# Warwick District Council Strategic Transport Assessment Modelling

PARAMICS Testing & Results

Report

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# 1 Introduction

## Background

1.1 JMP has been commissioned by Warwickshire County Council (WCC) to assist with the modelling of Warwick District Council's (WDC) proposed Local Development Framework (LDF) sites and utilise the available PARAMICS models to assess the resulting network conditions. In conjunction with WCC potential mitigation solutions have also been explored and a suggested package of measures developed.

1.2 A set of four potential options, each containing a mix of proposed LDF sites, has been provided by WCC and subsequently reflected within the relevant 2028 PARAMICS models. The impact of each option scenario has been assessed using various model outputs and summarised within the following report. A comparison between the options has also been carried out to highlight any significant differences between the various option packages.

1.3 The initial network impact review in conjunction with WCCs local knowledge has then been used to aid the development of a set of appropriate highway improvement measures designed to mitigate the impact observed in 2028 with the inclusion of the LDF development sites. The residual network stress is highlighted and a comparison between the 'Do Nothing' (DN) and 'Do Something' (DS) scenarios presented to measure the effectiveness of the proposed schemes.

## Existing Models

1.4 JMP has been instructed to make use of WCCs existing PARAMICS models. WCC are currently in possession of two PARAMICS models that cover the Warwick District highway network and are ideally suited for this assessment; namely the Kenilworth & Stoneleigh (KS) Model and the Warwick & Leamington (WL) Model. Both models have been independently audited and are deemed fit for purpose.

### Kenilworth & Stoneleigh (KS) Model

1.5 WCC previously undertook the development of a Kenilworth and Stoneleigh Area Wide PARAMICS 2009 Model as a response to the planning requirements identified through the WDC LDF.

1.6 The Kenilworth & Stoneleigh model covers the A46 from A46 / B4115 / A429 Coventry Rd junction in the south to Stivichall Island to the north. The A429 runs along the western edge of the model from Kenilworth centre in the south to the A429 / A45 junction to the north. The B4113 Stoneleigh Road runs along the eastern edge from Blackdown Roundabout to the south Coventry boundary. A46 Tollbar End junction is captured at the north eastern edge of the model. The model extent is highlighted in Figure 1.1.

1.7 The 2009 KS base year model has been forecast up to 2028 levels following WCCs standard forecasting methodology as summarised in the Kenilworth & Stoneleigh Future Year Reference Case Development Report. This report summarises the development of the 2016, 2018 and 2026 reference case models. The methodology followed when constructing the 2028 model has not differed with the exception of the use of the new TEMPRO data set v6.2.

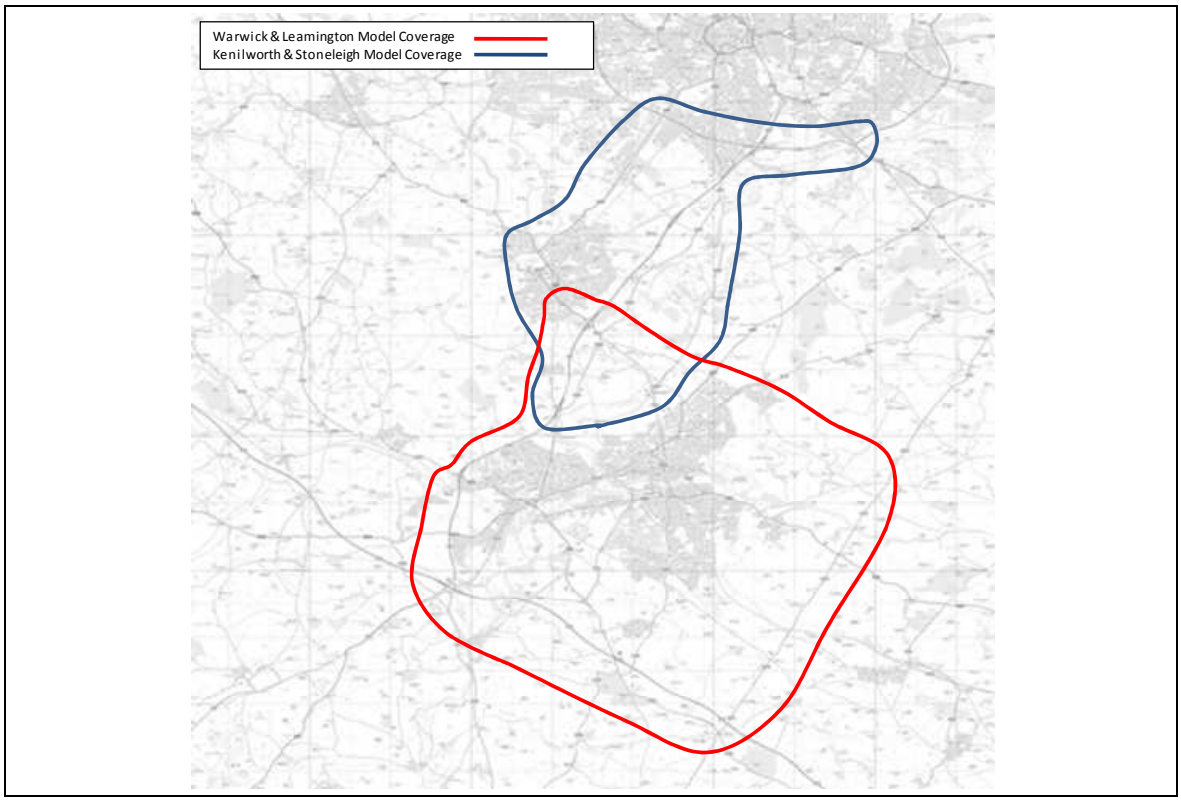
### Warwick & Leamington (WL) Model

1.8 The second model available for the assessment of WDCs LDF sites covers the Warwick & Leamington Wider Area and has recently been updated by JMP to reflect 2011 conditions.

1.9 The Warwick & Leamington model includes the A46 running along the western edge of the model from south of M40 J15 to north of Thickthorn Roundabout. The Fosse Way borders the eastern edge of the model and runs from the B4100 at the south to Offchurch at the north. Along the northern edge of the model is Leamington Road, A452, Bericote Road, Westhill Road, Kenilworth Road and Welsh Road from St. John's Gyratory to the west to the Fosse Way to the east. The southern edge of the model is bordered by M40 from J15 to J13 but also includes sections of A46, A429 and Banbury Road south of the M40. The model extent is highlighted in Figure 1.1.

1.10 The final base year model has been forecast to reflect the 2028 conditions. This model includes all known committed developments and committed schemes as provided by WCC. The growth element has been derived from DfT's TEMPRO v.6.2 and NTM factors and the standard WCC forecasting methodology has been followed. The details of the model development are covered within "Warwick & Leamington 2018 & 2028 Forecasting Report (March 2012)".

**Figure 1.1 Warwick District Model Coverage**




1.11 The two 2028 models noted above form the basis for the following assessment and have been used as the principal tools in identifying network impact and to assist the development of mitigation schemes.

## Report Structure

1.12 Chapter 2 of this report summarises the Option Scenarios, the trip generation assumptions and the subsequent inclusion of the development site trips within the final 2028 models.

1.13 Chapter 3 provides an overview of the assessment criteria used to capture the network impact and the presentation of the model findings within the report.

1.14 Chapter 4 focuses on the four ‘Do Nothing’ scenarios and presents the modelling results from each with accompanying comparisons between the options.

1.15 Chapter 5 discusses the proposed improvement schemes and presents the revised modelling results from the ‘Do Something’ models. Comparisons are made between these options and between the corresponding DN scenarios.

1.16 Chapter 6 provides the summary of the project findings and concludes the report.

# 2 Option Details

## Introduction

2.1 A selection of four potential options has been provided by WCC each containing a mix of WDCs proposed sites for housing and employment development. Each option contains total development of approximately 8,500 dwellings and 26 hectares of employment land.

2.2 In order to assess the impact of each of the four options on the Warwick & Leamington and Kenilworth & Stoneleigh networks it has been necessary to determine a set of trip generations for each site and assess the distribution of these trips within the two PARAMICS models. The assumptions and methods made in developing the option related demand matrices are summarised in the following sections.

## Option Site Inclusions & Development Quantum

2.3 Tables were provided by WCC that contained a list of the sites and associated land use quantum that were to be included within each of the four options.

2.4 The details are presented in Table 2.1 to Table 2.4 below.

**Table 2.1 Option 1 Sites**

| Site | No. of Dwellings | Employment Land |
|---|---|---|
| Urban regeneration sites: | | |
| Warwickshire College | 300 | |
| Land at Montague Rd | 80 | |
| Leam Cricket Club | 75 | |
| Station Approach | 150 | |
| Leam Fire Station | 50 | |
| Thickthorn | 770 | |
| Glasshouse Lane | 490 | 10 hectares |
| Crewe Gardens | 360 | |
| N Milverton East | 610 | |
| N Milverton West | 680 | 7 hectares |
| Blackdown | 1170 | |
| Loes Farm | 180 | |
| Woodside Farm | 250 | |
| Whitnash East | 650 | |
| Warwick Gates Employment Land | 200 | 7 hectares |
| West of Europa Way | 1105 | |
| South of Gallows Hill | 560 | |
| Westwood Heath | 880 | 2 hectares |
| **Total** | **8560** | **26 hectares** |

### Table 2.2 Option 2 Sites

| Site | No. of Dwellings | Employment Land |
|---|---|---|
| Urban regeneration sites: | | |
| Warwickshire College | 300 | |
| Land at Montague Rd | 80 | |
| Leam Cricket Club | 75 | |
| Station Approach | 150 | |
| Leam Fire Station | 50 | |
| Thickthorn | 770 | 10 hectares |
| Glasshouse Lane | 490 | |
| Crewe Gardens | 360 | |
| N Milverton East | 610 | 4 hectares |
| N Milverton West | 680 | |
| Red House Farm | 200 | |
| Fieldgate Lane | 95 | |
| Loes Farm | 180 | |
| Woodside Farm | 250 | |
| Whitnash East | 650 | |
| Warwick Gates Employment Land | 200 | 12 hectares |
| West of Europa Way | 1105 | |
| South of Harbury Lane | 2150 | |
| **Total** | **8395** | **26 hectares** |

### Table 2.3 Option 3 Sites

| Site | No. of Dwellings | Employment Land |
|---|---|---|
| Urban regeneration sites: | | |
| Warwickshire College | 300 | |
| Land at Montague Rd | 80 | |
| Leam Cricket Club | 75 | |
| Station Approach | 150 | |
| Leam Fire Station | 50 | |
| Thickthorn | 770 | 9 hectares |
| Glasshouse Lane | 490 | |
| N Milverton East | 610 | 7 hectares |
| N Milverton West (partial) | 340 | |
| Blackdown | 1170 | |
| Red House Farm | 200 | |
| Fieldgate Lane | 95 | |
| Loes Farm | 180 | |
| Woodside Farm | 250 | |
| Whitnash East | 650 | |
| Warwick Gates Employment Land | 200 | 10 hectares |
| West of Europa Way | 1105 | |
| South of Gallows Hill | 560 | |
| The Asps | 1040 | |
| Sustainable villages | 200 | |
| **Total** | **8515** | **26 hectares** |

**Table 2.4 Option 4 Sites**

| Site | No. of Dwellings | Employment Land |
|---|---|---|
| Urban regeneration sites: | | |
| Warwickshire College | 300 | |
| Land at Montague Rd | 80 | |
| Leam Cricket Club | 75 | |
| Station Approach | 150 | |
| Leam Fire Station | 50 | |
| Thickthorn | 770 | 6 hectares |
| N Milverton East | 610 | 10 hectares |
| N Milverton West | 680 | |
| Blackdown | 1170 | |
| Red House Farm | 200 | |
| Fieldgate Lane | 95 | |
| Loes Farm | 180 | |
| Woodside Farm | 250 | |
| Whitnash East | 650 | |
| Warwick Gates Employment Land | 200 | 10 hectares |
| West of Europa Way | 1105 | |
| South of Gallows Hill | 560 | |
| South of Harbury Lane (reduced site) | 600 | |
| Sustainable villages (opn4) | 400 | |
| Westwood Heath (reduced site) | 350 | |
| **Total** | **8475** | **26 hectares** |

## Site Locations & Access Arrangements

2.5 The location of each of the development sites was provided by WCC and is detailed within Appendix A. The proposed access points from the development sites onto the existing network were stipulated by WCC. The access assumptions are also provided in Appendix A.

2.6 It should be noted that at this stage the detailed access arrangement drawings were not available so assumptions have been made regarding their configuration and exact location. For the purposes of this testing the modelled junctions serve the primary purpose of allowing the development trips to enter and exit the network.

## Trip Generation Assumptions

2.7 In order to derive the trip generation to / from each development site various assumptions had to be made. The following assumptions were made with agreement from WCC.

### Residential Trips

2.8 The type of dwellings associated with each site was not specified so assumptions were made regarding the split of housing types. In order to get a reasonable approximation a recent Transport Assessment (TA) of a residential development within Warwickshire was used as a proxy.

2.9 The Cape Road development was selected for this purpose as it contained a mix of housing types, was located within Warwick, and the trip rates have previously been accepted by WCC. From this TA the following property split was noted.

- Private Housing: 16%
- Private Apartments: 54%
- Social Housing: 15%
- Social Apartments: 15%

2.10 The trip rates associated with each housing type were also taken from the Cape Road TA. The trip rates quoted within the TA had been obtained from the TRICS database. The peak hour trip rates are summarised below.

**Table 2.5 Residential Trip Rates (per Dwelling)**

| | AM Peak Hour (08:00-09:00) | | PM Peak Hour (17:00-18:00) | |
|---|---|---|---|---|
| **Property Type** | **In** | **Out** | **In** | **Out** |
| Private House | 0.19 | 0.50 | 0.57 | 0.27 |
| Private Apartment | 0.02 | 0.29 | 0.17 | 0.05 |
| Social Housing | 0.18 | 0.37 | 0.40 | 0.32 |
| Social Apartment | 0.08 | 0.12 | 0.14 | 0.08 |

2.11 The residential property split noted above and the associated trip rates in Table 2.5 were applied to all residential sites listed in the option tables. These assumptions enabled the total AM and PM peak hour residential trip generation to be determined for each site based on the number of dwellings.

2.12 It should be noted that this split has been used in the absence of any more detailed information about the residential developments. In the future developers would be expected to use accurate housing splits and trip rates where applicable.

### Employment Trips

2.13 For employment development only the employment land area was provided. As such, assumptions were necessary to determine the density of build on this land, the split of employment land use, and the trip rates to use.

2.14 The employment land use split was based on the District's allocations quoted within WDCs "Employment Monitoring Report 2008" and recommended within the project brief. The assumed split was as follows:

- B1 Business: 70%
- B2 General Industrial: 16%
- B8 Storage & Distribution: 14%

2.15 The land use density was based on a table previously provide by WDC during the Warwick & Leamington model forecasting process. The data was taken from the "Warwick District Planning, Policy & Conservation" report and suggested a Hectare to Gross Floor Area (GFA) factor of 0.4 (i.e. 40%).

2.16 The process therefore started with the gross employment land as provided in the option tables which was then multiplied by 0.4 to derive the GFA. This value was then split between B1, B2 and B8 based on the proportions noted above.

2.17 The trip rates for each of the three employment categories was then determined. The trip rates were taken from the TRICS database. For B2 a weighted average of Industrial Units and Industrial Estate trip rates was calculated based on the number of sample sites in the database. The resulting peak hour trip rates for each employment land use are presented below:

**Table 2.6 Employment Trip Rates (per 100m$^2$)**

| | AM Peak Hour (08:00-09:00) | | PM Peak Hour (17:00-18:00) | |
|---|---|---|---|---|
| **Employment Type** | **In** | **Out** | **In** | **Out** |
| B1 Business | 1.30 | 0.24 | 0.18 | 1.11 |
| B2 General Industrial | 0.36 | 0.14 | 0.07 | 0.27 |
| B8 Storage & Distribution | 0.11 | 0.07 | 0.06 | 0.11 |

### Discounting

2.18 WCC suggested that an element of discounting should be accounted for within the trip generation to reflect internalisation of trips and the effects of proposed improvements to sustainable travel infrastructure and the resulting modal shift. The following assumptions were applied:

- Assumed level of internalisation: 10%
    - The discount for internalisation was only to be applied if the site contained both employment & residential development.
- Assumed modal shift: 15%
    - The discount for sustainable mode shift was only applied to the element that was not internalised i.e. where both discounts are valid then the original trip generation was factored to remove internal trips and then the remainder factored to account for a shift to different modes.

2.19 The application of these assumptions are summarised on a site by site basis in Table 2.7.

**Table 2.7 Trip Generation Discounting**

| Site | Land Use | | Discount? | |
|---|---|---|---|---|
| | Resi | Employ | Internals | Modal Shift |
| Blackdown | X | X | Yes | Yes |
| Fieldgate Lane | X | | No | Yes |
| Glasshouse Lane | X | X | Yes | Yes |
| Crewe Gardens | X | X | Yes | Yes |
| Loes Farm | X | | No | Yes |
| N Milverton East | X | X | Yes | Yes |
| N Milverton West (full & partial) | X | X | Yes | Yes |
| Red House Farm | X | | No | Yes |
| South of Gallows Hill | X | X | Yes | Yes |
| The Asps | X | X | Yes | Yes |
| South of Harbury Lane (full & partial) | X | X | Yes | Yes |
| Thickthorn | X | X | Yes | Yes |
| Warwick Gates Employment Land | X | X | Yes | Yes |
| West of Europa Way | X | X | Yes | Yes |
| Westwood Heath | X | X | Yes | Yes |
| Westwood Heath (reduced site) | X | | No | Yes |
| Whitnash East | X | | No | Yes |
| Woodside Farm | X | | No | Yes |
| Warwickshire College | X | | No | Yes |
| Land at Montague Rd | X | | No | Yes |
| Leam Cricket Club | X | | No | Yes |
| Station Approach | X | | No | Yes |
| Leam Fire Station | X | | No | Yes |
| Sustainable Villages | X | | No | Yes |

### Final Trip Generation

2.20 The resulting peak hour trip generation for each site is summarised in Table 2.8.

**Table 2.8 Final Peak Hour Discounted Trip Generation (by Site)**

| Site | Peak Hour Trip Generation | | | |
|---|---|---|---|---|
| | AM IN | AM OUT | PM IN | PM OUT |
| Blackdown | 162 | 296 | 251 | 194 |
| Fieldgate Lane | 7 | 25 | 21 | 11 |
| Glasshouse Lane | 120 | 135 | 113 | 126 |
| Crewe Gardens | 52 | 92 | 78 | 62 |
| Loes Farm | 12 | 47 | 41 | 20 |
| N Milverton East | 98 | 157 | 133 | 112 |
| N Milverton West | 102 | 174 | 147 | 119 |
| N Milverton West (reduced site) | 81 | 93 | 78 | 85 |
| Red House Farm | 14 | 53 | 45 | 22 |
| South of Gallows Hill | 105 | 147 | 124 | 116 |
| The Asps | 154 | 265 | 224 | 181 |
| South of Harbury Lane | 353 | 555 | 469 | 403 |
| South of Harbury Lane (reduced site) | 127 | 161 | 135 | 137 |
| Thickthorn | 228 | 219 | 183 | 230 |
| Warwick Gates Employment Land | 83 | 62 | 51 | 80 |
| West of Europa Way | 138 | 277 | 235 | 170 |
| Westwood Heath | 114 | 221 | 187 | 139 |
| Westwood Heath (reduced site) | 24 | 92 | 79 | 39 |
| Whitnash East | 45 | 172 | 146 | 72 |
| Woodside Farm | 17 | 66 | 56 | 28 |
| Warwickshire College | 21 | 79 | 68 | 33 |
| Land at Montague Rd | 5 | 21 | 18 | 9 |
| Leam Cricket Club | 5 | 20 | 17 | 8 |
| Station Approach | 10 | 40 | 34 | 17 |
| Leam Fire Station | 3 | 13 | 11 | 6 |
| Sustainable Village - Bishop's Tachbrook | 5 | 20 | 17 | 8 |
| Sustainable Village - Radford Semele | 5 | 20 | 17 | 8 |
| Sustainable Village - Hampton Magna | 5 | 20 | 17 | 8 |

2.21 The trip generation for the shoulder hours was derived through the use of proxy ratios of peak hour to shoulder hour based on sample data taken from the TRICS database.

2.22 The residential TRICS category “Land Use 03 - RESIDENTIAL/M - MIXED PRIVATE/NON-PRIVATE HOUSING” was used to determine the proxy proportions for the residential element of the site’s trip generation and the employment category “Land Use 02 - EMPLOYMENT/A – OFFICE” for the employment element. The following relationships were applied to the peak hour trip generation to determine the shoulder hour trip generation.

**Table 2.9 Residential Proxy Trip Profiling**

| Trips | AM Period | | | PM Period | | |
|---|---|---|---|---|---|---|
| | 07-08:00 | 08-09:00 | 09-10:00 | 16-17:00 | 17-18:00 | 18-19:00 |
| IN | 65.1% | 100.0% | 101.9% | 72.6% | 100.0% | 76.0% |
| OUT | 68.5% | 100.0% | 46.1% | 96.4% | 100.0% | 97.9% |

**Table 2.10 Employment Proxy Trip Profiling**

| Trips | AM Period | | | PM Period | | |
|---|---|---|---|---|---|---|
| | 07-08:00 | 08-09:00 | 09-10:00 | 16-17:00 | 17-18:00 | 18-19:00 |
| IN | 55.6% | 100.0% | 58.0% | 120.3% | 100.0% | 51.1% |
| OUT | 64.7% | 100.0% | 88.2% | 87.3% | 100.0% | 35.6% |

## Site Distribution

2.23 In order that the impact of each of the key developments is fully assessed it is important that the trips from a site situated, for example, in Warwick are also accurately reflected within the Kenilworth model if the trips travel that far.

2.24 It is usually the case that a development that has to be tested would be located within the PARAMICS model. As such, the full trip generation (in and outbound trips) would start and / or end within the model. Trips travelling from the development site to areas outside the model extent are reflected by Origin-Destination trips (ODs) from the site to an appropriate external zone and trips travelling to the site from outside the model extent are reflected in ODs from an external zone to the site.

2.25 In the majority of cases the LDF sites being tested are located on land either captured in the KS model or the WL model. However, there are sites that are located outside both model networks but are close enough that a proportion of their trips will start or end within one of them (or pass through them).

2.26 For the purpose of this assessment it is not appropriate to just ignore trips that belong to developments that fall outside the networks and it is imperative that the trips that cross the borders between the models are actually reflected in both models.

2.27 In order to accurately capture the distribution of each site in the relevant models (despite the site's location) JMPs strategic assessment tool, CITEware has been used. CITEware has been used on numerous occasions to determine the distribution proportions to / from a site and other zones within a single PARAMICS model's zoning system. However, as explained above the distributions produced by CITEware on this occasion have to show origin or destinations that fall within either of the two models. To make this possible the following process has been followed:

- Step 1 – Including Development Site Zones

  Assign a zone within the appropriate PARAMICS model to reflect the location of each of the proposed sites. In the majority of cases a new zone was added however for a few smaller sites existing zones were used.

  N.B.: Westwood Heath does not fall within either model but was still assigned a zone within CITEware by adding a new zone within the KS model to the north west of the network at the point where the site is located. The fact that the network does not connect to this site does not matter as at this stage as it is solely to provide CITEware with a point of reference for each of the development sites.

- Step 2 – Combining the zone files

  The updated zone file from the WL and KS models had to be combined. To do this all KS zones were given the prefix of "999" to avoid duplicate zone names. Additionally, all external

zones located along the border of the two networks were removed. This ensured that no trips would be sent to these zones which do not technically represent an area but a ‘catch-all’ for trips exiting the models at these points.

A small number of overlapping zones were also removed to avoid any confusion when distributing within CITEware.

- Step 3 – Preparing CITEware

  The final combined zone file was then uploaded into CITEware. Taking each option in turn the site specific trip generation was associated to the relevant zones in CITEware. Only the sites that were to be included within a certain option were assigned trip generation numbers when carrying out a specific option run.

  This ensured that the generation and attraction of the development sites were included within the appropriate CITEware runs and that their impact on the distribution of other sites was taken into account when running the CITEware batches therefore enabling the potential for inter-site trips.

- Step 4 – CITEware Outputs

  Each option was run through CITEware and for each site that was included within an option a distribution table was produced. These tables represent the distribution proportions between the site and other zones within the combined zoning system.

  Additionally, the flows (in both directions) were captured on the links between the two models where the individual model’s external zones lie. N.B.: due to model overlap these location differ for each model so there was a set of links for the KS model and a slightly different set for WL.

- Step 5 – Converting the CITEware Distributions into Model Matrices

  As the zone plans within each of the individual models do not include the full set of zones used within the CITEware models it is not possible to simply distribute the trip generation by the unadjusted CITEware proportions and convert this into matrices.

  It was firstly necessary to convert the CITEware outputs back into proportions that could be used to build matrices suitable for the individual models. This had to be done on a site by site basis before eventually combining the resulting matrices.

  It was first necessary to determine which model the site falls within. Due to the zoning convention (i.e. KS prefix of “999”) it was then possible to determine the total proportion of the trips that originate or end their trip at a zone that belongs to the other model’s zoning system.

  Once this was known it is clear that these trips must exit the model in which the site falls via one of that model’s external zones, and conversely enter the other model’s zone system at one of its external zones.

  To correctly assign these trips to the model’s external zone (as an origin or destination) the flows captured in CITEware on the links where the zones are located were used. The appropriate direction of the flow is used depending on whether it is an inbound or outbound flow. This enabled the proportion of trips shown to travel to the other model’s zones to be allocated to an external zone when rebuilding the matrices.

  Minor variations to this methodology were employed to deal with the Westwood Heath trips (which enter / exit the KS model along the western edge of the model) and the Thickthorn site which lies on a site included in both PARAMICS models.

- Step 6 – Combining the site matrices

The process summarised above resulted in a separate KS and WL formatted matrix for each of the sites included within each option. To create the final matrix to be used within the WL and KS option models the relevant matrices were combined to derive a single matrix containing the appropriate element of trips from all sites included within each specific option scenario.

2.28 It should be noted that the distribution of the urban regeneration sites (with the exception of Warwickshire College) and the Sustainable Village trips were not derived through CITEware. In these cases the peak hour trip generation was less than 50 two-way trips and as such were deemed too low to result in a significant number of cross-border trips. As such, these trips were included within the option site matrices using the existing distribution of the zone in which the site falls.

## Final Model Demands

2.29 The option demand matrices have been included within their respective models using a new matrix level (matrix level 7). They have been included within the 2028 reference case models however a few final adjustments have been made to the existing matrices. The adjustments are summarised below:

- Step 1 – Removing Internal Growth from Reference Models

  The demand matrices have been taken directly from the 2028 reference models. These demands have been forecast through the processes outlined in WCC modelling protocol and include the committed developments and elements of unfocussed generic growth per TEMPRO / NTM estimations.

  For the purpose of the LDF site testing it has been assumed that all additional internal growth not captured within the committed development growth will be captured within the Option matrices (i.e. the development sites). As such, any surplus internal growth contained within the growth matrices of the reference matrices has been zeroed.

- Step 2 – Adjusting Existing External Growth to Avoid Double Counting

  As a result of the methodology used to construct the option matrices a number of ODs that can be classed as external occur (i.e. external zone to external zone). These trips have already been accounted for within the forecasting process when developing the 2028 reference models. As such, the Option matrices have been reviewed to highlight the level of trips that are classed as Externals and this total has been subtracted from the relevant reference matrix (level 5).

  The external trips have been removed from the reference model matrix (matrix level 5) based on the existing hourly proportions observed between the hourly matrices. N.B.: the level of external trips associated with each option differs as the sites and the distribution patterns differ.

  It has been noted that a significantly higher proportion of the KS option site matrices comprised of External trips. This is to be expected as the majority of development sites are located within the WL model and as such a higher proportion of KS trips will be crossing borders to reach the development sites. Additionally, there is a higher likelihood of trips travelling through the KS model to reach some of the larger sites within WL e.g. from Coventry or Birmingham whereas there is less chance of trips originating south or east of Warwick or Leamington and passing through to reach one of the few sites in the KS model.

- Step 3 – Include the Option Matrix

Once the relevant adjustments for double counting have been made the option matrices were assigned to the appropriate model scenario.

The sum of the three AM and three PM hour demands have been spread equally across the individual modelled hour i.e. 33% in each hour. The historic data provided by WCC indicates that in the future the level of growth in the shoulder periods will be considerably higher than the growth in the peak hours. However, the projected growth percentages (as used in the development of the future year reference matrices) would result in option site demands of zero in the AM peak hour which would not be realistic. As such, a flat profile has been deemed the most reasonable approximation in the absence of any further details.

It should be noted that peak spreading (in both the development of the 2028 reference demands and in the option site matrices) has not been assumed to result in a shift of trips outside the three AM and three PM hours. In reality this is likely and as a result the demands would be lower than those tested. Change in trip start times is not easily quantified however it is worth noting that the demands within the models may be overly robust for these reasons.

2.30 A summary of the final demands is provided in Table 2.11 and Table 2.12 below.

**Table 2.11 Kenilworth & Stoneleigh Option Model Demands**

| | 07-08:00 | 08-09:00 | 09-10:00 | 16-17:00 | 17-18:00 | 18-19:00 |
|---|---|---|---|---|---|---|
| 2028 Reference | | | | | | |
| Total Demands | 25,829 | 26,258 | 19,802 | 26,444 | 26,505 | 22,955 |
| Option 1 | | | | | | |
| Option Site Demands | 3,624 | | | 3,887 | | |
| Total Demands | 24,328 | 27,466 | 19,552 | 26,134 | 26,620 | 22,314 |
| Option 2 | | | | | | |
| Option Site Demands | 3,419 | | | 3,644 | | |
| Total Demands | 24,392 | 27,398 | 19,554 | 26,132 | 26,597 | 22,329 |
| Option 3 | | | | | | |
| Option Site Demands | 3,140 | | | 3,341 | | |
| Total Demands | 24,391 | 27,305 | 19,511 | 26,081 | 26,533 | 22,288 |
| Option 4 | | | | | | |
| Option Site Demands | 2,675 | | | 2,853 | | |
| Total Demands | 24,084 | 27,150 | 19,274 | 25,831 | 26,306 | 22,020 |

2.31 It can be seen from Table 2.11 above that Option 1 includes the highest level of development site trips that are captured within the KS model. However, the total level of demand within the models is generally consistent across all four option scenarios. This is because the higher level of option site demands is offset by a larger reduction in external trips from the background matrices as there are more trips being classed as External trips travelling cross border to / from WL sites.

2.32 The total KS option scenario demands are generally at levels in line with those included within the 2028 reference model.

**Table 2.12 Warwick & Leamington Option Model Demands**

| | 07-08:00 | 08-09:00 | 09-10:00 | 16-17:00 | 17-18:00 | 18-19:00 |
|---|---|---|---|---|---|---|
| 2028 Reference | | | | | | |
| Total Demands | 41,353 | 49,392 | 37,067 | 46,957 | 48,978 | 41,320 |
| Option 1 | | | | | | |
| Option Site Demands | 6,252 | | | 6,916 | | |
| Total Demands | 42,560 | 51,476 | 38682 | 49,211 | 51,260 | 43,521 |
| Option 2 | | | | | | |
| Option Site Demands | 6,955 | | | 7,691 | | |
| Total Demands | 42,798 | 51,710 | 38,918 | 49,471 | 51,519 | 43,783 |
| Option 3 | | | | | | |
| Option Site Demands | 7,183 | | | 7,950 | | |
| Total Demands | 42,879 | 51,786 | 38,997 | 49,560 | 51,607 | 43,875 |
| Option 4 | | | | | | |
| Option Site Demands | 6,981 | | | 7,740 | | |
| Total Demands | 42,823 | 51,719 | 38,935 | 49,495 | 51,539 | 43,815 |

2.33 It can be seen from Table 2.12 that Option 3 shows the highest level of development site trips within the WL model. However, with the exception of Option 1 the level of development trips is generally consistent across each option scenario. This is in-line with expectations as the level of residential and employment development presented within each of the option schedules is consistent.

2.34 It can also be seen that the total level of demands within each period of the WL option scenarios exceed the levels of trips included within the reference model, most notably in the PM periods. The methodology used to construct the reference models is particularly robust and is based on the TEMPRO / NTM growth predictions. The fact that the demands within the option scenarios exceed these levels indicates that the development trips exceed TEMPRO prediction and therefore may potentially be overly robust.

# 3 Assessment Criteria

3.1 For each modelled option the assessments discussed below have been carried out and presented in the proceeding chapters.

## Queue Lengths

### General

3.2 In order to highlight areas of congestion and to determine where the network is experiencing stress the maximum queue lengths on the approaches to key junctions have been collected. A comparison of significant queues noted in the DN and DS scenarios provides an indication of the effectiveness of the proposed schemes that have been tested later in this report.

### Junctions Locations

3.3 The junctions selected for analysis are presented in Appendix B.

### Queue Criteria

3.4 For the purpose of assessment PARAMICS has been set to recognise a queued vehicle when the vehicle's speed falls below 4.5mph and the gap between the vehicle and the vehicle in front is less than 10m. This is the default setting in PARAMICS.

3.5 The maximum queue refers to the longest queue occurring in any one of the lanes. The distances are quoted in vehicle numbers from the stop line / give way line to the back of the final queued vehicle on the approach.

### Queue Length Results

3.6 The queue lengths have been assessed for the hours between 07:00 and 10:00 and 16:00 and 19:00 in both models. The maximum queue length in each 10 minute interval has been recorded with the maximum of these values being used to determine the hourly maximum.

3.7 In order to capture the conditions across all the AM or PM hours within a single number the average of the three AM and three PM hour's maximums have been quoted throughout this report as the period's average maximum queue length.

3.8 The queue lengths have been presented graphically by highlighting approaches where the resulting average maximum queue is 15 or more vehicles in length within the KS network or 30 or more vehicles within the WL network. The location details and precise queue length have been provided for the longest queues in the accompanying tables. For the purpose of this exercise only locations where the maximum queue exceeds 50 vehicles have been listed.

3.9 This information is intended to provide an indication of where queues of notable length are experienced and highlight where stress may exists. The issues that the queue lengths highlight will vary based on junction size, location or level of importance given to its efficient operation,

### Queue Impact Assessments

3.10 To provide a comparison between the DN and DS scenarios the maximum queue lengths have been compared. The resulting differences have been presented graphically using colour banding to depict increases or decrease in queue lengths of varying degrees.

3.11 This assessment is intended to clearly highlight any benefits or dis-benefits resulting from the implementation of the proposed schemes.

## Journey Times

### General

3.12 The journey times on a selection of key routes through each model have been collected for each option scenario. The journey times noted in each scenario provide a useful comparison when comparing options and for assessing the impact of the potential improvement schemes on journey times in the modelled area.

