# TECHNICAL NOTE APPENDIX 3

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| **DATE:** | 27 April 2023 | **CONFIDENTIALITY:** | Public |
| **SUBJECT:** | Kings Lynn & West Norfolk Local Plan - Transport Evidence | | |
| **PROJECT:** | 70105985 - West Norfolk Borough - West Winch Growth Area Impact Assessments | **AUTHOR:** | Michael Johns |

## INTRODUCTION

This technical note has been produced by WSP on behalf of Norfolk County Council in response to the Local Plan Inspector's comments on the Examination in Public for the Kings Lynn and West Norfolk Borough Council (KLWNBC) Local Plan Review 2022. In particular, this note seeks to provide evidence to respond to queries raised on the following matters:

- Transport Strategy
- Summarise the results and findings of traffic and transport modelling undertaken to assess the impacts of the development proposed in the Plan and at the WWGA over the Plan period and beyond on the strategic and local transport network in the Borough.

- West Winch Growth Area (WWGA)
- An explanation of the results of any modelling of traffic and transport impacts arising from the growth of up to 4,000 dwellings at the WWGA, on the operation and safety of the transport network to accommodate this growth, and of the effects of transport interventions proposed to mitigate those impacts.

WSP have been engaged in extensive transport modelling on behalf of Norfolk County Council in relation to a range of different infrastructure schemes and transport strategies, including the following:

- Kings Lynn Transport Strategy
- West Winch Housing Access Road
- A47 / A17 Pullover roundabout
- Kings Lynn Sustainable Transport and Regeneration Scheme (STARS)

Please note a glossary of terms has been provided in Appendix A of this note

## AVAILABLE TRANSPORT MODELS

The following transport models have been developed by WSP on behalf of NCC and therefore offer a suite of models which can be deployed to test the impacts of future land use changes, changes in travel behaviour and infrastructure improvements:

- Kings Lynn Transport Model (KLTM), based in SATURN
- West Winch micro-simulation model, based in Paramics
- Kings Lynn Town Centre micro-simulation model, based in Paramics

These models were extensively updated in 2018 and 2019 to inform the various aforementioned studies, with further updates to these models due to take place as business cases for various schemes are developed to a greater degree of detail.

The analysis and evidence within this note will focus on the KLTM strategic transport model given this is considered to be the most appropriate modelling tool from which to determine the impact of Local Plan growth across Kings Lynn & West Norfolk

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## KINGS LYNN TRANSPORT MODEL (KLTM)

The KLTM is a strategic highway assignment model based in SATURN software. The model represents a 2018 base year from which 2039 forecasts have been derived for the following time periods:

- AM peak hour (0800-0900)
- PM peak hour (1700-1800)

Figure 1 outlines the coverage of the KLTM network across Kings Lynn and in the area within the vicinity of West Winch village. To date the KLTM has been utilised to inform studies focusing on Kings Lynn town centre, the A47 and the study area for the West Winch Housing Access Road (WWHAR) and therefore is suitably detailed in these locations to cover the main strategic routes for highway traffic.

**Figure 1 – KLTM model extent: Kings Lynn and West Winch area**

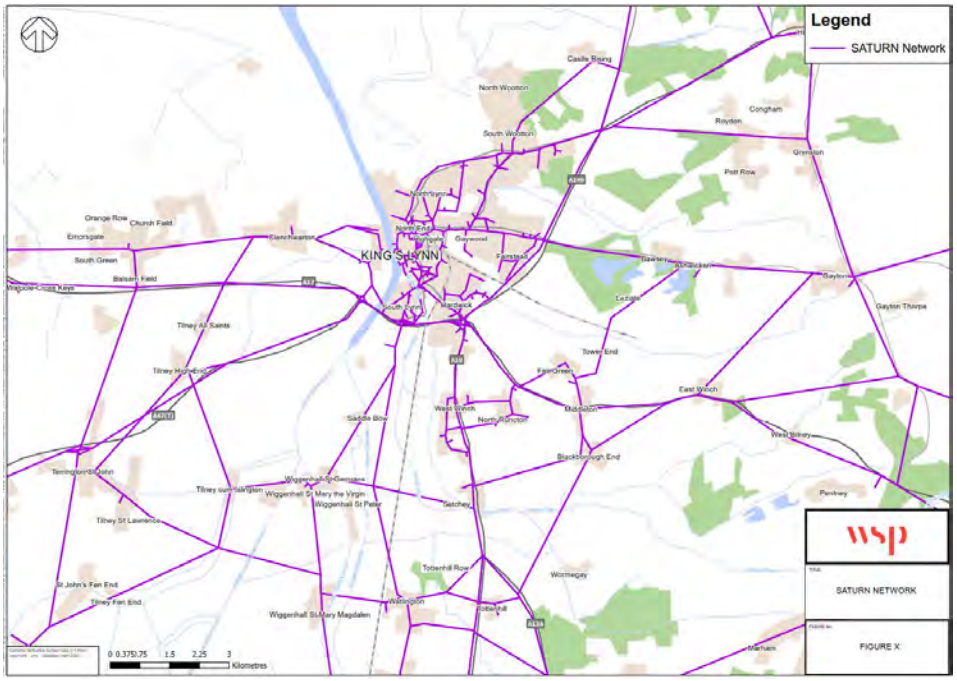


Figure 2 outlines the extent of the KLTM across a wider area which demonstrates the coverage of the model includes the key strategic routes within the KLWN borough.

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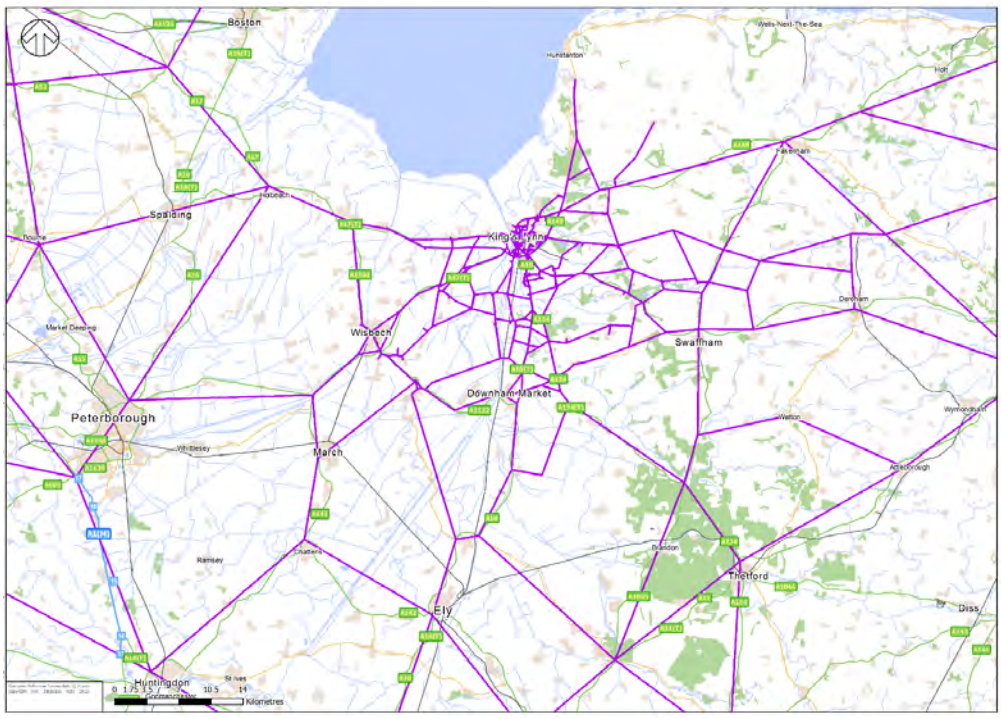
**Figure 2 – KLTM model extent: Wider extent**




In order to ensure a strategic transport model is a robust basis from which to derive future forecasts, the Department for Transport's Transport Analysis Guidance (TAG) should be followed. The KLTM has adhered to TAG both in terms of the generation of a suitable 2018 base year model and subsequently for the 2039 forecasts which have then been derived.

In order to demonstrate the 2018 base year model provides a reliable representation of existing traffic conditions, it should be validated and calibrated against a suitable array of observed traffic data. Figure 3 shows the coverage of Automatic Traffic Count (ATC) data which was collected over the following survey periods:

- 2018 ATC data collection – between 19th June 2018 and 13th July 2018
- 2019 ATC data collection – between 9th May 2019 and 10th June 2019.

These data collection dates are considered to follow a TAG definition of a neutral survey period, avoiding school holidays and abnormal traffic periods. The 2018 data collection was undertaken to enable the KLTM to be updated to a 2018 base year. The 2019 data collection was undertaken to enable an extension of the detailed area of the model (the simulation network) to inform an appraisal of the WWHAR. The coverage of ATC data is considered to be comprehensive and the KLTM has been demonstrated to appropriately validate against the average observed link flows derived from this data.

