File Note

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Project title	Kenilworth STA	Job number	
cc		File reference	232815-60.TN001
Prepared by	Barney Newbould	Date	20 November 2014
Subject	Kenilworth STA Testing		

Kenilworth STA Testing

1 Introduction

1.1 Scope

Arup have been commissioned by Warwickshire County Council (WCC) to undertake an additional sensitivity test using the Kenilworth and Stoneleigh Wide Area (KSWA) Paramics model which is intended to focus specifically on the impact of the relocation of Education facilities within the Kenilworth Area as part of the Local plan Process.

This Technical Note is intend to serve as an addendum to the previous Phase 4 Strategic Transport Assessment (STA) and builds upon the evidence presented within that and previous STA reports. It sets out the specific outcomes of the assessment pertaining to the relocation of education facilities as detailed within a subsequent section of this Note.

1.2 Study Objectives

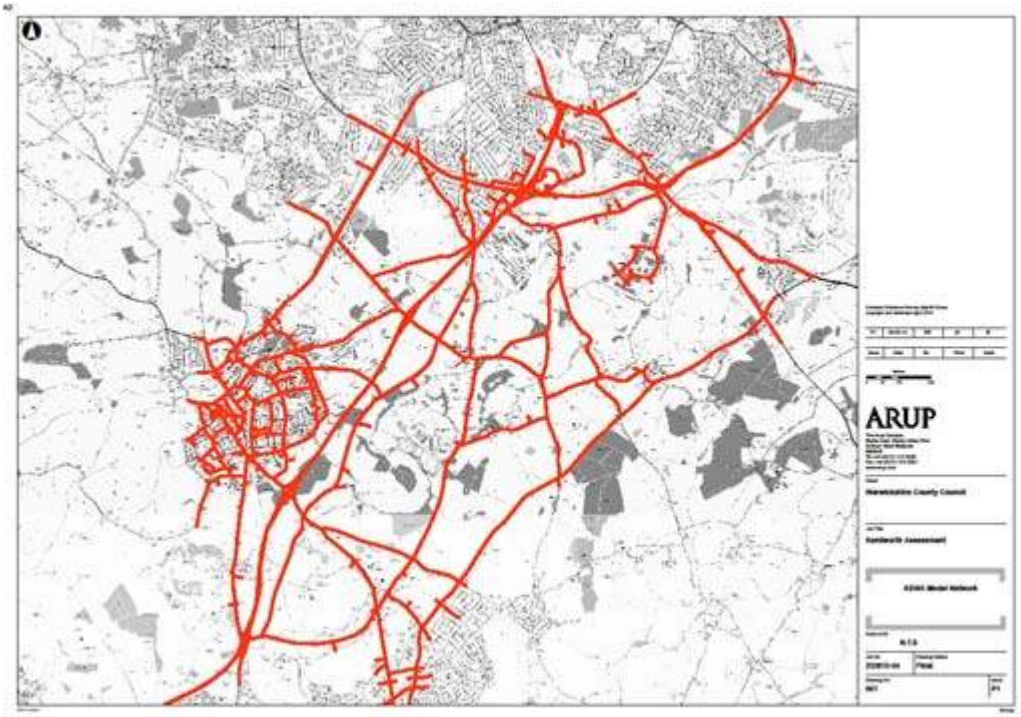
The objectives of this STA Phase 4 sensitivity test are summarised as follows:

- To update the assumptions pertaining to the assignment of Education trips within the models previously reported on during the Phase 4 STA work
- To assess the impacts on the network conditions, already reported as part of the original STA work, of relocating education facilities from central Kenilworth to a site towards the eastern periphery of Kenilworth town.

1.3 Study Area

The testing in this exercise has been undertaken within the Kenilworth and Stoneleigh Wide Area PARAMICS model (KSWA). The coverage of the KSWA model has been illustrated within the figure below:

Figure 1 KSWA Model Extent



1.4 Methodology

This latest assessments utilises the model scenarios produced and reported on during the WDC STA Phase 4, namely:

- 2028 KSWA Reference Demands
- 2028 KSWA Revised Development Approach Do Something (KSWA RDA DS) – The 2028 KSWA DN inclusive of the proposals at Thickthorn, Kenilworth Gyratory and the A452.

Full details on the assumptions contained within these model scenarios are available within the WDC STA Phase 4 report[1].

The education assumptions within these scenarios were updated and an additional scenario created to reflect the relocated schools. Further details on the methodology behind this are provided within the proceeding section of this note.

Aside from the update and revised scenario development the underlying forecast demands and the methodology pertaining to the assessment has been undertaken in a manner which is consistent to the earlier phase 4 STA assessment. It is recommended that this report is reviewed to identify the overall levels of growth assumed within the model scenarios, the mitigation measures and also the

[1] 232815-53.R001 WDC STA – Phase 4 Assessment Report, Ove Arup and Parnters Ltd, April 2014

specific details regarding the extraction and methodology for the production of the model outputs assessed.

2 Scenario Development

2.1 KSWA Reference Case & KSWA RDA

The first stage of scenario development involved updating the original KSWA STA scenarios to include more refined representation of the school trips that occur within the study area.

The reason that the update was required was because of the fact that, during a recent update to the KSWA base model the Education matrices were recombined with the general demand matrices. Previous to this, the KSWA Base model education matrices had been produced via direct interrogation of the school origin mode share data and, as a result, contained car specific trip generation totals which were directly related to the size of the school whilst the distribution of car based trips to/from the school was based on the known origins of the car based trips as identified through the interrogation of the origin mode share data for the schools.