### Selected Journey Paths

3.13 The journey paths selected for analysis are presented in the Figure 3.1 and Figure 3.2.

**Figure 3.1 Warwick & Leamington Journey Paths**

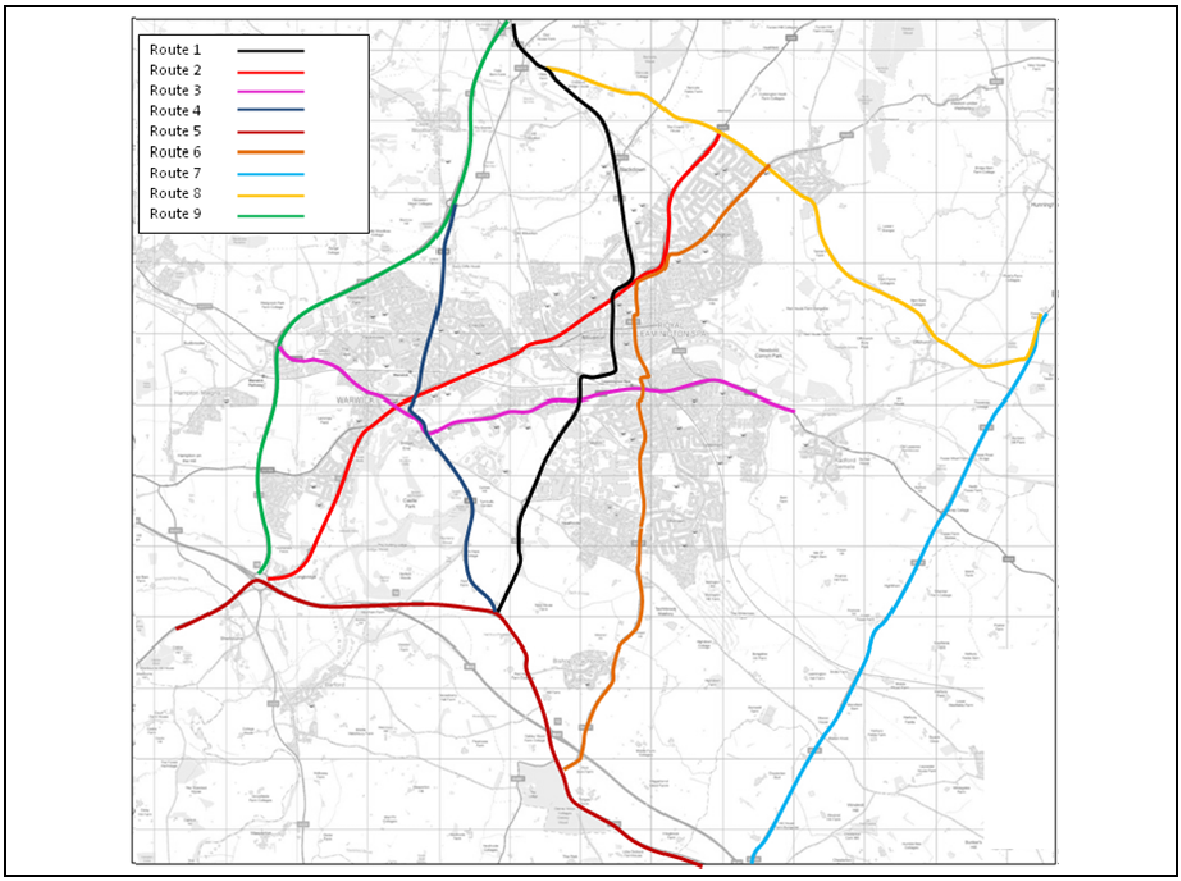
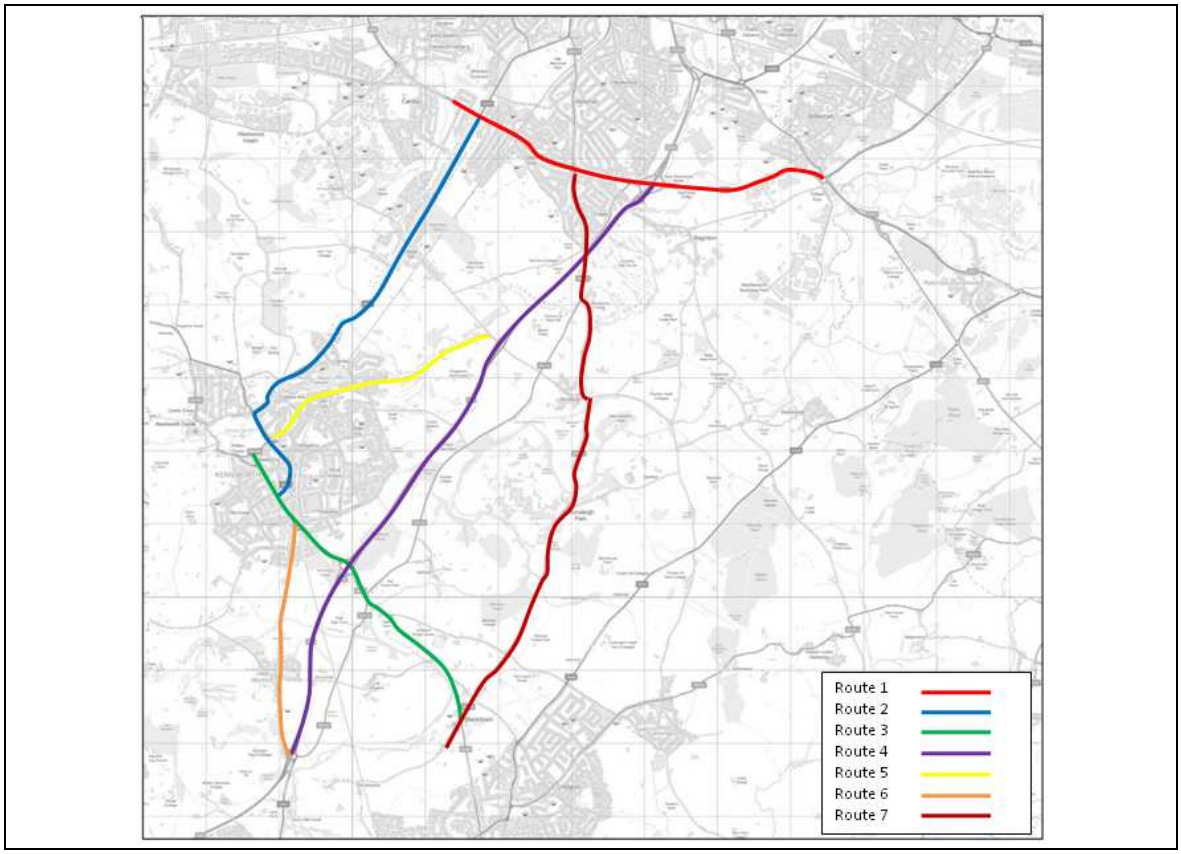


**Figure 3.2 Kenilworth & Stoneleigh Journey Paths**




### Journey Time Criteria

3.14 A selection of journey paths has been added to each model that is intended to represent the key routes on the network. Small sections have been used to ensure a large number of vehicles traverse the full length of the path and therefore construct a large sample of trips that can then be used to construct the average journey times. For the purpose of this report the component paths have been added together to derive the average journey time across the larger sections as depicted in the figures above.

3.15 The average journey times recorded across the final paths have been constructed for each hour with the average of the three AM hours and three PM hours presented in this report.

### Journey Time Impact Assessments

3.16 To provide a comparison between the various option scenarios and also between the DN and DS scenarios of the same scenario the journey times have been compared. This assessment is intended to clearly highlight any significant differences between the various option scenarios and also capture the benefits or dis-benefits resulting from the implementation of the proposed improvement schemes.

## Network Wide & Summary Statistics

### Network Wide Statistics

3.17 In order to provide an overview of network performance in each option scenario several network wide statistics have been collected. The following results have been presented:

- Average Distance (metres) – The average distance travelled by a vehicle that completed their journey during the model simulation period.
- Average Time (seconds) – The average travel time of a completed trip during the model simulation period.
- Average Speed (mph) – The average speed travelled by all vehicles that completed it journey during the model simulation period.
- Completed Trips (vehicles) – The number of completed trips recorded during the model simulation.

3.18 The first three measurements are averages so can be used to compare between option scenarios and also between DN and DS scenarios.

3.19 The final measurement is an absolute and is dependent on congestion on the network (as this will prevent trips from completing) and the demand within the model (i.e. the number of trips actually trying to complete). As demand differs between option scenarios we cannot expect the number of completed trips to be the same, however, as the demands do not differ significantly it can still provide an indication of the relative congestion on each network. Using this statistic for comparison between the DN and the DS of the same option scenario does however provide a fair comparison and is a good indication of the relative congestion and throughput achieved on the different networks with the same level of demands.

## Network Profiling (Vehicles on the Network)

3.20 The number of vehicles on the network during each minute of each model simulation has been recorded. This data can be plotted in a graph to highlight the profile of vehicles across a modelled period.

3.21 In a model that is extremely congested to the point of gridlock this information helps to highlight this issue as the number of vehicles is shown to continually increase until the end of the simulation. It also highlights at what point the network 'breaks'. In circumstances like this there is little benefit from extracting any further model results, such as queue lengths and journey times, as they would be meaningless.

3.22 The following analysis has highlighted issues in the Warwick & Leamington model during the PM periods in both the DN and DS scenarios. As such, the plotting of the vehicles on the network across the PM period have been used to highlight the issue and also draw comparisons between the DN and DS scenarios in the absence of useful queue and journey time outputs.

## Westwood Heath

3.23 The proposed site at Westwood Heath is not situated in either the Warwick & Leamington or Kenilworth & Stoneleigh model networks. As such, it is not possible to assess this development's impact on its immediate surrounding network in the existing PARAMICS models. It should be noted that the impact from this development on the modelled networks is however captured through the methodology discussed in Chapter 2 (i.e. using CITEware distribution).

3.24 In order to assess the impact on the immediate roads surrounding this site a separate CITEware run has been carried out and the increase in trips on the local roads assessed using the GEH statistics.

3.25 As this site is included as both a full site and a partial site in different option scenarios both have been assessed in CITEware using the corresponding trip generations. The AM and PM impacts have been presented graphically in Appendix C.

3.26 The results indicate that under partial development the Westwood Heath development has minimal impact on the surrounding road network with the GEH less than 5 on all links. The assessment of the full site highlights notable increases in flows on the local roads of Westwood Heath Road, Crackley Lane and Cryfield Grange Road between the site and the A429.

# 4 2028 ‘Do Nothing’ Option Scenarios

## General

4.1 The Warwick & Leamington and Kenilworth & Stoneleigh 2028 future year reference models have been forecast using an agreed and robust methodology. These models have been used as the starting point in which to assess the four Option scenarios, each of which containing a different mix of proposed development sites.

4.2 The methodology, assumptions and inclusions used in the construction of the option demand matrices and the final ‘Do Nothing’ models has been discussed in the preceding chapters.

4.3 This chapter focuses on the network conditions observed in the WL and KS ‘Do Nothing’ models. The following ‘Do Nothing’ models have been tested:

- 2028 Warwick & Leamington ‘Do Nothing’ Model - Option 1 [WL DN (Opn 1)]
- 2028 Kenilworth & Stoneleigh ‘Do Nothing’ Model - Option 1 [KS DN (Opn 1)]
- 2028 Warwick & Leamington ‘Do Nothing’ Model - Option 2 [WL DN (Opn 2)]
- 2028 Kenilworth & Stoneleigh ‘Do Nothing’ Model - Option 2 [KS DN (Opn 2)]
- 2028 Warwick & Leamington ‘Do Nothing’ Model - Option 3 [WL DN (Opn 3)]
- 2028 Kenilworth & Stoneleigh ‘Do Nothing’ Model - Option 3 [KS DN (Opn 3)]
- 2028 Warwick & Leamington ‘Do Nothing’ Model - Option 4 [WL DN (Opn 4)]
- 2028 Kenilworth & Stoneleigh ‘Do Nothing’ Model - Option 4 [KS DN (Opn 4)]

### DN Network Conditions

4.4 An individual assessment of the queue lengths experienced in each of the option scenario has been provided initially in this section to highlight the areas of stress on the network. For each option the queues of notable length have been presented graphically and in more detail in an accompanying table.

### DN Option Comparisons

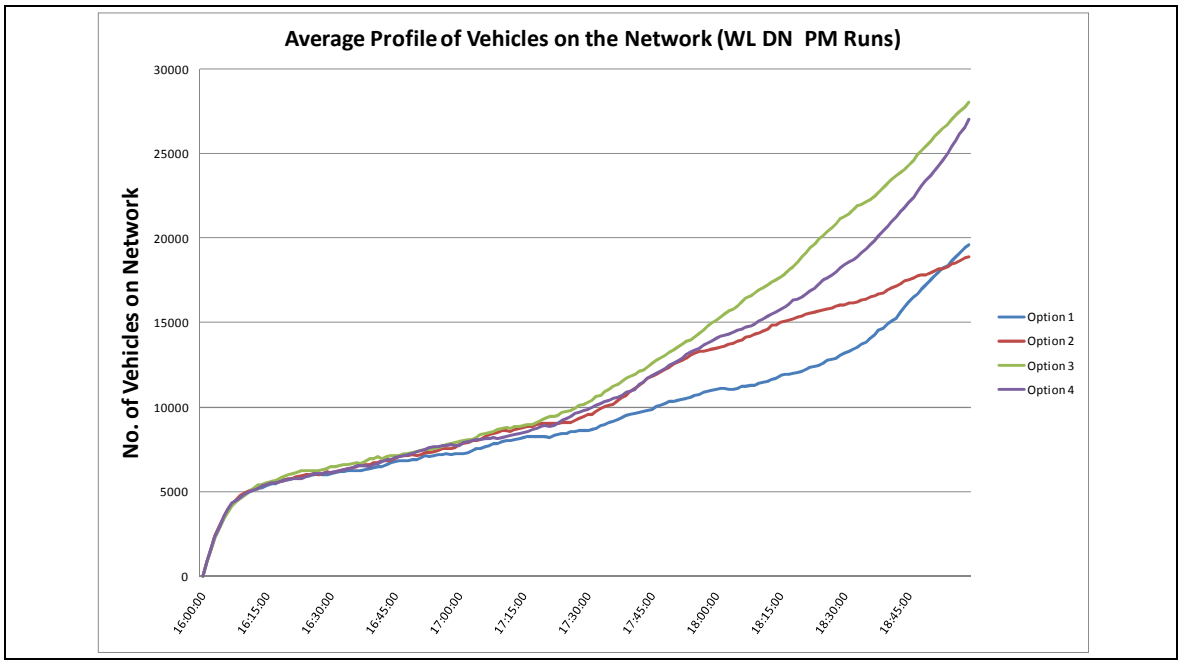
4.5 Following the queue assessments from the individual options the journey times on the key routes (as depicted in Figure 3.1 and Figure 3.2) are provided for each option alongside each other to provide a comparison between the delays in each of the four scenarios. Additionally, the summarised network wide statistics as discussed in Chapters 3 are presented at this point to further emphasis option differences.

### Warwick & Leamington ‘Do Nothing’ PM Period

4.6 The testing carried out within the Warwick & Leamington PM Period DN models has indicated levels of congestion that do not allow for meaningful outputs to be presented. The congestion on the network reaches levels where unrealistic / extreme delay is experienced and network ‘grid-lock’ occurs. As such, the queue and journey time data from the WL DN PM model runs would be misleading if included.

4.7 This is not uncommon given the level of demand within the model, the inclusion of the large LDF sites, and the lack of any additional network interventions to improve capacity (or optimise existing model calibration). However, it does make quantifying the model outputs very difficult.

4.8 As noted in Chapter 3 plotting the number of vehicles on the network can help highlight this issue. It can be seen that the number of trips on the network reach a point where they continue to increase exponentially until the end of the model simulation. This highlights the effect of the excessive congestion and the fact that trips are not clearing the network. This occurs in each of the four WL DN option models.




4.9 It can be seen from the graph above that by the end of the simulation there are approximately 20,000 vehicles or more stuck on the network. This is in contrast to the WL DN AM models which generally end with approximately 6,000 vehicles in the network after peaking at 11,000 vehicles midway through the simulation.

4.10 This highlights how critical it will be to identify the correct mitigation package in order to mitigate the potentially very significant cumulative impact especially in the PM peak hours, of the proposed housing and employment growth in the District.

## 'Do Nothing' Network Conditions

### Option 1

4.11 The junction approaches within the WL Option 1 'Do Nothing' model (AM period only) that experience an average maximum queue of 30 of more vehicles are presented in Figure 4.1. The junction approaches within the KS Option 1 'Do Nothing' model that show an average maximum queue of 15 of more vehicles are presented in Figure 4.2 & Figure 4.3.

4.12 The queues that exceed 50 vehicles are summarised in the accompanying tables (Table 4.1 to Table 4.3). The junction locations are presented in Appendix B.

**Table 4.1 WL DN (Opn 1) – Significant Queues (AM Period)**

| Ref | Junction | Approach | Dir | Max Q (vehs) |
|---|---|---|---|---|
| 4 | Stoneleigh Rd / Westhill Rd / Bericote Rd | Stoneleigh Rd | NB | 61 |
| | | Bericote Rd | EB | 65 |
| 5 | Leicester Lane / Kenilworth Rd / Westhill Rd | Leicester Lane | SB | 62 |
| | | Kenilworth Rd | WB | 67 |
| | | Leicester Lane | NB | 97 |
| 7 | Blackdown Rbt | Stoneleigh Rd | WB | 60 |
| 9 | Lillington Rd / Cubbington Rd / Warren Cl | A445 Lillington Rd | SB | 58 |
| 22 | Emscote Rd / Rugby Rd/ Warwick New Rd | Rugby Rd | SB | 65 |
| 26 | Princes Drive / Park Drive/ A452 | Princes Drive | SB | 56 |
| 27 | Princes Dr / Old Warwick Rd / Myton Rd | Old Warwick Rd | WB | 64 |
| | | Myton Rd | EB | 52 |
| 34 | Fosse Way / Southam Rd | Fosse Way | SB | 52 |
| 38 | Tachbrook Rd / Heathcote Rd | Tachbrook Rd | SB | 57 |
| 39 | Tachbrook Rd / Harbury Ln | Harbury Lane | WB | 56 |
| 41 | Greys Mallory | Banbury Rd | SB | 59 |
| 47 | Longbridge Island | Warwick Bypass | SB | 75 |
| | | A429 | WB | 86 |
| | | A429 | NB | 60 |
| 48 | Longbridge Island Mini-Rbt | SB Approach | SB | 80 |
| | | EB Approach | EB | 97 |
| 49 | Stank's Island | A46 | SB | 88 |
| | | A46 | NB | 75 |
| 51 | Saltisford / Theatre Street | Saltisford | EB | 69 |
| 54 | A429 / A445 / Weston Close | A429 | SB | 56 |
| 55 | A425 / A452 / Jury Street | Jury Street | EB | 67 |
| 57 | BanburyRd / A425 / Bridge End | A425 | WB | 59 |
| 58 | A425 / Gallows Hill | A425 | NB | 78 |
| 59 | A425 / High Street | High Street | EB | 71 |
| 62 | Spinney Hill Percy Island | A429 | SB | 77 |
| 65 | Hampton Rd / Purser Drive | Hampton Rd | EB | 70 |
| 67 | Stratford Rd / Alders Gr / Shakespeare Av | Stratford Rd | NB | 58 |

F 4.1-2028 Warwick & Leamington "Do Nothing" Model-Option 1 (AM Period)
Significant Queue Lengths

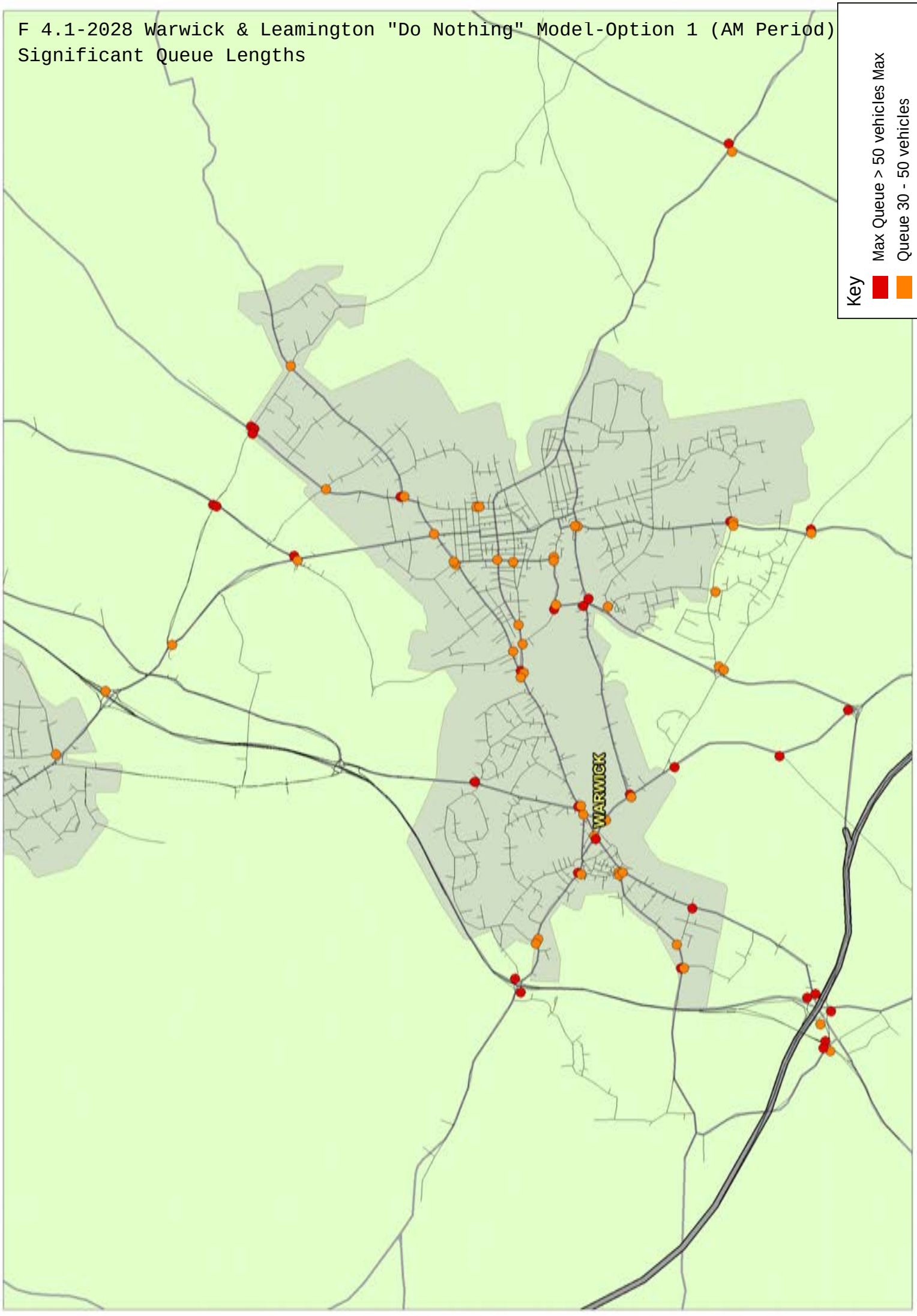


**Table 4.2 KS DN (Opn 1) – Significant Queues (AM Period)**

| Ref | Junction | Approach | Dir | Max Q (vehs) |
|---|---|---|---|---|
| 1 | A429 / A45 | A429 | SB | 86 |
| | | A429 | NB | 65 |
| | | A45 | EB | 68 |
| 3 | Leamington Rd / A45 / St Martin's Rd | A45 | WB | 85 |
| | | St Martin's Rd | NB | 55 |
| 5 | Toll Bar End | A45 | NB | 61 |
| 7 | Gibbet Hill Junction | A429 | SB | 68 |
| | | Stoneleigh Rd | WB | 72 |
| | | A429 | NB | 51 |
| 8 | Stoneleigh Rd / Kings Hill Ln | Kings Hill Lane | WB | 55 |
| 9 | Stoneleigh Rd / Dalehouse Ln | Dalehouse Ln | EB | 79 |
| 11 | B4115 / Birmingham Rd / Stoneleigh Rd | B4115 | SB | 74 |
| 31 | St John’s Gyratory | Birches Lane | WB | 52 |
| 35 | A46 Thickthorn Rdbt | A46 | SB | 52 |
| | | Leamington Rd | EB | 74 |
| 37 | Kenilworth Rd / Bericote Rd | Bericote Road | WB | 123 |
| | | Kenilworth Rd | NB | 158 |
| 39 | Blackdown Rdbt | Kenilworth Rd | SB | 53 |
| | | Stoneleigh Rd | SB | 98 |
| 40 | A46 / Coventry Rd / Warwick Rd | Warwick Road | EB | 51 |

F 4.2-2028 Kenilworth & Stoneleigh "Do Nothing" Model-Option 1 (AM Period)
Significant Queue Lengths

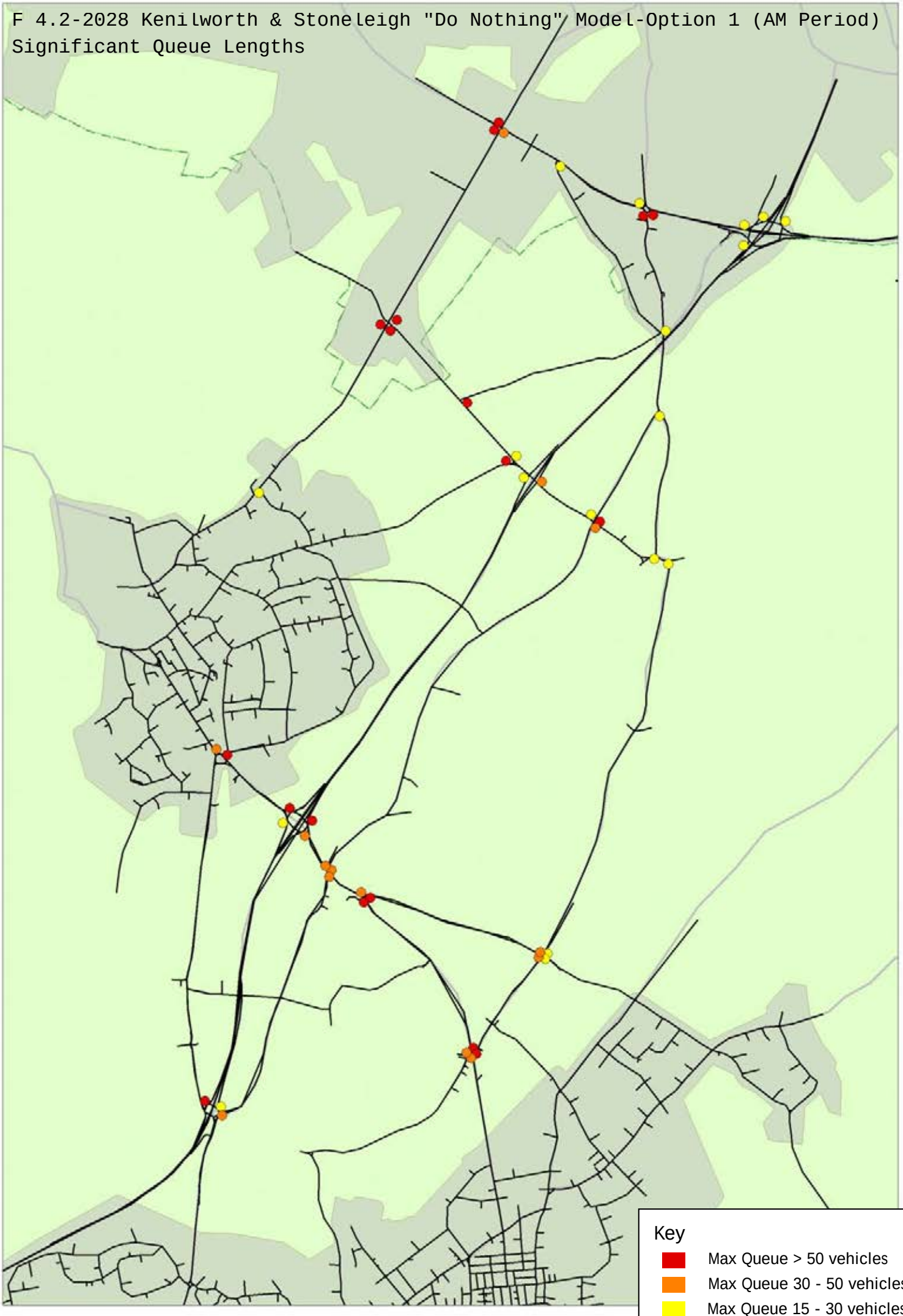
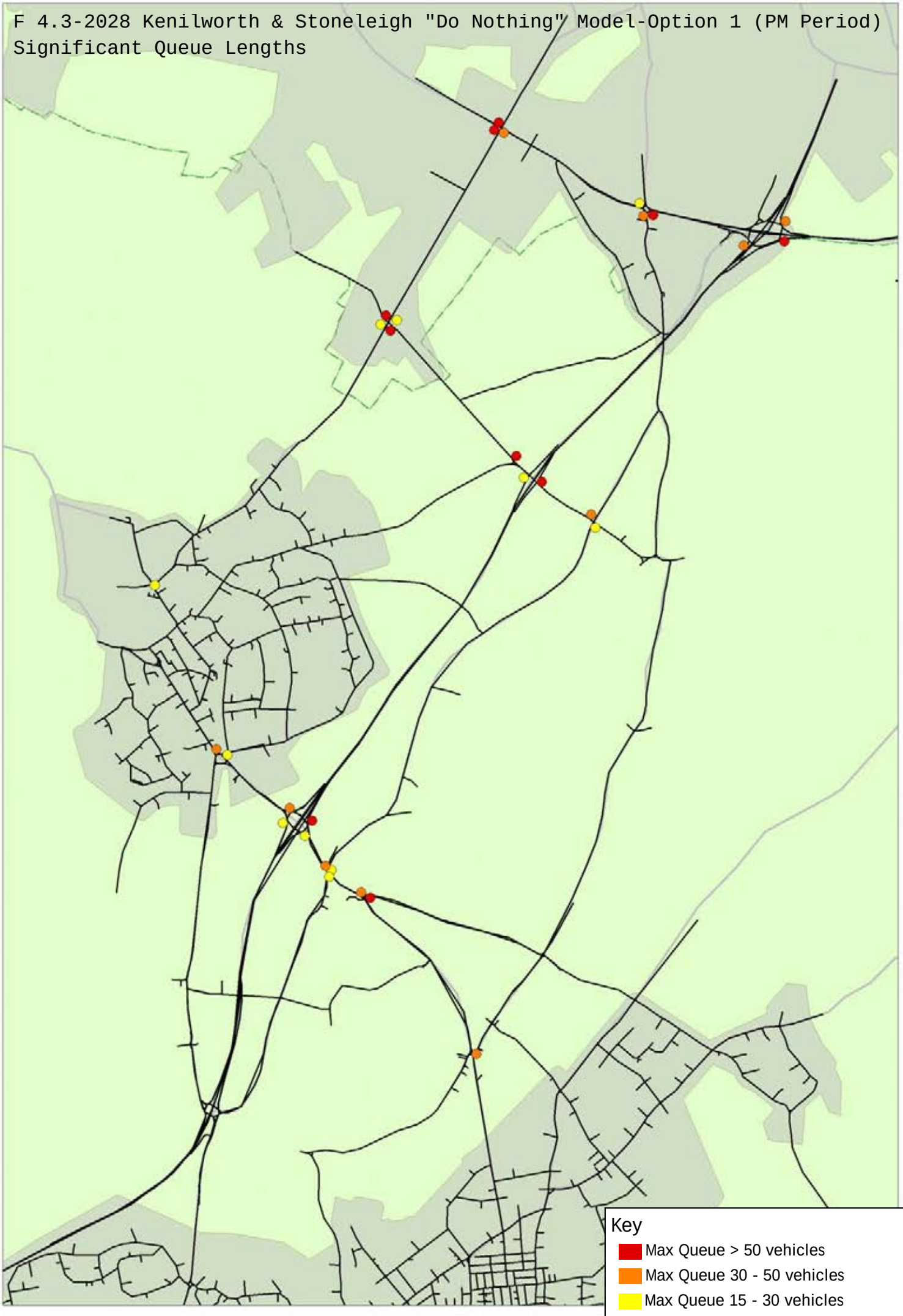


**Table 4.3 KS DN (Opn 1) – Significant Queues (PM Period)**

| Ref | Junction | Approach | Dir | Max Q (vehs) |
|---|---|---|---|---|
| 1 | A429 / A45 | A429 | NB | 60 |
| | | A45 | EB | 98 |
| 3 | Leamington Rd / A45 / St Martin's Rd | A45 | WB | 156 |
| 4 | Stivichall Rdbt | A45 (offslip) | WB | 139 |
| 5 | Toll Bar End | A45 | NB | 99 |
| | | Rowley Road | NB | 125 |
| | | A45 | EB | 87 |
| | | Siskin Drive | NB | 88 |
| 7 | Gibbet Hill Junction | Stoneleigh Rd | WB | 55 |
| | | Gibbet Hill Rd | EB | 58 |
| 9 | Stoneleigh Rd / Dalehouse Ln | Stoneleigh Rd | SB | 54 |
| 10 | A46 / Stoneleigh Rd | A46 | SB | 84 |
| 35 | A46 Thickthorn Rdbt | A46 | SB | 55 |
| 37 | Kenilworth Rd / Bericote Rd | Bericote Road | WB | 116 |

F 4.3-2028 Kenilworth & Stoneleigh "Do Nothing" Model-Option 1 (PM Period)
Significant Queue Lengths



### Option 2

4.13 The junction approaches within the WL Option 2 'Do Nothing' model (AM period only) that experience an average maximum queue of 30 of more vehicles are presented in Figure 4.4 The junction approaches within the KS Option 2 'Do Nothing' model that show an average maximum queue of 15 of more vehicles are presented in Figure 4.5 & Figure 4.6.

4.14 The queues that exceed 50 vehicles in length are summarised in the accompanying tables (Table 4.4 to Table 4.6). The junction locations are presented in Appendix B.