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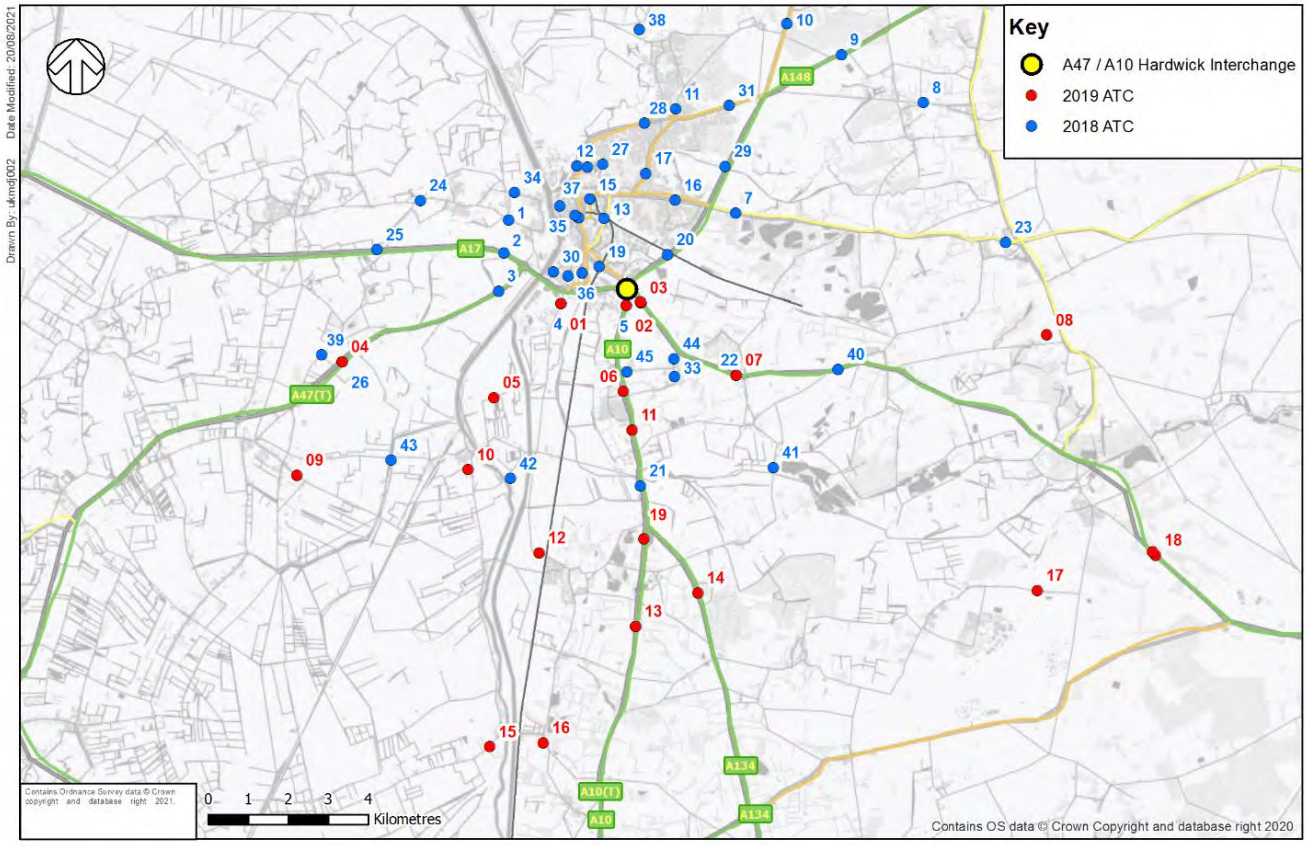
**Figure 3 – KLTM 2018 and 2019 ATC data coverage**




In addition, single day Manually Classified Turning Count (MCTC) data was collected at the locations shown in Figure 4 on the following days, overlapping with the ATC survey periods:

- 2018 MCTC data collection – 28th June 2018
- 2019 MCTC data collection – 22nd May 2019

The MCTC data provides a reliable source of data on the split of vehicle types and turning movements at key junctions which the KLTM has been suitably validated to.

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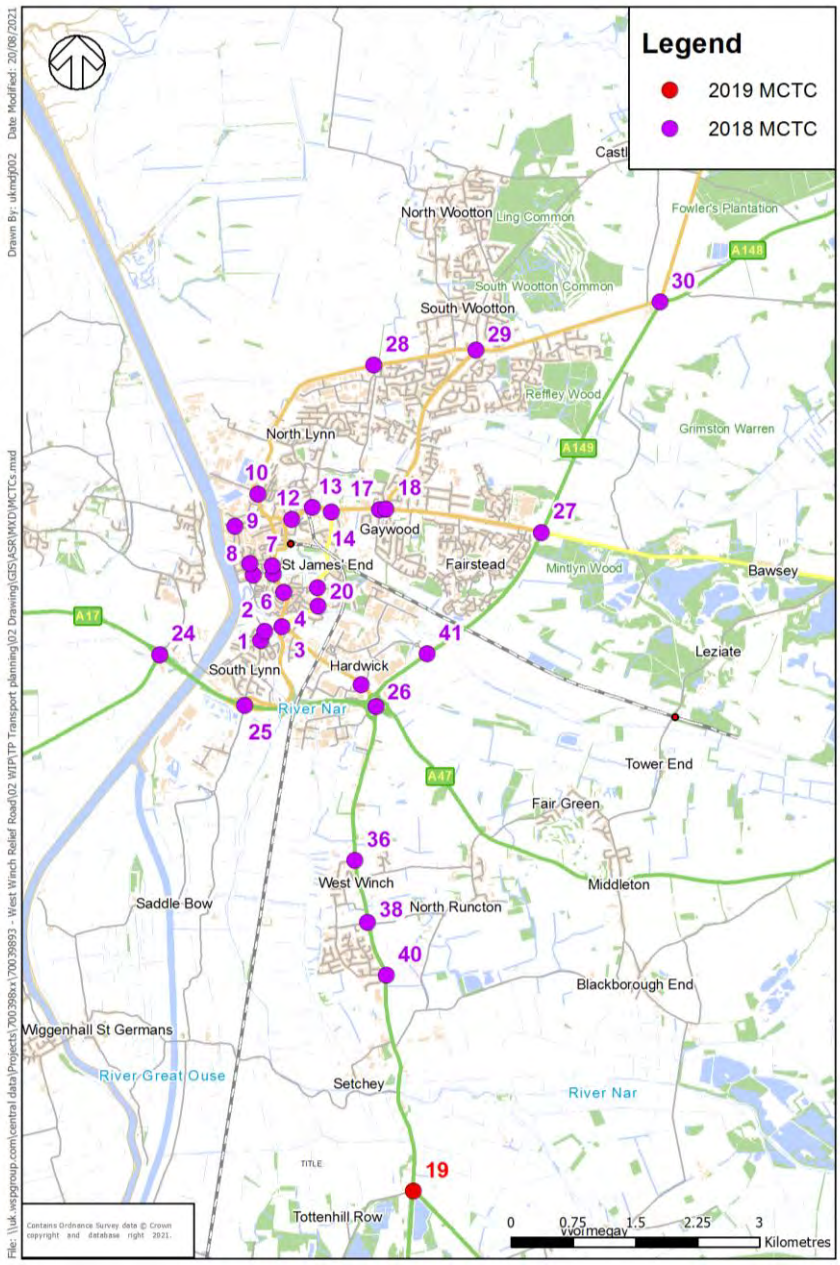
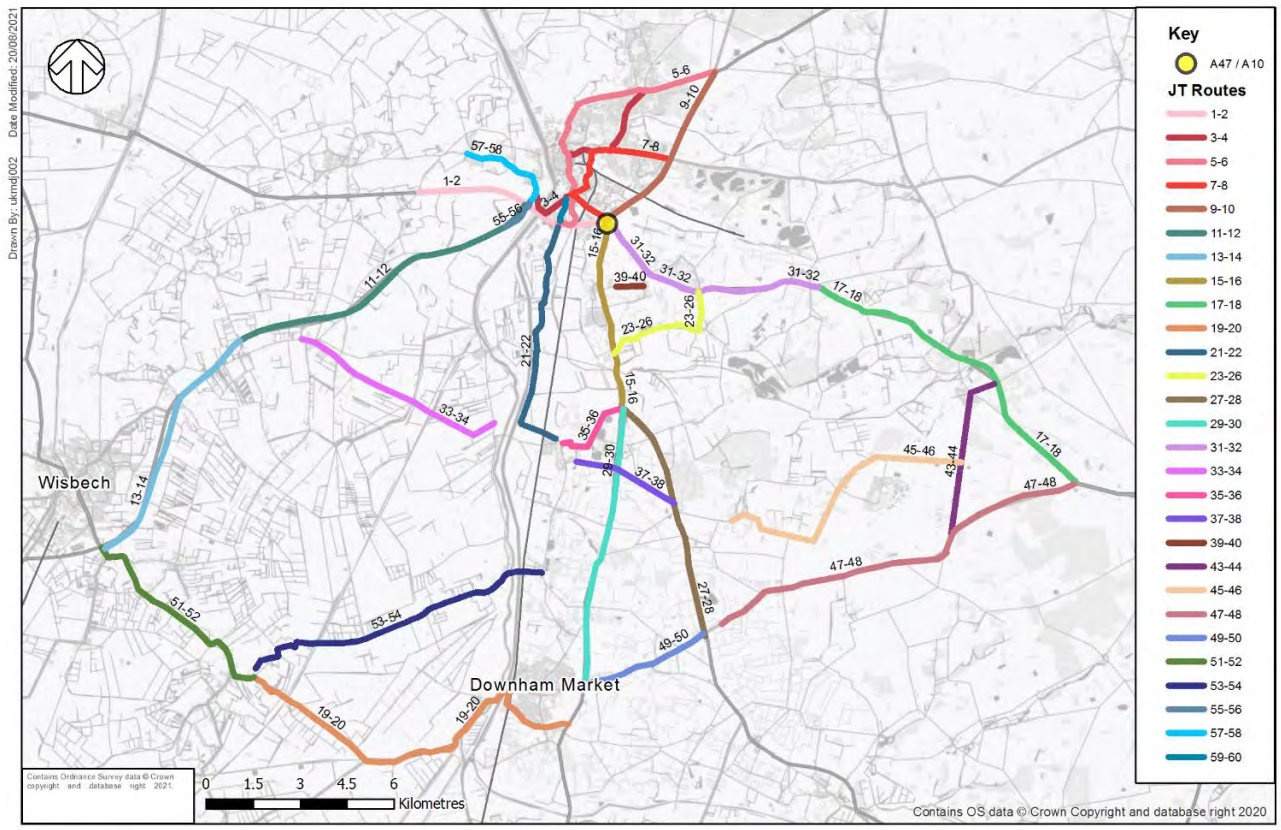
**Figure 4 – KLTM 2018 and 2019 Manual Classified Turning Count Coverage**



Further observed data which the KLTM has used for validation is journey time data. Figure 5 shows the extent of journey time routes which have been defined using a combination of Trafficmaster data, Inrix GPS data and Automatic Number Plate Recognition (ANPR) surveys.

