington Rd/A425** – Leamington Road approach increased to two lanes and A425 Exit increased to two lanes

2031 Southam Core Strategy Assessment

Network Wide Reserve Site Analysis

11. This section considers the impact of the potential Reserve Site demands at all of the identified Southam mitigation sites combined. This identifies the Reserve Sites which contribute the majority of the traffic to all areas of the network where mitigation is required.

12. **Table 1** and **Table 2** shows the breakdown of Reserve Site generated traffic, which enables an indication of the sites with the largest and smallest impact on network flows. The traffic generated by each site has been graded in terms of impact using the following categorisation:

- Category 1 – 0-10% of trips generated to route via mitigation scheme
- Category 2 – 11-20% of trips generated to route via mitigation scheme
- Category 3 – 21-30% of trips generated to route via mitigation scheme
- Category 4 – 30% + of trips generated to route via mitigation scheme

Table 1 Total Trips on the Network by Reserve Site, AM Period (0700-1000)

Reserve Site	No. of Vehicles	% of Flows	Category
Site Adjacent to A423	1447	16%	2
Site Adjacent to Banbury Road	1163	13%	2
Lower Farm Stoneythorpe	3222	35%	4
Former Southam Cement Works	778	8%	1
North of Former Harbury Cement Works	1012	11%	2
Site East of A423/North of Daventry Road	1287	14%	2
Site West of Banbury Road	350	4%	1

Table 2 Total Trips on the Network by Reserve Site, PM Period (1600-1900)

Reserve Site	No. of Vehicles	% of Flows	Category
Site Adjacent to A423	1507	16%	2
Site Adjacent to Banbury Road	1260	13%	2
Lower Farm Stoneythorpe	3312	34%	4
Former Southam Cement Works	815	9%	1
North of Former Harbury Cement Works	1072	11%	2
Site east of Bypass/North of Daventry Road	1299	14%	2
Site West of Banbury Road	369	4%	1

13. **Table 1** and **Table 2** indicate that the Lower Farm Stoneythorpe site contributes the highest volumes of traffic flows across the network. This is to be expected since the development at this site has largest number of dwellings associated with it, whilst it is also one of the more central Reserve Sites in terms of the modelled network.

14. The sites that have the least impact on the network flows, based on **Table 1** and **Table 2**, are the Former Southam Cement works and the Site West of Banbury Rd. The Site West of Banbury Rd is the site with the smallest number of dwellings, therefore can be expected to have the least amount of impact on the model network. In the case of the Former Southam Cement Works, this site lies outside of the model extent with only 34% of the site traffic predicted to enter the Southam model network.

Mitigation Scheme Analysis

15. In this section the Reserve Site flows will be interrogated at each of the mitigation sites individually, to identify the level of traffic generated by each of the Reserve Sites across the specifically mitigated parts of the network. This will highlight the mitigation requirements associated with each site.

16. Using the categorisation described previously, the following tables detail the Reserve Site modelled flows, across the AM and PM period combined, recorded at each of the mitigation sites.

Table 3 Mitigation Site 1 - Junction Flows by Reserve Site

Reserve Site	No. of Vehicles	% of Flows	Category
Site Adjacent to A423	635	21%	3
Site Adjacent to Banbury Road	307	10%	1
Lower Farm Stoneythorpe	844	28%	3
Former Southam Cement Works	406	13%	2
North of Former Harbury Cement Works	231	8%	1
Site East of A423/North of Daventry Road	531	17%	2
Site West of Banbury Road	95	3%	1

Table 4 Mitigation Site 2 - Junction Flows by Reserve Site

Reserve Site	No. of Vehicles	% of Flows	Category
Site Adjacent to A423	699	57%	4
Site Adjacent to Banbury Road	64	5%	1
Lower Farm Stoneythorpe	217	18%	2
Former Southam Cement Works	99	8%	1
North of Former Harbury Cement Works	54	4%	1
Site East of A423/North of Daventry Road	82	7%	1
Site West of Banbury Road	20	2%	1

Table 5 Mitigation Site 3 - Junction Flows by Reserve Site

Reserve Site	No. of Vehicles	% of Flows	Category
Site Adjacent to A423	281	12%	2
Site Adjacent to Banbury Road	284	13%	2
Lower Farm Stoneythorpe	946	42%	4
Former Southam Cement Works	75	3%	1
North of Former Harbury Cement Works	236	10%	1
Site East of A423/North of Daventry Road	352	16%	2
Site West of Banbury Road	87	4%	1