**Table 4.4 WL DN (Opn 2) – Significant Queues (AM Period)**

| Ref | Junction | Approach | Dir | Max Q (vehs) |
|---|---|---|---|---|
| 4 | Stoneleigh Rd / Westhill Rd / Bericote Rd | Stoneleigh Rd | NB | 61 |
| 5 | Leicester Ln / Kenilworth Rd / Westhill Rd | Leicester Lane | SB | 76 |
| | | Kenilworth Rd | WB | 68 |
| | | Leicester Lane | NB | 79 |
| 22 | Emscote Rd / Rugby Rd / Warwick New Rd | Rugby Road | SB | 63 |
| 26 | Princes Drive / Park Drive / A452 | Princes Drive | SB | 65 |
| 27 | Princes Dr / Old Warwick Rd / A452 / Myton Rd | Old Warwick Rd | WB | 72 |
| | | Myton Road | EB | 54 |
| 34 | Fosse Way / Southam Rd | Fosse Way | SB | 55 |
| 38 | Tachbrook Rd / Heathcote Rd / Heathcote Ln | Tachbrook Rd | SB | 63 |
| | | Tachbrook Rd | NB | 67 |
| 40 | Europa Way / Harbury Ln / Gallows Hill | Harbury Lane | WB | 56 |
| 41 | Greys Mallory | Banbury Road | SB | 82 |
| 47 | Longbridge Island | Warwick Bypass | SB | 93 |
| | | A429 | WB | 89 |
| | | A429 | NB | 62 |
| 48 | Longbridge Island Mini-Rbt | SB Approach | SB | 75 |
| | | EB Approach | EB | 78 |
| 49 | Stank's Island | A46 | NB | 55 |
| 51 | Saltisford / Theatre St | Saltisford | EB | 70 |
| | | Theatre Street | NB | 50 |
| 54 | A429 / A445 / Weston Cl | A429 | SB | 61 |
| | | A445 | WB | 51 |
| 55 | A425 / A452/ Jury St | Jury Street | EB | 69 |
| 57 | Banbury Rd / A425 / Bridge End | A425 | WB | 60 |
| 58 | A425 / Gallows Hill | A425 | NB | 60 |
| 59 | A425 / High St | High Street | EB | 95 |
| 61 | Friars St / A429 | A429 | EB | 50 |
| 62 | Spinney Hill Percy Island | A429 | SB | 63 |
| 65 | Hampton Rd / Purser Dr | Hampton Road | EB | 78 |

F 4.4-2028 Warwick & Leamington "Do Nothing" Model-Option 2 (AM Period)
Significant Queue Lengths

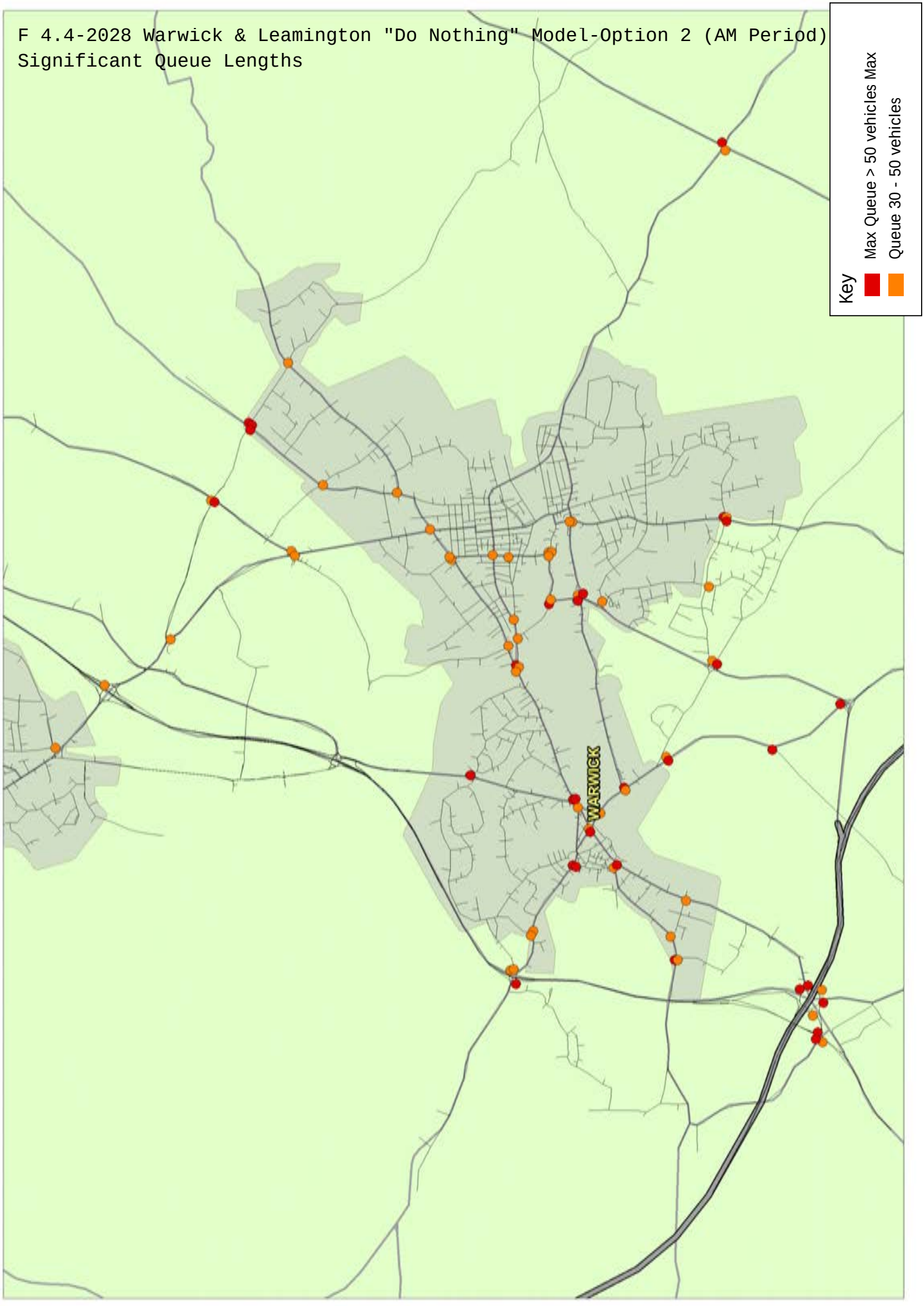


**Table 4.5 KS DN (Opn 2) – Significant Queues (AM Period)**

| Ref | Junction | Approach | Dir | Max Q (vehs) |
|---|---|---|---|---|
| 1 | A429 / A45 | A429 | SB | 65 |
| | | A45 | EB | 54 |
| 3 | Leamington Rd / A45 / St Martin's Rd | A45 | WB | 85 |
| | | St Martin's Rd | NB | 51 |
| 5 | Toll Bar End | A45 | NB | 62 |
| 7 | Gibbet Hill Junction | A429 | SB | 70 |
| | | Stoneleigh Rd | WB | 76 |
| | | A429 | NB | 53 |
| 9 | Stoneleigh Rd / Dalehouse Ln | Dalehouse Lane | EB | 68 |
| 10 | A46 / Stoneleigh Rd | A46 | SB | 67 |
| 11 | B4115 / Birmingham Rd / Stoneleigh Rd | B4115 | SB | 66 |
| 35 | A46 Thickthorn Rdbt | Leamington Rd | EB | 77 |
| 37 | Kenilworth Rd / Bericote Rd | Bericote Road | WB | 102 |
| | | Kenilworth Rd | NB | 112 |
| 39 | Blackdown Rdbt | Stoneleigh Rd | SB | 83 |

F 4.5-2028 Kenilworth & Stoneleigh "Do Nothing" Model-Option 2 (AM Period)
Significant Queue Lengths

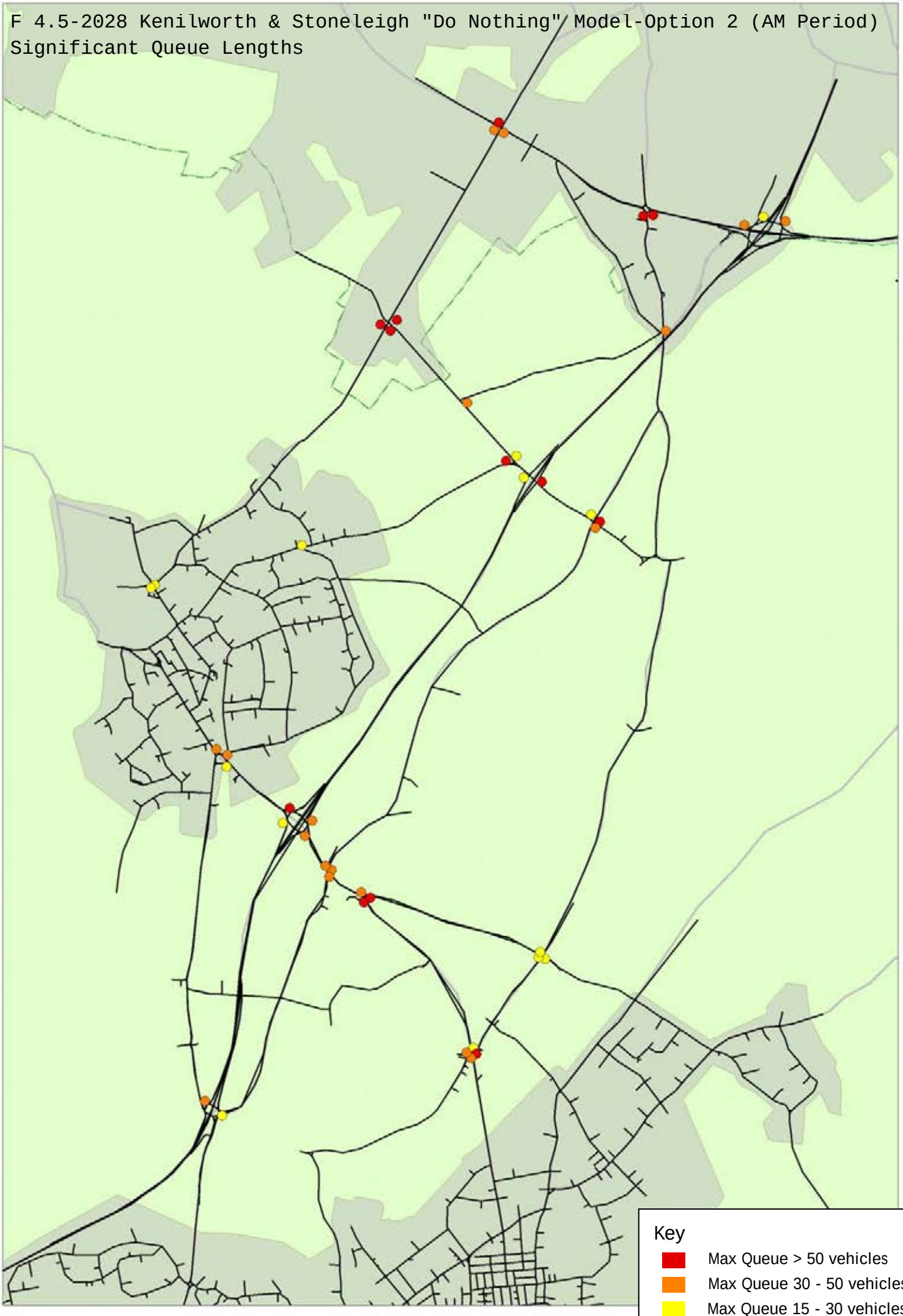
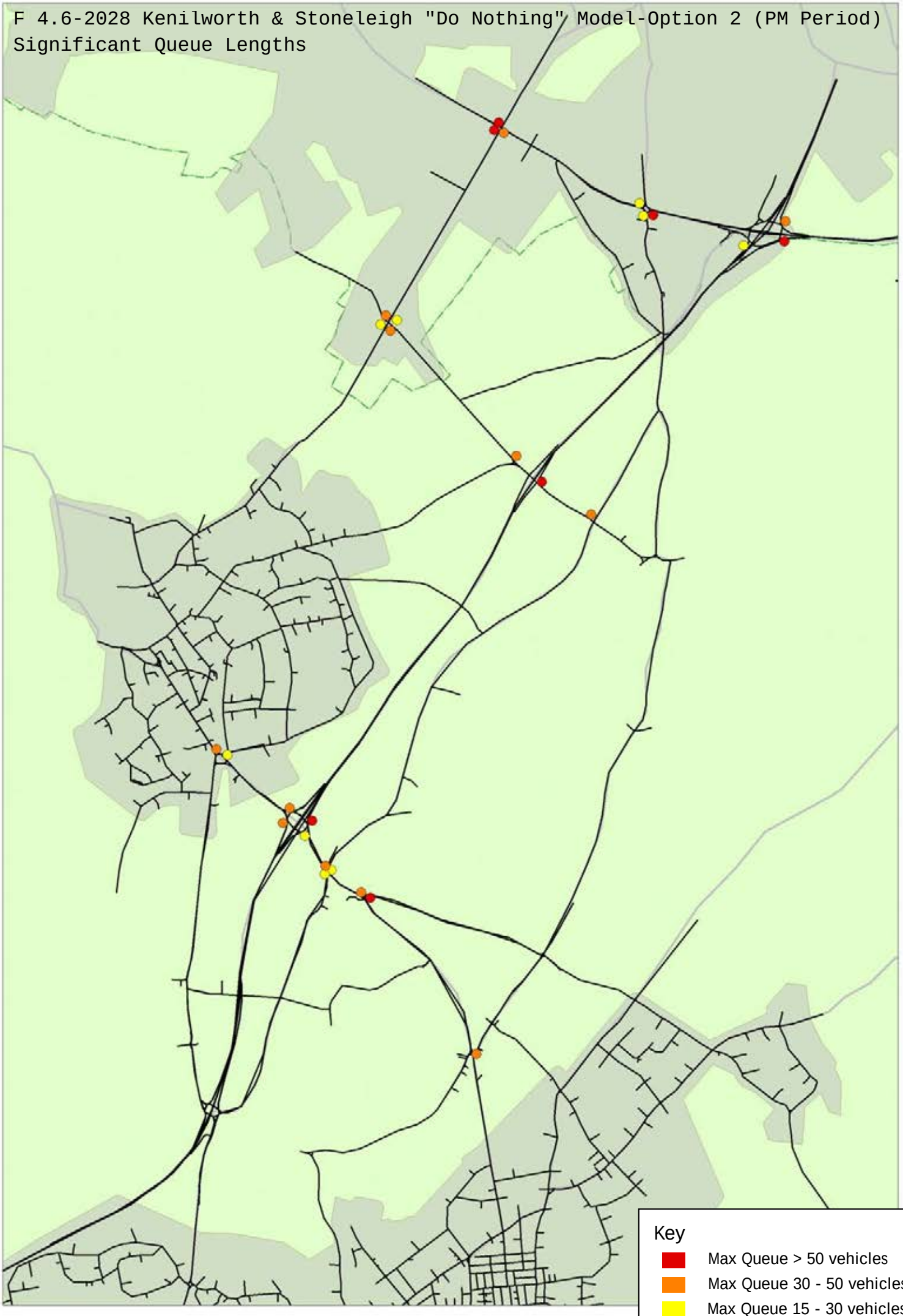


**Table 4.6 KS DN (Opn 2) – Significant Queues (PM Period)**

| Ref | Junction | Approach | Dir | Max Q (vehs) |
|---|---|---|---|---|
| 1 | A429 / A45 | A429 | NB | 54 |
| | | A45 | EB | 95 |
| 3 | Leamington Rd / A45 / St Martin's Rd | A45 | WB | 161 |
| 4 | Stivichall Rdbt | A45 (offslip) | WB | 111 |
| 5 | Toll Bar End | A45 | NB | 80 |
| | | Rowley Road | NB | 100 |
| | | A45 | EB | 65 |
| | | Siskin Drive | NB | 86 |
| 10 | A46 / Stoneleigh Rd | A46 | SB | 82 |
| 35 | A46 Thickthorn Rdbt | A46 | SB | 58 |
| 37 | Kenilworth Rd / Bericote Rd | Bericote Road | WB | 128 |

F 4.6-2028 Kenilworth & Stoneleigh "Do Nothing" Model-Option 2 (PM Period)
Significant Queue Lengths



### Option 3

4.15 The junction approaches within the WL Option 3 'Do Nothing' model (AM period only) that experience an average maximum queue of 30 of more vehicles are presented in Figure 4.7. The junction approaches within the KS Option 3 'Do Nothing' model that show an average maximum queue of 15 of more vehicles are presented in Figure 4.8 & Figure 4.9.

4.16 The queues that exceed 50 vehicles in length are summarised in the accompanying tables (Table 4.7 to Table 4.9). The junction locations are presented in Appendix B.

**Table 4.7 WL DN (Opn 3) – Significant Queues (AM Period)**

| Ref | Junction | Approach | Dir | Max Q (vehs) |
|---|---|---|---|---|
| 4 | Stoneleigh Rd / Westhill Rd / Bericote Rd | Stoneleigh Rd | NB | 64 |
| | | Bericote Road | EB | 66 |
| 5 | Leicester Ln / Kenilworth Rd / Westhill Rd | Leicester Lane | SB | 69 |
| | | Kenilworth Rd | WB | 72 |
| | | Leicester Lane | NB | 100 |
| 7 | Blackdown Rbt | Stoneleigh Rd | WB | 58 |
| 9 | Lillington Rd / Cubbington Rd / Warren Cl | Lillington Rd | SB | 59 |
| 22 | Emscote Rd / Rugby Rd / Warwick New Rd | Rugby Road | SB | 54 |
| 26 | Princes Drive / Park Drive / A452 | Princes Drive | SB | 54 |
| 27 | Princes Dr / Old Warwick Rd / Myton Rd | Old Warwick Rd | WB | 74 |
| | | Myton Road | EB | 61 |
| 34 | Fosse Way / Southam Rd | Fosse Way | SB | 52 |
| 38 | Tachbrook Rd / Heathcote Rd/ Heathcote Ln | Tachbrook Rd | NB | 53 |
| 40 | Europa Way / Harbury Ln / Gallows Hill | Harbury Ln | WB | 53 |
| 41 | Greys Mallory | Banbury Road | SB | 78 |
| 47 | Longbridge Island | Warwick Bypass | SB | 87 |
| | | A429 | WB | 86 |
| | | A429 | NB | 60 |
| 48 | Longbridge Island Mini-Rbt | SB Approach | SB | 72 |
| | | EB Approach | EB | 79 |
| 49 | Stank's Island | A46 | SB | 73 |
| | | A46 | NB | 70 |
| 51 | Saltisford / Theatre St | Saltisford | EB | 53 |
| | | Theatre Street | NB | 52 |
| 53 | A445 / A429 | A445 | EB | 52 |
| 54 | A429 / A445 / Weston Cl | A429 | SB | 68 |
| | | A445 | WB | 56 |
| 55 | A425 / A452 / Jury St | Jury Street | EB | 69 |
| 57 | Banbury Rd / A425 / Bridge End | A425 | WB | 65 |
| 62 | Spinney Hill Percy Island | A429 | SB | 79 |

F 4.7-2028 Warwick & Leamington "Do Nothing" Model-Option 3 (AM Period)
Significant Queue Lengths

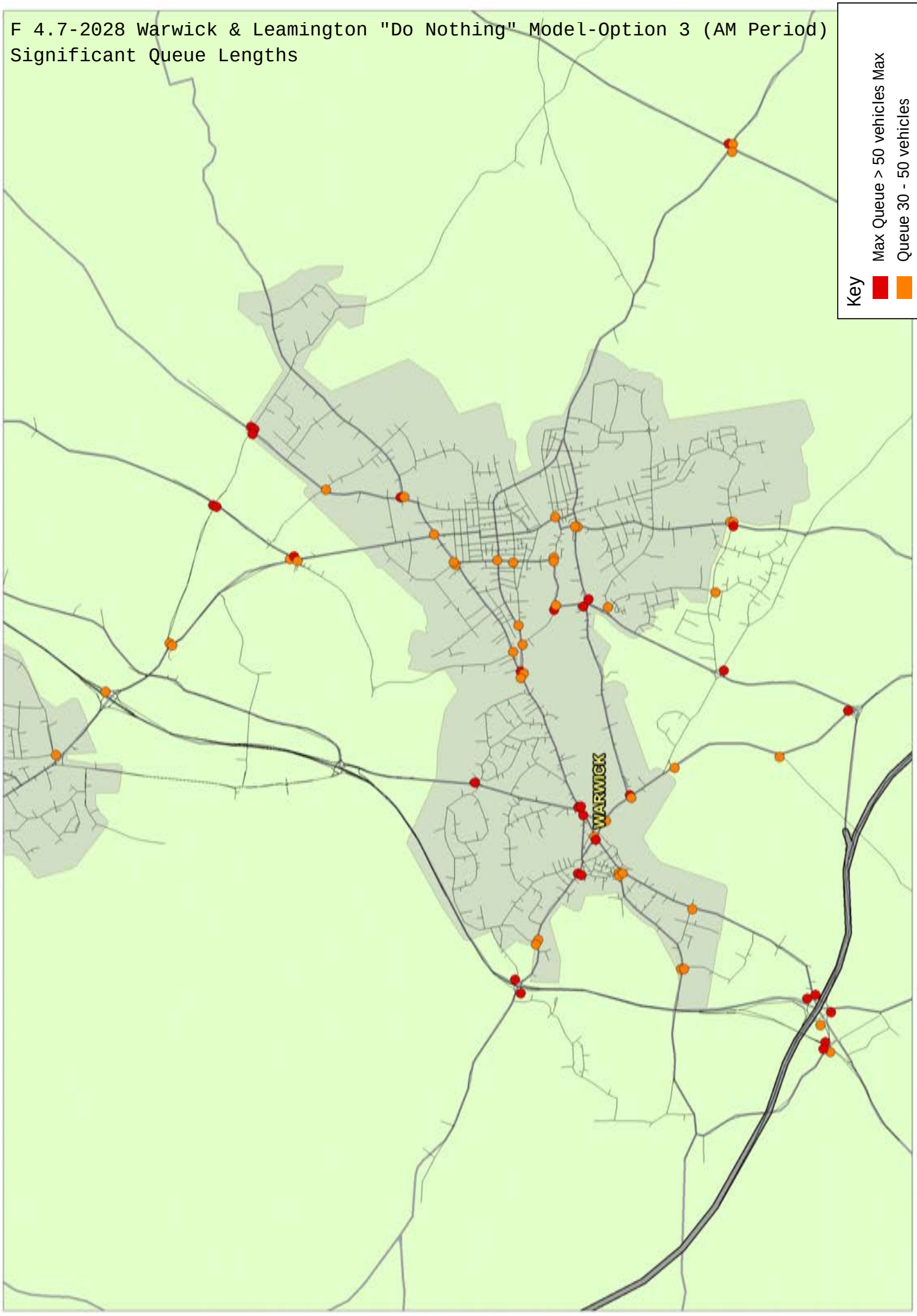


**Table 4.8 KS DN (Opn 3) – Significant Queues (AM Period)**

| Ref | Junction | Approach | Dir | Max Q (vehs) |
|---|---|---|---|---|
| 1 | A429 / A45 | A429 | SB | 71 |
| | | A45 | EB | 54 |
| 3 | Leamington Rd / A45 / St Martin's Rd | A45 | WB | 92 |
| | | St Martin's Rd | NB | 55 |
| 5 | Toll Bar End | A45 | NB | 65 |
| 7 | Gibbet Hill Junction | A429 | SB | 66 |
| | | Stoneleigh Rd | WB | 66 |
| | | A429 | NB | 63 |
| 9 | Stoneleigh Rd / Dalehouse Ln | Dalehouse Ln | EB | 67 |
| 10 | A46 / Stoneleigh Rd | A46 | SB | 53 |
| 11 | B4115 / Birmingham Rd / Stoneleigh Rd | B4115 | SB | 69 |
| 31 | St John's Gyratory | Birches Lane | WB | 60 |
| 35 | A46 Thickthorn Rdbt | Leamington Rd | EB | 71 |
| 37 | Kenilworth Rd / Bericote Rd | Bericote Road | WB | 120 |
| | | Kenilworth Rd | NB | 160 |

F 4.8-2028 Kenilworth & Stoneleigh "Do Nothing" Model-Option 3 (AM Period)
Significant Queue Lengths

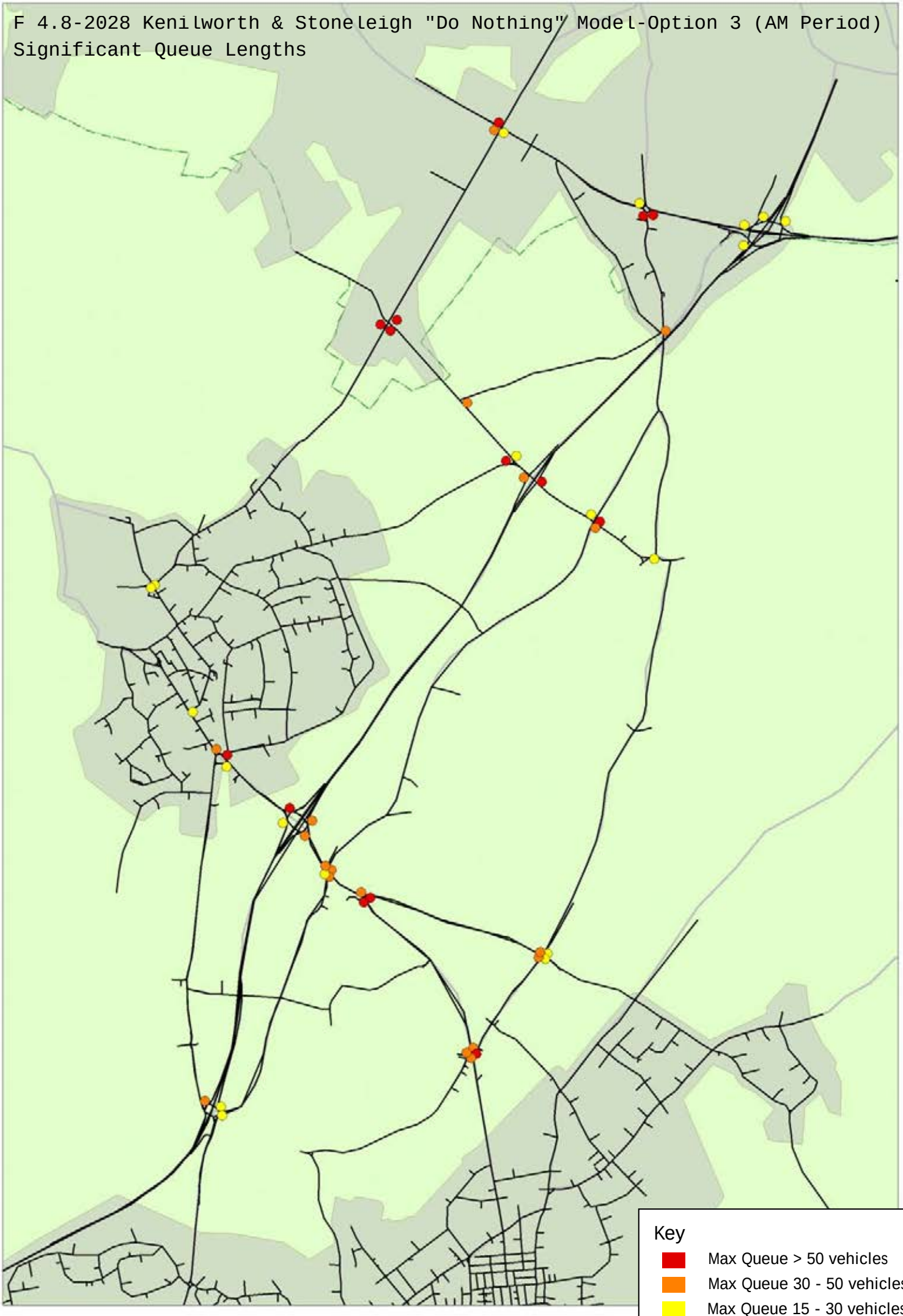
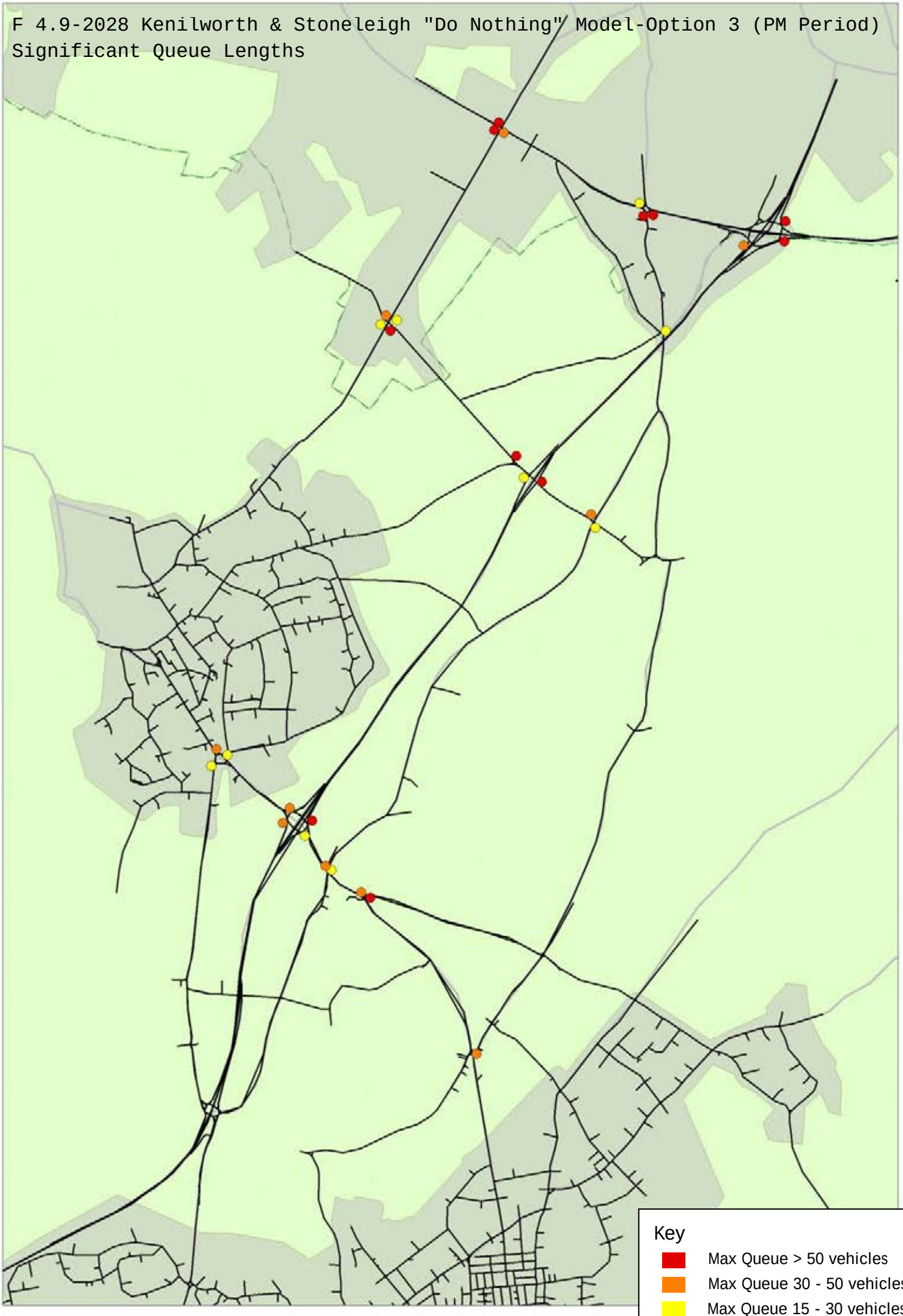


**Table 4.9 KS DN (Opn 3) – Significant Queues (PM Period)**

| Ref | Junction | Approach | Dir | Max Q (vehs) |
|---|---|---|---|---|
| 1 | A429 / A45 | A429 | NB | 59 |
| | | A45 | EB | 94 |
| 3 | Leamington Road / A45 / St Martin's Road | A45 | WB | 163 |
| | | St Martin's Rd | NB | 51 |
| 4 | Stivichall Rdbt | A444 (offslip) | SB | 55 |
| | | A45 (offslip) | WB | 136 |
| 5 | Toll Bar End | A45 | NB | 109 |
| | | Rowley Road | NB | 128 |
| | | A45 | EB | 98 |
| | | Siskin Drive | NB | 91 |
| 7 | Gibbet Hill Junction | Stoneleigh Rd | WB | 55 |
| 9 | Stoneleigh Road / Dalehouse Lane | Stoneleigh Rd | SB | 53 |
| 10 | A46 / Stoneleigh Road | A46 | SB | 84 |
| 35 | A46 Thickthorn Rdbt | A46 | SB | 51 |
| 37 | Kenilworth Road / Bericote Road | Bericote Road | WB | 126 |

F 4.9-2028 Kenilworth & Stoneleigh "Do Nothing" Model-Option 3 (PM Period)
Significant Queue Lengths



### Option 4

4.17 The junction approaches within the WL Option 4 'Do Nothing' model (AM period only) that experience an average maximum queue of 30 of more vehicles are presented in Figure 4.10. The junction approaches within the KS Option 4 'Do Nothing' model that show an average maximum queue of 15 of more vehicles are presented in Figure 4.11 & Figure 4.12.

4.18 The queues that exceed 50 vehicles in length are summarised in the accompanying tables (Table 4.10 to Table 4.12). The junction locations are presented in Appendix B.