**Figure 5 – KLTM 2018 and 2019 Manual Classified Turning Count Coverage**




The observed journey time data is used in conjunction with link flow and turning count data in order to demonstrate the KLTM appropriately matches time period specific travel times and therefore congestion. The KLTM has been demonstrated to appropriately validate against this extensive array of journey time routes.

In summary, the range of observed data which has been used to validate the KLTM is considered to be comprehensive and therefore demonstrates it forms a suitable basis from which future forecasts can be derived.

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## 2039 TRAFFIC FORECASTS

The KLTM has utilised 2039 traffic forecasts which are consistent with the housing growth projections outlined within the Kings Lynn & West Norfolk Local Plan. These 2039 forecasts have made use of the following key inputs which have been applied against the 2018 base year:

- National Trip End Model (NTEM) Version 7.2
- Accessed via TEMPro software
- Utilised for generating car traffic growth between 2018-2039

- National Transport Model (NTM)
- 2018 Scenario 1 Road Traffic Forecasts for the East of England
- Utilised for determining general increases in Light Goods Vehicles (LGVs) and Heavy Goods Vehicles (HGVs) between 2018-2039

It is recognised that the NTEM has been updated to Version 8.0 in August 2022 and that forecasts from the NTM have been updated in the form of the release of the National Road Traffic Projections (NRTP22) in December 2022. However, the KLTM 2039 forecasts are still considered to form a suitable basis from which to determine the impact of Local Plan growth across KLWN. The KLTM 2039 forecasts have suitably represented KLWN Local Plan housing growth as explained below.

In the 2039 KLTM forecasts, the car trip-end growth produced by NTEM 7.2 has been constrained on the basis of 555 dwellings per annum being delivered in Kings Lynn & West Norfolk during the Local Plan period, therefore between 2018 and 2039 it has been assumed 11,655 dwellings would come forward. The 555 dwelling per annum figure is consistent with the March 2019 Local Plan Review[1] which was defined for a period between 2016-2036. For the purposes of the 2039 forecast year produced in the KLTM it was therefore assumed this level of housing delivery would continue between 2036-2039.

The latest Local Housing Need (LHN) figure within Kings Lynn & West Norfolk is 571 dwellings per annum according to the December 2022 Housing Land Supply, resulting in a cumulative target of 9,707 dwellings between 2022/2023 and 2038/2039.

The difference in per annum housing delivery between the KLTM forecast inputs and the latest LHN is considered to be negligible, particularly once completions between 2018/2019 and 2021/2022 are taken in account.

[1] Local Plan Review 2019 (west-norfolk.gov.uk)

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Table **1** outlines that when combining actual completions and the latest LHN, a total of 11,473 dwellings is calculated for a period between 2018/2019 and 2038/2039.

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**Table 1 – Housing growth 2018/2019 to 2038/2039 based on latest LHN**

| Housing delivery period | Total dwellings |
|---|---|
| 2018/2019 Completions | 432 |
| 2019/2020 Completions | 591 |
| 2020/2021 Completions | 340 |
| 2021/2022 Completions | 403 |
| 2022/2023 to 2038/2039 (571 dwellings p/a) | 9,707 |
| **Total** | **11,473** |

This latest figure of 11,473 dwellings is 182 dwellings lower than the 11,655 dwellings figure which has been used to inform the 2039 KLTM traffic forecasts, therefore this is considered to be a very close match. If hypothetically the 2039 KLTM forecast were adjusted to reflect the lower 11,473 dwellings figure it is considered there would be no discernible difference in the highway assignments produced by this new forecast compared to the 2039 forecasts which have already been produced. Therefore the existing 2039 KLTM forecasts are suitable as a basis for demonstrating the impact of the latest LHN on highway traffic growth.

Table 2 summarises the growth in households and jobs which were input into NTEM 7.2 using the Alternative Planning Assumptions Tool within TEMPro in order to derive car traffic growth constraint factors.

**Table 2 – Household and Jobs NTEM inputs – 2018 to 2039**

| Metric | 2018 Base | 2039 Forecast Year | 2039 vs 2018 Difference | 2039 vs 2018 % Diff |
|---|---|---|---|---|
| Households | 71,143 | 82,798 | 11,655 | 16% |
| Jobs | 71,418 | 76,570 | 5,152 | 7% |

Following a combination of the following:

- Car traffic growth factors; derived from NTEM 7.2 using TEMPro software
- LGV & HGV growth factors; derived from NTM 2018 Road Traffic Forecasts

The level of traffic growth modelled in the 2039 KLTM forecasts using growth factors from the aforementioned sources is outlined below by vehicle type and in terms of the overall growth.

- Car growth (2018 to 2039) = 22.8%
- LGV growth (2018 to 2039): 33.9%
- HGV growth (2018 to 2039): 10.5%
- Overall growth (Car + LGV + HGV - 2018 to 2039): 23.4%

WSP have undertaken a range of different 2039 forecasts using the KLTM which include the following outlined in Table 3 below. These have been described in terms of scenarios within the context of providing evidence for the KLWN Local Plan and what their intended use would be within this context.

**Table 3 – 2039 KLTM forecast scenarios**

| Name | West Winch Housing Access Road provided | Intended use for scenario |
|---|---|---|
| West Winch Growth Area Scenario 1 (WWGA Sc1) | × | Demonstrates unacceptable network performance if the WWHAR scheme does not come forward, but the WWGA does |
| West Winch Growth Area Scenario 2 (WWGA Sc2) | ✓ | Demonstrates the WWHAR scheme will mitigate impacts from the WWGA and wider growth to an acceptable level |
| Area Wide Modelling | × A47 junction only | Demonstrates impacts of Local Plan growth across the wider borough and that this growth can be accommodated |

For all scenarios, the trip rates which have been utilised for the West Winch Growth Area are consistent with those applied in the planning applications submitted by Hopkins homes (13/01615/OM) and ZAL / Metacre (18/02289/OM), these trip rates are outlined in Table 4 below. These trip rates have been applied across the full 4,000 dwelling WWGA mean that the 2039 KLTM forecasts form a very robust stress test of the highway network. It is considered that if a trip generation exercise were to be conducted for the 4,000 dwelling masterplan, including taking account of complementary non-residential land uses and the potential to shift to more sustainable modes of travel, then the trip generation would be lower than what has been modelled in the 2039 KLTM forecasts.

**Table 4 – West Winch Growth Area trip rates**

| AM Peak Hour (08:00 - 09:00) | | | PM Peak Hour (17:00 - 18:00) | | |
|---|---|---|---|---|---|
| Depart | Arrive | Two-way | Depart | Arrive | Two-way |

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|---|---|---|---|---|---|
| 0.450 | 0.152 | 0.602 | 0.242 | 0.424 | 0.666 |

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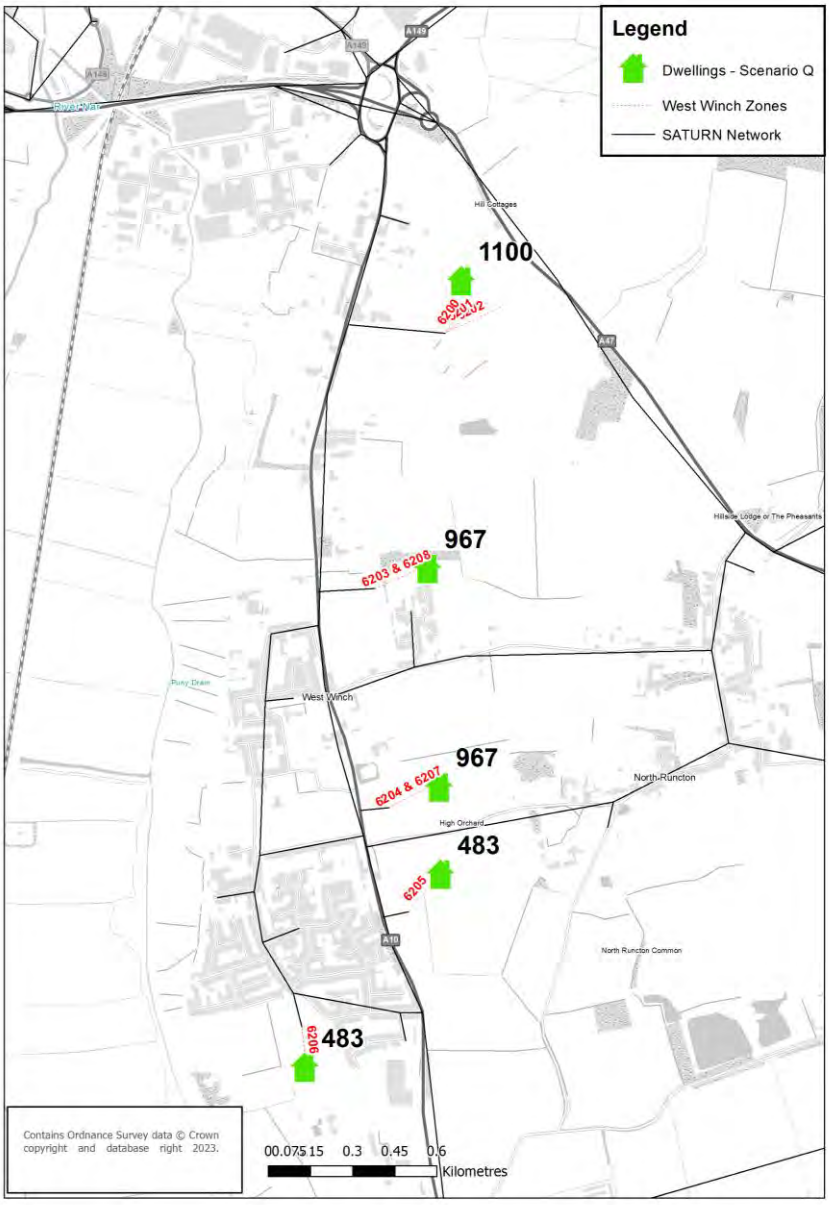
*West Winch Growth Area Scenario 1*

In this scenario, the 4,000 dwellings at the West Winch Growth Area have been specifically included in the model. However, the West Winch Housing Access Road is not included. Figure 6 shows the split of how the 4,000 dwellings were assumed to access the existing A10 and Gravelhill Lane in this scenario.