An overview of this updated is provided as follows:

2.2 Education Trips

The KSWA Reference Case and KSWA RDA scenarios contain a zone for the Education matrices within the model. This was coded in at Zone 110 which is located to the south of Leyes Lane in Kenilworth, the site of the existing Kenilworth School.

The method of determining the trip generation totals within the base model differed from those contained in the KSWA STA models, as detailed in Section 2.1. The table below outlines the differences in trip generation between the KSWA Base Model and KSWA STA scenarios.

	Base Model Demands		**Original STA Model Demands**	
	Arrivals	Departures	Arrivals	Departures
AM	389	180	347	234
PM	112	236	112	233

Based on the fact that the method of trip generation undertaken in the KSWA Base Model is considered more robust than the method used in the STA models, it was determined that the Base Model Education matrices would be incorporated into the STA models. All trips relating to zone 110 in the Base Model were included as a new matrix level in the STA model matrices, which would form an updated Education matrix. Simultaneously all existing trips with the STA models with an origin or destination being zone 110 were removed from the demand matrices.

2.3 Re-location of Education Facilities

As detailed above the education facilities have been incorporated into zone 110 of the base model and KSWA STA models. This reflects the facilities being located to the south of Leyes Lane in Kenilworth.

As part of this modelling exercise, a sensitivity test was undertaken, in order to ascertain the impact of relocating the education facilities to a site to the east of Kenilworth town centre. The revised location would be to the east of Glasshouse Lane, and south of Crew Lane. In order to undertake this testing the education trips which had previously been assigned to zone 110 were reassigned to a new zone, zone 294. The new zone would be accessed via a priority junction off Glasshouse Lane.

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The figure below identifies the location of the sensitivity test education facilities and the proposed access junction.

Figure 2 Relocated Education Facilities

3 Impact Assessment

The following section of the report presents the results obtained from the testing undertaken for the following three scenarios:

- 2028 KSWA Reference Demands
- 2028 KSWA Revised Development Approach (KSWA RDA) – The 2028 Reference Case network plus the 2028 RDA Demands
- 2028 KSWA Revised Development Approach Revised School (KSWA RDA RS) – The 2028 KSWA RDA inclusive of relocated school

3.1 Model Stability

An initial assessment of the level of model stability was undertaken by comparing the number of completed runs against the number of runs assumed to have failed. The network stability within the AM and PM simulation runs across the three scenarios is illustrated within Table 1**.**

Table 1 Model Stability Assessment 2028 Reference vs 2028 KSWA RDA

	Reference Case	KSWA RDA	KSWA RDA + RS
AM	100%	100%	100%
PM	100%	100%	100%

Given the above it is clear, that there are no notable differences between the Reference Case and KSWA RDA scenarios, when considering network stability. The relocation of the school appears to have no impact on the model stability.

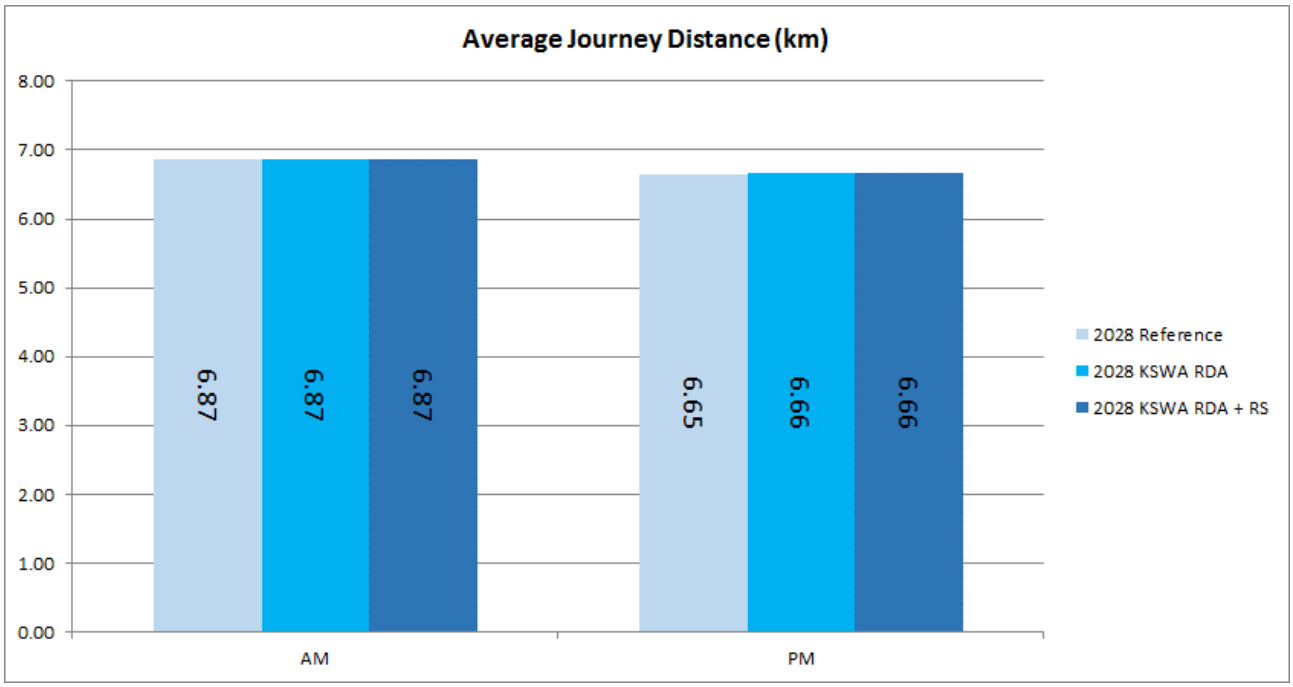
3.2 Network Wide Statistics

The following sets out the changes in network wide statistics between the 2028 Reference Case and the two 2028 KSWA RDA scenarios.