**Table 4.10 WL DN (Opn 4) – Significant Queues (AM Period)**

| Ref | Junction | Approach | Dir | Max Q (vehs) |
|---|---|---|---|---|
| 4 | Stoneleigh Rd / Westhill Rd / Bericote Rd | Stoneleigh Rd | NB | 61 |
| | | Bericote Road | EB | 59 |
| 5 | Leicester Ln / Kenilworth Rd / Westhill Rd | Leicester Lane | SB | 53 |
| | | Kenilworth Rd | WB | 65 |
| | | Leicester Lane | NB | 93 |
| 7 | Blackdown Rbt | Kenilworth Rd | SB | 56 |
| | | Stoneleigh Rd | WB | 58 |
| 8 | A445 / Lime Ave / Sandy Ln | A445 | NB | 50 |
| 9 | Lillington Rd / Cubbington Rd / Warren Cl | Lillington Road | SB | 50 |
| 22 | Emscote Rd / Rugby Rd / Warwick New Rd | Rugby Road | SB | 52 |
| 26 | Princes Drive / Park Drive / A452 | Princes Drive | SB | 58 |
| 27 | Princes Dr / Old Warwick Rd / Myton Rd | Old Warwick Rd | WB | 75 |
| | | Myton Road | EB | 60 |
| 38 | Tachbrook Rd / Heathcote Rd / Heathcote Ln | Tachbrook Rd | NB | 55 |
| 40 | Europa Way / Harbury Ln / Gallows Hill | Harbury Lane | WB | 50 |
| 41 | Greys Mallory | Banbury Road | SB | 69 |
| 47 | Longbridge Island | Warwick Byp | SB | 75 |
| | | A429 | WB | 71 |
| | | A429 | NB | 61 |
| 48 | Longbridge Island Mini-Rbt | SB Approach | SB | 87 |
| | | NB Approach | NB | 54 |
| | | EB Approach | EB | 107 |
| 49 | Stank's Island | A46 | SB | 96 |
| | | A46 | NB | 109 |
| | | Birmingham Rd | EB | 73 |
| 51 | Saltisford / Theatre St | Saltisford | EB | 55 |
| 54 | A429 / A445 / Weston Cl | A429 | SB | 70 |
| | | A445 | WB | 55 |
| 55 | A425 / A452 / Jury St | Jury Street | EB | 68 |
| 57 | Banbury Rd / A425 / Bridge End | A425 | WB | 66 |
| 58 | A425 / Gallows Hill | A425 | NB | 68 |
| 59 | A425 / High St | High Street | EB | 87 |
| 62 | Spinney Hill Percy Island | A429 | SB | 78 |
| 65 | Hampton Rd / Purser Dr | Hampton Road | EB | 71 |
| | | Purser Drive | NB | 55 |

F 4.10-2028 Warwick & Leamington "Do Nothing" Model-Option 4 (AM Period)
Significant Queue Lengths

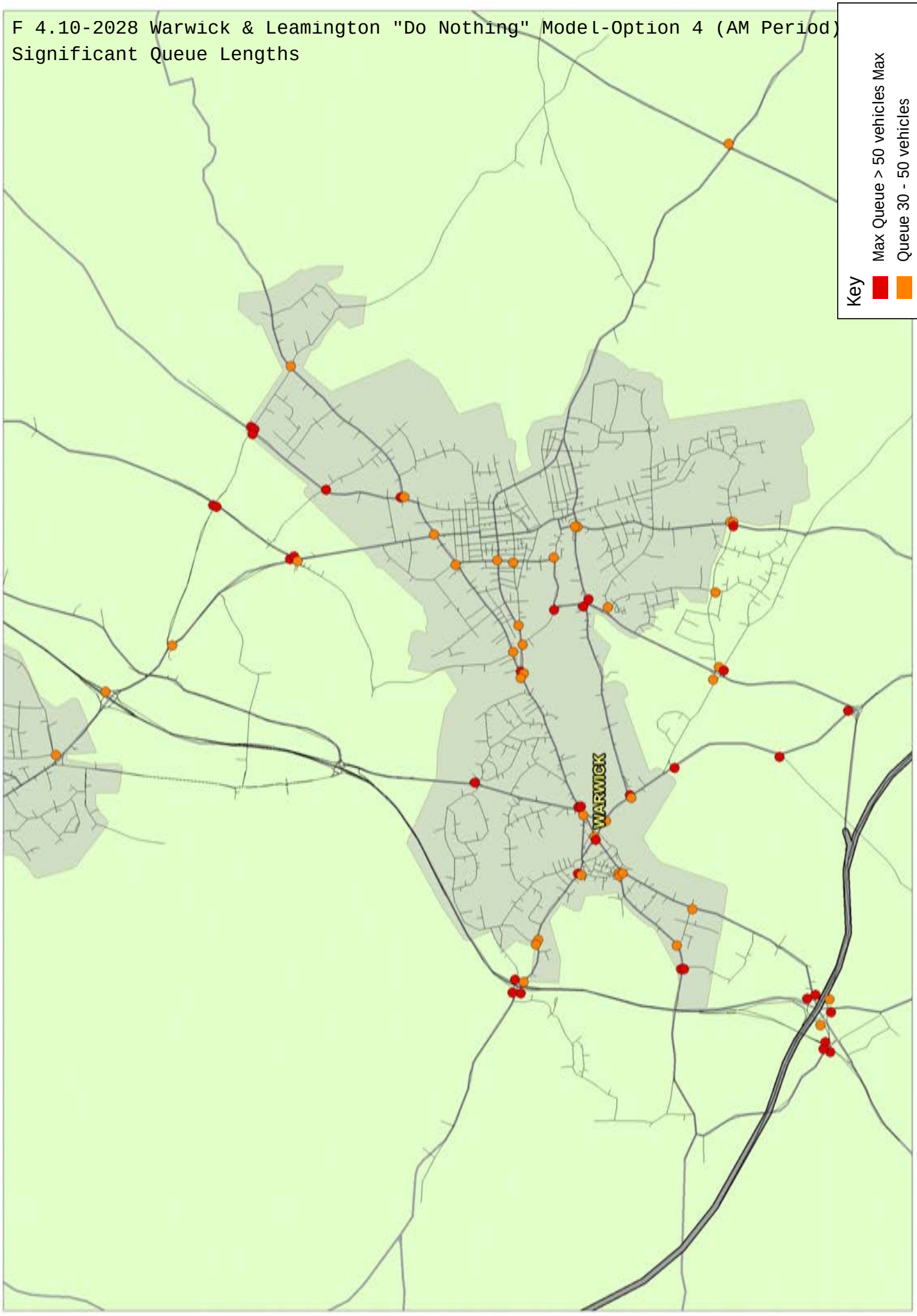


**Table 4.11 KS DN (Opn 4) – Significant Queues (AM Period)**

| Ref | Junction | Approach | Dir | Max Q (vehs) |
|---|---|---|---|---|
| 1 | A429 / A45 | A429 | SB | 53 |
| | | A45 | EB | 55 |
| 3 | Leamington Road / A45 / St Martin's Road | A45 | WB | 87 |
| | | St Martin's Rd | NB | 52 |
| 5 | Toll Bar End | A45 | NB | 64 |
| 7 | Gibbet Hill Junction | A429 | SB | 66 |
| | | Stoneleigh Rd | WB | 70 |
| | | A429 | NB | 56 |
| 9 | Stoneleigh Road / Dalehouse Lane | Dalehouse Ln | EB | 66 |
| 11 | B4115 / Birmingham Road / Stoneleigh Rd | B4115 | SB | 69 |
| 35 | A46 Thickthorn Rdbt | A46 | SB | 52 |
| | | Leamington Rd | EB | 78 |
| 37 | Kenilworth Road / Bericote Road | Bericote Road | WB | 123 |
| 37 | Kenilworth Road / Bericote Road | Kenilworth Rd | NB | 144 |
| 39 | Blackdown Rdbt | Stoneleigh Rd | SB | 93 |

F 4.11-2028 Kenilworth & Stoneleigh "Do Nothing" Model-Option 4 (AM Period)
Significant Queue Lengths

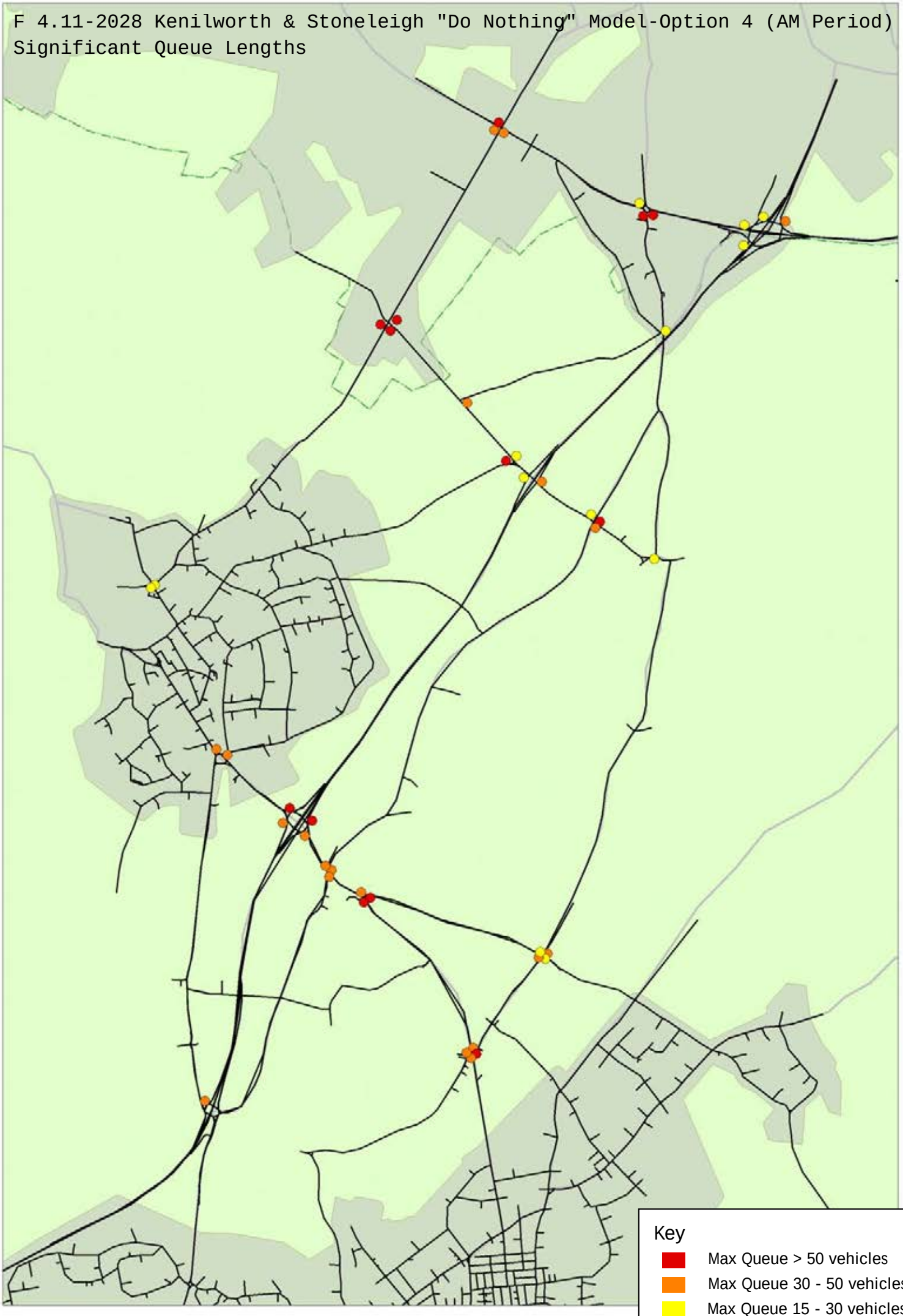
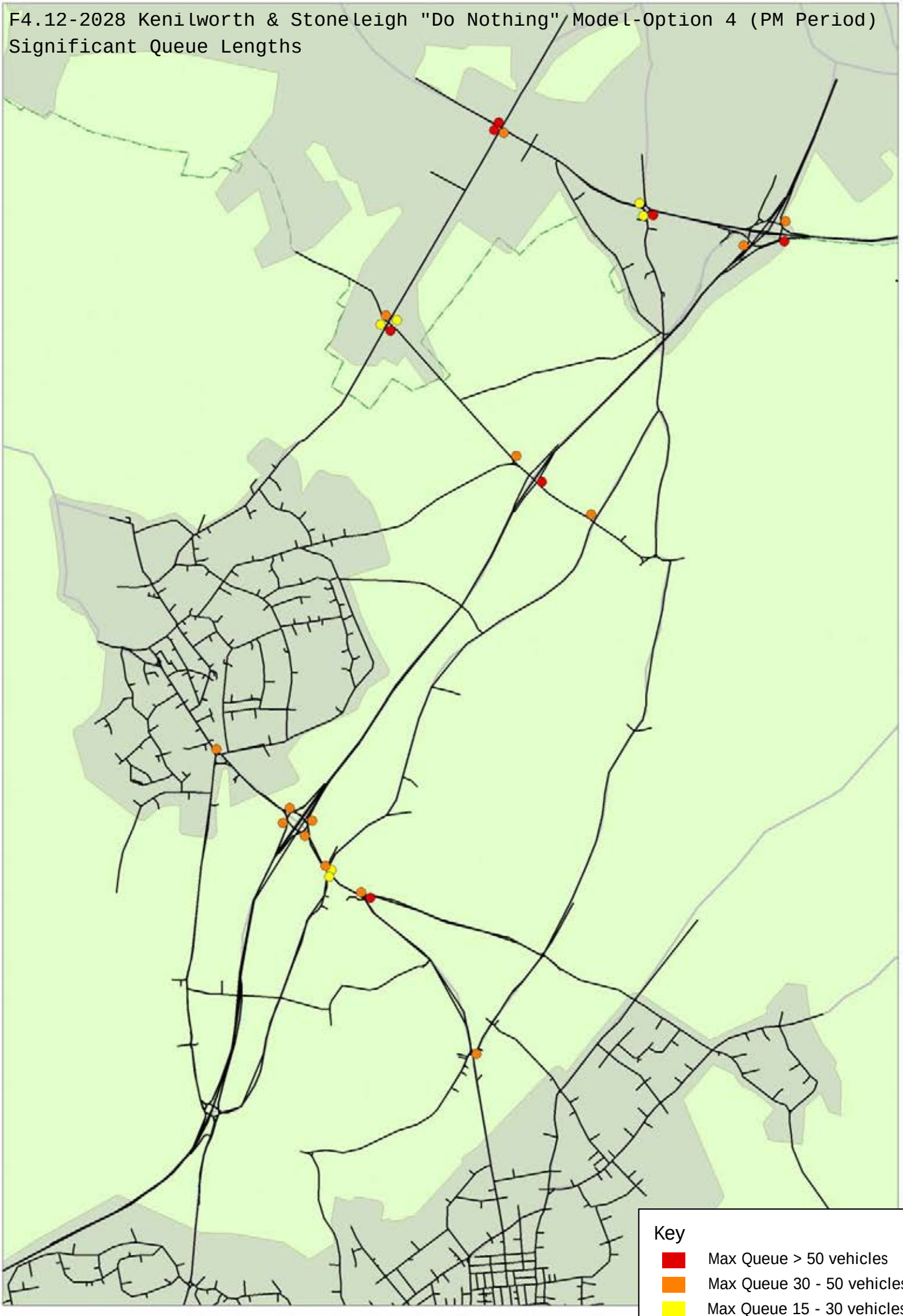


**Table 4.12 KS DN (Opn 4) – Significant Queues (PM Period)**

| Ref | Junction | Approach | Dir | Max Q (vehs) |
|---|---|---|---|---|
| 1 | A429 / A45 | A429 | NB | 53 |
| | | A45 | EB | 99 |
| 3 | Leamington Road / A45 / St Martin's Road | A45 | WB | 153 |
| 4 | Stivichall Rdbt | A45 (offslip) | WB | 110 |
| 5 | Toll Bar End | A45 | NB | 89 |
| | | Rowley Road | NB | 130 |
| | | A45 | EB | 78 |
| | | Siskin Drive | NB | 89 |
| 7 | Gibbet Hill Junction | Stoneleigh Rd | WB | 51 |
| 10 | A46 / Stoneleigh Road | A46 | SB | 73 |
| 37 | Kenilworth Road / Bericote Road | Bericote Road | WB | 110 |

F4.12-2028 Kenilworth & Stoneleigh "Do Nothing" Model-Option 4 (PM Period)
Significant Queue Lengths



## ‘Do Nothing’ Option Comparisons

### Journey Time Analysis

4.19 The journey times on each of the routes depicted within Figure 3.1 and Figure 3.2 have been collected from each DN option model and presented below. Again, only the Warwick & Leamington AM period results have been presented due to the high level of congestion observed in the PM period.

4.20 The shortest and longest journey times observed on each route have been highlighted to indicate the option which provides the lowest and highest levels of delay.

**Table 4.13 WL DN All Options - Journey Times (Seconds) (AM Period)**

| Route | Option 1 | Option 2 | Option 3 | Option 4 |
|---|---|---|---|---|
| Route 1 NB | 1471 | 1162 | 1183 | 1184 |
| Route 1 SB | 1234 | 1360 | 1363 | 1390 |
| Route 2 NB | 1972 | 1834 | 2054 | 1863 |
| Route 2 SB | 3198 | 3123 | 3350 | 3013 |
| Route 3 EB | 1255 | 1234 | 1318 | 1217 |
| Route 3 WB | 1456 | 1564 | 1540 | 1497 |
| Route 4 NB | 931 | 969 | 1146 | 1063 |
| Route 4 SB | 997 | 1116 | 1279 | 1179 |
| Route 5 WB | 528 | 559 | 531 | 549 |
| Route 5 EB | 815 | 818 | 792 | 873 |
| Route 6 NB | 1283 | 1335 | 1336 | 1294 |
| Route 6 SB | 1405 | 1401 | 1379 | 1427 |
| Route 7 NB | 486 | 491 | 495 | 474 |
| Route 7 SB | 464 | 470 | 455 | 456 |
| Route 8 EB | 657 | 555 | 657 | 623 |
| Route 8 WB | 885 | 822 | 893 | 807 |
| Route 9 NB | 369 | 363 | 389 | 403 |
| Route 9 SB | 520 | 518 | 521 | 543 |
| **TOTAL** | **19926** | **19694** | **20681** | **19855** |

4.21 From Table 4.13 above it can be seen that the journey times across the key routes through Warwick & Leamington are shown to be highest with the inclusion of Option 3 development sites. Option 2 generally shows the lowest levels of delay on the network

**Table 4.14 KS DN All Options - Journey Times (Seconds) (AM Period)**

| Route | Option 1 | Option 2 | Option 3 | Option 4 |
|---|---|---|---|---|
| Route 1 EB | 439 | 425 | 401 | 410 |
| Route 1 WB | 590 | 532 | 546 | 532 |
| Route 2 NB | 881 | 791 | 821 | 779 |
| Route 2 SB | 684 | 710 | 723 | 673 |
| Route 3 NB | 640 | 566 | 646 | 597 |
| Route 3 SB | 673 | 622 | 710 | 659 |
| Route 4 SB | 726 | 781 | 785 | 715 |
| Route 4 NB | 454 | 430 | 474 | 460 |
| Route 5 NB | 629 | 511 | 511 | 506 |
| Route 5 SB | 246 | 242 | 247 | 247 |
| Route 6 NB | 175 | 177 | 177 | 175 |
| Route 6 SB | 296 | 282 | 252 | 254 |
| Route 7 NB | 989 | 975 | 1049 | 949 |
| Route 7 SB | 715 | 644 | 679 | 708 |
| **TOTAL** | **8137** | **7688** | **8021** | **7664** |

**Table 4.15 KS DN All Options - Journey Times (Seconds) (PM Period)**

| Route | Option 1 | Option 2 | Option 3 | Option 4 |
|---|---|---|---|---|
| Route 1 EB | 529 | 495 | 545 | 521 |
| Route 1 WB | 822 | 779 | 833 | 794 |
| Route 2 NB | 776 | 766 | 790 | 761 |
| Route 2 SB | 492 | 489 | 493 | 491 |
| Route 3 NB | 360 | 359 | 358 | 365 |
| Route 3 SB | 535 | 550 | 560 | 523 |
| Route 4 SB | 1494 | 1452 | 1429 | 1642 |
| Route 4 NB | 440 | 425 | 458 | 430 |
| Route 5 NB | 248 | 241 | 242 | 240 |
| Route 5 SB | 235 | 235 | 234 | 232 |
| Route 6 NB | 181 | 182 | 185 | 180 |
| Route 6 SB | 230 | 251 | 215 | 209 |
| Route 7 NB | 582 | 524 | 537 | 621 |
| Route 7 SB | 488 | 476 | 489 | 470 |
| **TOTAL** | **7412** | **7224** | **7368** | **7479** |

4.23 Table 4.14 and Table 4.15 highlight Option 2 as having the least impact on the journey times across the key routes through Kenilworth & Stoneleigh. Option 1 appears to highlight the highest journey times, particularly in the AM period.

### Network Wide Statistics

4.24 As noted in Chapter 3 several network wide statistics have been extracted from each DN scenario. The average distance travelled, average travel time and average speed have all been noted. Additionally, the number of completed trips has also been recorded.

4.25 No statistics were available for the Warwick & Leamington PM period.

**Table 4.16 WL DN All Options – Network Statistics (AM Period)**

| | Option 1 | Option 2 | Option 3 | Option 4 |
|---|---|---|---|---|
| Ave Distance (metres) | 6,778 | 6,808 | 6,798 | 6,754 |
| Ave Travel Time (secs) | 608 | 630 | 632 | 633 |
| Ave Speed (mph) | 24.9 | 24.2 | 24.1 | 23.9 |
| Completed Trips | 124,926 | 126,009 | 126,227 | 125,774 |

4.26 The network statistics highlighted above indicate that within Warwick and Leamington Option 1 is best performing in the AM period. However, the results are generally consistent across all option scenarios.

**Table 4.17 KS DN All Options – Network Statistics (AM Period)**

| | Option 1 | Option 2 | Option 3 | Option 4 |
|---|---|---|---|---|
| Ave Distance (metres) | 6,692 | 6,691 | 6,714 | 6,718 |
| Ave Travel Time (secs) | 549 | 522 | 551 | 525 |
| Ave Speed (mph) | 27.3 | 28.5 | 27.2 | 28.6 |
| Completed Trips | 68,633 | 69,097 | 68,762 | 68,176 |

**Table 4.18 KS DN All Options – Network Statistics (PM Period)**

| | Option 1 | Option 2 | Option 3 | Option 4 |
|---|---|---|---|---|
| Ave Distance (metres) | 6,557 | 6,557 | 6,574 | 6,567 |
| Ave Travel Time (secs) | 618 | 583 | 624 | 603 |
| Ave Speed (mph) | 23.7 | 25.1 | 23.5 | 24.4 |
| Completed Trips | 70,268 | 70,734 | 69,878 | 69,620 |

4.27 Table 4.17 and Table 4.18 appear to both indicate that the Kenilworth & Stoneleigh network operated best with the inclusion of the Option 2 sites which is also consistent with the conclusion indicated by the journey time results.

# 5 2028 ‘Do Something’ Option Scenarios

## General

### Scheme Development

5.1 The ‘Do Nothing’ assessments presented in the previous chapter have been used to focus attention on the areas of the network where high levels of congestion are apparent and therefore where it is likely that intervention will be necessary.

5.2 Additionally, WCC have provided invaluable assistance through their local knowledge and experiences on the networks to help target known ‘hot-spots’ and devise appropriate (and reasonable) mitigation schemes.

5.3 The process of selecting the areas to mitigate was therefore primarily driven by the ‘Do Nothing’ testing and local knowledge. However, the actual scheme design and the level of intervention required was a far more iterative process whereby JMP and WCC discussed various options before getting an initial impression of their effectiveness by observing their operation within the models.

5.4 It was often shown that on occasion that the inclusion of a scheme designed to mitigate a perceived issue at one junction would have an impact at other locations that had not been envisaged. An improvement in capacity at junction A was shown to effect routing and therefore significantly alter flows at junction B. This made it very difficult to isolate and fully mitigate each individual issue. As a result the focus shifted to attempting to achieve an overall improvement on the networks as a whole, and on key corridors throughout the models, as opposed to on single junctions.

5.5 The resulting package of schemes is discussed in the proceeding section and the results from the models following scheme inclusion are summarised later in this chapter. It should be noted that the packages are not necessarily exhaustive but have been shown to significantly improve network performance and elevate the highest number of perceived issues.

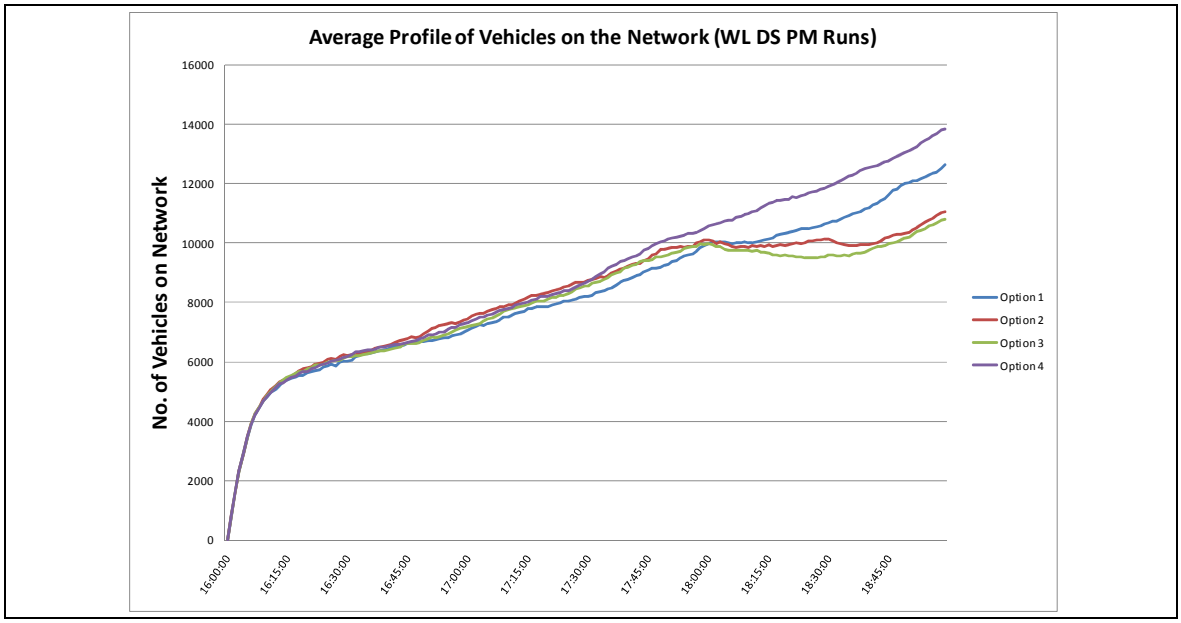
5.6 The nature of micro-simulation modelling means that there will be potential for the networks to be refined further to fully optimise model calibration to the new network conditions of the DS models. It is likely that additional benefits could be gained from optimising existing signal times and potentially coordinating signals along some of the key corridors where several junctions are signal controlled. Such changes may not incur major costs or require physical alternations to the existing roads. Additionally, minor revisions to lane marking or signage may also provide additional benefits not assessed in the final DS models.

5.7 It is also worth note that there are several mitigation strategies that have not been explicitly reflected within the PARAMICS models as they do not directly alter the existing network configuration. These strategies take the form of sustainable travel improvements and are likely to impact the vehicle demand on the network as opposed to the network itself. These interventions have not been captured within the models but would likely have a positive impact on the network operation and the results presented in this chapter.

### Warwick & Leamington ‘Do Something’ PM Period

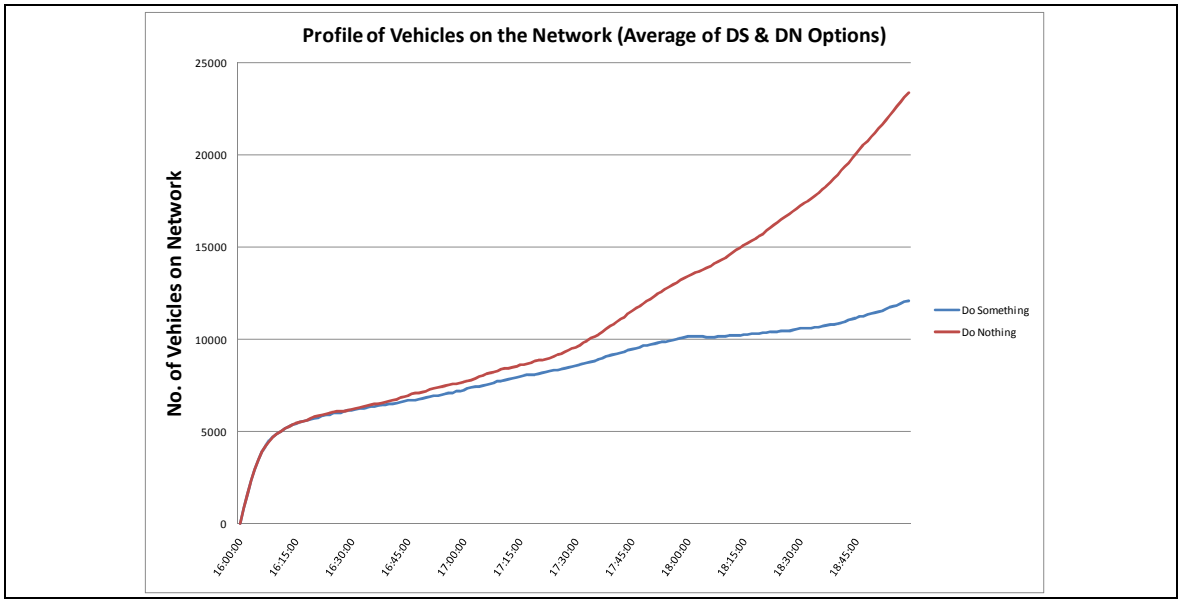
5.8 The testing carried out within the Warwick & Leamington PM Period DS model continues to highlight levels of congestion that do not allow for meaningful outputs to be presented. The congestion on the network does appear to be significantly lower than in the corresponding DN models but is still at levels that would make the queue and journey time data difficult to use. The

average number of vehicles on the network throughout the simulation of the WL DS PM models is presented below for each option.




5.9 It can be seen from the graph above that the number of vehicles continues to rise until the end of the simulation and do not appear to be clearing the network. As such, no queue, journey time or network statistics have been presented in this section for the WL DS PM period.

5.10 The number of vehicles on the network throughout the PM period in both the DS and DN scenarios (average of the 4 options) has been presented in the same graph below to highlight the improved throughput and reduction in congestion that the DS packages appear to have allowed.




5.11 It can be seen from the graph above that the inclusion of the mitigation schemes does greatly improve the congestion in the PM model despite still exhibiting high levels of delay.

5.12 As noted previously, there are several reasons why this situation continues to occur in the WL PM period and various adjustments that would help alleviate the remaining issues.

1. Overstated PM Demands

   A comparison of the 2028 reference case model's demand in the PM period suggests levels significantly lower than those included in the 2028 Option scenarios, particularly in the period 16:00 to 17:00. This may indicate an overestimation of the option site demands and that there is room for discounting.

   Valid discounting may be required to reflect peak spreading of trips outside the modelled hours or to capture further modal shift to public transport.

2. Existing Network Optimisation

   There is potential within the existing network for certain model parameters to be adjusted to reflect the extreme conditions witnessed in the PM option models. This may include adjusting signal times or revising driver behaviour to reflect the heightened congestion.

3. Additional Scheme Inclusion

   WCC have suggested schemes that have not been explicitly reflected within the current DS models that may show additional improvements. The impact of the sustainable transport strategies may also have a positive impact on reducing the demands on the network.

## Mitigation Strategy

5.13 The final list of mitigation strategies are presented in full in Appendix D along with estimated costing and descriptions. As noted above there are certain schemes that have not been explicitly modelled in the DS models as they do not directly impact the modelled network.

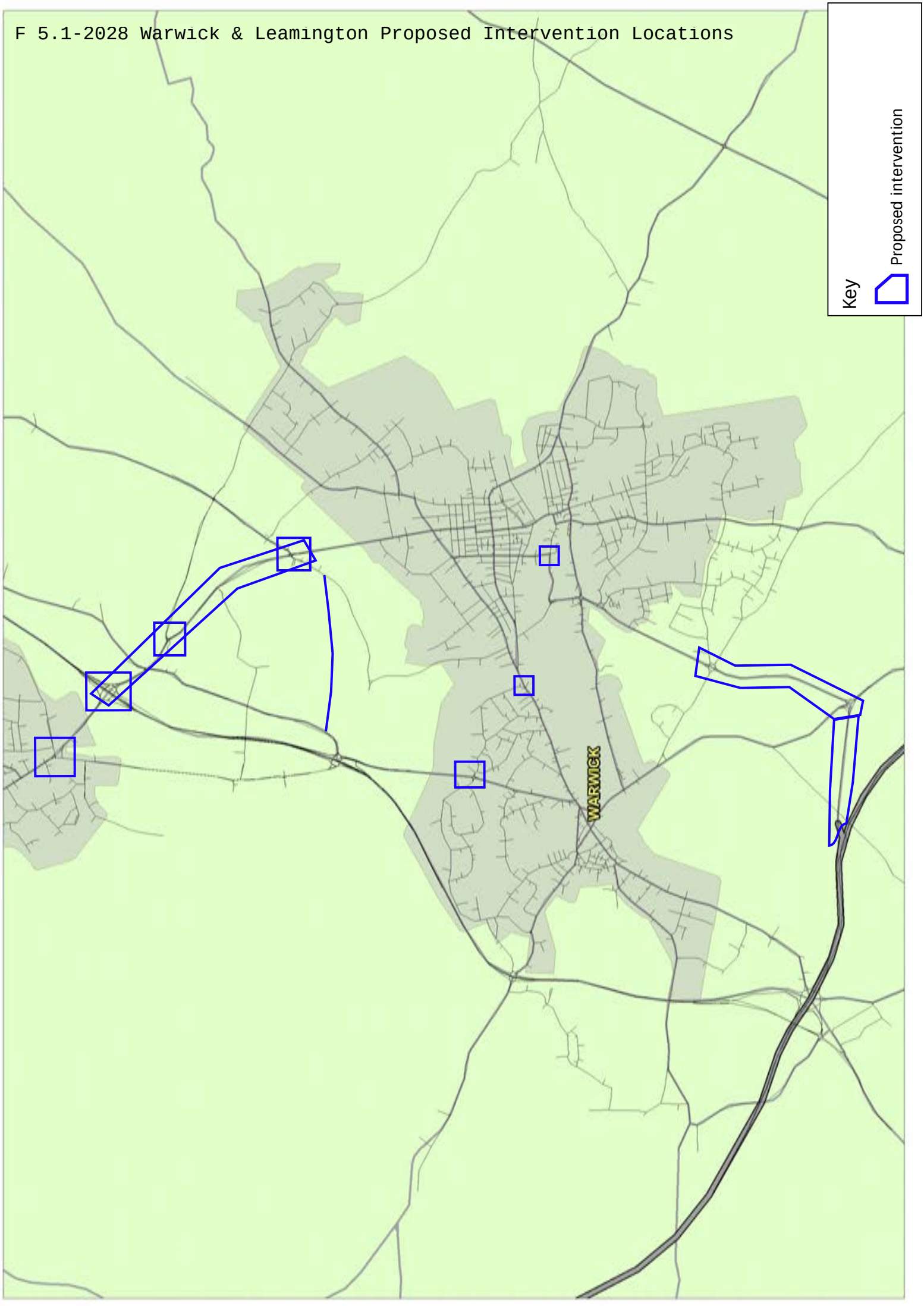
5.14 For each option the relevant schemes have been coded into the DS option model and the model results extracted and presented in this chapter. Two additional variations to Option 4 have also been assessed which each include an additional large scale mitigation strategy, the details of which are discussed later in this chapter.

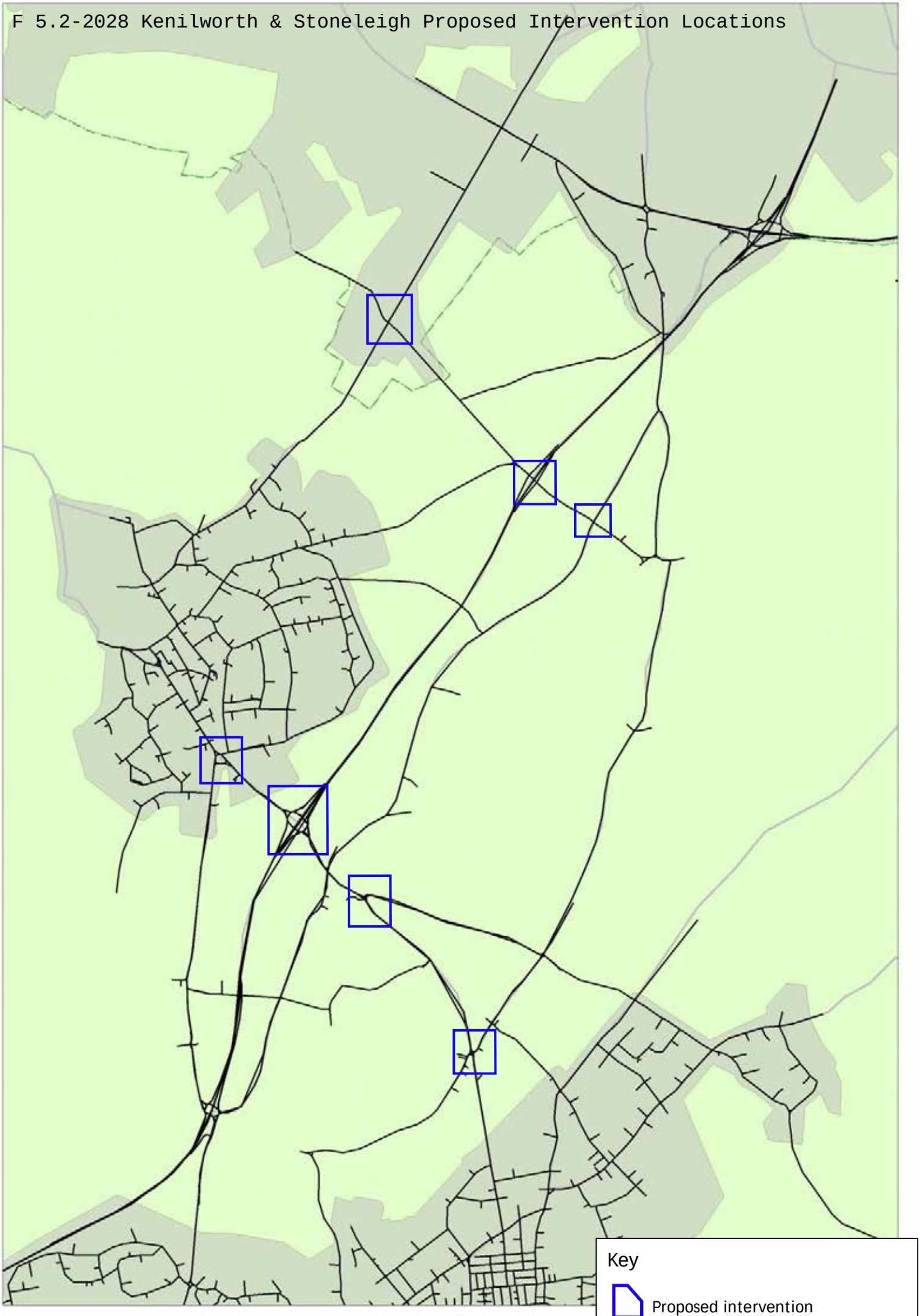
### Modelled Schemes

5.15 The schemes listed in Table 5.1 below have been explicitly included within their respective DS option scenario. The locations of these schemes are highlighted in Figure 5.1 & Figure 5.2. The full details are provided in Appendix D.