**Figure 6 – 2039 WWGA Scenario 1: West Winch Growth Area housing accesses**



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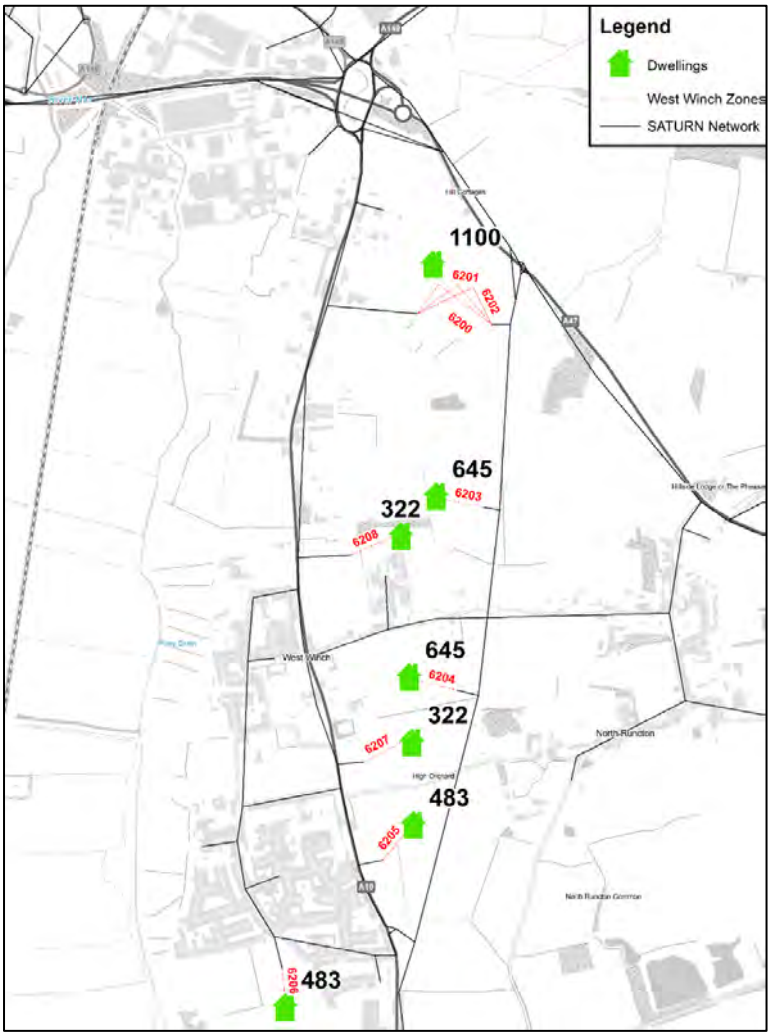
*West Winch Growth Area Scenario 2*

In this scenario, the 4,000 dwellings at the West Winch Growth Area have again been specifically included in the model, but with the West Winch Housing Access Road included. **Figure 7** shows the split of how the 4,000 dwellings were assumed to access the existing A10, the WWHAR and Gravelhill Lane in this scenario.

**Figure 7 – 2039 WWGA Scenario 2: West Winch Growth Area housing accesses including WWHAR**



*Area Wide Modelling*

This scenario relates to a 2039 KLTM forecast which was required to be used for a business case submission to the DfT and included an assessment of growth across the Borough during the plan period. As part of TAG, it is a requirement to generate an Uncertainty Log which compiles a summary of local housing and employment developments which will come forward over the period being considered in the modelling. This entails generating a Core Scenario where only developments which are under construction, have planning consent or have a planning application submitted / imminent should be specifically modelled. Local Plan allocations which had an associated planning application were modelled in detail according to their specific location. Other allocations and housing windfall due to come forward within the plan period were taken account of in general background traffic growth across the borough.

## WEST WINCH GROWTH AREA MODELLING

In this section, results from the KLTM will focus on the following metrics in the first instance related to WWGA Scenario 1:

- The impact in terms of difference in traffic flows which the 4,000 dwelling WWGA would have on the A10 and wider network if the WWHAR were not delivered
- Volume / Capacity (V/C) percentages along the A10 and wider network if the 4,000 dwellings at WWGA were delivered, without the WWHAR

The above results will demonstrate why the delivery of the 4,000 dwellings at WWGA produces an unacceptable impact on the wider highway network **without** the WWHAR scheme in place, and will therefore demonstrate why it is essential the WWHAR scheme is delivered.

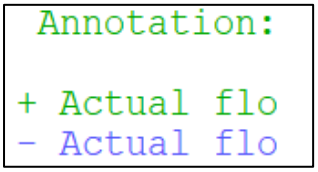
Following on from this, the results from WWGA Scenario 2 (4,000 WWGA + WWHAR scheme) will be presented in terms of the following metrics:

- Volume / Capacity (V/C) percentages along the A10, WWHAR and wider network

The results from WWGA Scenario 2 will demonstrate that the WWHAR scheme is able to mitigate the impacts associated with the WWGA.

The following section contains a series of plots taken directly from the KLTM using SATURN. An explanation of the colour coding and metrics in these images is provided below.

The **traffic flow differences** are green for positive increases in traffic flow and blue for negative increases in traffic flow, defined in SATURN as follows, with traffic flows represented as PCUs per hour:



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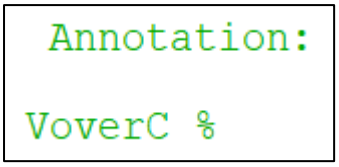
The **V/C percentages** are shown as green bandwidths and numbers representing percentage figures, denoted as follows in SATURN:




V/C percentages are considered a metric in a strategic model which is able to indicate where congestion is most likely to occur. The following thresholds are considered as representing issues when considering V/C figures:

- 85 percent to 99 percent for priority controlled junctions or 90 to 99 percent for signalised junctions; this is considered a threshold at which delays are considered likely to be notable
- 100 percent represents locations which are over-capacity where there is the potential for substantial delays to occur and associated impacts of increased journey times

The 85 percent+ figure for priority controlled junctions is in line with the conventional view on Ratio to Flow Capacity (RFC) values in Junctions modelling software which states RFC values below 0.85 are considered to represent satisfactory performance (see page 88 of the Junctions 9 manual).

The 90 percent+ figure for signalised junctions is line with assumptions within LinSig junction modelling software which states a Degree of Saturation value of 90 percent or greater is generally considered to be a maximum for a line before there are significant performance issues (see page 240 of the LinSig Version 3 manual).

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*WWGA Scenario 1 results – 4,000 dwellings at WWGA without WWHAR scheme*

Figure 8 provides AM peak hour traffic flow (pcu/hr) differences comparing a 2039 forecast which includes the 4,000 dwellings at the WWGA to a 2039 forecast without the WWHAR scheme. This figure and other subsequent flow difference figures in this note have been filtered to only show absolute differences of greater than +/- 20 pcus.

The AM traffic flow differences demonstrate the following trends:

- Notable increases in flow on the northern section of the A10 in both directions between the northern Hopkins access on the A10 and the A47 Hardwick Interchange
- Decreases in traffic flow on the A10 northbound, south of West Winch, as a result of traffic seeking to re-route to avoid congestion on the A10
- Re-routing of traffic to avoid congestion on the A10 via Rectory Lane, High Road via Saddle Bow and Setch Road as traffic seeks alternative routes to access the A47