3.2.1 Average Journey Distance

Analysis of the average journey distance within each scenario, across the AM and PM model periods is presented in Figure 3 on the following page.

Figure 3 Average Journey Distance (2028 Ref vs KSWA RDA and KSWA RDA + RS)



Analysis of the Figure 4 indicates very little difference between the three scenarios assessed. An increase in the distance travelled may indicate an increase in the number of longer distance trips occurring within an option, or it may indicate an increased propensity for vehicles to reassign along longer routes in response to congestion. Due to the fact that these results show no change in the trip duration in the AM peak and a small change in the PM peak, it appears that the relocation of the school has no impact on the modelled network.

3.2.2 Average Journey Speed

Analysis of the average journey speed within the three scenarios, across the AM and PM model periods, is presented on the following page.

Figure 4 Average Journey Speed (2028 Ref vs KSWA RDA and KSWA RDA + RS)

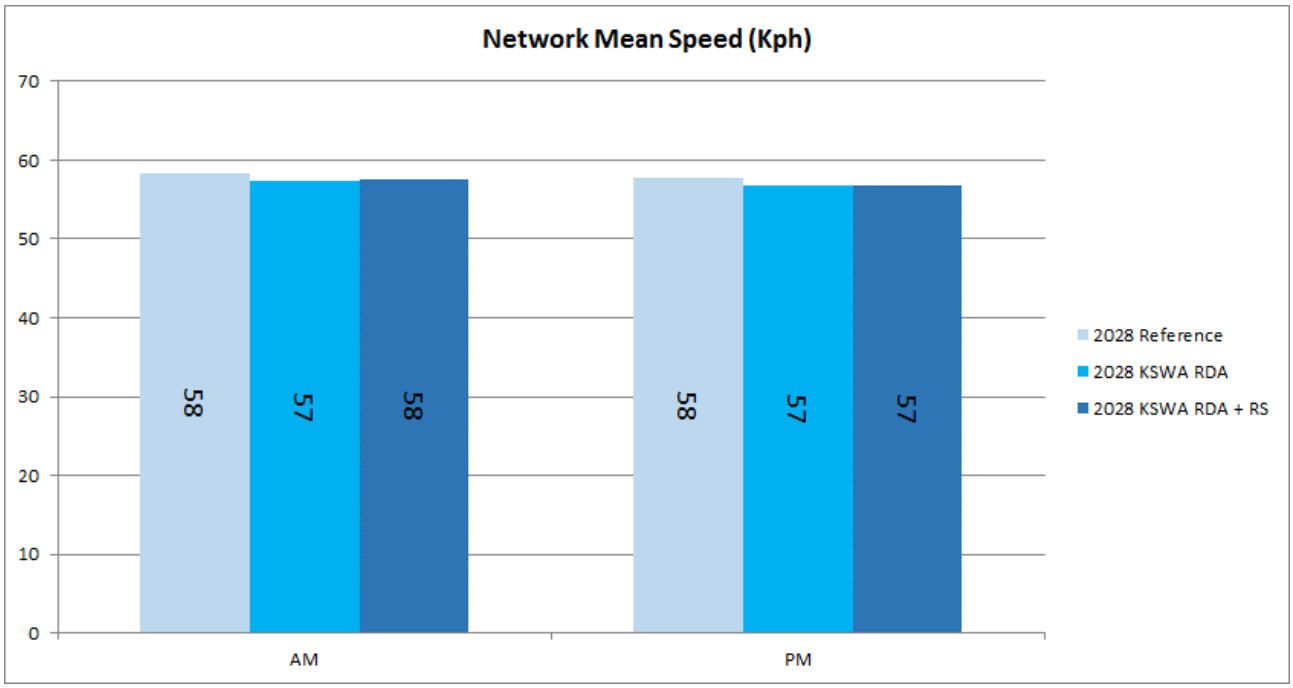


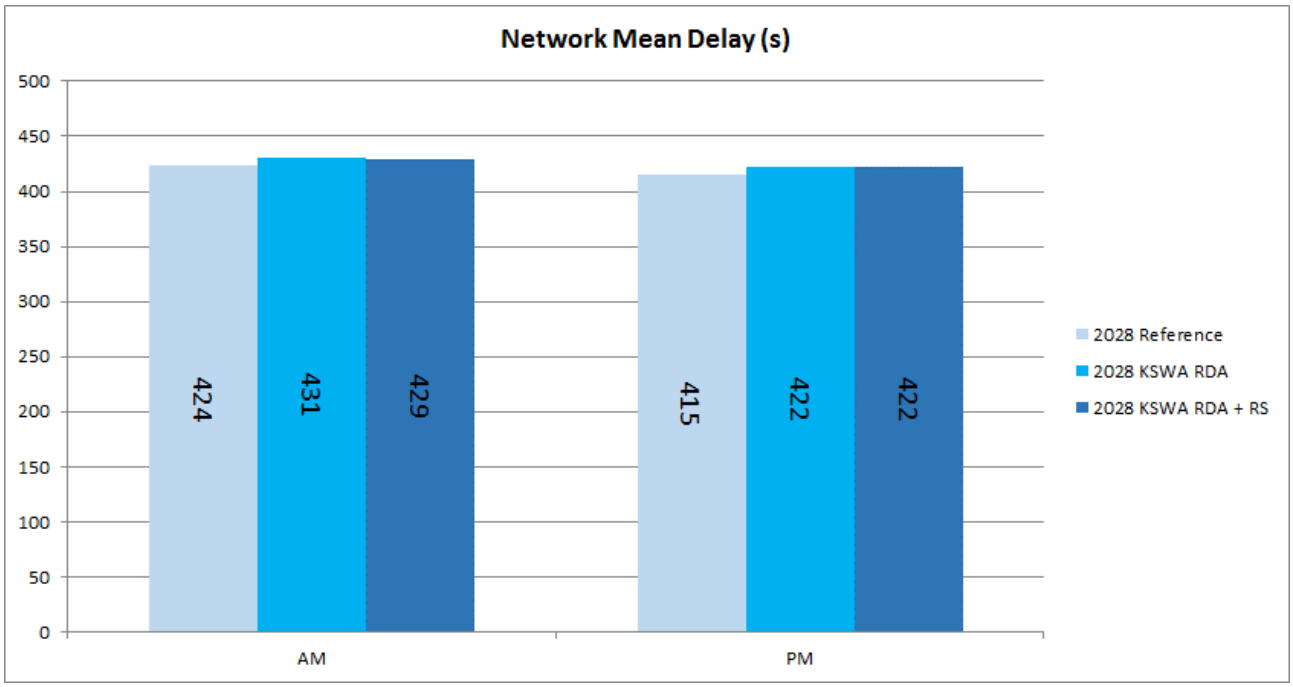
Figure 4 demonstrates that the allocation of the RDA strategy results in a negligible drop in the average speed of vehicles, on the network, in the AM and PM peak periods respectively.

The drop in average speeds in a modelled network is likely to be indicative of the general effects of the assignment of the additional demand and the congestion effects thereof. The fact that there is very little change in the average speeds between all three scenarios suggests that the inclusion of the schools related traffic, and the relocation of the school, is unlikely to have a significant impact on this aspect of the network performance.

3.2.3 Average Journey Time (Seconds)

Analysis of the average journey time, within each scenario, across the AM and PM model periods, is presented in Figure 5 on the following page.

Figure 5 Average Journey Time (2028 Ref vs KSWA RDA and KSWA RDA + RS)