**Table 5.1 Modelled 'Do Something' Schemes**

| Location | Summary of Scheme |
|---|---|
| Gibbet Hill Junction | Increased flares on A429 (**Option 1 only**) |
| Dalehouse Lane, A46/C32 & C32/B4115 | Signalise A46/C32, increased capacity at Dalehouse junction and convert C32/B4115 to roundabout |
| St John's Gyratory | Increase flare on Birches approach and additional lane on northern circulatory |
| Thickthorn Roundabout | Full signalisation |
| Blackdown Roundabout | Widening on approaches and additional exit re-merge sections |
| Bericote Rd / Kenilworth Rd | Widening on approaches, extending WB re-merge section, designated slip to Bericote Rd |
| Coventry Road/Spinney Hill Percy Island | Widening of approaches, exits and circulatory |
| A452 Europa Way | NB and SB dualling (**Option 1 only**) |
| A452 Europa Way and Banbury Spur | Full dualling from M40 to Gallows Hill (**Option 2 – 4**) |
| Leamington Northern Relief Road | Relief road connecting Sandy Ln to B4115 at A46/B4115/Coventry Rd (**Option 4A only**) |
| M40 Junction 13 and 14 | Dualling J14 off-slip & signalising J13 |
| A452 between Kenilworth and Leamington | Dualling NB & SB from Blackdown to Thickthorn (**Option 4B only**) |
| Greville Rd / Emscote Rd | Signalisation |
| Adelaide Rd / Park Dr | Signalisation |


F 5.1-2028 Warwick & Leamington Proposed Intervention Locations
Key
Proposed intervention
WARWICK


F 5.2-2028 Kenilworth & Stoneleigh Proposed Intervention Locations
Key
Proposed intervention

## Final ‘Do Something’ Scenarios

5.16 The following ‘Do Something’ models have been tested and are presented in this chapter:

- 2028 Warwick & Leamington ‘Do Nothing’ Model - Option 1 [WL DS (Opn 1)]
- 2028 Kenilworth & Stoneleigh ‘Do Nothing’ Model - Option 1 [KS DS (Opn 1)]
- 2028 Warwick & Leamington ‘Do Nothing’ Model - Option 2 [WL DS (Opn 2)]
- 2028 Kenilworth & Stoneleigh ‘Do Nothing’ Model - Option 2 [KS DS (Opn 2)]
- 2028 Warwick & Leamington ‘Do Nothing’ Model - Option 3 [WL DS (Opn 3)]
- 2028 Kenilworth & Stoneleigh ‘Do Nothing’ Model - Option 3 [KS DS (Opn 3)]
- 2028 Warwick & Leamington ‘Do Nothing’ Model - Option 4 [WL DS (Opn 4)]
- 2028 Kenilworth & Stoneleigh ‘Do Nothing’ Model - Option 4 [KS DS (Opn 4)]

5.17 An individual assessment of the queue lengths experienced in each of the option scenario listed above has been provided in this section to highlight the areas of stress on the network. For each option the queues of notable length have been presented graphically and in more detail in an accompanying tables.

5.18 Following the queue assessments from the individual options the journey times on the key routes (as depicted in Figure 3.1 and Figure 3.2) are provided for comparison between the delays in each of the four DS option scenarios. Additionally, the summarised network wide statistics as discussed in Chapters 3 are presented at this point to further emphasis option differences.

5.19 A final set of comparisons is provided where the DS option scenarios are compared to their equivalent DN scenario. The queue length differences are presented graphically to highlight where benefits or dis-benefits have been recorded with the implementation of the proposed mitigation schemes. The journey times and network statistics are also compared for each option scenario.

5.20 Two additional variations of the Option 4 DS scenario are tested at this point, namely:

- 2028 Warwick & Leamington ‘Do Nothing’ Model - Option 4A [WL DS (Opn 4A)]
- 2028 Warwick & Leamington ‘Do Nothing’ Model - Option 4B [WL DS (Opn 4B)]

5.21 Option 4 has been highlighted as the option that contains the largest levels of development on the land north of Leamington. As such, two additional large scale schemes focused on improving capacity and reducing congestion in this area have been tested within the Option 4 model.

5.22 Option 4A includes the addition of the Leamington Northern Relief Road that connects north Leamington with the A46 to the west of Warwick. Option 4B includes the dualling of the A452 in both directions between A46 Thickthorn Roundabout to the north and Blackdown Roundabout to the south.

5.23 The model results from Option 4A and Option 4B have been compared to Option 4 DS to assess the benefits or dis-benefits that the additional schemes highlight over the ‘standard’ Option 4 mitigation package.

## ‘Do Something’ Network Conditions

### Option 1

5.24 The approaches within the WL Option 1 ‘Do Something’ model (AM period only) that experience an average maximum queue of 30 of more vehicles are presented in Figure 5.3. The approaches within the KS Option 1 ‘Do Something’ model that show an average maximum queue of 15 of more vehicles are presented in Figure 5.4 & Figure 5.5.

5.25 The queues that exceed 50 vehicles in length within both models are summarised in the accompanying tables (Table 5.2 to Table 5.4). The junction locations are presented in Appendix B.

**Table 5.2 WL DS (Opn 1) – Significant Queues (AM Period)**

| Ref | Junction | Approach | Dir | Max Q (vehs) |
|---|---|---|---|---|
| 5 | Leicester Ln / Kenilworth Rd / Westhill Rd | Leicester Lane | SB | 61 |
| 26 | Princes Drive / Park Drive/ A452 | Princes Drive | SB | 57 |
| | | Park Drive | WB | 50 |
| 27 | Princes Dr / Old Warwick Rd / Myton Rd | Old Warwick Rd | WB | 73 |
| 34 | Fosse Way / Southam Rd | Fosse Way | SB | 53 |
| 38 | Tachbrook Rd / Heathcote Rd/ Heathcote Ln | Tachbrook Rd | SB | 67 |
| 40 | Europa Way/ Harbury Ln / Gallows Hill | Europa Way | NB | 67 |
| 47 | Longbridge Island | Warwick Bypass | SB | 56 |
| | | A429 | WB | 87 |
| | | A429 | NB | 59 |
| 48 | Longbridge Island Mini-Rbt | SB Approach | SB | 60 |
| | | EB Approach | EB | 90 |
| 49 | Stanks Island | A46 | NB | 50 |
| 51 | Saltisford / Theatre St | Saltisford | EB | 65 |
| 54 | A429 / A445 / Weston Cl | A429 | SB | 68 |
| | | A445 | WB | 54 |
| 55 | A425 / A452 / Jury St | Jury Street | EB | 69 |
| 59 | A425 / High St | High Street | EB | 51 |
| 61 | Friars St / A429 | A429 | EB | 52 |
| 65 | Hampton Rd / Purser Dr | Hampton Road | EB | 56 |
| 67 | Stratford Rd / Alders Grv / Shakespeare Ave | Stratford Road | NB | 59 |

F5.3-2028 Warwick & Leamington "Do Something" Model-Option 1 (AM Period)
Significant Queue Lengths

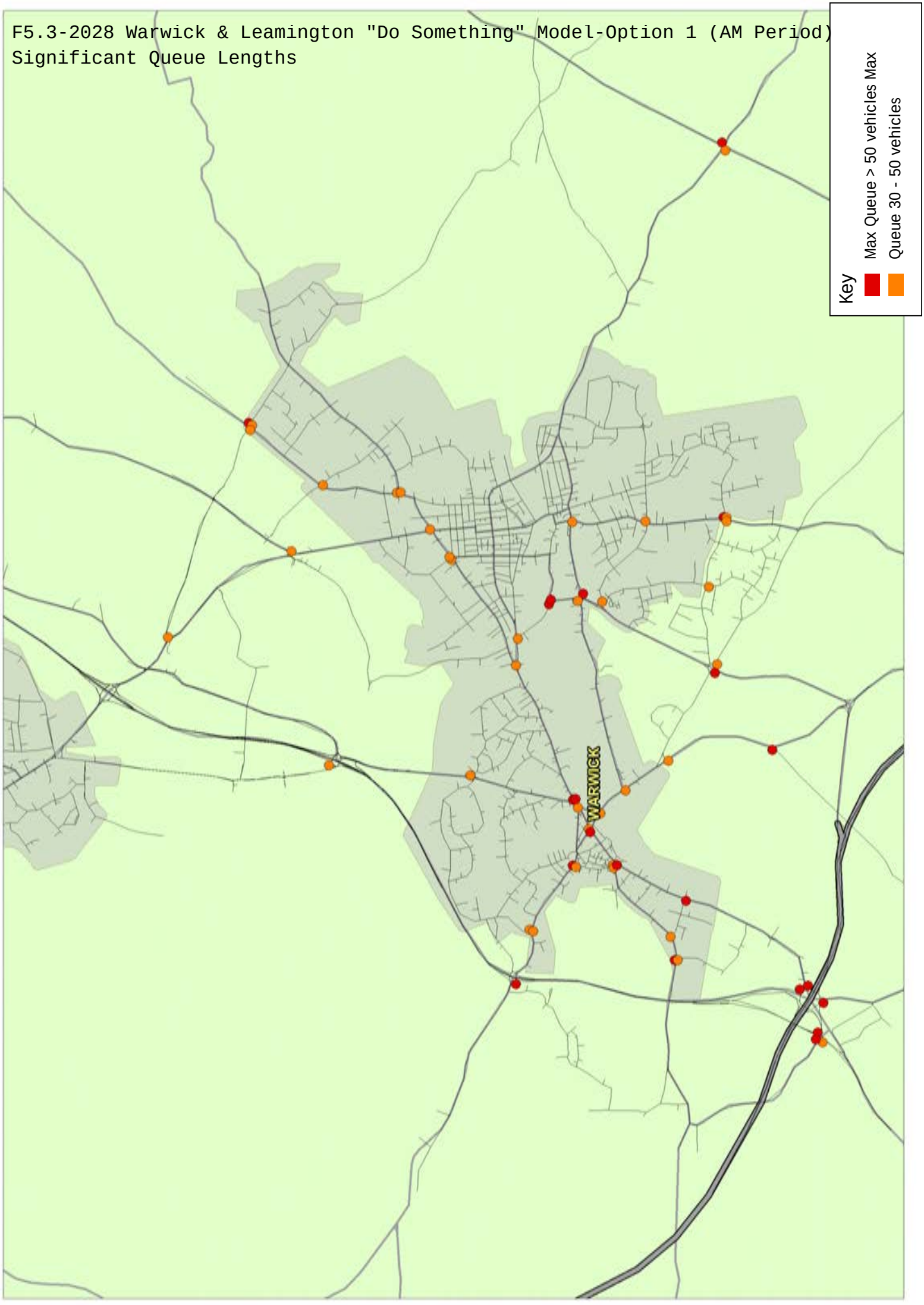


**Table 5.3 KS DS (Opn 1) – Significant Queues (AM Period)**

| Ref | Junction | Approach | Dir | Max Q (vehs) |
|---|---|---|---|---|
| 1 | A429 / A45 | A429 | SB | 88 |
| | | A429 | NB | 83 |
| | | A45 | EB | 95 |
| 3 | Leamington Rd / A45 / St Martin's Rd | A45 | WB | 71 |
| 5 | Toll Bar End | A45 | NB | 61 |

F5.4-2028 Kenilworth & Stoneleigh "Do Something" Model-Option 1 (AM Period)
Significant Queue Lengths

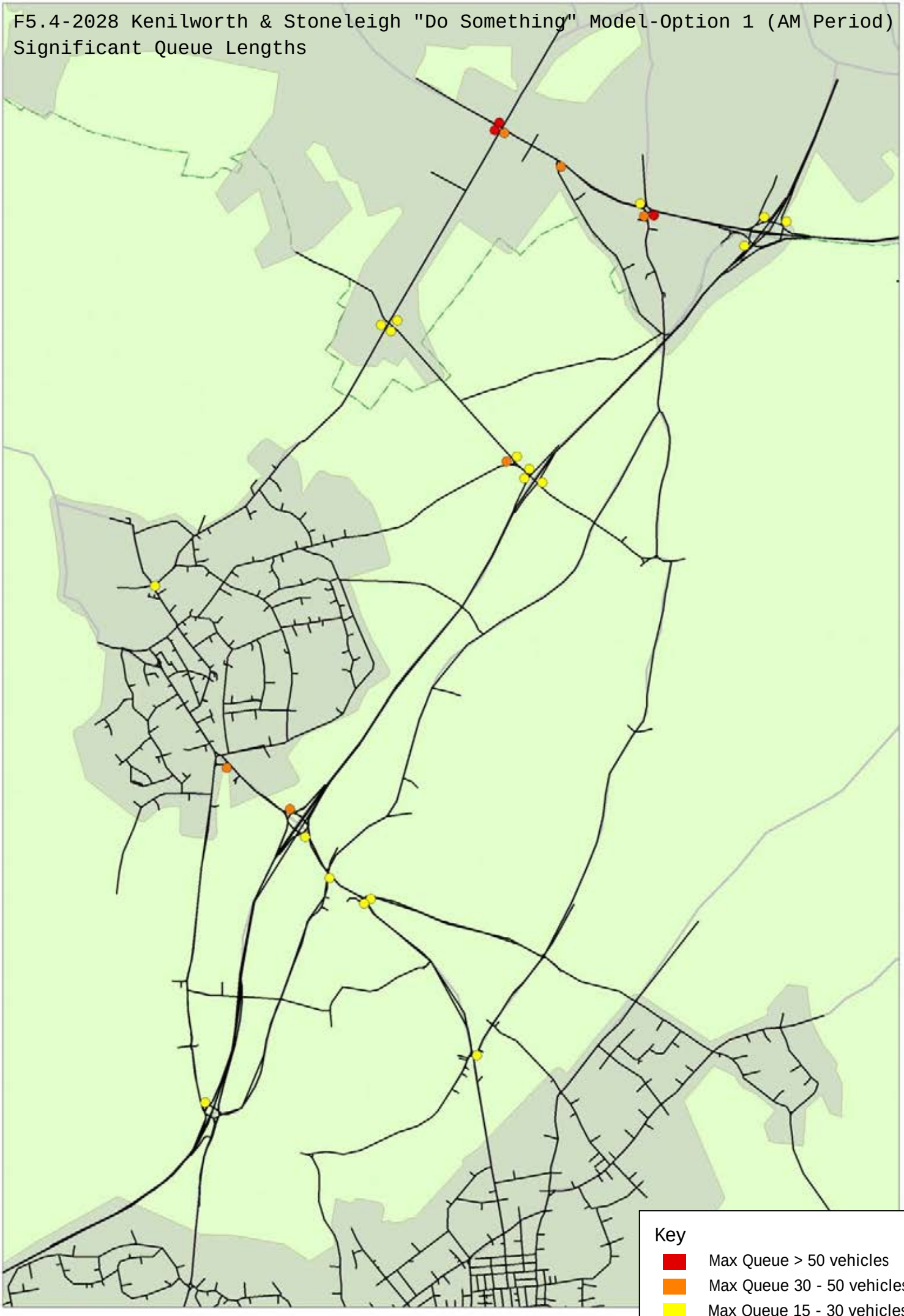
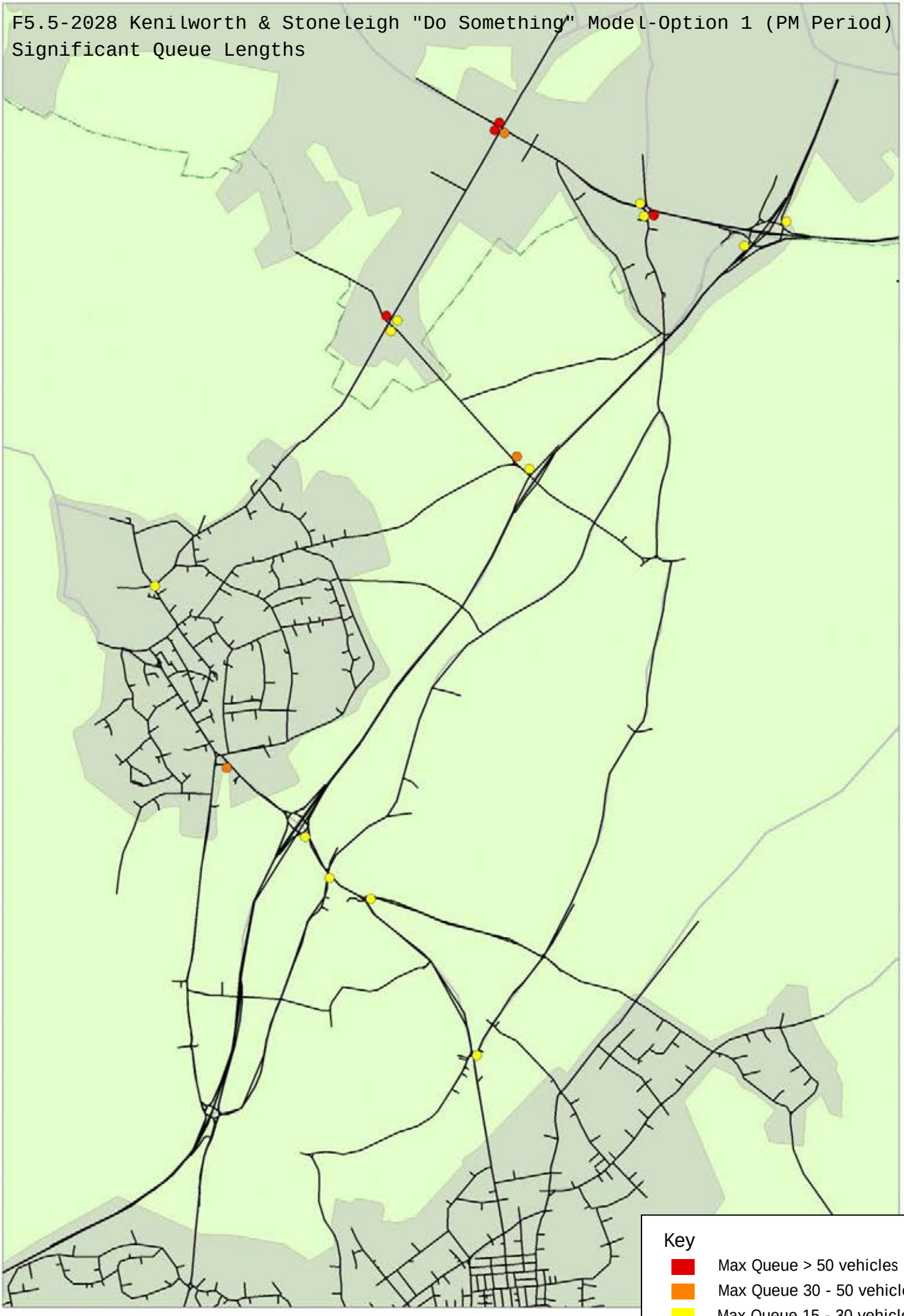


**Table 5.4 KS DS (Opn 1) – Significant Queues (PM Period)**

| Ref | Junction | Approach | Dir | Max Q (vehs) |
|---|---|---|---|---|
| 1 | A429 / A45 | A429 | NB | 75 |
| | | A45 | EB | 108 |
| 3 | Leamington Rd / A45 / St Martin's Rd | A45 | WB | 82 |
| 5 | Toll Bar End | A45 | NB | 78 |
| | | Rowley Road | NB | 110 |
| | | Siskin Drive | NB | 85 |
| 7 | Gibbet Hill Junction | Gibbet Hill Rd | EB | 66 |

F5.5-2028 Kenilworth & Stoneleigh "Do Something" Model-Option 1 (PM Period)
Significant Queue Lengths



### Option 2

5.26 The junction approaches within the WL Option 2 'Do Something' model (AM period only) that experience an average maximum queue of 30 of more vehicles are presented in Figure 5.6. The junction approaches within the KS Option 2 'Do Something' model that show an average maximum queue of 15 of more vehicles are presented in Figure 5.7 & Figure 5.8.

5.27 The queues that exceed 50 vehicles in length are summarised in the accompanying tables (Table 5.5 to Table 5.7). The junction locations are presented in Appendix B.

**Table 5.5 WL DS (Opn 2) – Significant Queues (AM Period)**

| Ref | Junction | Approach | Dir | Max Q (vehs) |
|---|---|---|---|---|
| 5 | Leicester Ln / Kenilworth Rd / Westhill Rd | Leicester Lane | SB | 51 |
| 9 | Lillington Rd / Cubbington Rd / Warren Cl | Lillington Rd | SB | 51 |
| 26 | Princes Drive / Park Drive/ A452 | Princes Drive | SB | 60 |
| | | Park Drive | WB | 54 |
| 27 | Princes Dr / Old Warwick Rd / A452 / Myton Rd | Old Warwick Rd | WB | 76 |
| | | Myton Road | EB | 53 |
| 34 | Fosse Way / Southam Rd | Fosse Way | SB | 54 |
| 38 | Tachbrook Rd / Heathcote Rd/ Heathcote Ln | Tachbrook Rd | SB | 62 |
| | | Tachbrook Rd | NB | 63 |
| 40 | Europa Way / Harbury Ln / Gallows Hill | Harbury Lane | WB | 54 |
| | | Europa Way | NB | 52 |
| 47 | Longbridge Island | Warwick Byp | SB | 62 |
| | | A429 | WB | 78 |
| | | A429 | NB | 60 |
| 48 | Longbridge Island Mini-Rbt | SB Approach | SB | 61 |
| | | EB Approach | EB | 60 |
| 51 | Saltisford / Theatre St | Saltisford | EB | 82 |
| 54 | A429 / A445/ Weston Cl | A429 | SB | 70 |
| | | A445 | WB | 56 |
| 55 | A425 / A452/ Jury St | Jury Street | EB | 68 |
| 61 | Friars St / A429 | A429 | EB | 52 |
| 65 | Hampton Rd / Purser Dr | Purser Drive | NB | 51 |
| 67 | Stratford Rd / Alders Grv / Shakespeare Ave | Stratford Road | NB | 57 |

F5.6-2028 Warwick & Leamington "Do Something" Model-Option 2 (AM Period)
Significant Queue Lengths

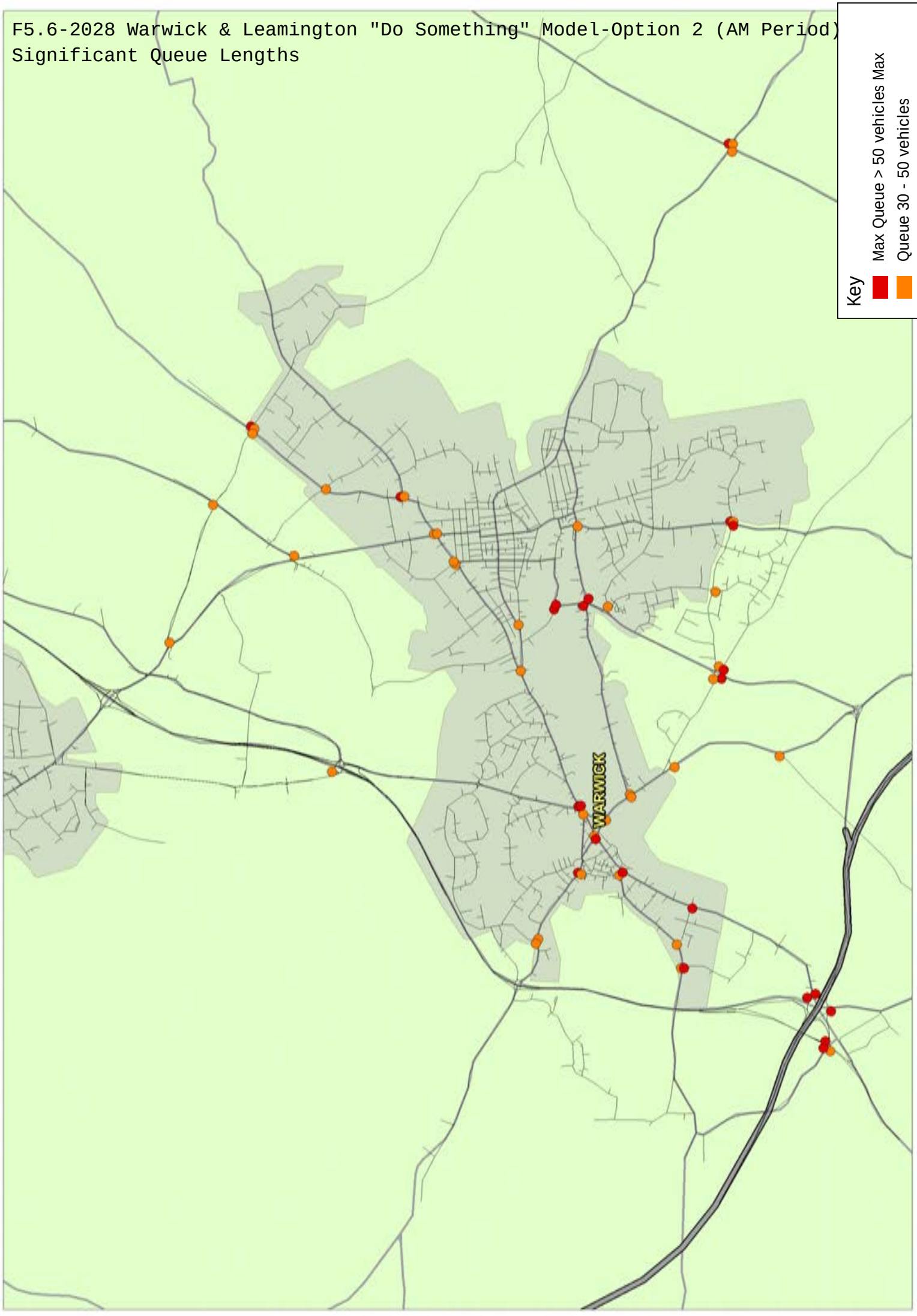


**Table 5.6 KS DS (Opn 2) – Significant Queues (AM Period)**

| Ref | Junction | Approach | Dir | Max Q (vehs) |
|---|---|---|---|---|
| 1 | A429 / A45 | A429 | SB | 57 |
| | | A429 | NB | 57 |
| | | A45 | EB | 55 |
| 3 | Leamington Rd / A45 / St Martin's Rd | A45 | WB | 84 |
| 5 | Toll Bar End | A45 | NB | 60 |

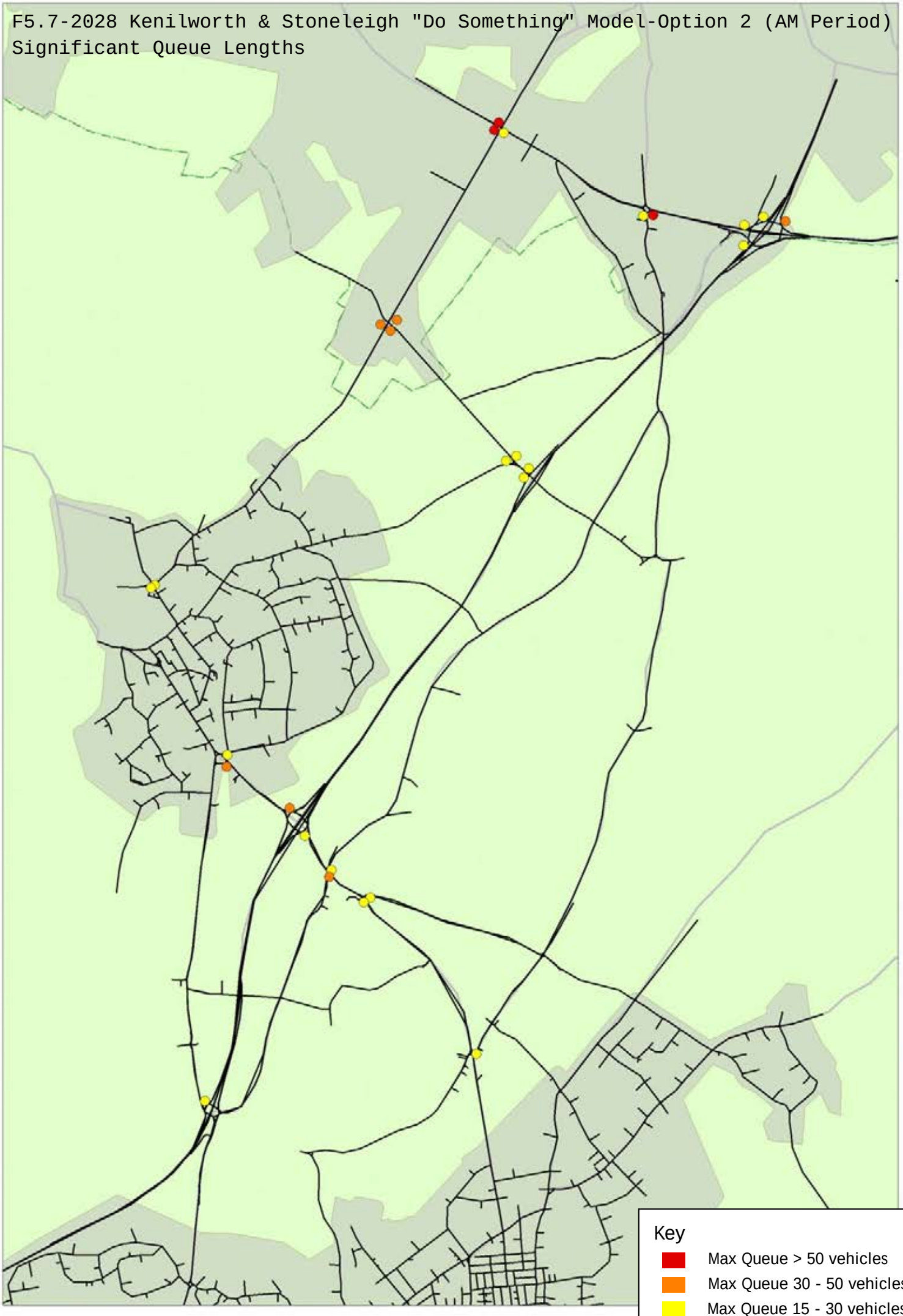
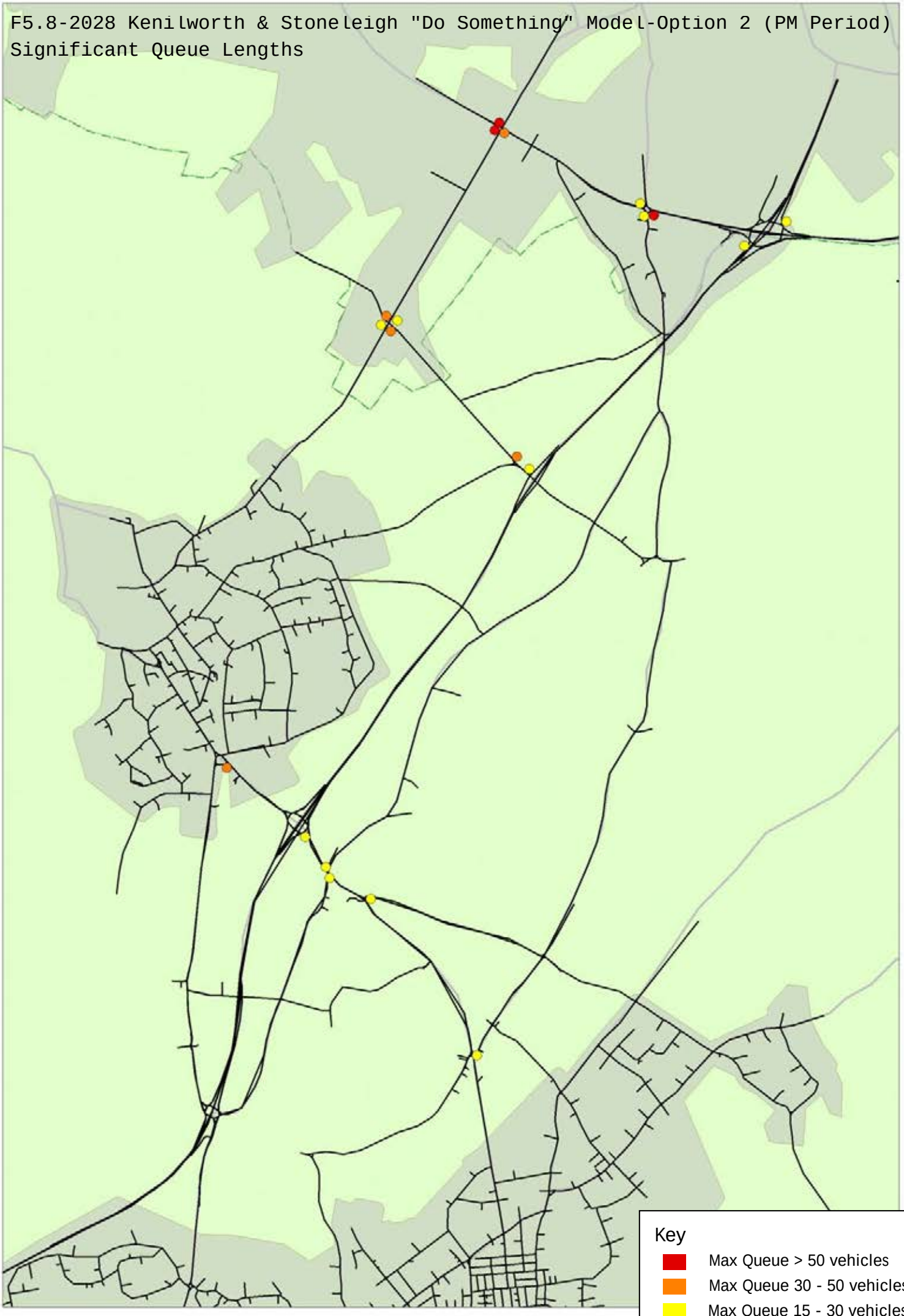

F5.7-2028 Kenilworth & Stoneleigh "Do Something" Model-Option 2 (AM Period)
Significant Queue Lengths
Key
Max Queue > 50 vehicles
Max Queue 30 - 50 vehicles
Max Queue 15 - 30 vehicles

**Table 5.7 KS DS (Opn 2) – Significant Queues (PM Period)**

| Ref | Junction | Approach | Dir | Max Q (vehs) |
|---|---|---|---|---|
| 1 | A429 / A45 | A429 | NB | 57 |
| | | A45 | EB | 96 |
| 3 | Leamington Rd / A45 / St Martin's Rd | A45 | WB | 75 |
| 5 | Toll Bar End | A45 | NB | 74 |
| | | Rowley Road | NB | 115 |
| | | A45 | EB | 50 |
| | | Siskin Drive | NB | 85 |

F5.8-2028 Kenilworth & Stoneleigh "Do Something" Model-Option 2 (PM Period)
Significant Queue Lengths



### Option 3

5.28 The junction approaches within the WL Option 3 'Do Something' model (AM period only) that experience an average maximum queue of 30 of more vehicles are presented in Figure 5.9. The junction approaches within the KS Option 3 'Do Something' model that show an average maximum queue of 15 of more vehicles are presented in Figure 5.10 & Figure 5.11.

5.29 The queues that exceed 50 vehicles in length are summarised in the accompanying tables (Table 5.8 to Table 5.10). The junction locations are presented in Appendix B.