**Figure 8 – 2039 WWGA Scenario 1: Traffic flow differences with and without 4,000 dwellings at WWGA: AM peak**

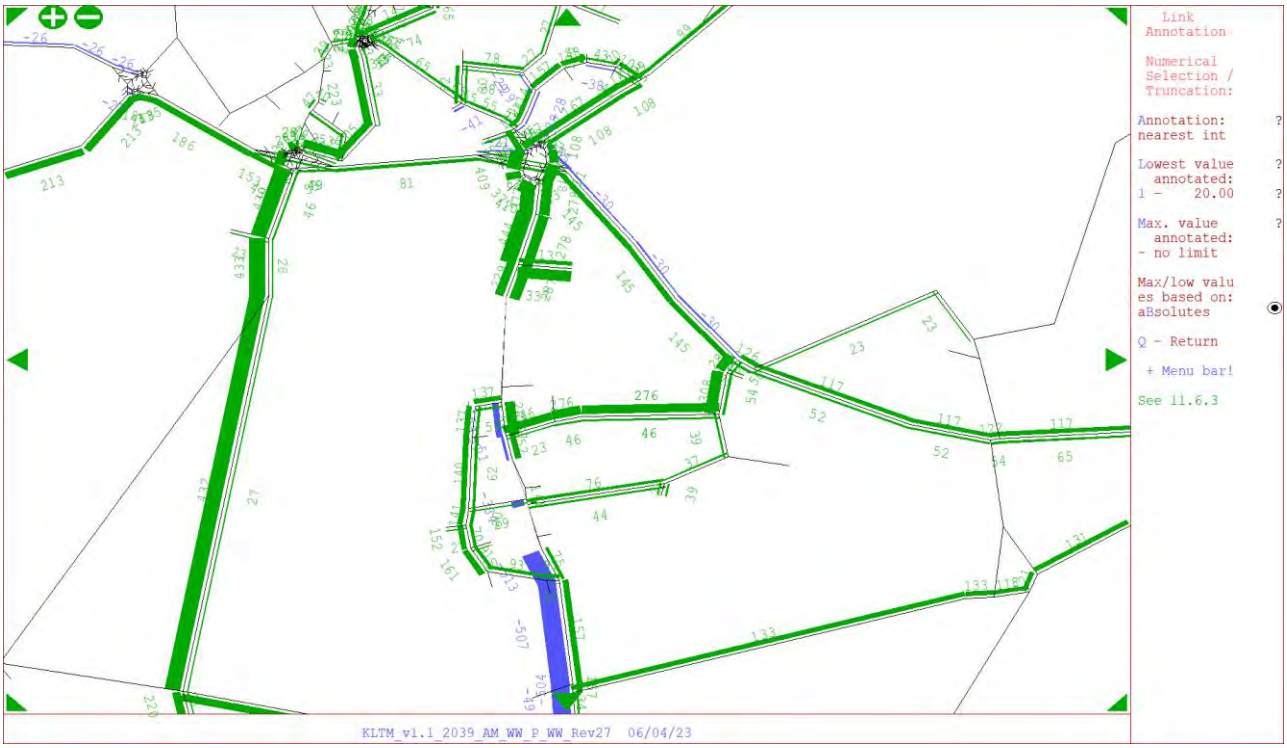

Figure 9 presents the Volume / Capacity (V/C) percentages for WWGA Scenario 1 in the AM peak. This figure and other subsequent figures in this note presenting V/C have had a filter applied to only show values of 80% or higher.

This figure demonstrates that in WWGA Scenario 1, the A10 becomes over capacity northbound with V/C figures above 100% for the section between the Hopkins homes roundabout and the A47 Hardwick Interchange. Also, the New Road approach to the A47 becomes over capacity as a result of the congestion generated by traffic re-routing via Rectory Lane to access the A47. Within the A47 Hardwick Interchange, the most congested section is at the signalised circulatory approach at the intersection with the A47 eastbound off-slip, the V/C reaches 89% at this location and is therefore operating within capacity.

**Figure 9 – 2039 WWGA Scenario 1: Volume / Capacity: AM peak**

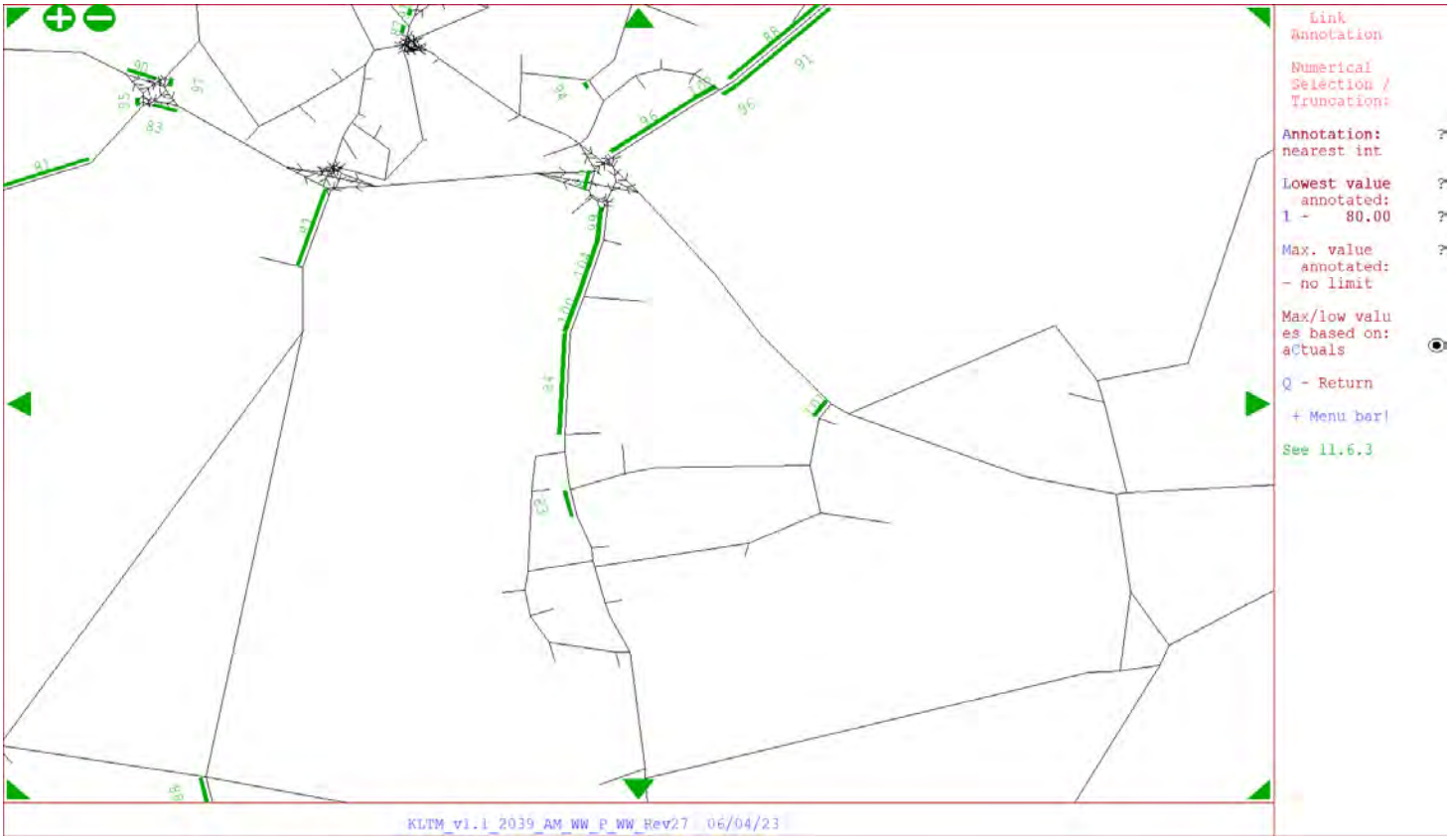


Figure 10 shows PM peak hour traffic flow (pcu/hr) differences comparing a 2039 forecast which includes the 4,000 dwellings at the WWGA to a 2039 forecast without the WWHAR scheme

The PM traffic flow differences demonstrate the following trends:

- Notable increases in flow on the northern section of the A10 in both directions between the northern Hopkins access on the A10 and the A47 Hardwick Interchange

- Decreases in traffic flow on the A10 southbound, south of West Winch, as a result of traffic seeking to re-route to avoid congestion on the A10
- Re-routing of traffic to avoid congestion on the A10 via Rectory Lane, Chequers Lane, High Road via Saddle Bow and Setch Road as traffic seeks alternative routes to access the A10 from the A47, avoiding the congestion occurring further north on the A10