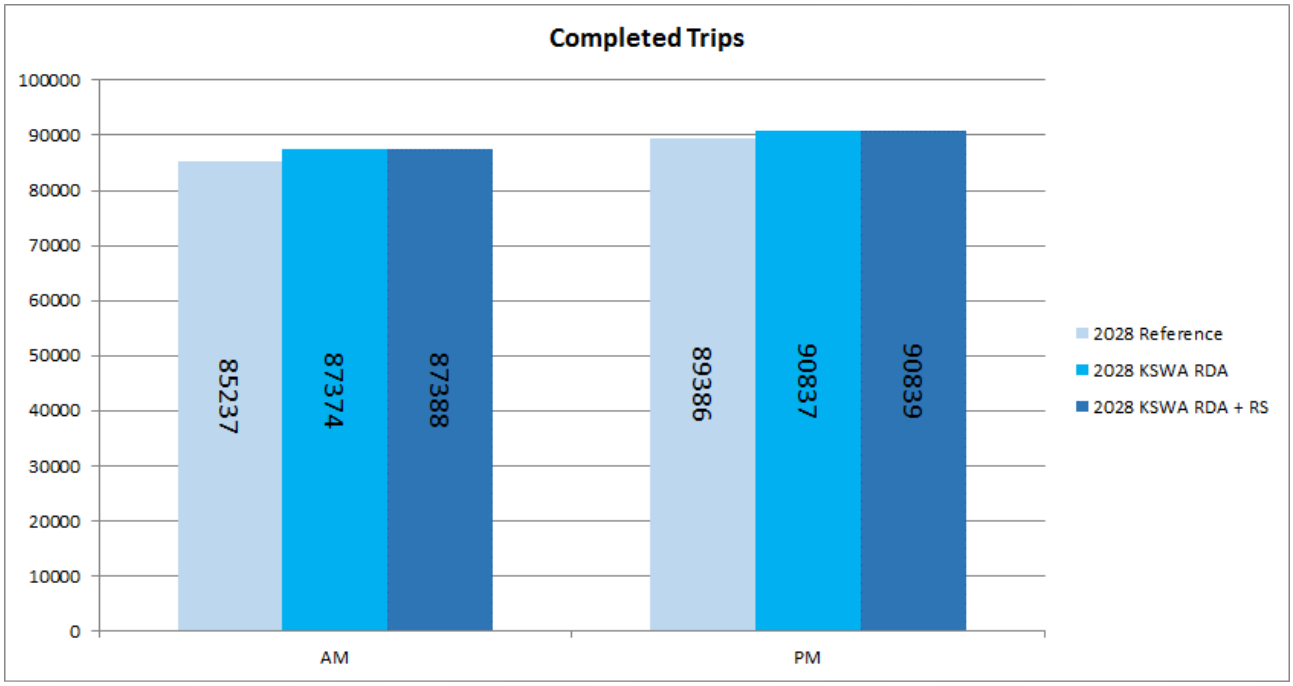


Analysis of the difference in average journey times between the 2028 Reference Case and the KSWA RDA scenarios indicates a slight increase in the time it takes to complete a journey in both the KSWA RDA scenarios. The average journey times are marginally lower in the KSWA RDA + RS scenario than the KSWA RDA scenario during the AM peak, and are the same in the PM peak.

3.2.4 Completed Trips

Analysis of the total number of completed trips within each scenario, during the AM and PM model periods, is presented in Figure 6 on the following page.

Figure 6 Completed Trips (2028 Ref vs KSWA RDA and KSWA RDA + RS)



Analysis of Figure 6 above indicates that there is an increase in completed trips in both the KSWA RDA scenarios when compared to the 2028 Reference Case.

The number of completed trips increases by 2.5% in the KSWA RDA scenarios during the AM period and 1.6% in the PM period. The fact that the number of completed trips is the same in the KSWA RDA + RS scenario when compared to the KSWA RDA scenario suggests that the network operation remains the same with the relocation of the school.

3.3 Queue Length Analysis

The following sets out observations based on the differences in queue lengths between the 2028 Reference Case and 2028 KSWA RDA scenarios.The maps which are referred to within the following analysis are presented within Appendix A of this report.

3.3.1 AM Analysis (MQ001 and MQ003)

Analysis of the difference in queuing between the 2028 Reference and 2028 KSWA RDA scenario, during the AM peak period, reveals the following:

- The majority of junctions assessed show no change in queue conditions between the Reference Case and the RDA scenario.
- There are two junctions in the modelled network which trigger the criteria, whereby maximum queue lengths increase by less than 5 vehicles. This occurs at the A46/A452 junction and the A452/Bericote Road roundabout. The impacts of these changes in in queue lengths are however negligible.

Analysis of the difference in queuing between the 2028 Reference and 2028 KSWA RDA + RS scenario, during the AM peak period, reveals the following:

- The majority of junctions assessed show no change in queue lengths between the Reference Case and the KSWA RDA + RS scenario.
- There are three junctions in the modelled network which trigger the criteria, whereby maximum queue lengths increase by less than 5 vehicles. This occurs at the A46/A452 junction, the A452/Bericote Road roundabout and the A452/Warwick Road junction. As the previous scenario, the results show that the impact on queue lengths at each of these junctions will be minor.

3.3.2 PM Analysis (MQ002 and MQ004)

Analysis of the differences in queue lengths between the 2028 Reference and 2028 KSWA RDA scenario, during the PM peak period, reveals the following:

- The majority of junctions assessed show no change in queue conditions between the Reference Case and the RDA scenario.
- There are two junctions in the modelled network which trigger the criteria, whereby maximum queue lengths increase by less than 5 vehicles. This occurs at the A46/A452 junction and the A452/Bericote Road roundabout. The impacts of these changes in in queue lengths are forecast to be minor.

Analysis of the difference in queuing between the 2028 Reference and 2028 KSWA RDA + RS scenario, during the PM peak period, reveals the following:

- The majority of junctions assessed show no change in queue lengths between the Reference Case and the KSWA RDA + RS scenario.
- There are four junctions in the modelled network which trigger the criteria, whereby maximum queue lengths increase by less than 5 vehicles. This occurs at the A46/A452 junction, the A452/Bericote Road roundabout, the A452/Warwick Road junction and the Warwick Road/Waverley Road junction.

3.3.3 Queue Analysis Summary

A summary of the findings obtained through comparing the changes in queue conditions between the 2028 Reference Case and 2028 RDA Scenarios is provided as follows:

- The 2028 KSWA RDA junction performance is largely comparable to the 2028 Reference Case network, with the only observed impacts being an increase in queue lengths of less than of 5 vehicles, at a small number of junctions;
- The 2028 KSWA RDA network impacts are similar in magnitude during both AM and PM periods
- The relocation of the school in the KSWA RDA + RS scenario shows little impact in terms of queue conditions when compared to both the Reference Case and the 2028 KSWA RDA scenario.

3.4 Journey Time Analysis

The following sets out observations from the journey time analysis plots for the three key scenarios; 2028 Reference Case and 2028 KSWA RDA and 2028 KSWA RDA +SR. The comments in the remainder of this section are based on observations of the modelled journey times across pre-defined routes within the model area during both AM (08:00 to 09:00) and PM (17:00 to 18:00) peak hours. The maps which are referred to within the following analysis are presented within

Appendix B of this report, whilst the specific drawing number relating to each element of the analysis has been provided.

3.4.1 AM Analysis (MD001 and MD003)

Analysis of the difference in delay between the 2028 Reference and 2028 KSWA RDA scenario, during the AM peak hour, reveals the following:

- The routes into and out of Kenilworth experience minor or no changes in journey times when compared to the Reference Case. This is with the exception of the A429 Kenilworth Road, which experiences an increase in delay of between 25-50% in a northbound direction during the AM peak hour.