**Table 5.8 WL DS (Opn 3) – Significant Queues (AM Period)**

| Ref | Junction | Approach | Dir | Max Q (vehs) |
|---|---|---|---|---|
| 5 | Leicester Ln / Kenilworth Rd / Westhill Rd | Leicester Lane | SB | 79 |
| | | Kenilworth Rd | WB | 52 |
| | | Leicester Lane | NB | 52 |
| 26 | Princes Drive / Park Drive / A452 | Princes Drive | SB | 59 |
| 27 | Princes Dr / Old Warwick Rd / Myton Rd | Old Warwick Rd | WB | 74 |
| 34 | Fosse Way / Southam Rd | Fosse Way | SB | 57 |
| 38 | Tachbrook Rd / Heathcote Rd/ Heathcote Ln | Tachbrook Rd | SB | 73 |
| | | Tachbrook Rd | NB | 66 |
| 47 | Longbridge Island | Warwick Byp | SB | 56 |
| | | A429 | WB | 89 |
| | | A429 | NB | 60 |
| 48 | Longbridge Island Mini-Rbt | SB Approach | SB | 60 |
| | | EB Approach | EB | 79 |
| 51 | Saltisford / Theatre St | Saltisford | EB | 65 |
| | | Theatre Street | NB | 52 |
| 54 | A429 / A445 / Weston Cl | A429 | SB | 67 |
| | | A445 | WB | 53 |
| 55 | A425 / A452 / Jury St | Jury Street | EB | 69 |
| 65 | Hampton Rd / Purser Dr | Hampton Road | EB | 53 |

F5.9-2028 Warwick & Leamington "Do Something" Model-Option 3 (AM Period)
Significant Queue Lengths

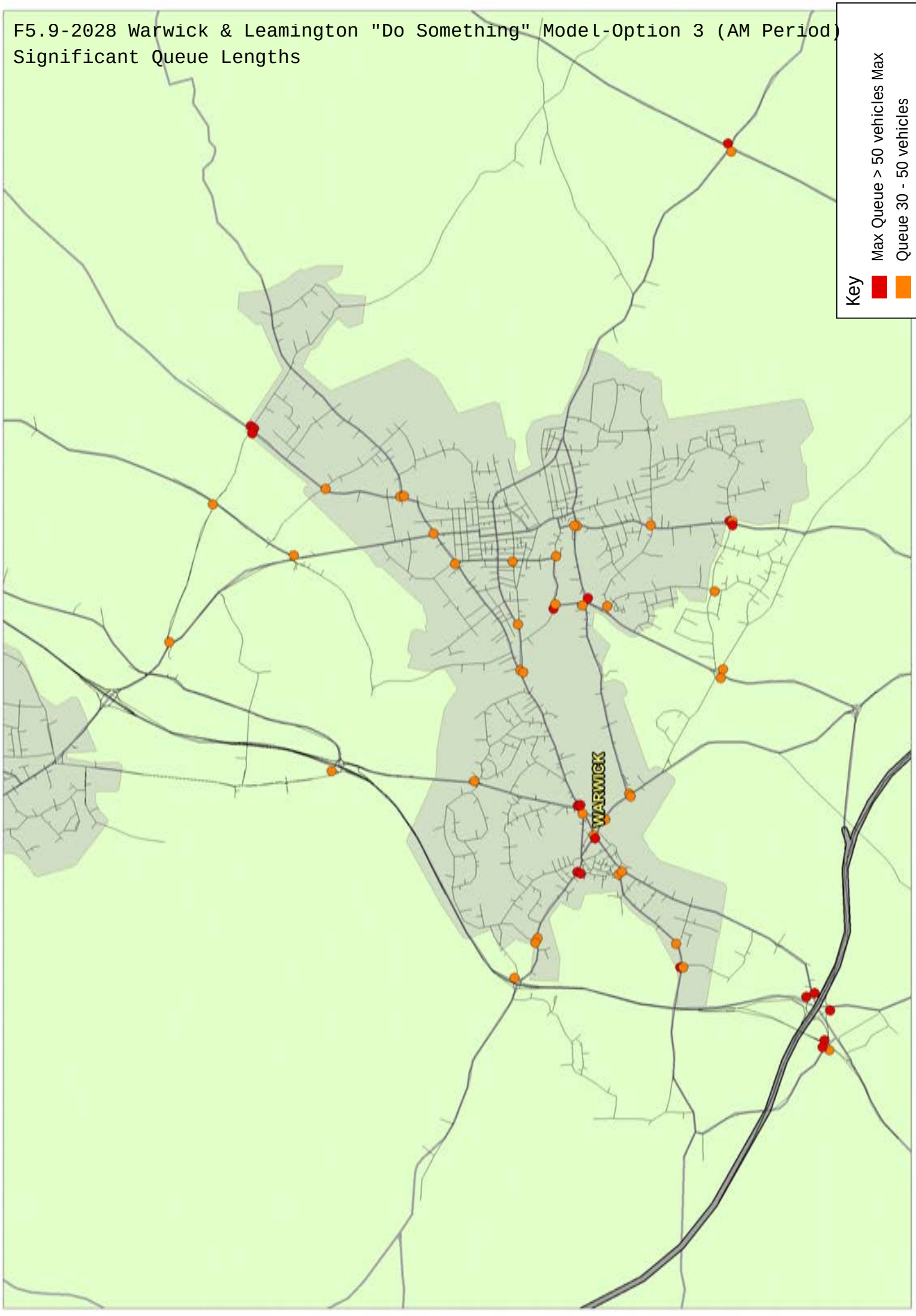


**Table 5.9 KS DS (Opn 3) – Significant Queues (AM Period)**

| Ref | Junction | Approach | Dir | Max Q (vehs) |
|---|---|---|---|---|
| 1 | A429 / A45 | A429 | SB | 68 |
| | | A429 | NB | 59 |
| | | A45 | EB | 58 |
| 3 | Leamington Rd / A45 / St Martin's Rd | A45 | WB | 81 |
| 5 | Toll Bar End | A45 | NB | 66 |

F5.10-2028 Kenilworth & Stoneleigh "Do Something" Model-Option 3 (AM Period)
Significant Queue Lengths

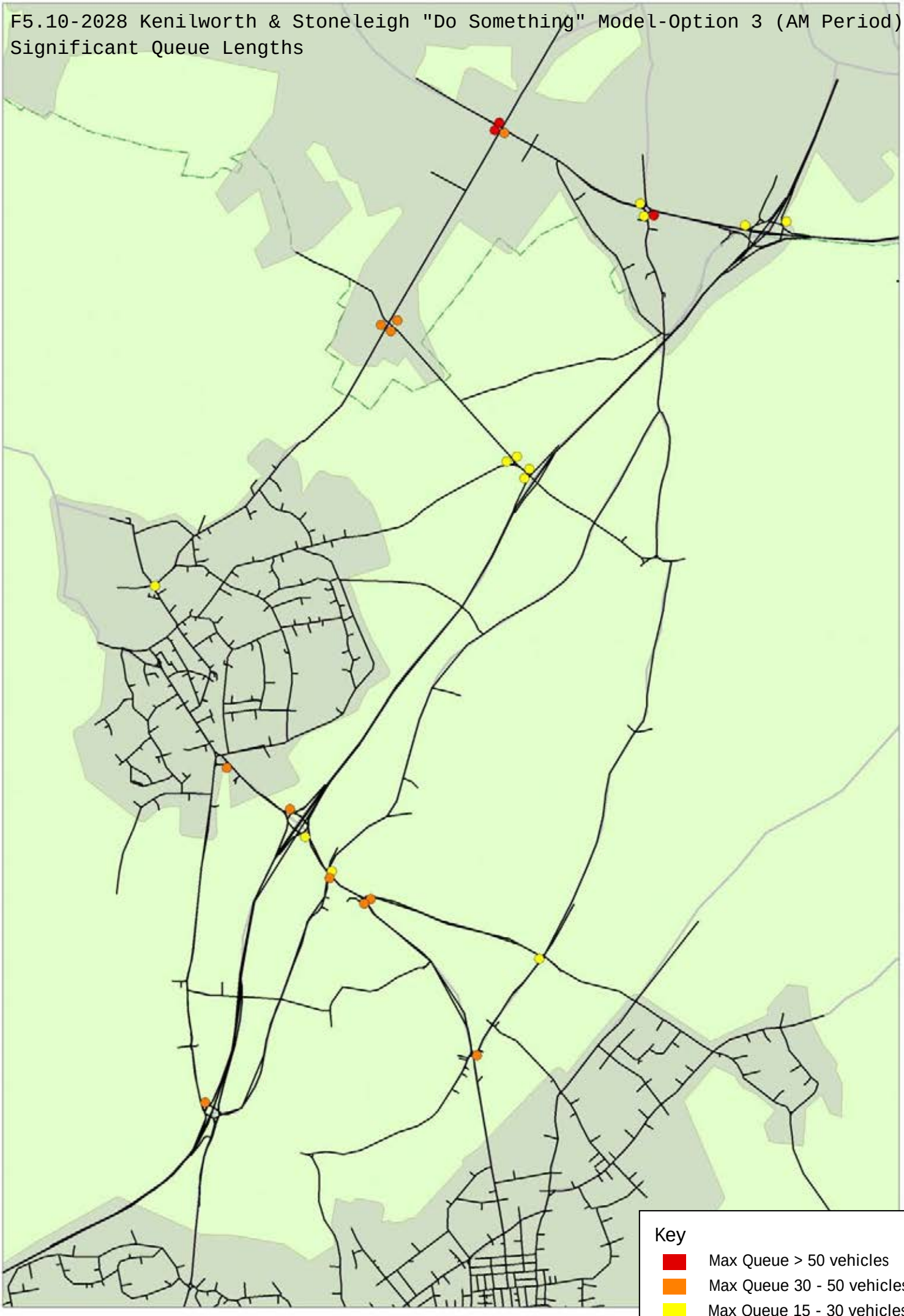
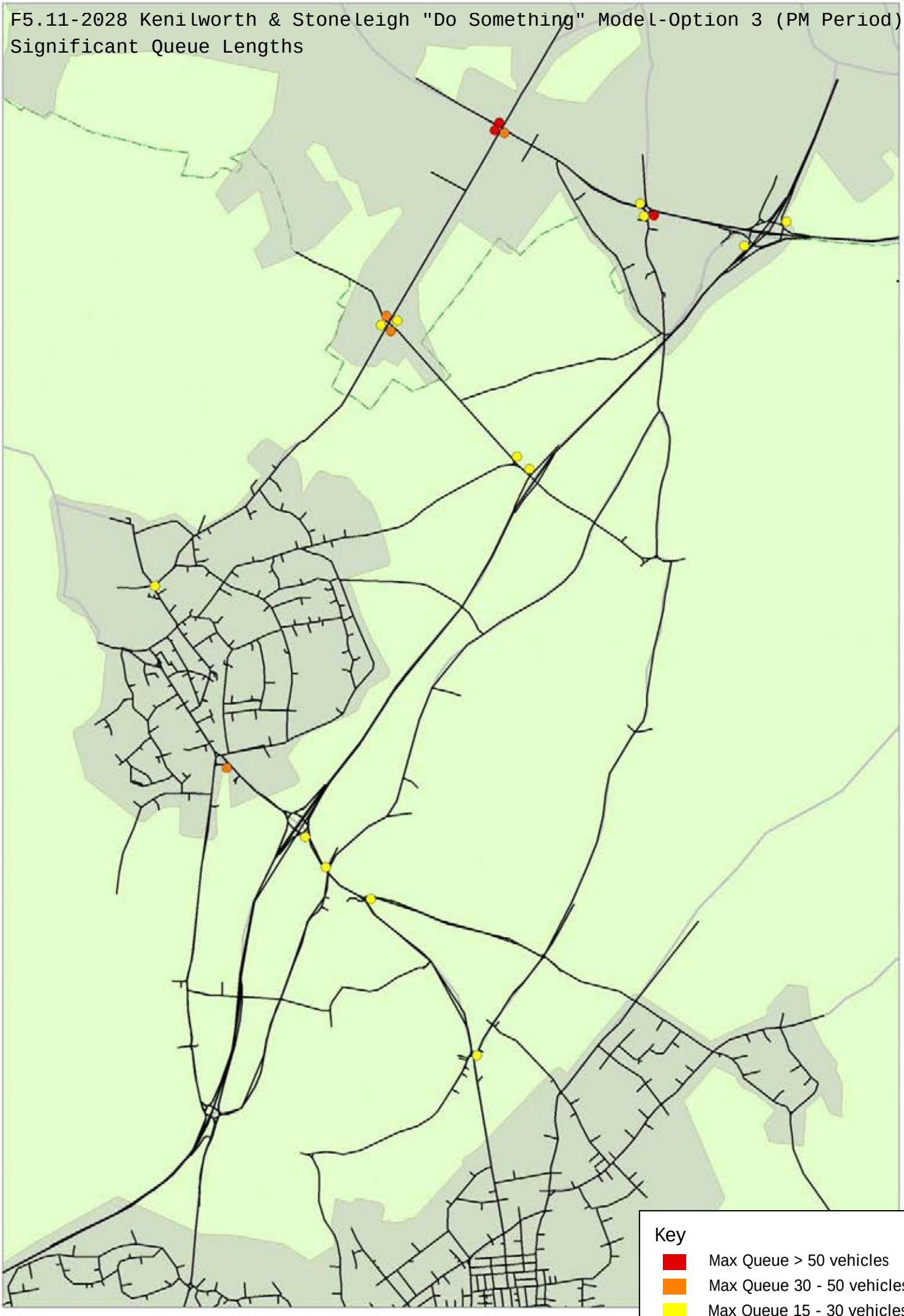


**Table 5.10 KS DS (Opn 3) – Significant Queues (PM Period)**

| Ref | Junction | Approach | Dir | Max Q (vehs) |
|---|---|---|---|---|
| 1 | A429 / A45 | A429 | NB | 59 |
| | | A45 | EB | 99 |
| 3 | Leamington Rd / A45 / St Martin's Rd | A45 | WB | 79 |
| 5 | Toll Bar End | A45 | NB | 76 |
| | | Rowley Road | NB | 120 |
| | | Siskin Drive | NB | 91 |

F5.11-2028 Kenilworth & Stoneleigh "Do Something" Model-Option 3 (PM Period)
Significant Queue Lengths



### Option 4

5.30 The junction approaches within the WL Option 4 'Do Something' model (AM period only) that experience an average maximum queue of 30 of more vehicles are presented in Figure 5.12. The junction approaches within the KS Option 4 'Do Something' model that show an average maximum queue of 15 of more vehicles are presented in Figure 5.13 & Figure 5.14.

5.31 The queues that exceed 50 vehicles in length are summarised in the accompanying tables (Table 5.11 to Table 5.13). The junction locations are presented in Appendix B.

**Table 5.11 WL DS (Opn 4) – Significant Queues (AM Period)**

| Ref | Junction | Approach | Dir | Max Q (vehs) |
|---|---|---|---|---|
| 5 | Leicester Ln / Kenilworth Rd/ Westhill Rd | Leicester Lane | SB | 69 |
| | | Leicester Lane | NB | 51 |
| 9 | Lillington Rd / Cubbington Rd/ Warren Cl | Lillington Rd | SB | 59 |
| 26 | Princes Drive / Park Drive/ A452 | Princes Drive | SB | 58 |
| 27 | Princes Dr / Old Warwick Rd / Myton Rd | Old Warwick Rd | WB | 64 |
| | | Myton Road | EB | 53 |
| 34 | Fosse Way / Southam Rd | Fosse Way | SB | 54 |
| 38 | Tachbrook Rd / Heathcote Rd/ Heathcote Ln | Tachbrook Rd | SB | 52 |
| | | Tachbrook Rd | NB | 61 |
| 40 | Europa Way / Harbury Ln / Gallows Hill | Harbury Lane | WB | 52 |
| | | Europa Way | NB | 61 |
| 47 | Longbridge Island | Warwick Byp | SB | 52 |
| | | A429 | WB | 69 |
| | | A429 | NB | 60 |
| | | M40 (SB Offslip) | EB | 58 |
| 51 | Saltisford / Theatre St | Saltisford | EB | 62 |
| 54 | A429 / A445/ Weston Cl | A429 | SB | 74 |
| | | A445 | WB | 56 |
| 55 | A425 / A452/ Jury St | Jury Street | EB | 65 |
| 59 | A425 / High St | High Street | EB | 51 |

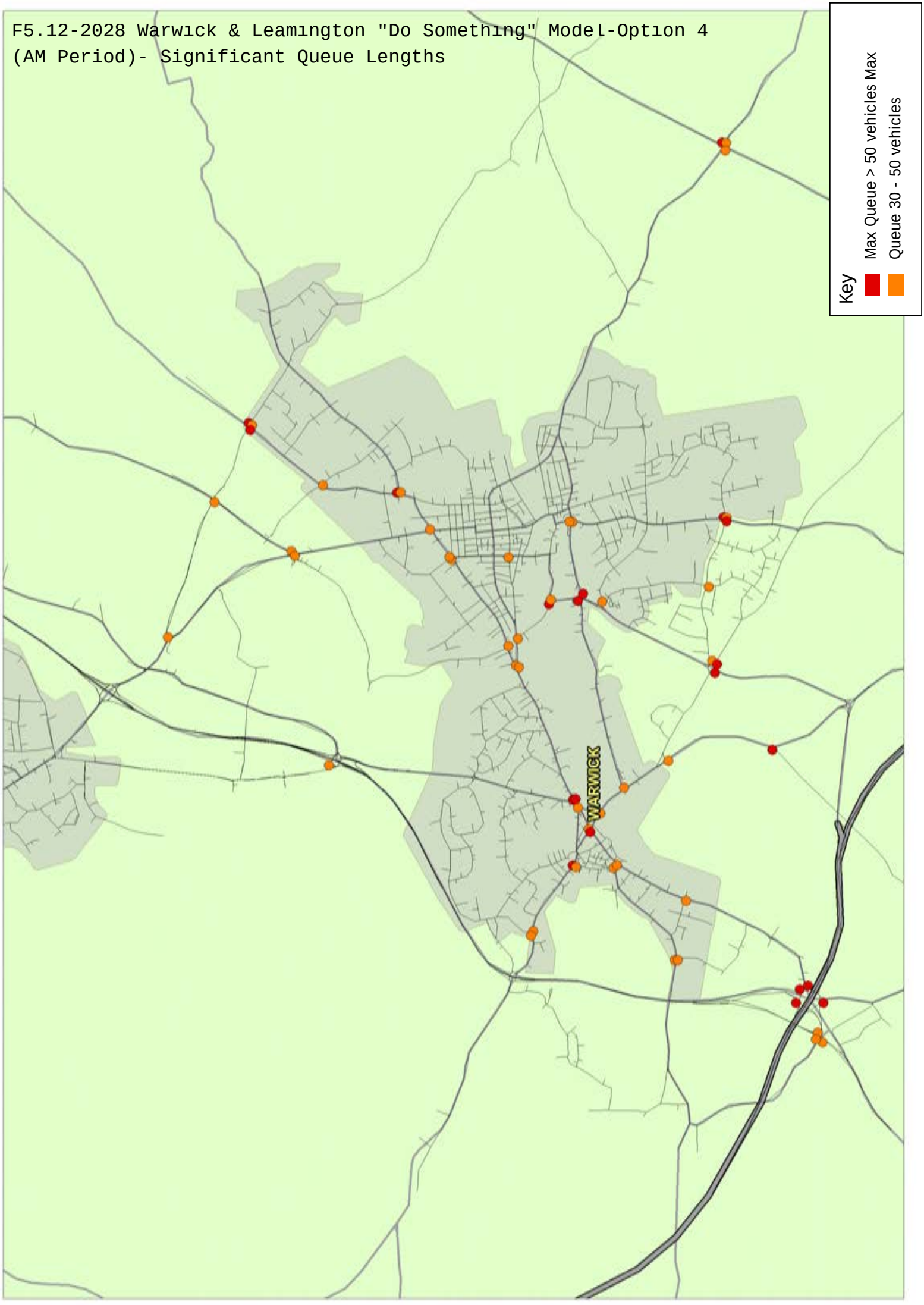

F5.12-2028 Warwick & Leamington "Do Something" Model-Option 4
(AM Period)- Significant Queue Lengths
Key
Max Queue > 50 vehicles Max
Queue 30 - 50 vehicles
WARWICK

**Table 5.12 KS DS (Opn 4) – Significant Queues (AM Period)**

| Ref | Junction | Approach | Dir | Max Q (vehs) |
|---|---|---|---|---|
| 1 | A429 / A45 | A429 | SB | 74 |
| | | A429 | NB | 65 |
| | | A45 | EB | 61 |
| 3 | Leamington Rd / A45 / St Martin's Rd | A45 | WB | 82 |
| 5 | Toll Bar End | A45 | NB | 64 |

F5.13-2028 Kenilworth & Stoneleigh "Do Something" Model-Option 4 (AM Period)
Significant Queue Lengths

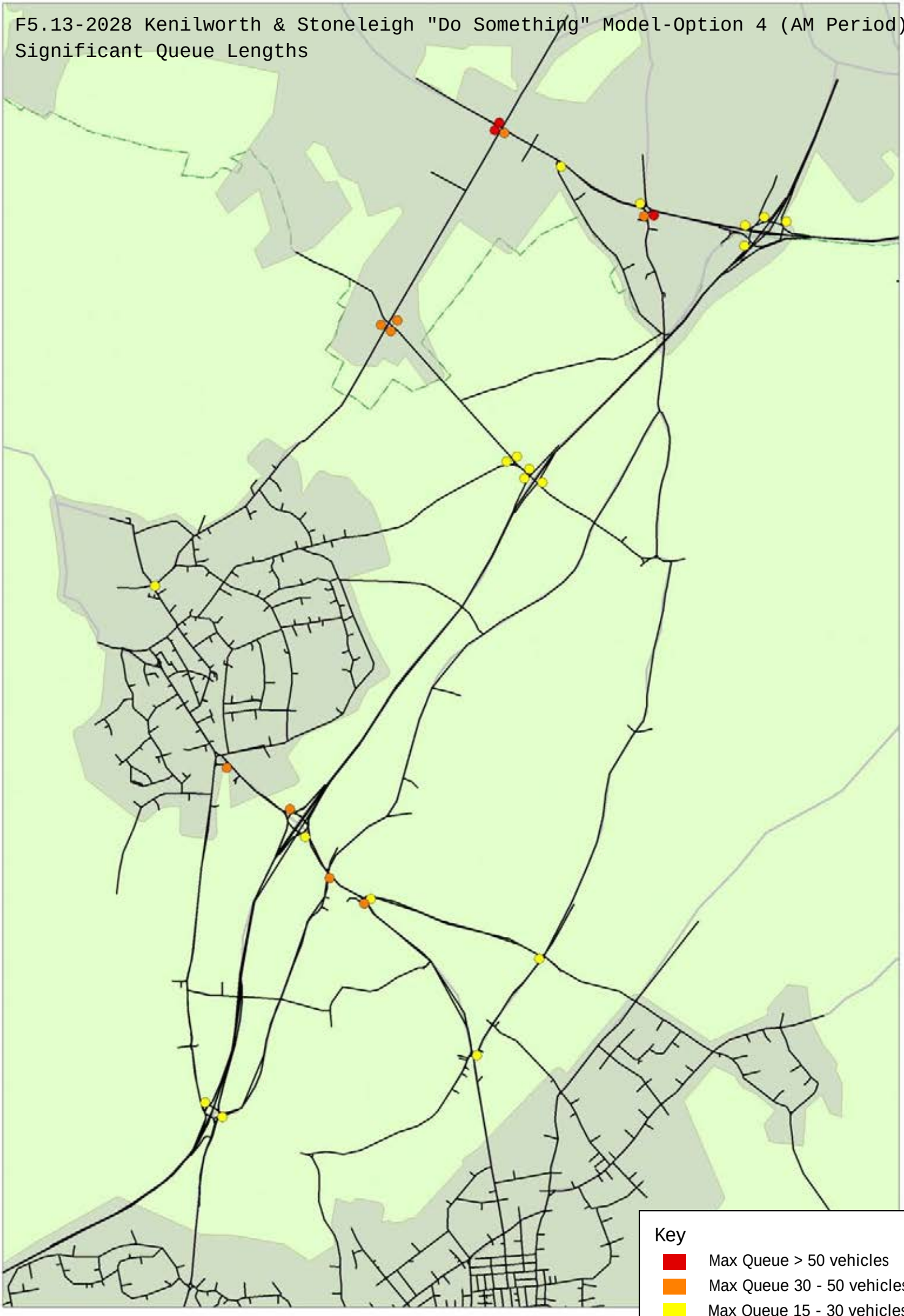
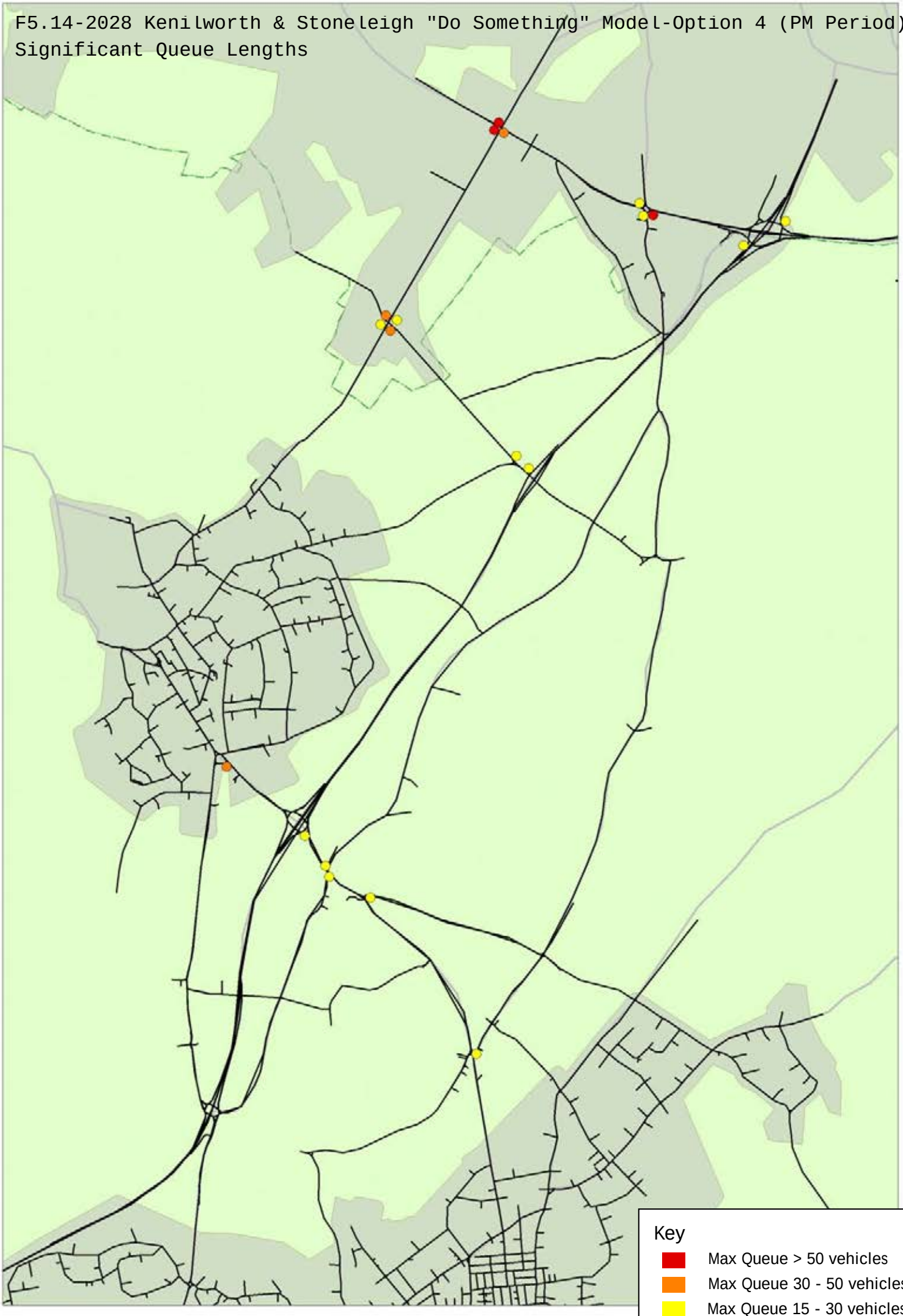


**Table 5.13 KS DS (Opn 4) – Significant Queues (PM Period)**

| Ref | Junction | Approach | Dir | Max Q (vehs) |
|---|---|---|---|---|
| 1 | A429 / A45 | A429 | NB | 62 |
| | | A45 | EB | 98 |
| 3 | Leamington Rd / A45 / St Martin's Rd | A45 | WB | 83 |
| 5 | Toll Bar End | A45 | NB | 77 |
| | | Rowley Road | NB | 103 |
| | | Siskin Drive | NB | 82 |

F5.14-2028 Kenilworth & Stoneleigh "Do Something" Model-Option 4 (PM Period)
Significant Queue Lengths



## ‘Do Something’ Option Comparisons

### Journey Time Analysis

5.32 The journey times on each of the routes depicted within Figure 3.1 and Figure 3.2 have been collected from each DS option model and presented below. Again, only the Warwick & Leamington AM period results have been presented due to the high level of congestion observed in the PM period.

5.33 The shortest and longest journey times observed on each route have been highlighted to indicate the option which provides the lowest and highest levels of delay.

**Table 5.14 WL DS All Options - Journey Times (Seconds) (AM Period)**

| Route | Option 1 | Option 2 | Option 3 | Option 4 |
|---|---|---|---|---|
| Route 1 NB | 1003 | 1436 | 1009 | 980 |
| Route 1 SB | 1123 | 1239 | 1171 | 1107 |
| Route 2 NB | 1747 | 1703 | 1569 | 1602 |
| Route 2 SB | 2981 | 3022 | 2625 | 2633 |
| Route 3 EB | 1134 | 1231 | 1154 | 1145 |
| Route 3 WB | 1329 | 1419 | 1415 | 1305 |
| Route 4 NB | 858 | 836 | 792 | 769 |
| Route 4 SB | 873 | 866 | 864 | 812 |
| Route 5 WB | 535 | 538 | 531 | 531 |
| Route 5 EB | 724 | 730 | 699 | 705 |
| Route 6 NB | 1207 | 1283 | 1262 | 1227 |
| Route 6 SB | 1292 | 1364 | 1368 | 1250 |
| Route 7 NB | 486 | 516 | 485 | 493 |
| Route 7 SB | 468 | 473 | 464 | 473 |
| Route 8 EB | 556 | 566 | 613 | 555 |
| Route 8 WB | 909 | 956 | 943 | 926 |
| Route 9 NB | 366 | 354 | 347 | 351 |
| Route 9 SB | 472 | 482 | 476 | 459 |
| **TOTAL** | **18063** | **19014** | **17787** | **17323** |

5.34 It can be seen from Table 5.14 that Option 4 is now showing the lowest journey times on the Warwick & Leamington network. In the DN scenarios Option 1 and 2 were highlighting the lowest level of delay but with the inclusion of the DS schemes this appears to have changed.

5.35 Option 2 is now shown to be the option that has significantly higher levels of delay across the majority key routes in Warwick & Leamington.

**Table 5.15 KS DS All Options - Journey Times (Seconds) (AM Period)**

| Route | Option 1 | Option 2 | Option 3 | Option 4 |
|---|---|---|---|---|
| Route 1 EB | 415 | 392 | 399 | 408 |
| Route 1 WB | 670 | 520 | 529 | 558 |
| Route 2 NB | 963 | 748 | 756 | 784 |
| Route 2 SB | 491 | 551 | 563 | 562 |
| Route 3 NB | 448 | 448 | 485 | 451 |
| Route 3 SB | 375 | 377 | 389 | 378 |
| Route 4 SB | 343 | 333 | 343 | 345 |
| Route 4 NB | 408 | 408 | 410 | 416 |
| Route 5 NB | 315 | 292 | 288 | 283 |
| Route 5 SB | 242 | 243 | 245 | 243 |
| Route 6 NB | 175 | 176 | 175 | 175 |
| Route 6 SB | 225 | 226 | 229 | 225 |
| Route 7 NB | 626 | 642 | 636 | 651 |
| Route 7 SB | 429 | 434 | 446 | 437 |
| **TOTAL** | **6125** | **5790** | **5893** | **5916** |

**Table 5.16 KS DS All Options - Journey Times (Seconds) (PM Period)**

| Route | Option 1 | Option 2 | Option 3 | Option 4 |
|---|---|---|---|---|
| Route 1 EB | 465 | 476 | 469 | 455 |
| Route 1 WB | 553 | 509 | 521 | 535 |
| Route 2 NB | 807 | 732 | 750 | 752 |
| Route 2 SB | 474 | 483 | 483 | 484 |
| Route 3 NB | 376 | 370 | 378 | 368 |
| Route 3 SB | 363 | 358 | 358 | 353 |
| Route 4 SB | 309 | 308 | 307 | 308 |
| Route 4 NB | 375 | 376 | 374 | 372 |
| Route 5 NB | 238 | 239 | 237 | 237 |
| Route 5 SB | 235 | 235 | 237 | 234 |
| Route 6 NB | 177 | 177 | 178 | 176 |
| Route 6 SB | 199 | 206 | 203 | 200 |
| Route 7 NB | 552 | 537 | 578 | 555 |
| Route 7 SB | 446 | 439 | 437 | 435 |
| **TOTAL** | **5569** | **5445** | **5510** | **5464** |

5.36 Table 5.15 and Table 5.16 indicate that on the KS DS networks the Option 2 package of sites highlights the lowest level of delay and shortest journey times on the network. This is consistent with the finding from the DN testing also.

5.37 Option 1 still highlights the highest levels of delay in Kenilworth & Stoneleigh.

### Network Wide Statistics

5.38 As noted in Chapter 3 several network wide statistics have been extracted from each DS scenario. The average distance travelled, average travel time and average speed have all been noted. Additionally, the number of completed trips has also been recorded.

5.39 No statistics were available for the Warwick & Leamington PM period.

**Table 5.17 WL DS All Options – Network Statistics (AM Period)**

| | Option 1 | Option 2 | Option 3 | Option 4 |
|---|---|---|---|---|
| Ave Distance (metres) | 6,732 | 6,761 | 6,718 | 6,708 |
| Ave Travel Time (secs) | 578 | 585 | 565 | 557 |
| Ave Speed (mph) | 26.1 | 25.8 | 26.5 | 26.9 |
| Completed Trips | 127,561 | 128,138 | 128,375 | 128,549 |

5.40 The network statistics obtained from the WL DS model runs indicate that the Option 4 package of sites in conjunction with the proposed mitigation schemes performs the best. This is in line with the journey time findings.