Table 6 Mitigation Site 4 - Junction Flows by Reserve Site

Reserve Site	No. of Vehicles	% of Flows	Category
Site Adjacent to A423	247	9%	1
Site Adjacent to Banbury Road	314	12%	2
Lower Farm Stoneythorpe	1145	44%	4
Former Southam Cement Works	201	8%	1
North of Former Harbury Cement Works	315	12%	2
Site East of A423/North of Daventry Road	290	11%	2
Site West of Banbury Road	96	4%	1

Table 7 Mitigation Site 5 - Junction Flows by Reserve Site

Reserve Site	No. of Vehicles	% of Flows	Category
Site Adjacent to A423	327	13%	2
Site Adjacent to Banbury Road	306	12%	2
Lower Farm Stoneythorpe	822	33%	4
Former Southam Cement Works	300	12%	2
North of Former Harbury Cement Works	229	9%	1
Site East of A423/North of Daventry Road	391	16%	2
Site West of Banbury Road	94	4%	1

Table 8 Mitigation Site 6 - Junction Flows by Reserve Site

Reserve Site	No. of Vehicles	% of Flows	Category
Site Adjacent to A423	327	10%	1
Site Adjacent to Banbury Road	702	21%	3
Lower Farm Stoneythorpe	1086	33%	4
Former Southam Cement Works	300	9%	1
North of Former Harbury Cement Works	295	9%	1
Site East of A423/North of Daventry Road	391	12%	2
Site West of Banbury Road	191	6%	1

Table 9 Mitigation Site 7 - Junction Flows by Reserve Site

Reserve Site	No. of Vehicles	% of Flows	Category
Site Adjacent to A423	5	1%	1
Site Adjacent to Banbury Road	9	2%	1
Lower Farm Stoneythorpe	3	1%	1
Former Southam Cement Works	79	18%	2
North of Former Harbury Cement Works	332	76%	4
Site East of A423/North of Daventry Road	6	1%	1
Site West of Banbury Road	2	0%	1

Table 10 Mitigation Site 8 - Junction Flows by Reserve Site

Reserve Site	No. of Vehicles	% of Flows	Category
Site Adjacent to A423	282	12%	2
Site Adjacent to Banbury Road	285	12%	2
Lower Farm Stoneythorpe	957	42%	4
Former Southam Cement Works	84	4%	1
North of Former Harbury Cement Works	250	11%	2
Site East of A423/North of Daventry Road	354	15%	2
Site West of Banbury Road	87	4%	1

Table 11 Mitigation Site 9 - Junction Flows by Reserve Site

Reserve Site	No. of Vehicles	% of Flows	Category
Site Adjacent to A423	150	12%	2
Site Adjacent to Banbury Road	152	12%	2
Lower Farm Stoneythorpe	515	41%	4
Former Southam Cement Works	48	4%	1
North of Former Harbury Cement Works	140	11%	2
Site East of A423/North of Daventry Road	189	15%	2
Site West of Banbury Road	46	4%	1

The tables above demonstrate the impact that each of the potential Reserve Sites have on each of the mitigated junctions within the model network. Based upon the results presented within these tables, a matrix of the predicted mitigation requirements for each site can be derived, which is presented within **Table 12**.

Table 12 Mitigation Schemes Required By Site

Site	Mitigation Scheme Number								
	1	2	3	4	5	6	7	8	9
Site Adjacent to A423	✓	✓			✓				
Site Adjacent to Banbury Road				✓	✓	✓			
Lower Farm Stoneythorpe	✓		✓	✓	✓	✓		✓	✓
Former Southam Cement Works					✓		✓		
North of Former Harbury Cement Works				✓			✓		
Site East of A423/North of Daventry Road	✓		✓	✓	✓				✓
Site West of Banbury Road									

17. **Table 12** indicates the mitigation schemes likely to be required by each of the Reserve Sites. The table demonstrates that the Lower Farm Stoneythorpe site is likely to result in the need for mitigation at 7 locations across the network.

18. The Site East of the A423/North of Daventry Road is likely to trigger the need for four of the identified schemes, whilst the Site Adjacent to the A423 and Site Adjacent to Banbury Road trigger the need for three schemes each.

19. The analysis indicates that the Former Southam Cement Works, and North of Former Harbury Cement works sites could be included within the network with less significant mitigation requirements, with both sites indicating the need for just two mitigation schemes. Finally, the Site West of Banbury Road indicates that no mitigation schemes are required alongside this site.