Analysis of the difference in delay between the 2028 Reference and 2028 KSWA RDA + RS scenario, during the AM peak hour, reveals the following:

- The routes into and out of Kenilworth experience minor or no changes in journey times when compared to the Reference Case. This is with the exception of the A429 Kenilworth Road, which as in the previous scenario, experiences an increase in delay of between 25-50% in a northbound direction during the AM peak hour.

3.4.2 PM Analysis (MD002 and MD004)

Analysis of the difference in delay between the 2028 Reference and 2028 KSWA RDA scenario, during the PM peak hour, reveals that all modelled routes into and out of Kenilworth experience limited or no change in journey times between the two scenarios.

As above, analysis of the difference in delay between the 2028 Reference and 2028 KSWA RDA + RS scenario, during the PM peak hour, reveals that all modelled routes into and out of Kenilworth experience limited or no change in journey times between the two scenarios.

3.4.3 Journey Time Summary

A summary of the findings obtained through comparing the changes in queuing between the 2028 Reference Case and 2028 RDA Scenarios is provided as follows:

- The level of delay modelled in the 2028 KSWA RDA scenarios is largely comparable to the 2028 Reference Case network with the only notable impacts occurring on the A429 Kenilworth Road in a northbound direction during the AM peak;
- This impact is observed in both the KSWA RDA and KSWA RDA + RS scenario
- The relocation of the school in the KSWA RDA + RS scenario shows no impact on network delay when compared to the 2028 KSWA RDA scenario.

The impact along the A429 is most likely indicative of the need for further optimisation of the signal strategy along this corridor. The increase in demand along this corridor, in both STA scenarios, is unlikely to be considered significant. Thus it is reasonable to conclude that the increase in delays experienced within the STA scenarios is indicative of a need for optimisation of the signalised junctions along this corridor rather than anything more substantial.

4 Summary & Conclusions

4.1 Summary

This exercise has involved the updated of the KSWA STA models to include the education trips contained within the KSWA Base Model. These trips have been assumed to be a more accurate standalone representation of education trips associated with the schools within Kenilworth. The impact of this revised trip generation on the KSWA model network has been tested in both the 2028 Reference Case and 2028 RDA scenario. Additionally, a sensitivity test has been undertaken to determine the impact of relocating the education facilities to a proposed site to the east of Kenilworth.

4.2 Conclusions

Based upon the analysis undertaken in this modelling exercise, it is clear that the development of the proposed school in Kenilworth will have a negligible impact on the local road network. The modelling indicates that there will be minor increase in queue lengths at a small number of junctions, and an increase in delay on one route out of Kenilworth during the AM peak hour.

The scenario in which the proposed school is relocated, results in a similar magnitude of impact, suggesting that the relocation of the school will not change the operation of the road network in and around Kenilworth.