**Table 5.18 KS DS All Options – Network Statistics (AM Period)**

| | Option 1 | Option 2 | Option 3 | Option 4 |
|---|---|---|---|---|
| Ave Distance (metres) | 6,547 | 6,541 | 6,550 | 6,572 |
| Ave Travel Time (secs) | 450 | 426 | 439 | 437 |
| Ave Speed (mph) | 32.5 | 34.3 | 33.3 | 33.6 |
| Completed Trips | 68,945 | 69,559 | 69,483 | 68,761 |

**Table 5.19 KS DS All Options – Network Statistics (PM Period)**

| | Option 1 | Option 2 | Option 3 | Option 4 |
|---|---|---|---|---|
| Ave Distance (metres) | 6,472 | 6,472 | 6,476 | 6,491 |
| Ave Travel Time (secs) | 524 | 518 | 523 | 518 |
| Ave Speed (mph) | 27.6 | 27.9 | 27.6 | 28.0 |
| Completed Trips | 71,166 | 71,195 | 71,724 | 70,350 |

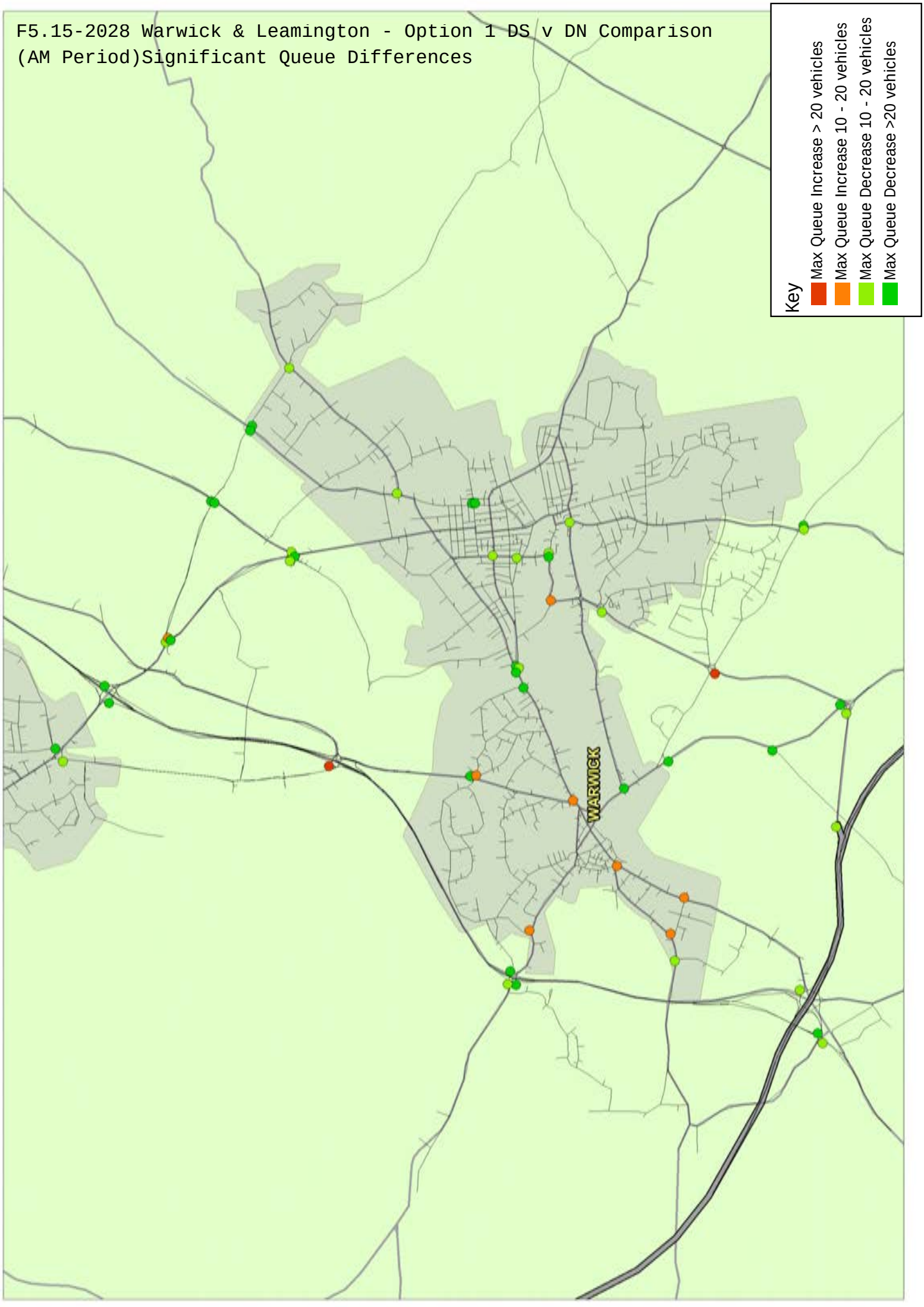
5.41 Table 5.18 and Table 5.19 appear to support the journey time findings and indicate that Option 2 generally performs the best on the Kenilworth & Stoneleigh network, however , closely followed by option 4..

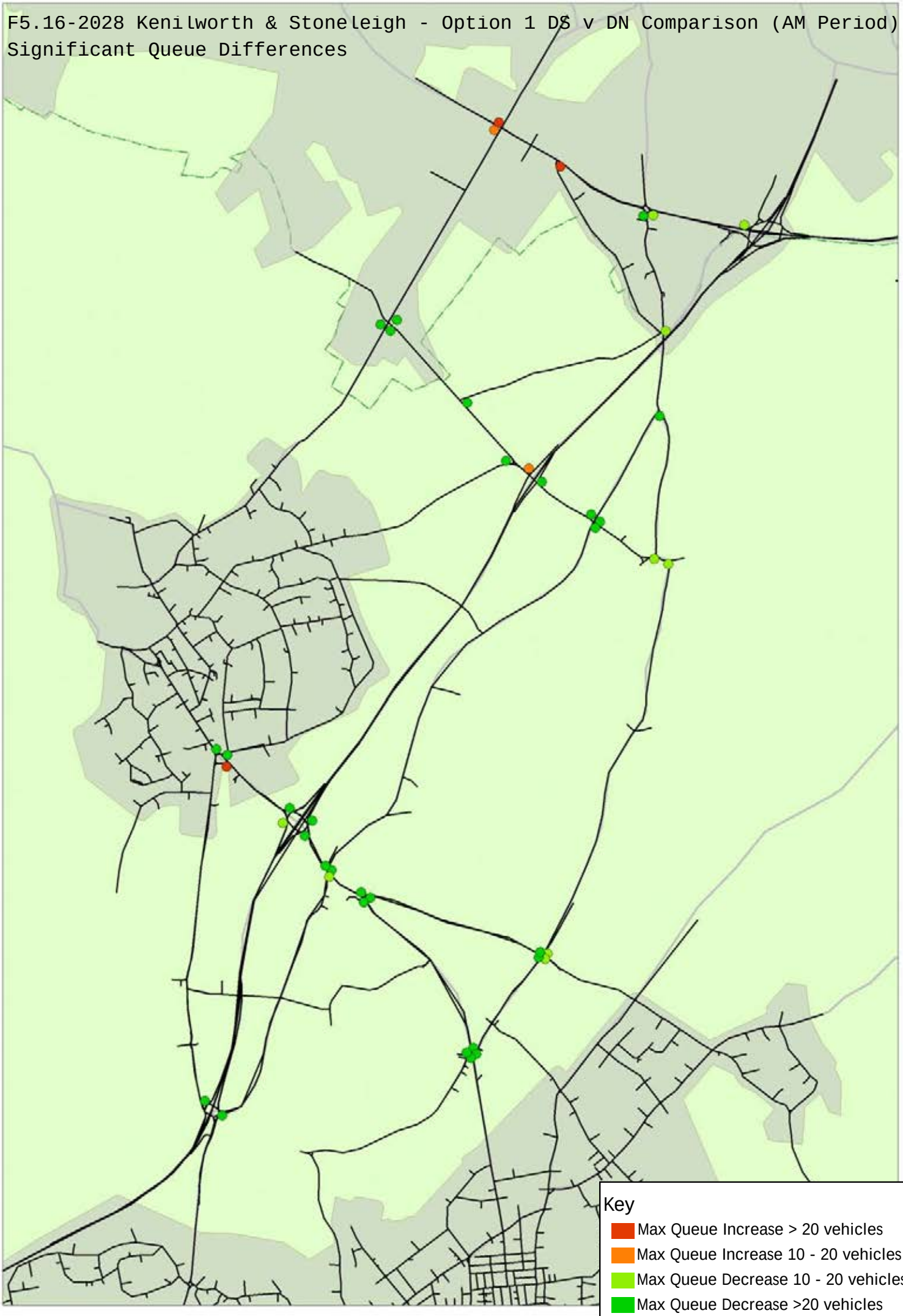
## ‘Do Something’ versus ‘Do Nothing’ Comparisons

### Queue Impact Assessments

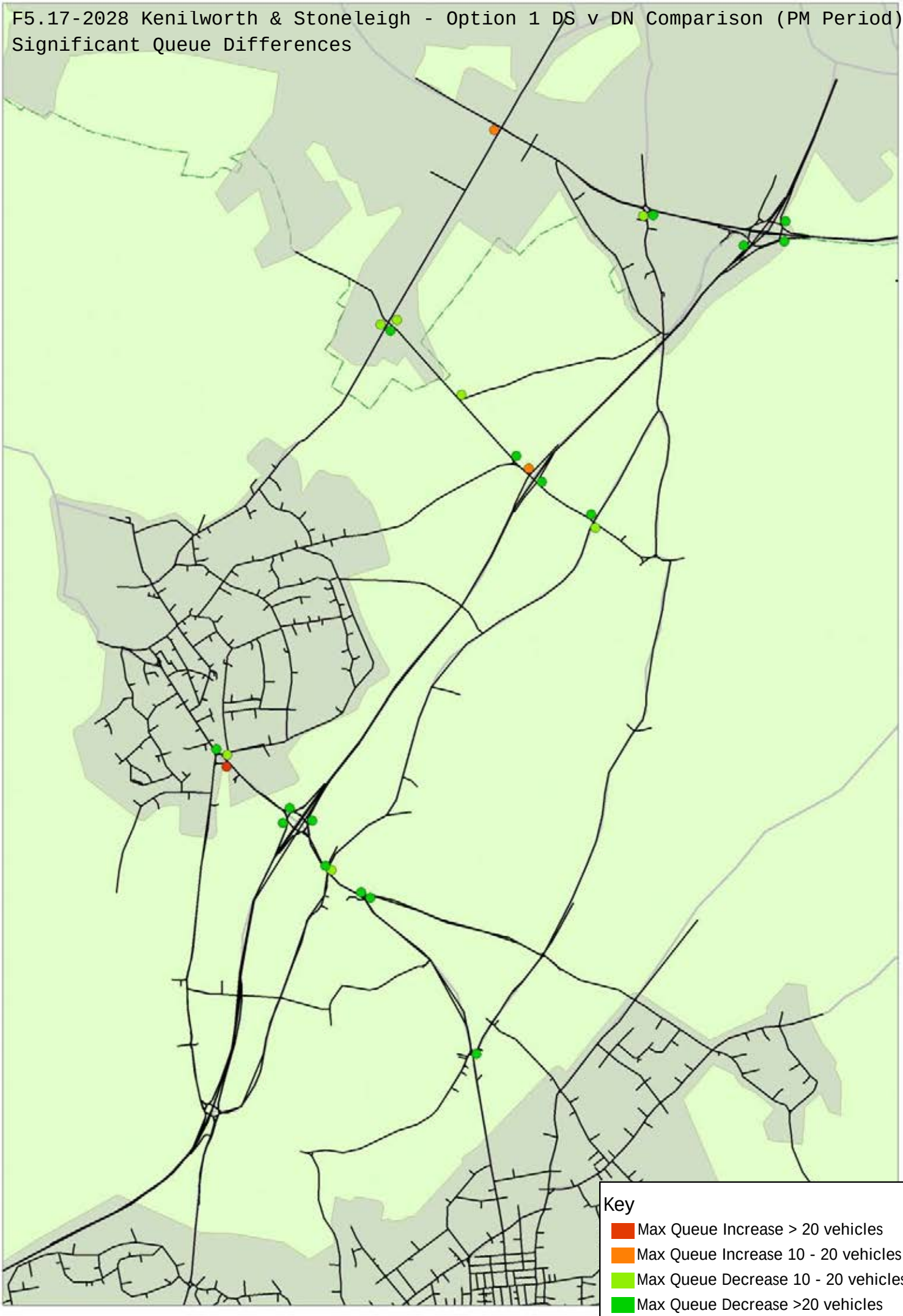
5.42 To provide a comparison between the DS and DN scenarios the maximum queue lengths have been compared for each corresponding option. The resulting differences have been presented graphically using colour banding to depict increases or decrease in queue lengths of notable degrees.

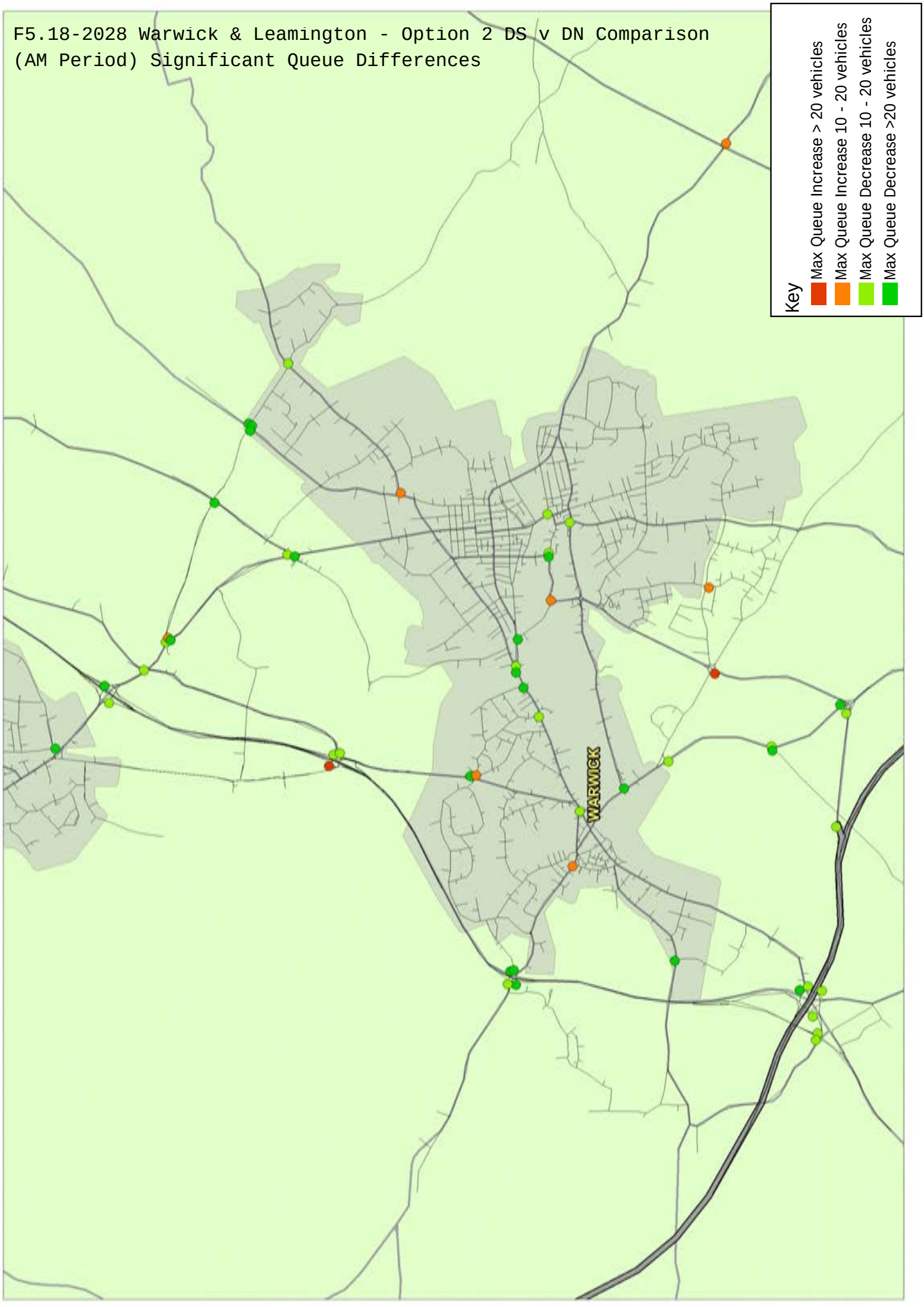
5.43 Figure 5.15 to Figure 5.26 contains the queue difference plots for each option and on each model network. Again, the Warwick & Leamington PM period has not been assessed for the reasons noted previously so such plots are not included below.


F5.15-2028 Warwick & Leamington - Option 1 DS v DN Comparison
(AM Period)Significant Queue Differences
Key
Max Queue Increase > 20 vehicles
Max Queue Increase 10 - 20 vehicles
Max Queue Decrease 10 - 20 vehicles
Max Queue Decrease >20 vehicles
WARWICK

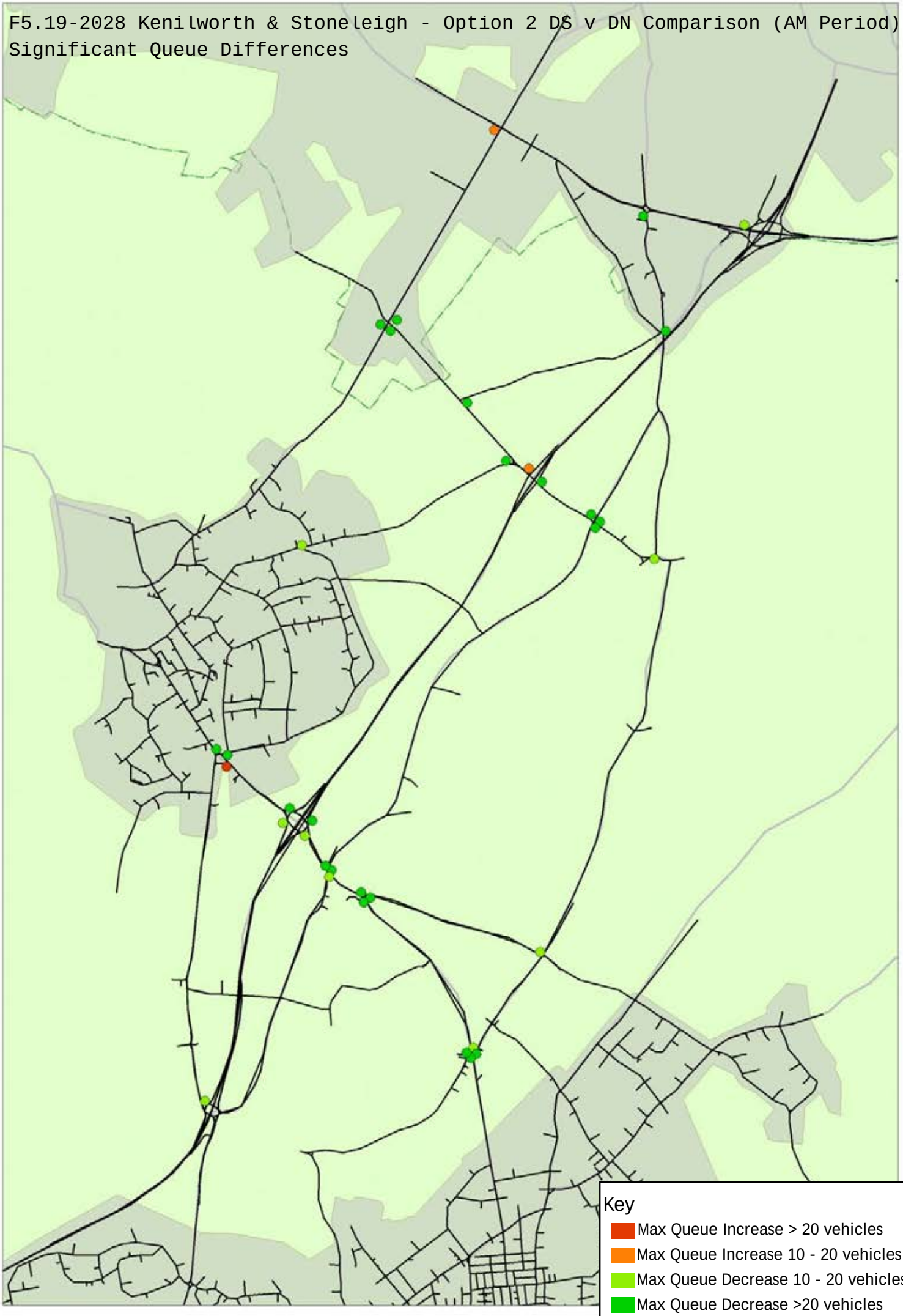

F5.16-2028 Kenilworth & Stoneleigh - Option 1 DS v DN Comparison (AM Period)
Significant Queue Differences
Key
Max Queue Increase > 20 vehicles
Max Queue Increase 10 - 20 vehicles
Max Queue Decrease 10 - 20 vehicles
Max Queue Decrease >20 vehicles

F5.17-2028 Kenilworth & Stoneleigh - Option 1 DS v DN Comparison (PM Period)
Significant Queue Differences

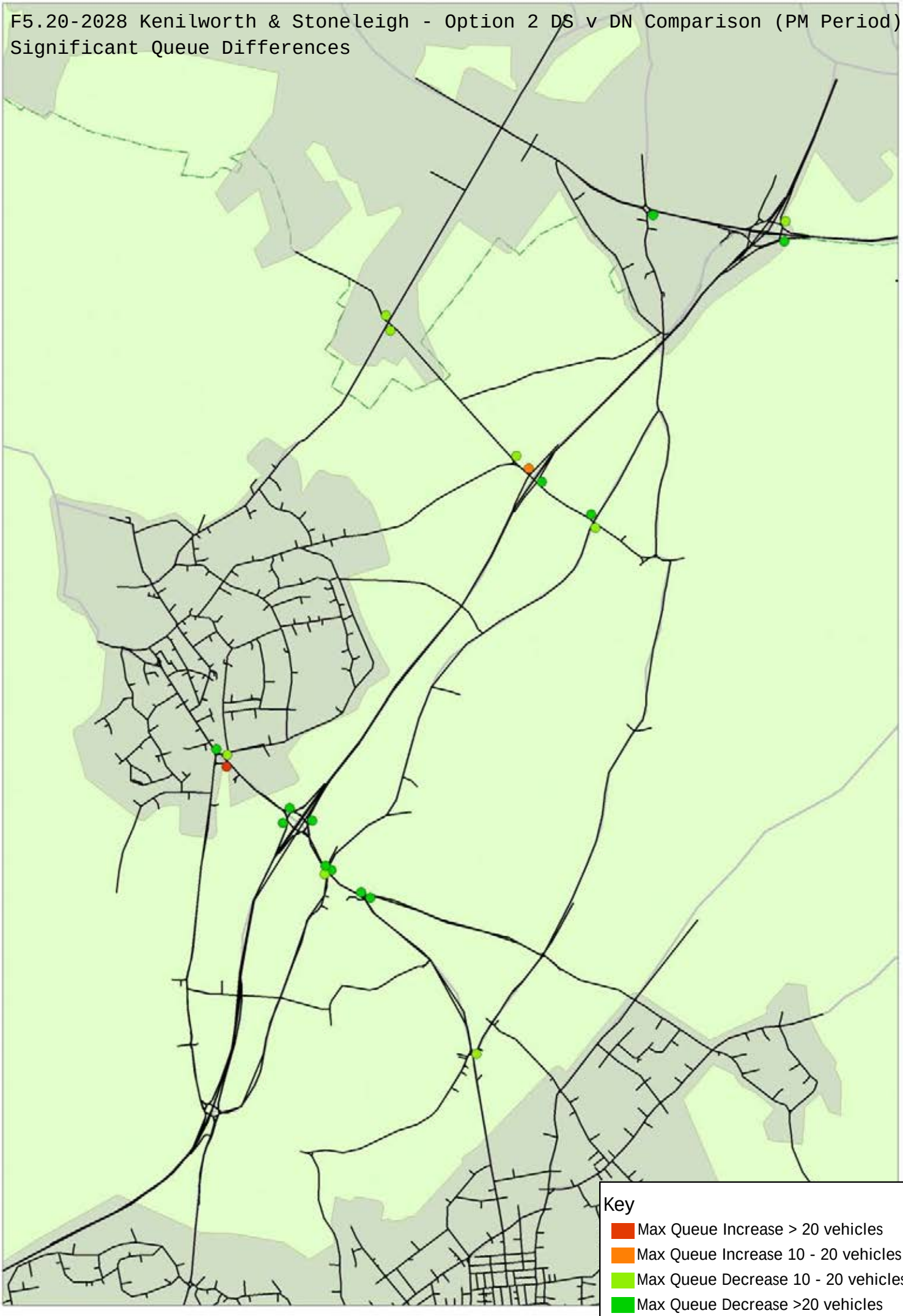


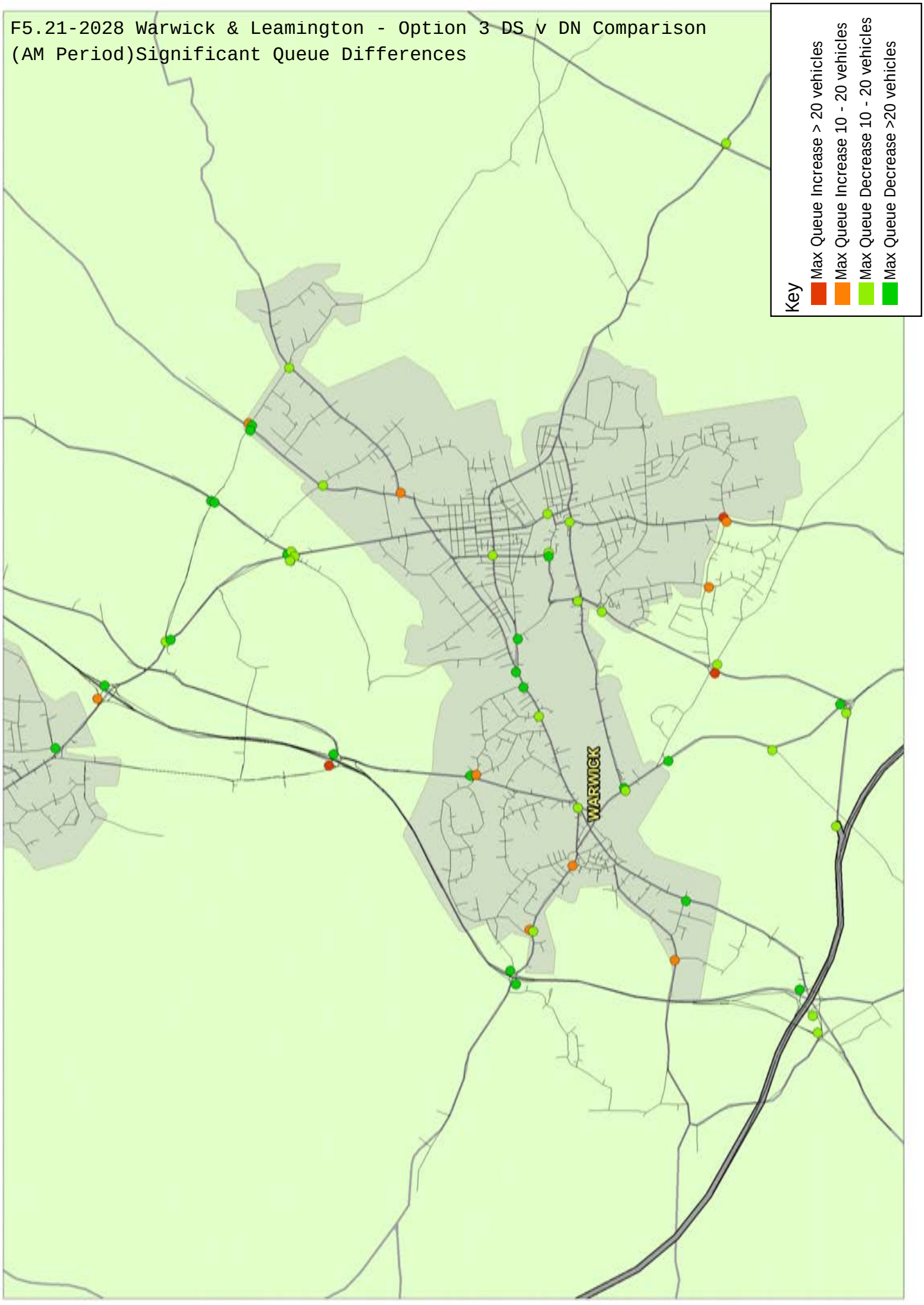

F5.18-2028 Warwick & Leamington - Option 2 DS v DN Comparison
(AM Period) Significant Queue Differences
Key
Max Queue Increase > 20 vehicles
Max Queue Increase 10 - 20 vehicles
Max Queue Decrease 10 - 20 vehicles
Max Queue Decrease >20 vehicles
WARWICK

F5.19-2028 Kenilworth & Stoneleigh - Option 2 DS v DN Comparison (AM Period)
Significant Queue Differences

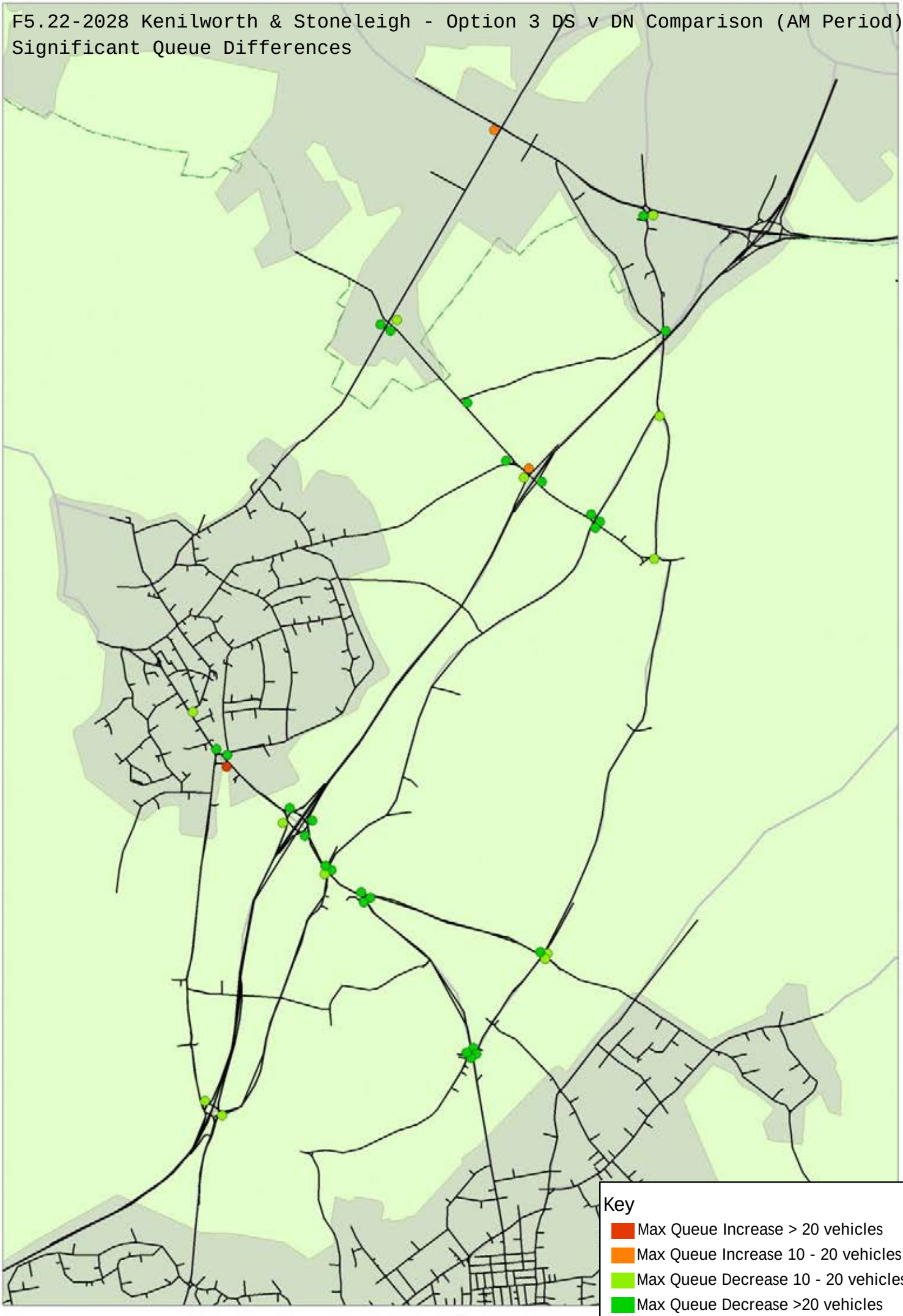


F5.20-2028 Kenilworth & Stoneleigh - Option 2 DS v DN Comparison (PM Period)
Significant Queue Differences

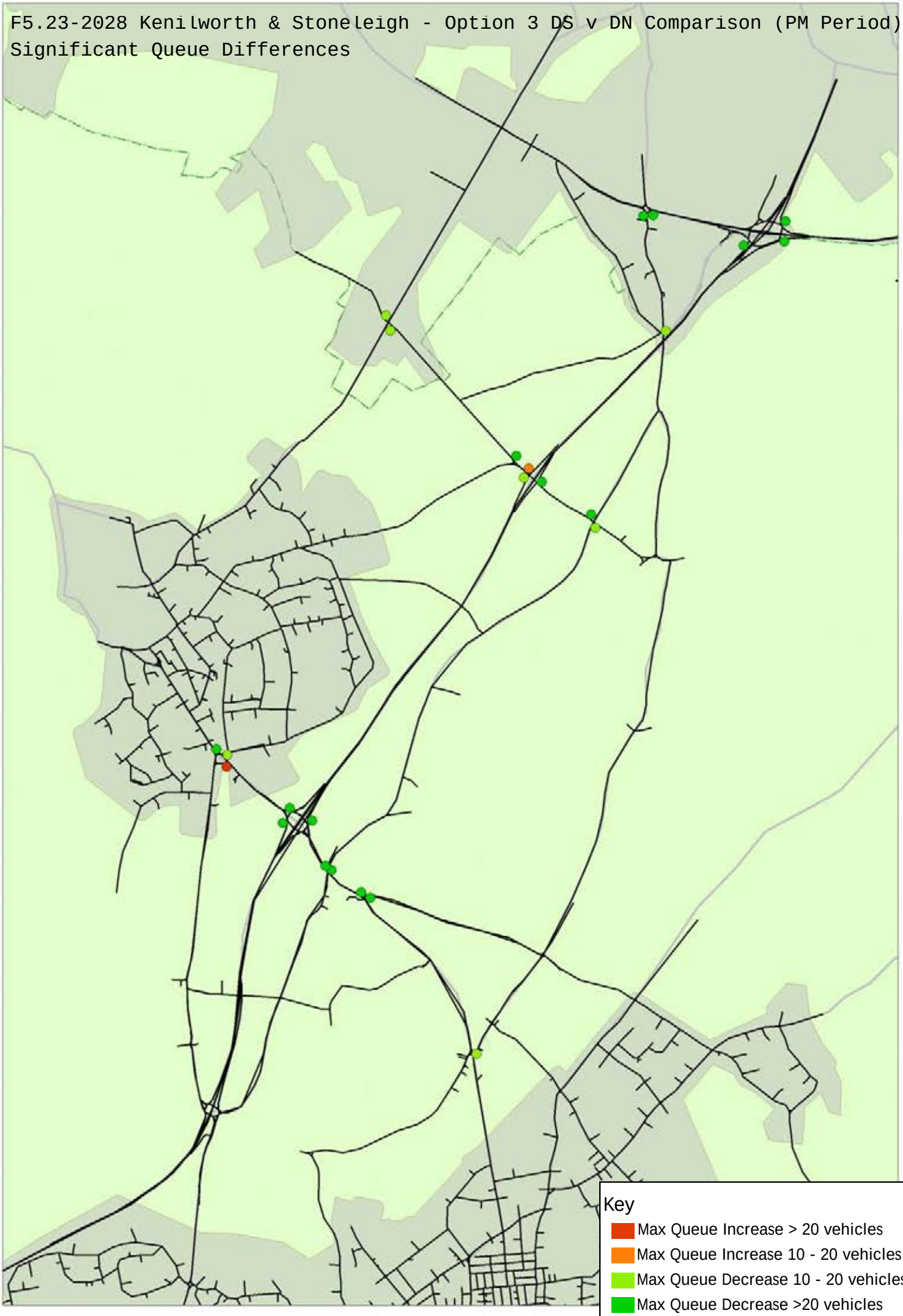


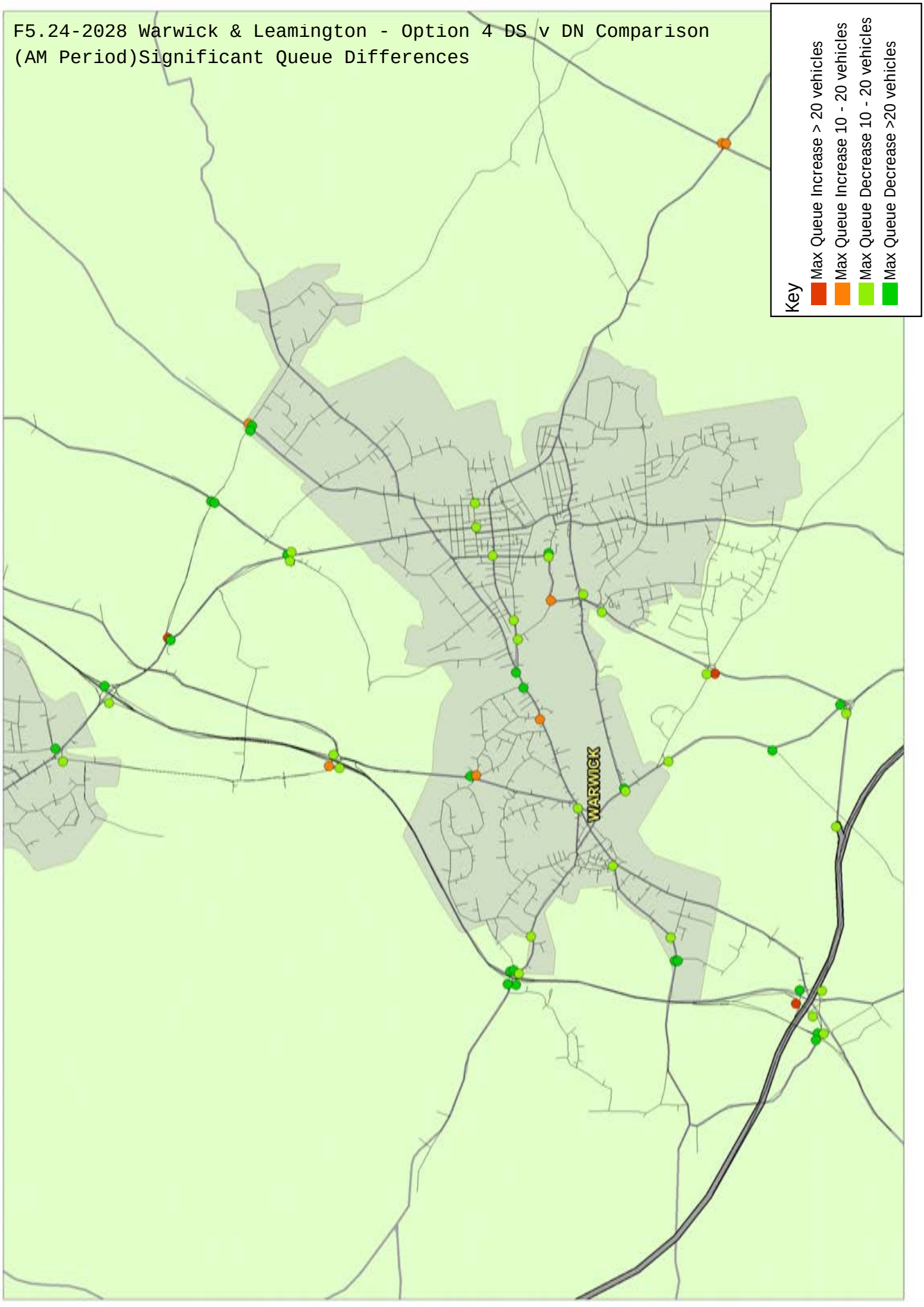

F5.21-2028 Warwick & Leamington - Option 3 DS v DN Comparison
(AM Period)Significant Queue Differences
Key
Max Queue Increase > 20 vehicles
Max Queue Increase 10 - 20 vehicles
Max Queue Decrease 10 - 20 vehicles
Max Queue Decrease >20 vehicles
WARWICK