**Figure 10 – 2039 WWGA Scenario 1: Traffic flow differences with and without 4,000 dwellings at WWGA: PM peak**

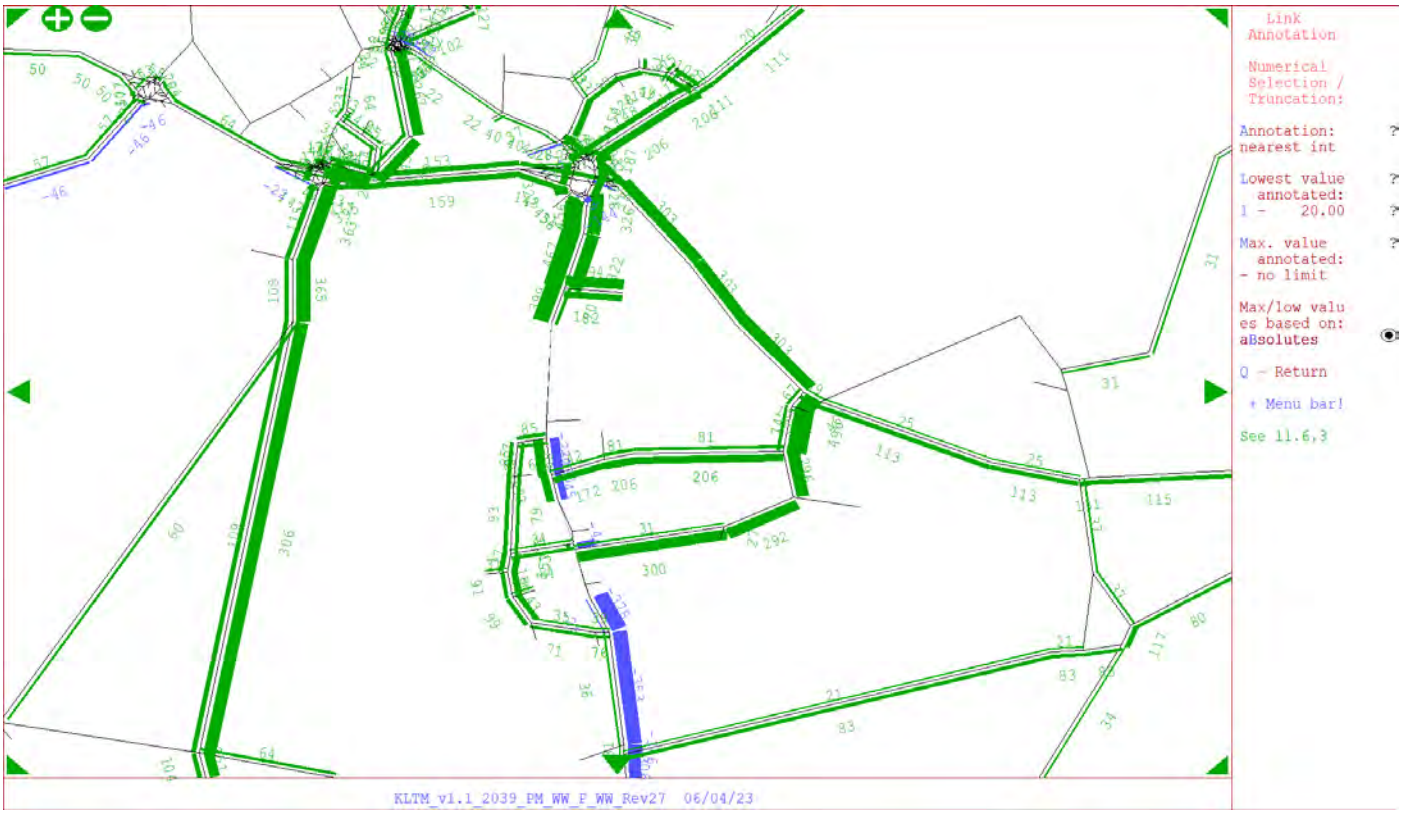

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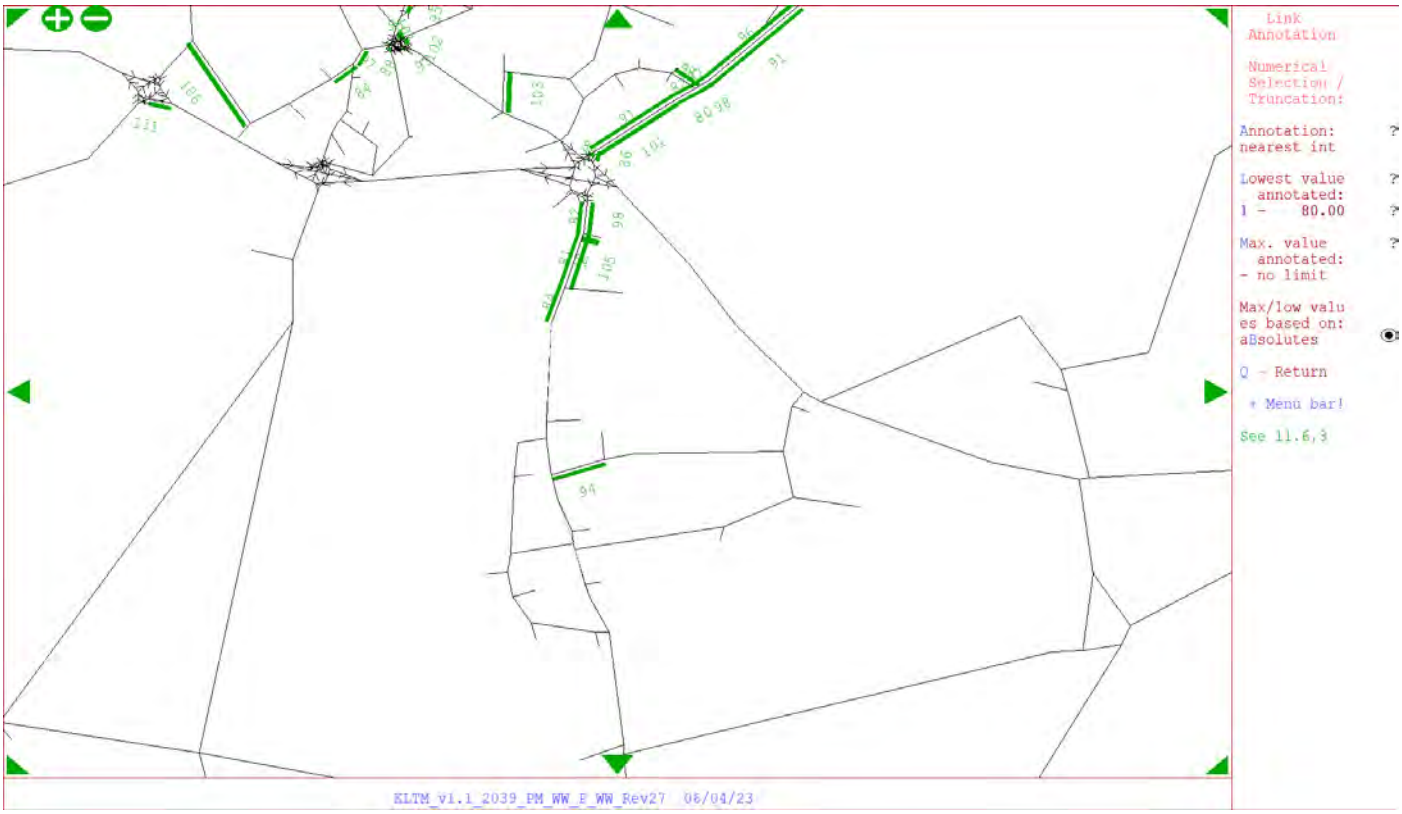
Figure 11 presents the Volume / Capacity (V/C) percentages for WWGA Scenario 1 in the PM peak.

This figure demonstrates that in WWGA Scenario 1, the A10 becomes over capacity southbound with V/C figures close to or above 100% for the section between the A47 Hardwick Interchange and Hopkins homes roundabout on the A10. Also, the Rectory Lane approach to the A47 becomes close to capacity as a result of the congestion generated by traffic re-routing via the A47 and New Road to access the A10. In this time period, the A47 Hardwick Interchange is shown to operate within capacity, though the A149 Queen Elizabeth Way demonstrates congestion, though operates within capacity at the approach to the interchange with a V/C of 86%, though the main carriageway prior to this is shown to be operating at capacity.

**Figure 11 – 2039 WWGA Scenario 1: Volume / Capacity: PM peak**



It is considered the flow differences and V/C percentages presented for WWGA Scenario 1 demonstrate a range of undesirable impacts on the wider highway network as a result of the full 4,000 WWGA dwelling development being in place **without** the WWHAR scheme. This includes the following:

- Reduction in northbound traffic on the A10 in the AM, with a southbound reduction occurring on the A10 in the PM as traffic seeks to re-route to avoid the significant congestion at the northern end of the A10 near to the Hardwick Interchange / WWGA access junction. If this were to materialise it would significantly reduce the function of the A10 as a strategic route to access Kings Lynn
- Re-routing of traffic via unsuitable routes to avoid congestion on the A10 such as Rectory Lane, Chequers Lane and Setch Road as traffic seeks alternative routes to access the A47. These roads are not designed to accommodate significant levels of traffic beyond what they currently experience and the impact on local communities such as North Runcton would be adverse
- Increases in delay occurring on the A10 at the approach to the A10 / Rectory Lane and the A47 New Road
- Traffic opting to re-route via High Road / Saddle Bow in order to access the A47 via the A47 / A148 / High Road junction

*Scenario 2 results – 4,000 dwellings at WWGA with WWHAR scheme*

Figure 12 provides the V/C percentages above 80% in the AM peak for WWGA Scenario 2. This demonstrates there are no significant capacity issues on the existing A10, A47 or on the WWHAR scheme.

However, it should be noted the A47 Hardwick Interchange shows higher V/C percentages. This occurs as the WWHAR scheme removes the existing A47 Constitution Hill roundabout to the east of the interchange, increasing traffic levels within the interchange itself. The most congested location within the interchange occurs at the signalised A10 approach, the A10 approach is at 97% V/C, whilst the circulatory is at 96% V/C. It should be noted that despite this, the A47 Hardwick Interchange is shown to continue to operate within capacity in the AM peak. Further to this, the congestion shown is considered to demonstrate the impact of releasing the congestion shown further south on the A10 in Scenario 1, with this then shifting onto the A47 Hardwick Interchange. This is considered to be desirable given there will be the ability to manage and optimise the signals within the interchange. In Scenario 2, the circulatory approach to the intersection with the A47 eastbound off-slip is shown to operate with a V/C of 89%, therefore at the same level shown in Scenario 1.

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**Figure 12 – 2039 WWGA Scenario 2: Volume / Capacity: AM peak**