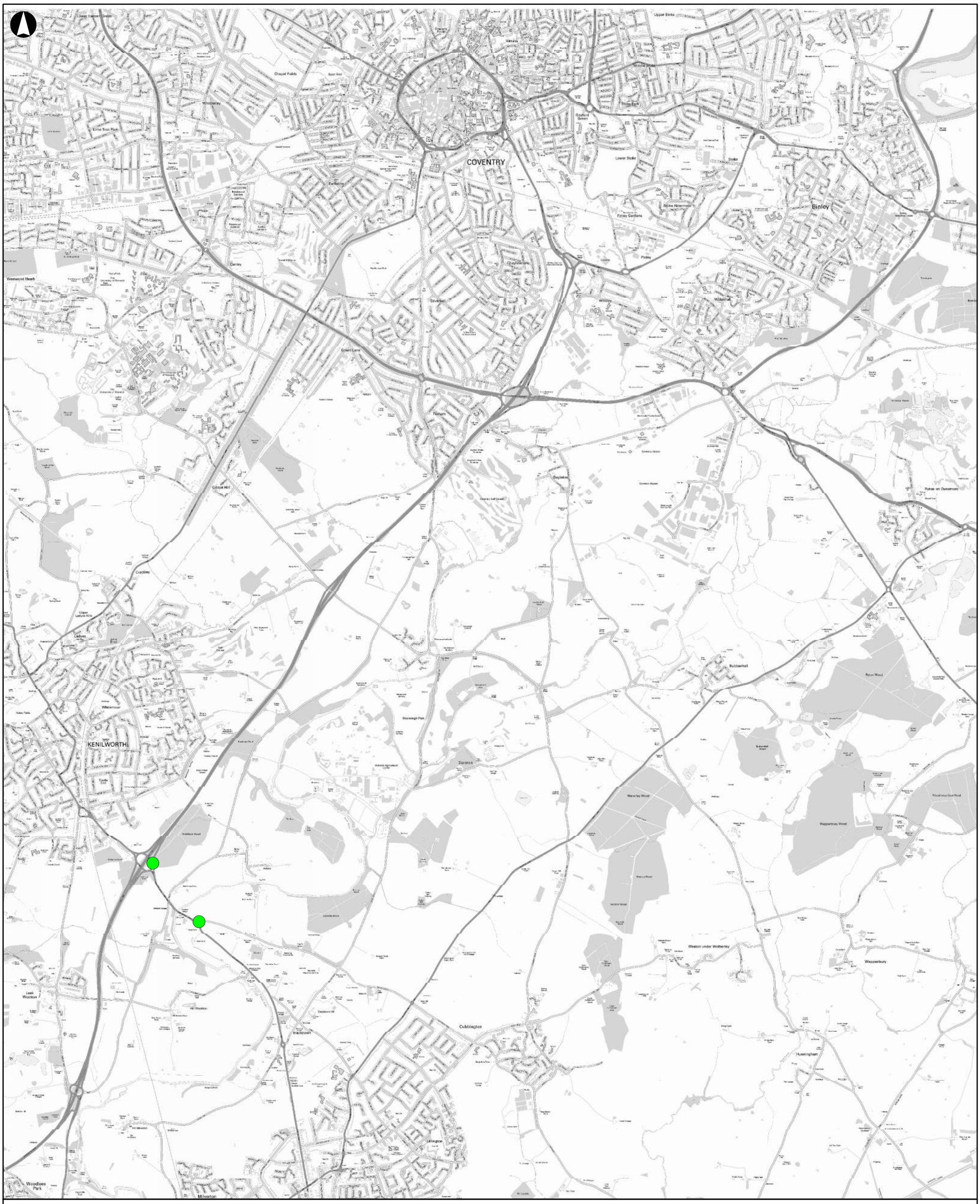
4.3 Recommendations

It should be acknowledged that the focus of this analysis has been undertaken at the strategic level and, as such, the potential for localised impacts to occur as a result of the relocation of the schools has not been assessed. It anticipated that this, more detailed, level of localised impact analysis would be undertaken as part of the preparation of any planning application and transport impact assessment undertaken to support the proposals to relocate the education facilities as outlined previously within this note.