F5.22-2028 Kenilworth & Stoneleigh - Option 3 DS v DN Comparison (AM Period)
Significant Queue Differences

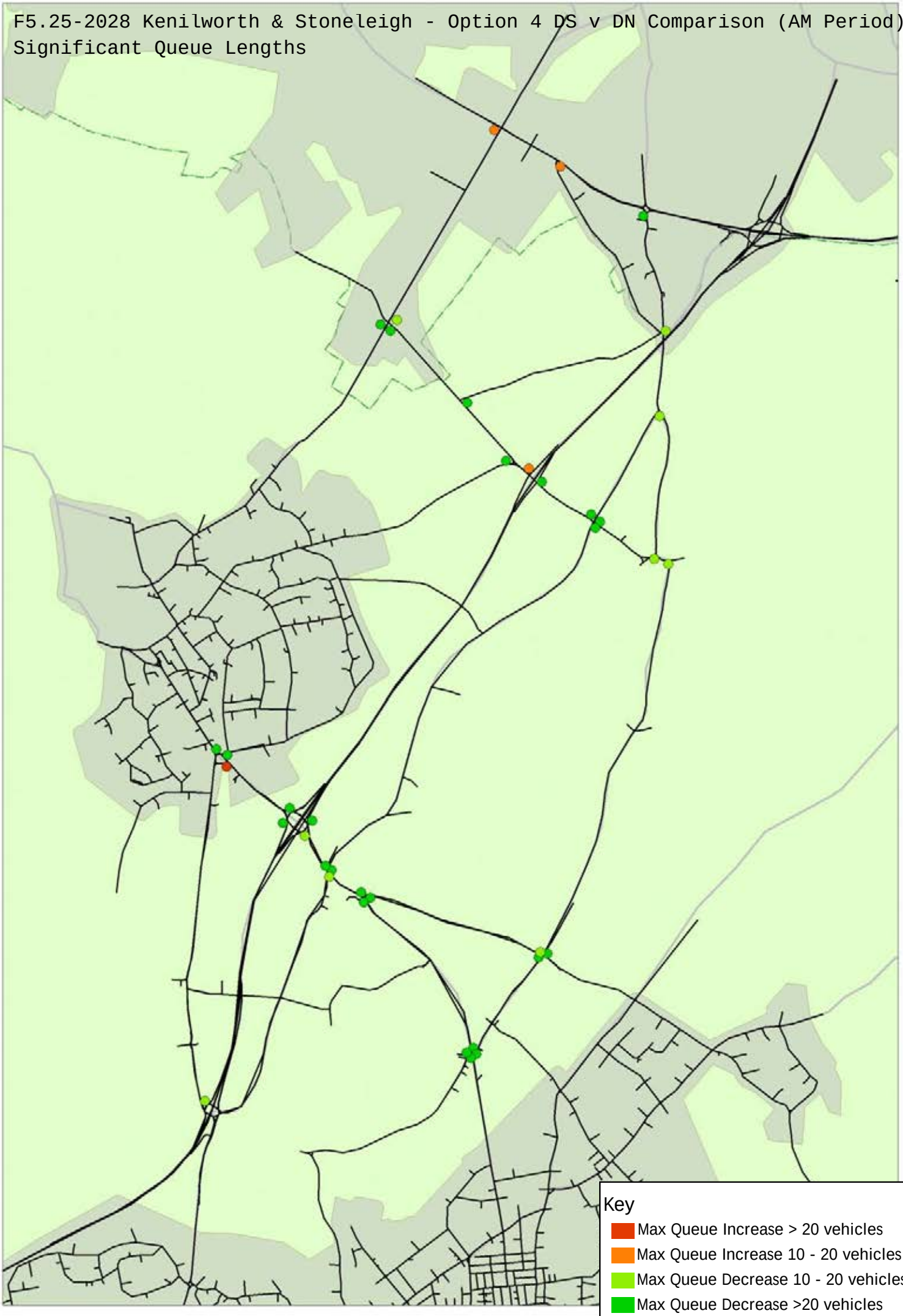


F5.23-2028 Kenilworth & Stoneleigh - Option 3 DS v DN Comparison (PM Period)
Significant Queue Differences

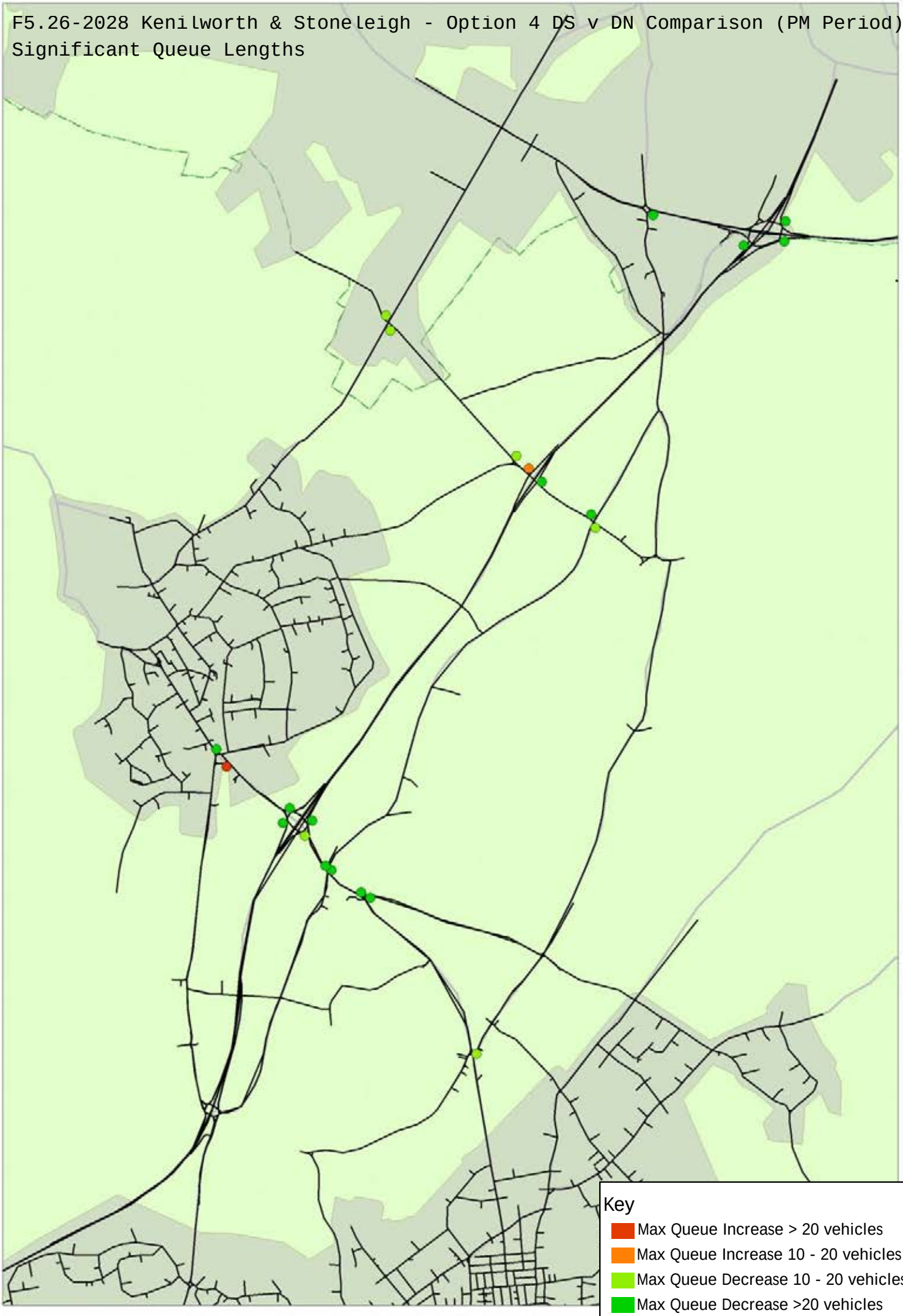



F5.24-2028 Warwick & Leamington - Option 4 DS v DN Comparison
(AM Period)Significant Queue Differences
Key
Max Queue Increase > 20 vehicles
Max Queue Increase 10 - 20 vehicles
Max Queue Decrease 10 - 20 vehicles
Max Queue Decrease >20 vehicles
WARWICK

F5.25-2028 Kenilworth & Stoneleigh - Option 4 DS v DN Comparison (AM Period)
Significant Queue Lengths



F5.26-2028 Kenilworth & Stoneleigh - Option 4 DS v DN Comparison (PM Period)
Significant Queue Lengths



### Journey Time Analysis

5.44 The journey times on each of the routes depicted within Figure 3.1 and Figure 3.2 have been collected from both the DS and DN options and compared in the tables below. No comparisons are presented for the Warwick & Leamington PM period.

**Table 5.20 WL DS v. DN All Options - Journey Times (Seconds) (AM Period)**

| Route | Option 1 | | Option 2 | | Option 3 | | Option 4 | |
|---|---|---|---|---|---|---|---|---|
| | Diff | % | Diff | % | Diff | % | Diff | % |
| Route 1 NB | -468 | *32%* | 274 | *24%* | -180 | 15% | -204 | *17%* |
| Route 1 SB | -111 | *9%* | -121 | *9%* | -240 | 18% | -283 | *20%* |
| Route 2 NB | -225 | *11%* | -131 | *7%* | -307 | 15% | -261 | *14%* |
| Route 2 SB | -217 | *7%* | -101 | *3%* | -369 | 11% | -380 | *13%* |
| Route 3 EB | -121 | *10%* | -3 | *0%* | -184 | 14% | -72 | *6%* |
| Route 3 WB | -127 | *9%* | -145 | *9%* | -211 | 14% | -192 | *13%* |
| Route 4 NB | -73 | *8%* | -133 | *14%* | -288 | 25% | -294 | *28%* |
| Route 4 SB | -124 | *12%* | -250 | *22%* | -406 | 32% | -367 | *31%* |
| Route 5 WB | 7 | *1%* | -21 | *4%* | 4 | 1% | -18 | *3%* |
| Route 5 EB | -91 | *11%* | -88 | *11%* | -68 | 9% | -168 | *19%* |
| Route 6 NB | -76 | *6%* | -52 | *4%* | -129 | 10% | -67 | *5%* |
| Route 6 SB | -113 | *8%* | -37 | *3%* | -87 | 6% | -177 | *12%* |
| Route 7 NB | 0 | *0%* | 25 | *5%* | -9 | 2% | 19 | *4%* |
| Route 7 SB | 4 | *1%* | 3 | *1%* | 13 | 3% | 17 | *4%* |
| Route 8 EB | -101 | *15%* | 11 | *2%* | -101 | 15% | -68 | *11%* |
| Route 8 WB | 24 | *3%* | 134 | *16%* | 16 | 2% | 119 | *15%* |
| Route 9 NB | -3 | *1%* | -9 | *2%* | -23 | 6% | -52 | *13%* |
| Route 9 SB | -48 | *9%* | -36 | *7%* | -49 | 9% | -84 | *15%* |
| **TOTAL** | **-1,863** | | **-680** | | **-2,618** | | **-2,532** | |

5.45 The results above indicate significant improvement in journey times across the Warwick & Leamington AM network with the inclusion of the proposed mitigation strategy. The most notable improvements are highlighted in Option 4 which supports the DS journey time and network statistics which also indicated Option 4 as being the best performing network.

**Table 5.21 KS DS v. DN All Options - Journey Times (Seconds) (AM Period)**

| Route | Option 1 | | Option 2 | | Option 3 | | Option 4 | |
|---|---|---|---|---|---|---|---|---|
| | Diff | % | Diff | % | Diff | % | Diff | % |
| Route 1 EB | -24 | *5%* | -33 | *8%* | -2 | *0%* | -2 | *0%* |
| Route 1 WB | 80 | *14%* | -12 | *2%* | -17 | *3%* | 26 | *5%* |
| Route 2 NB | 82 | *9%* | -43 | *5%* | -65 | *8%* | 5 | *1%* |
| Route 2 SB | -193 | *28%* | -159 | *22%* | -160 | *22%* | -111 | *16%* |
| Route 3 NB | -192 | *30%* | -118 | *21%* | -161 | *25%* | -146 | *24%* |
| Route 3 SB | -298 | *44%* | -245 | *39%* | -321 | *45%* | -281 | *43%* |
| Route 4 SB | -383 | *53%* | -448 | *57%* | -442 | *56%* | -370 | *52%* |
| Route 4 NB | -46 | *10%* | -22 | *5%* | -64 | *14%* | -44 | *10%* |
| Route 5 NB | -314 | *50%* | -219 | *43%* | -223 | *44%* | -223 | *44%* |
| Route 5 SB | -4 | *2%* | 1 | *0%* | -2 | *1%* | -4 | *2%* |
| Route 6 NB | 0 | *0%* | -1 | *1%* | -2 | *1%* | 0 | *0%* |
| Route 6 SB | -71 | *24%* | -56 | *20%* | -23 | *9%* | -29 | *11%* |
| Route 7 NB | -363 | *37%* | -333 | *34%* | -413 | *39%* | -298 | *31%* |
| Route 7 SB | -286 | *40%* | -210 | *33%* | -233 | *34%* | -271 | *38%* |
| **TOTAL** | **-2,012** | | **-1,898** | | **-2,128** | | **-1,748** | |

**Table 5.22 KS DS v. DN All Options - Journey Times (Seconds) (PM Period)**

| Route | Option 1 | | Option 2 | | Option 3 | | Option 4 | |
|---|---|---|---|---|---|---|---|---|
| | Diff | % | Diff | % | Diff | % | Diff | % |
| Route 1 EB | -64 | *12%* | -19 | *4%* | -76 | *14%* | -66 | *13%* |
| Route 1 WB | -269 | *33%* | -270 | *35%* | -312 | *37%* | -259 | *33%* |
| Route 2 NB | 31 | *4%* | -34 | *4%* | -40 | *5%* | -9 | *1%* |
| Route 2 SB | -18 | *4%* | -6 | *1%* | -10 | *2%* | -7 | *1%* |
| Route 3 NB | 16 | *4%* | 11 | *3%* | 20 | *6%* | 3 | *1%* |
| Route 3 SB | -172 | *32%* | -192 | *35%* | -202 | *36%* | -170 | *33%* |
| Route 4 SB | -1185 | *79%* | -1144 | *79%* | -1122 | *79%* | -1334 | *81%* |
| Route 4 NB | -65 | *15%* | -49 | *12%* | -84 | *18%* | -58 | *13%* |
| Route 5 NB | -10 | *4%* | -2 | *1%* | -5 | *2%* | -3 | *1%* |
| Route 5 SB | 0 | *0%* | 0 | *0%* | 3 | *1%* | 2 | *1%* |
| Route 6 NB | -4 | *2%* | -5 | *3%* | -7 | *4%* | -4 | *2%* |
| Route 6 SB | -31 | *13%* | -45 | *18%* | -12 | *6%* | -9 | *4%* |
| Route 7 NB | -30 | *5%* | 13 | *2%* | 41 | *8%* | -66 | *11%* |
| Route 7 SB | -42 | *9%* | -37 | *8%* | -52 | *11%* | -35 | *7%* |
| **TOTAL** | **-1,843** | | **-1,779** | | **-1,858** | | **-2,015** | |

5.47 The results in Table 5.21 and Table 5.22 highlight significant improvements in journey times across the key routes within the Kenilworth & Stoneleigh network. It is also clear from Table 5.21 that the impact of the proposed mitigation strategy is most notable in the AM period where large reductions in journey times are experienced on almost all routes.

### Network Wide Statistics

5.48 As noted in Chapter 3 several network wide statistics have been extracted from each DS scenario. The average distance travelled, average travel time and average speed have all been noted. Additionally, the number of completed trips has also been recorded.

5.49 No statistics were available for the Warwick & Leamington PM period.

**Table 5.23 WL DS v. DN All Options – Network Statistics (AM Period)**

| | Option 1 | Option 2 | Option 3 | Option 4 |
|---|---|---|---|---|
| Ave Distance (metres) | -46 | -47 | -80 | -46 |
| Ave Travel Time (secs) | -30 | -45 | -67 | -76 |
| Ave Speed (mph) | 1.2 | 1.6 | 2.4 | 3.0 |
| Completed Trips | 2634 | 2129 | 2148 | 2774 |

5.50 The above table indicates that the impact of the mitigation strategy is most apparent in option 4. The previous results have also all indicated that this option performs the best.

5.51 All network statistics have however been improved significantly by the addition of the mitigation schemes but Option 4 is clearly achieves the largest benefits.

**Table 5.24 KS DS v. DN All Options – Network Statistics (AM Period)**

| | Option 1 | Option 2 | Option 3 | Option 4 |
|---|---|---|---|---|
| Ave Distance (metres) | -145 | -150 | -164 | -146 |
| Ave Travel Time (secs) | -99 | -96 | -112 | -88 |
| Ave Speed (mph) | 4.7 | 5.5 | 5.8 | 4.4 |
| Completed Trips | 311 | 460 | 721 | 585 |

**Table 5.25 KS DS v. DN All Options – Network Statistics (PM Period)**

| | Option 1 | Option 2 | Option 3 | Option 4 |
|---|---|---|---|---|
| Ave Distance (metres) | -85 | -85 | -98 | -76 |
| Ave Travel Time (secs) | -94 | -65 | -101 | -85 |
| Ave Speed (mph) | 3.9 | 2.8 | 4.1 | 3.6 |
| Completed Trips | 899 | 461 | 1,846 | 730 |

5.52 Table 5.24 and Table 5.25 indicate that the KS DS Option 3 scenario achieves the largest benefits from the introduction of the mitigation schemes. However, the assessment of the individual DS scenarios has indicated that Option 2 still experiences the most favourable network conditions. The significant improvement shown in KS DS Option 3 is therefore partially a result of the DN option 3 starting from worse conditions.

5.53 The results clearly indicate a positive impact in the Kenilworth & Stoneleigh network with the inclusion of the mitigation strategy in each DS option.

## Additional Option 4 Testing

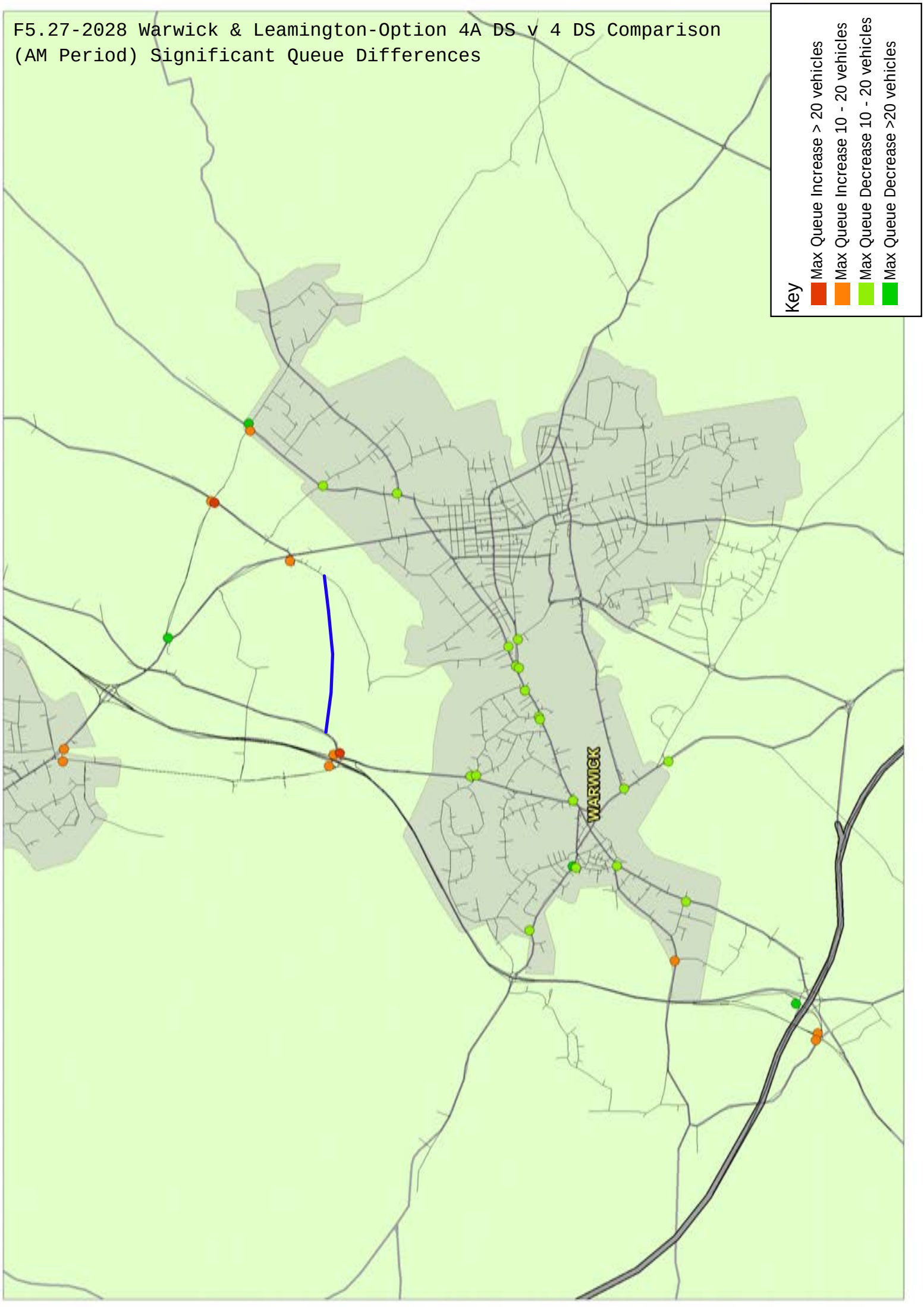
5.54 As noted earlier in this chapter two additional variations on the WL DS Option 4 scenario have been tested. Option 4A and Option 4B both contain an additional mitigation scheme intended to help further elevate the congestion caused by the development sites to the north of Leamington.

5.55 Option 4A includes the Leamington Northern Relief Road that creates a direct route between Kenilworth Road and the A46. Option 4B includes the dualling of Kenilworth Road from Blackdown Roundabout to A46 Thickthorn Roundabout. Both options also include all the other mitigation schemes proposed and included in the original Option 4 scenario.

5.56 Option 4A and Option 4B have been compared to the Option 4 DS scenario. This comparison is intended to highlight any further improvements that can be assumed with the inclusion of the additional schemes.

5.57 It is worth note that even with the inclusion of the additional schemes neither Option 4A nor Option 4B resulted in a fully operational PM period model. As such, the analysis continues to focus solely on the AM period.

5.58 The following figures and tables represent the difference observed when comparing the Option 4A and Option 4B results with the DS Option 4 results. The queue lengths are presented graphically in Figure 5.27 and 5.28 and the journey times presented in Table 5.26.


F5.27-2028 Warwick & Leamington-Option 4A DS v 4 DS Comparison
(AM Period) Significant Queue Differences
Key
Max Queue Increase > 20 vehicles
Max Queue Increase 10 - 20 vehicles
Max Queue Decrease 10 - 20 vehicles
Max Queue Decrease >20 vehicles
WARWICK

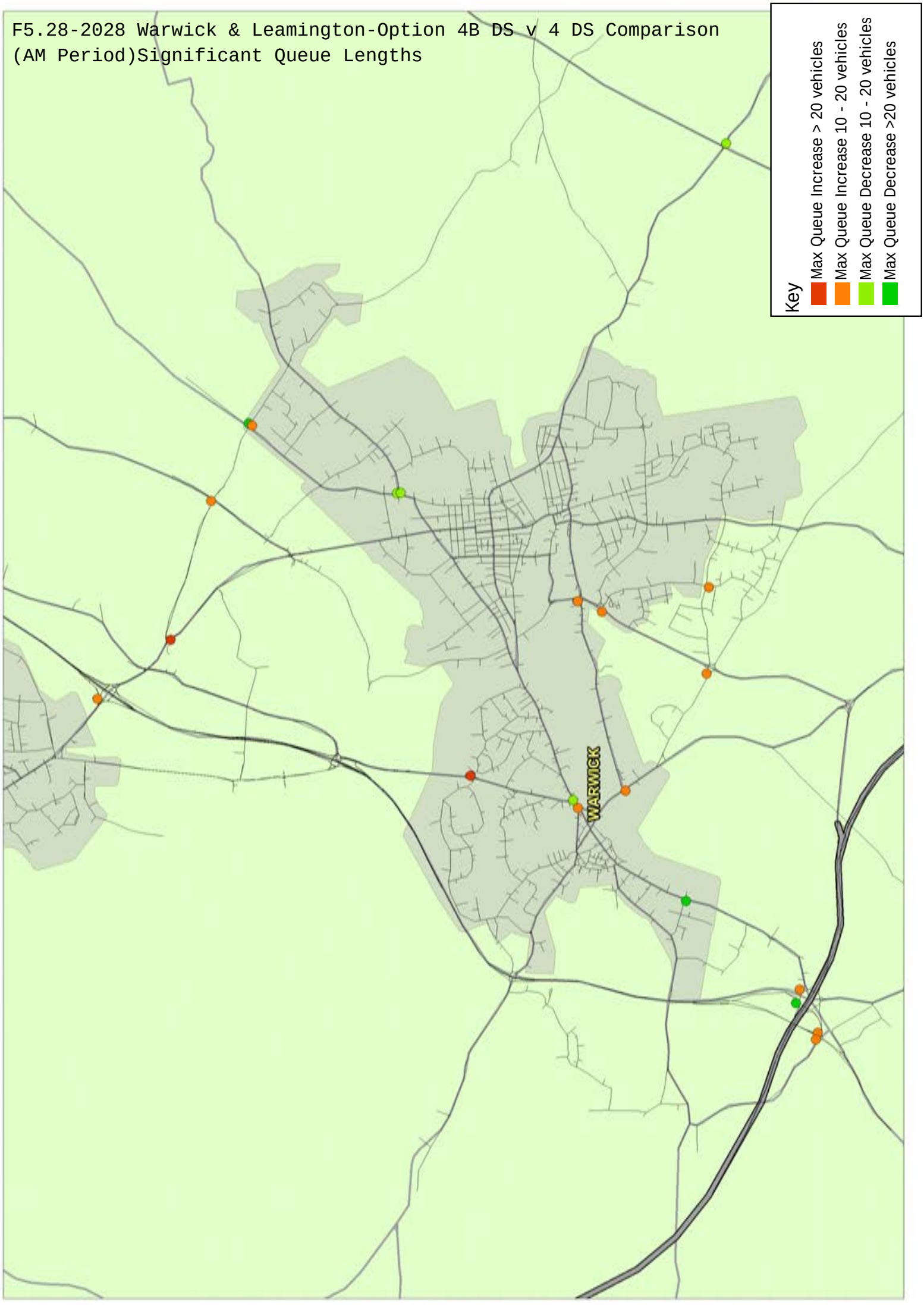

F5.28-2028 Warwick & Leamington-Option 4B DS v 4 DS Comparison
(AM Period)Significant Queue Lengths
Key
Max Queue Increase > 20 vehicles
Max Queue Increase 10 - 20 vehicles
Max Queue Decrease 10 - 20 vehicles
Max Queue Decrease >20 vehicles
WARWICK

**Table 5.26 WL DS Options 4 Comparisons - Journey Times (Seconds) (AM Period)**

| Route | Option 4 | Option 4A | Option 4B |
|---|---|---|---|
| Route 1 NB | 980 | 919 | 1299 |
| Route 1 SB | 1107 | 966 | 1171 |
| Route 2 NB | 1602 | 1509 | 1650 |
| Route 2 SB | 2633 | 2188 | 2536 |
| Route 3 EB | 1145 | 1035 | 1197 |
| Route 3 WB | 1305 | 1171 | 1323 |
| Route 4 NB | 769 | 684 | 807 |
| Route 4 SB | 812 | 723 | 831 |
| Route 5 WB | 531 | 527 | 533 |
| Route 5 EB | 705 | 703 | 731 |
| Route 6 NB | 1227 | 1169 | 1226 |
| Route 6 SB | 1250 | 1218 | 1275 |
| Route 7 NB | 493 | 509 | 520 |
| Route 7 SB | 473 | 459 | 471 |
| Route 8 EB | 555 | 575 | 592 |
| Route 8 WB | 926 | 704 | 841 |
| Route 9 NB | 351 | 348 | 349 |
| Route 9 SB | 459 | 455 | 476 |
| **TOTAL** | **17,323** | **15,862** | **17,828** |

5.59 The WL DS testing has indicated that Option 4 experiences the most favourable network conditions of the four options. The table above highlights that with the additional inclusion of the Leamington Northern Relief Road the journey times with the inclusion of the option 4 sites and the full mitigation strategy reduce even further.

5.60 It is worth note that the alternative variation tested that included the dualling between Blackdown and Thickthron roundabouts does not appear to highlight any significant improvements over the results obtained in the original Option 4 DS scenario.

# 6 Summary & Conclusion

6.1 The methodology and assumptions used in the construction and assessment of four alternative 2028 Option models of the Kenilworth & Stoneleigh and Warwick & Leamington areas has been presented in the preceding chapters.

6.2 The PARAMICS models have been used to capture the network conditions across the District in both 'Do Nothing' and 'Do Something' scenarios. The 'Do Something' scenarios have included various network interventions devised and included in an attempting to mitigate much of the congestions observed on the network.

6.3 The initial results from the 'Do Nothing' scenarios indicated significant congestions across all key corridors and within the town centres and highlighted various junctions experiencing stress.

6.4 Congestion was most notable within the Warwick & Leamington PM period model where the forecast growth, plus the inclusion of the development sites associated with each option package, indicated severe congestions and eventual grid-lock. As such, it was not possible to extract meaningful outputs from the Warwick & Leamington 2028 PM model. Further work may be required at a later stage to investigate the issues and overcome the problems experienced in this initial review.

6.5 Following the review of the 'Do Nothing' scenarios a package of mitigation measures was developed with assistance from WCC. Interventions were designed and targeted at locations where known issues exist and where stress had been highlighted in the model testing. The models with the inclusion of the interventions were then assessed and the impact on the network presented.

6.6 In summary the results indicate that the Option 4 package of development sites is accommodated, and subsequently operates the most efficiently, of the four potential options. Option 4 shows the lowest combined journey times within the Warwick & Leamington AM model and also in the Kenilworth & Stoneleigh PM model. Option 4 is also shown to experience the most notable improvement when the mitigation measures are included.

6.7 Option 4 contains several large scale developments to the south of Warwick centres around Europa Way, Harbury Lane and Gallows Hill. This location has benefited from various mitigation schemes that have enabled much of the development traffic to be adequately accommodated on the local road network. Additionally, Option 4 also includes a significant amount of development north of Leamington centred around Kenilworth Road and Stoneleigh Road. Again, the inclusion of various junction enhancements along this corridor has improved access to these sites, particularly to / from the north and via A46 Thickthorn Roundabout.

6.8 Option 4 also includes several sites to the south-east of Leamington where no specific mitigation has been proposed at present due to the proximity to the town centre and the limitations on improvements this entails. Without mitigation in this area these sites do pose a risk to the congestion in Leamington. However, the development of schemes for this area, and for Leamington centre in general, may deliver further improvements if possible in the future.

6.9 Option 4 only includes partial development at Westwood Heath, south of Coventry, and on the land south of Harbury Lane. The reduced site at Westwood Heath is shown to result in little to no impact on the local roads surrounding the site and therefore is unlikely to require any direct mitigation. Similarly, the reduced site south of Harbury lane appears to be accommodated by the proposed mitigation along the Europa Way corridor. Generally, reduced sites at both these locations appears

to be accommodated well within the Option 4 ‘Do Something’ models but are shown to struggle when the full sites are included in other Option models (e.g. Option 2).

6.10 Further testing of Option 4 was carried out that included the addition of the Leamington Northern Relief Road which was shown to improve journey time and overall network performance further. The development trips from the developments to the north of Leamington again benefit from this improved access to the A46 and subsequently Leamington town centre is relieved of some of the traffic that previously had to pass through on route to Warwick and the west.

6.11 In conclusion Option 4 appears to contain a collection of development sites that can be accommodated on the local network when specific mitigation is put in place. Improvements to the key corridors in and out of both Warwick and Leamington and the connections to the A46 are shown to greatly improve the networks capacity and subsequent ability to accommodate the large developments proposed on the outskirts of the town centres.