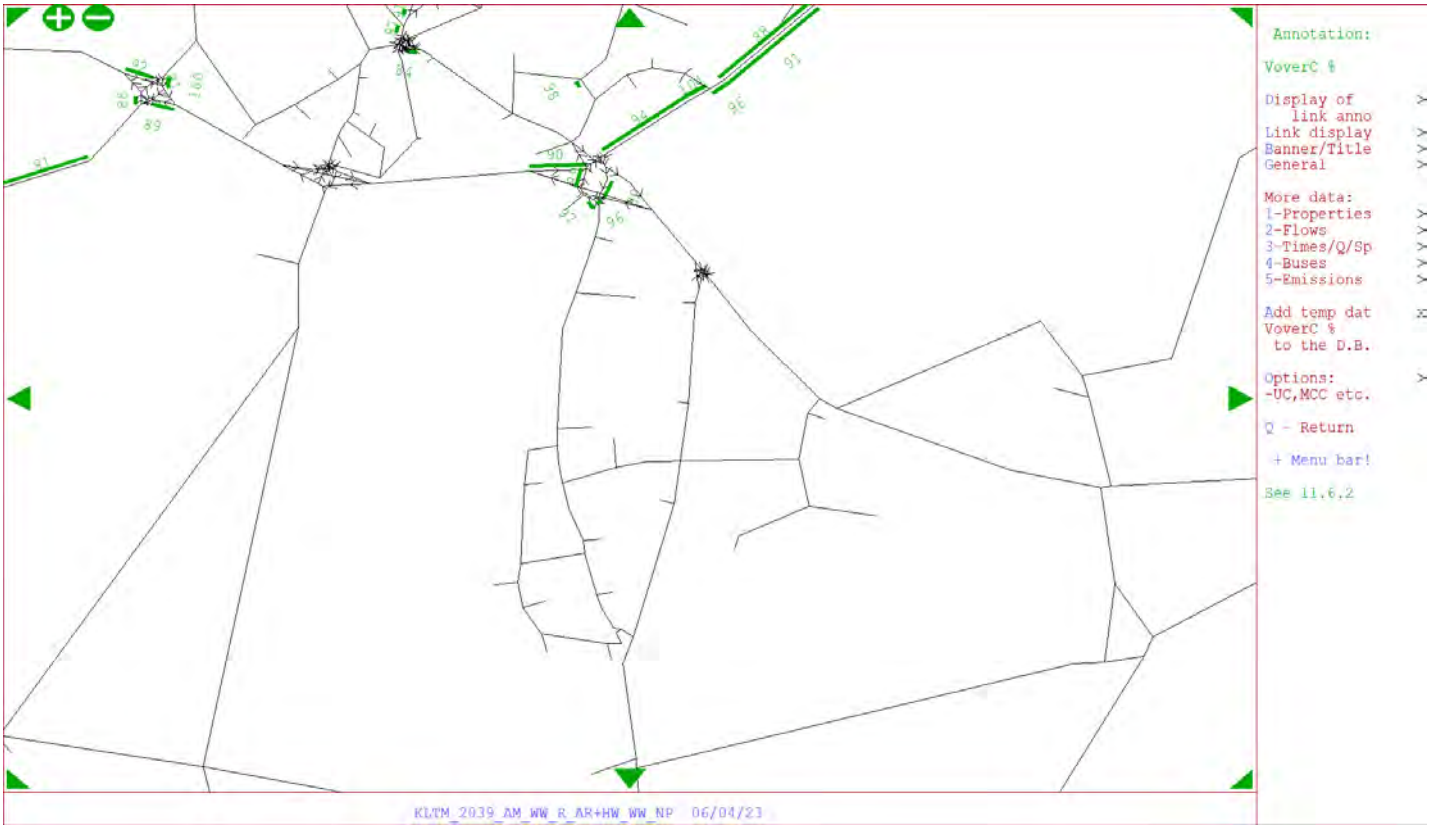

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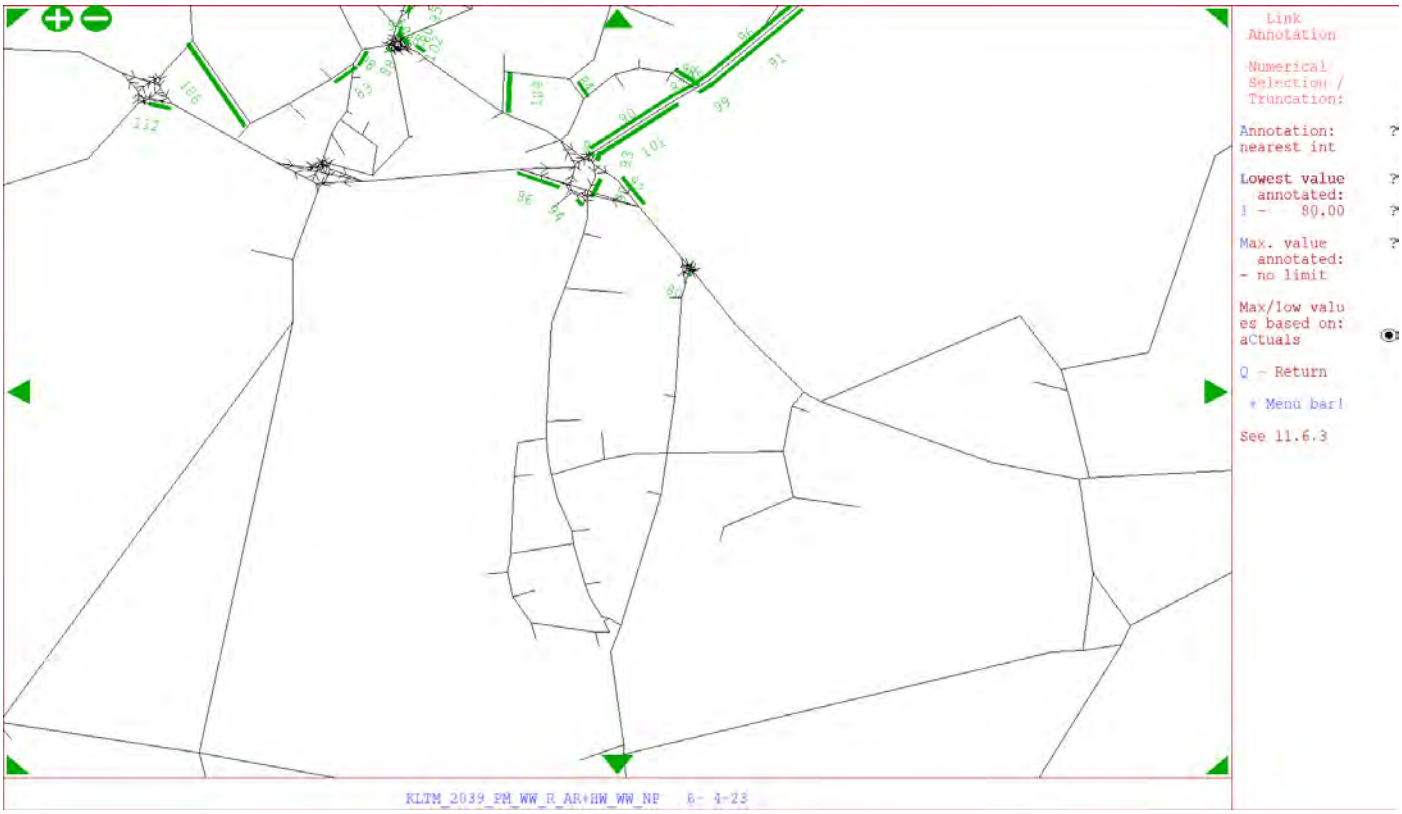
Figure 13 provides the V/C percentages above 80% in the PM peak for WWGA Scenario 2. This demonstrates there are no significant capacity issues on the existing A10, A47 or on the WWHAR scheme.

However, the PM peak also shows increased congestion occurs within the A47 Hardwick Interchange itself. The A149 Queen Elizabeth Way intersection shows increased congestion with the A149 approach at 93% V/C (compared to 86% V/C in Scenario 1) and at 91% V/C within the circulatory (compared to 84% V/C in Scenario 1). Other parts of the interchange showing congestion is the proposed circulatory approach to A47 westbound off-slip (97% V/C) and the A10 approach (94% V/C) . In summary, whilst the A47 Hardwick Interchange shows congestion in the PM peak in Scenario 2 it is shown to be continue to operate within capacity.

**Figure 13 – 2039 WWGA Scenario 2: Volume / Capacity: PM peak**



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In summary, the KLTM 2039 forecasts which have been presented for WWGA Scenario 1 and Scenario 2 are considered to show the West Winch Housing Access Road (WWHAR) scheme is key to support the delivery of the 4,000 dwellings in West Winch Growth Area and that the scheme is able to mitigate the impacts of this development on the wider highway network. The WWHAR scheme is shown to be appropriately designed to accommodate significant future traffic growth and will ease capacity issues which are currently present on the existing A10. Delivery of the WWHAR scheme will also ensure that the local highway network and associated communities will not be adversely affected by increases in traffic growth.

The 2039 KLTM forecasts which have been generated are considered to be a significant stress-test of the network given the high trip rates which have been assumed for the overall West Winch Growth Area, and therefore whilst the A47 Hardwick Interchange is shown to experience increased congestion as a result of both the WWGA and removal of the Constitution Hill roundabout as part of the WWHAR scheme, it has been demonstrated this key interchange will continue to operate within capacity.

The KLTM is a strategic modelling which is able to give an understanding of the impact of the spatial strategy within the KLWN Local Plan across the wider strategic road network. In terms of ensuring an understanding of the impact on safety of the WWHAR scheme, it is considered the Paramics micro-simulation model utilised to inform the WWHAR design has fulfilled this requirement. The Paramics model is capable of modelling the interactions between individual vehicles in a high level of delay including the consideration of queuing interactions between junctions and impacts of traffic merging and diverging from the SRN. The WWHAR Paramics model has considered in detail how the WWHAR scheme performs, including the A47 and A47 Hardwick Interchange, and has been used to scrutinise and test the scheme design at a micro-level and inform the scheme highway design to ensure it is appropriate and provides a safe solution for how vehicles will interact on the highway network.