DOCUMENT CHECKING (not mandatory for File Note)

	Prepared by	Checked by	Approved by
Name	Barney Newbould	James Edwards	James Edwards
Signature	bn	jme	jme

A3



Legend

Mean Queue

- 🟢 < -5 vehicles
- 🟡 15 - 30 vehicles
- 🟠 30- 50 vehicles
- 🔴 > 50 vehicles

Metres
0 485 970 1,940

KSWA Reference V RDA
2028 AM Peak Period
Average Maximum Queue

Scale at A3
N.T.S.

Job No	Drawing Status
232815-53	For Information

Drawing No	Issue
MQ_001	P1

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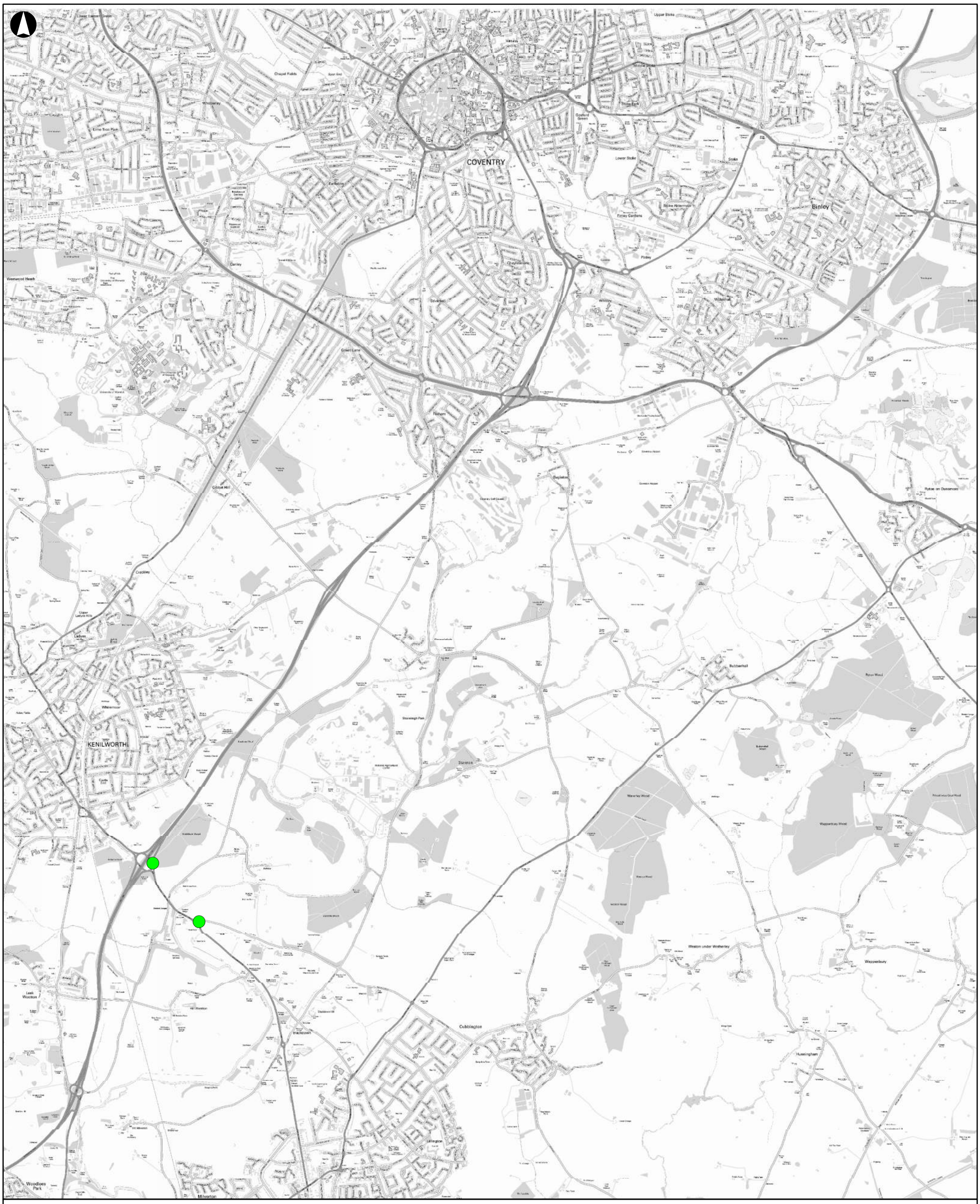
Client
Warwickshire County Council