20. On the basis of the above analysis, the following sites could be included individually on the network with only minor mitigation requirements:

- Former Southam Cement Works
- North of Former Harbury Cement Works
- Site West of Banbury Road

21. It is likely that including these sites cumulatively would require some mitigation interventions on the network.

22. In addition to this, the analysis indicates that the majority of sites could be included within the network with the only mitigation requirements being within and around Southam town

and surrounding network. There are however two schemes identified that lie outside of the Southam area, namely schemes 3 and 8 at the A425/Fosse Way junction and the A425/B4452 junction. The analysis has indicated that the following sites trigger the need for these schemes:

- Lower Farm Stoneythorpe
- Site East of A423/North of Daventry Road

23. On the basis of the above, the remaining Reserve Sites individually could be included within the network without triggering the need for mitigation at these two outlying junctions.

South Leamington Model Assessment

24. Following the assessment of the likely mitigation requirements as a result of the potential Reserve Sites within the Southam model network, it is also pertinent to review the volume of traffic generated by these sites predicted to enter the South Leamington model network, with a view to outlining mitigation requirements in this model network.

25. The initial Reserve Sites assessment work undertaken reviewed the impact on the South Leamington model network, identifying the requirement for three mitigation schemes within this model network.

26. In order to assess the predicted impact on the South Leamington network, and therefore likely mitigation requirements, the Southam model link flow data has been utilised to calculate the traffic flows generated by each of the Reserve Sites that are travelling in and out of the South Leamington Model network extent. This data is displayed for the AM and PM modelled hours combined in **Table 13**.

Table 13 South Leamington Network Reserve Site Traffic Flows

Reserve Site	No. of Vehicles	% of Flows	Category
Site Adjacent to A423	132	12%	2
Site Adjacent to Banbury Road	133	13%	2
Lower Farm Stoneythorpe	443	42%	4
Former Southam Cement Works	36	3%	1
North of Former Harbury Cement Works	111	10%	2
Site East of A423/North of Daventry Road	166	16%	2
Site West of Banbury Road	41	4%	1

27. **Table 13** demonstrates that almost half of the total Reserve Site flows in and out of South Leamington are associated with the Lower Farm Stoneythorpe site.

28. Although the Site East of the A423/North of Daventry Road, Site Adjacent to the A423, and Site Adjacent to Banbury Road do send a notable proportion of development traffic in and out of the South Leamington network, these total flows remain significantly below those predicted to be generated by the Lower Farm site traffic.

29. The sites that contribute the least amount of traffic to the South Leamington network are the Site West of Banbury Road and the Former Southam Cement Works.

30. On the basis of the above it is likely that the majority of sites could be developed individually before the need for mitigation within the South Leamington network is triggered.

31. The development of the Lower Farm Stoneythorpe site is likely to result in the requirement for mitigation given the high volumes of traffic predicted to route into/out of the South Leamington network.

Summary and Conclusions

32. This Note forms part of a series produced by Vectos Microsim (VM) in response to a request from Stratford District Council (SDC) for assistance in assessing the potential implications of the delivery of a strategy for the allocation of Reserve Sites, which may be necessary to bridge any perceived shortfall that has arisen in the housing delivery profile for Stratford District, post adoption of the Core Strategy.

33. This Note specifically assesses the likely mitigation requirements associated with each of the potential Reserve Sites tested in the Southam area, with a view to determining the sites which could be developed without the need for large scale mitigation across the network, and the identification of the sites that are likely to trigger the need for significant mitigation schemes both within Southam and on the surrounding highway network.

34. The analysis has identified that three of the identified potential Reserve Sites could be delivered on an individual basis without the requirement for significant amounts of highway mitigation. These are the Former Southam Cement Works, North of Former Harbury Cement Works and West of Banbury Road sites.

35. The analysis has indicated that all of the potential Reserve Sites could be delivered individually before the need for mitigation at the outlying A425/Fosse Way roundabout, with the exception of the Lower Farm Stoneythorpe and East of A423/North of Daventry Road sites, which are likely to trigger the need for a scheme at this location

36. Finally, the assessment has reviewed the likely impact of the Southam potential Reserve Sites on the South Leamington network. This stage of the analysis has identified that the Lower Farm Stoneythorpe site generates significantly higher traffic flows on this part of the network than any of the other sites, and on this basis it is likely that the need for mitigation within South Leamington is only triggered once this site has been built out. Conversely, it is likely that all remaining sites could be built out within Southam before the need for mitigation in the South Leamington network is triggered.