Job Title
WDC STA Addendum 03

P1	13/11/2014	ZW	JE	JE
Issue	Date	By	Chkd	Appd

A3



Legend

Mean Queue

- < -5 vehicles
- 15 - 30 vehicles
- 30- 50 vehicles
- > 50 vehicles

Issue	Date	By	Chkd	Appd
P1	13/11/2014	ZW	JE	JE

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Job Title
WDC STA Addendum 03

Metres
0 485 970 1,940

KSWA Reference V RDA
2028 PM Peak Period
Average Maximum Queue

Scale at A3
N.T.S.

Job No
232815-53

Drawing Status
For Information

Drawing No
MQ_002

Issue
P1

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A3

Legend

Mean Queue

- < -5 vehicles
- 15 - 30 vehicles
- 30- 50 vehicles
- > 50 vehicles

Metres

0 485 970 1,940

Issue	Date	By	Chkd	Appd
P1	13/11/2014	ZW	JE	JE

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Job Title
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KSWA Reference V RDA + RS
2028 AM Peak Period
Average Maximum Queue

Scale at A3
N.T.S.

Job No
232815-53

Drawing Status
For Information

Drawing No
MQ_003

Issue
P1

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A3

Legend

Mean Queue

- < -5 vehicles
- 15 - 30 vehicles
- 30- 50 vehicles
- > 50 vehicles

Issue	Date	By	Chkd	Appd
P1	13/11/2014	ZW	JE	JE

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Metres
0 485 970 1,940

KSWA Reference V RDA + RS
2028 PM Peak Period
Average Maximum Queue

Scale at A3
N.T.S.

Job No	Drawing Status
232815-53	For Information

Drawing No	Issue
MQ_004	P1

MXD Location Document Path: J:\232000\232815-53\4 Internal Project Data\4-04 Calculations\GIS\05 mxd\20141113_update\MQ_004.mxd

A3

Legend

Mean Delay

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- < -15%
- -15% - 15%
- 15% -25%
- 25%- 50%
- >50%

Issue	Date	By	Chkd	Appd
P1	13/11/2014	ZW	JE	JE

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Metres
0 485 970 1,940

KSWA Reference V RDA
2028 AM Peak Hour 0800-0900
Percentage Difference Mean Delay

Scale at A3
N.T.S.

Job No
232815-53

Drawing Status
For Information

Drawing No
MD_001

Issue
P1

MXD Location Document Path: \\global.arup.com\europe\Midlands\jobs\232000\232815-53\4 Internal Project Data\4-04 Calculations\GIS\05 mxd\20141113_update\MD_001.mxd

A3

Legend

Mean Delay

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- < -15%
- -15% - 15%
- 15% -25%
- 25%- 50%
- >50%

Issue	Date	By	Chkd	Appd
P1	13/11/2014	ZW	JE	JE

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WDC STA Addendum 03

Metres
0 485 970 1,940

KSWA Reference V RDA
2028 PM Peak Hour 1700-1800
Percentage Difference Mean Delay

Scale at A3
N.T.S.

Job No	Drawing Status
232815-53	For Information

Drawing No	Issue
MD_002	P1

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A3

Legend

Mean Delay

- no data
- < -15%
- -15% - 15%
- 15% -25%
- 25%- 50%
- >50%

Issue	Date	By	Chkd	Appd
P1	13/11/2014	ZW	JE	JE

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Job Title
WDC STA Addendum 03

Metres
0 485 970 1,940

KSWA Reference V RDA + RS
2028 AM Peak Hour 0800-0900
Percentage Difference Mean Delay

Scale at A3
N.T.S.

Job No	Drawing Status
232815-53	For Information

Drawing No	Issue
MD_003	P1

MXD Location Document Path: J:\232000\232815-53\4 Internal Project Data\4-04 Calculations\GIS\05 mxd\20141113_update\MD_003.mxd

A3

Legend

Mean Delay

- ▬ no data
- ▬ < -15%
- ▬ -15% - 15%
- ▬ 15% -25%
- ▬ 25%- 50%
- ▬ >50%

Issue	Date	By	Chkd	Appd
P1	13/11/2014	ZW	JE	JE

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Job Title
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Metres
0 485 970 1,940

**KSWA Reference V RDA + RS
2028 PM Peak Hour 1700-1800
Percentage Difference Mean Delay**

Scale at A3
N.T.S.

Job No	Drawing Status
232815-53	For Information

Drawing No	Issue
MD_004	P1

MXD Location Document Path: J:\232000\232815-53\4 Internal Project Data\4-04 Calculations\GIS\05 mxd\20141113_update\MD_004.mxd