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# AREA WIDE STRATEGIC MODELLING

In this section, analysis of modelling results will focus on the 2039 KLTM Area Wide Modelling. The Area Wide Modelling is considered the most appropriate basis from which to consider the impacts of Local Plan growth across the wider borough, focusing on Kings Lynn town and the Strategic Road Network (SRN). The following metric will be focused on in the analysis of the Area Wide Modelling forecast:

- Volume / Capacity (V/C) percentage

The following locations outlined in bullets below will be focused on as they demonstrate instances of where V/C percentages are 80% or greater, and in certain instances locations which are over capacity with V/C percentages of 100% or greater. These locations have been focused on as they show the greatest levels of stress in the Area Wide Modelling at the end of the plan period:

- A149 Queen Elizabeth Way, east of Kings Lynn
- A47 / A17 Pullover roundabout
- Southgates roundabout (A148 / A149 Hardwick Road / Wisbech Road / B1144 Vancouver Avenue)
- Kings Lynn town centre, also encompassing Tennyson Avenue and the A1076
- A148, specifically the A148 / Castle Rising Road / A1078 signals, and the A1078

It should be noted that the above bullet points outline the locations which demonstrate congestion issues on the highway network which will be discussed in turn. However, there are key locations within KLWN where the highway network is shown to continue to operate satisfactorily in a 2039 forecast scenario, these locations include the following:

- Downham Market
- Watlington

*A149 Queen Elizabeth Way corridor*

Figure 14 outlines the V/C along the A149 Elizabeth Way corridor in the AM peak, which demonstrates the following issues:

- Both A149 Queen Elizabeth Way approaches to the Jubilee roundabout (Greenyard Way) are close to capacity
- A149 southern approach to the A149 / A1076 / B1145 roundabout is close to capacity, with the B1145 at capacity, reaching 100% V/C, with issues also following on from this westbound on the A1076 up to the A1076 / Winston Churchill Drive roundabout

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**Figure 14 – 2039 Area Wide Modelling: Volume / Capacity: AM peak – A149 Queen Elizabeth Way corridor**

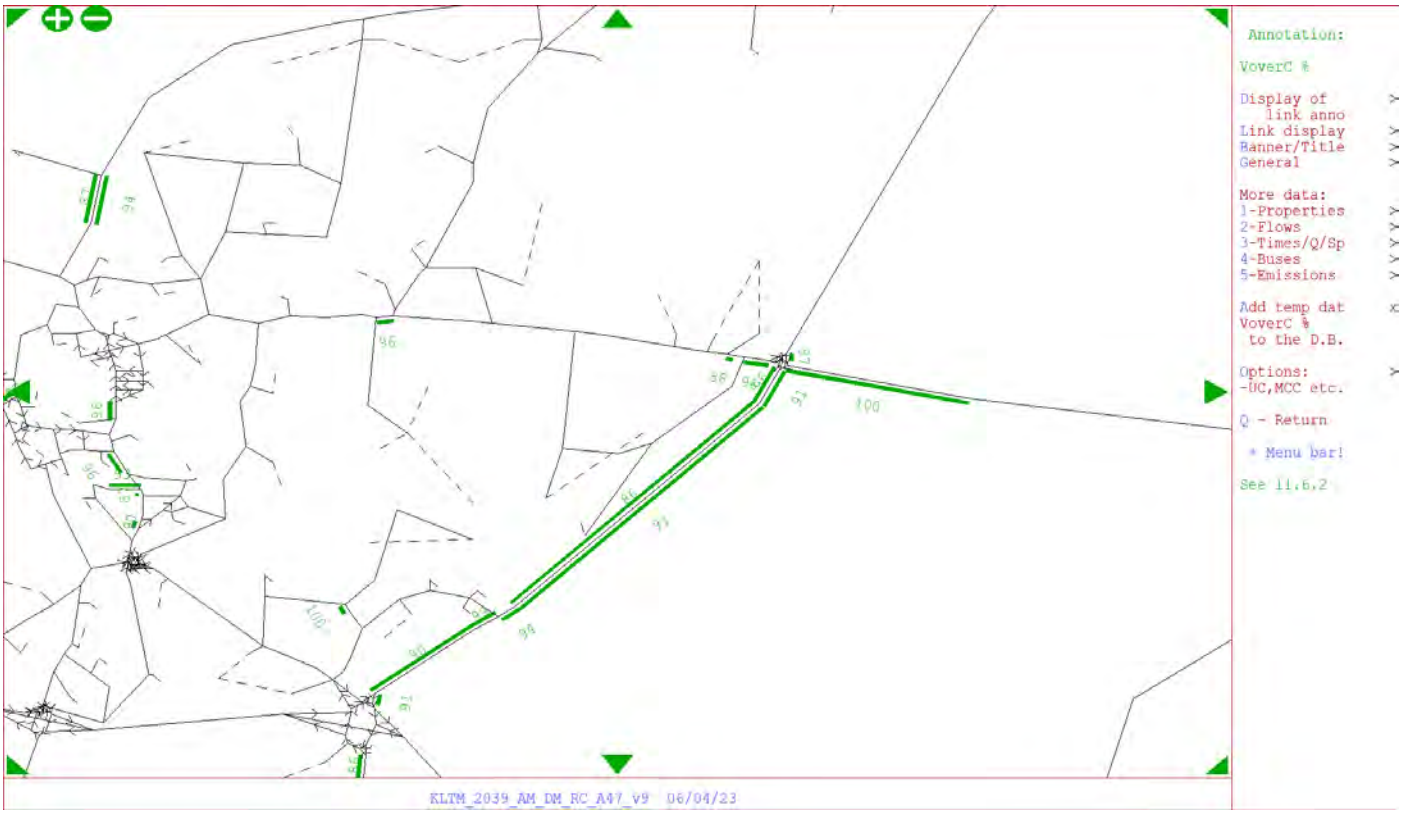


Figure 15 outlines the V/C along the A149 Elizabeth Way corridor in the PM peak, which demonstrates the following issues:

- A149 Queen Elizabeth Way itself reaches capacity northbound with a V/C of 100%
- Capacity issues occur at the Jubilee roundabout, with the northern A149 and Greenyard Way approaches being close to capacity
- The A149 / A1076 / B1145 roundabout operates with capacity, aside from the capacity issues on the A149 southern approach
- The A149 Queen Elizabeth Way becomes close to capacity northbound prior to the A149 / A148 roundabout

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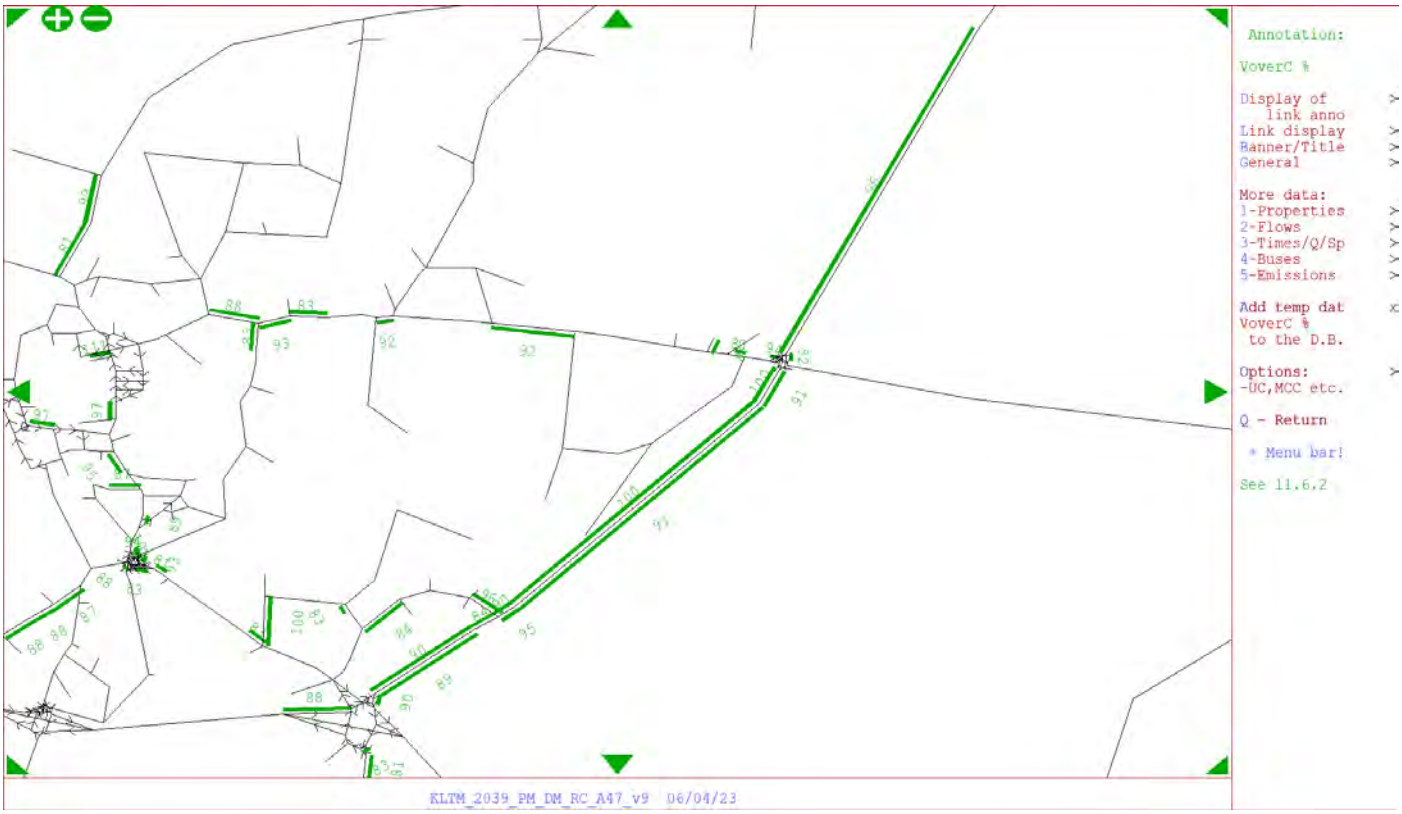
**Figure 15 – 2039 Area Wide Modelling: Volume / Capacity: PM peak – A149 Queen Elizabeth Way corridor**




The A149 Queen Elizabeth Way is therefore shown in the Area Wide Modelling to experience significant delays and capacity issues both in terms of link capacity for the A149 itself and also at the approaches to junctions along the A149 corridor.

NCC are currently considering the scope of a study of the A149 corridor which will determine improvements and opportunities for linkages to complementary area-wide sustainable transport improvements.

It should be understood the KLTM 2039 forecasts are considered to present a worst-case stress test of the existing highway along this corridor.

*A47 / A17 Pullover roundabout*

Figure 16 outlines the capacity issues which are experienced in the AM peak in the Area Wide Modelling at the A47 / A17 Pullover roundabout, this shows that multiple arms of this junction will be over capacity including the A17 western approach, A47 southern approach and the Clenchwarton Road approach.

**Figure 16 – 2039 Area Wide Modelling: Volume / Capacity: AM peak – A47 / A17 Pullover roundabout**

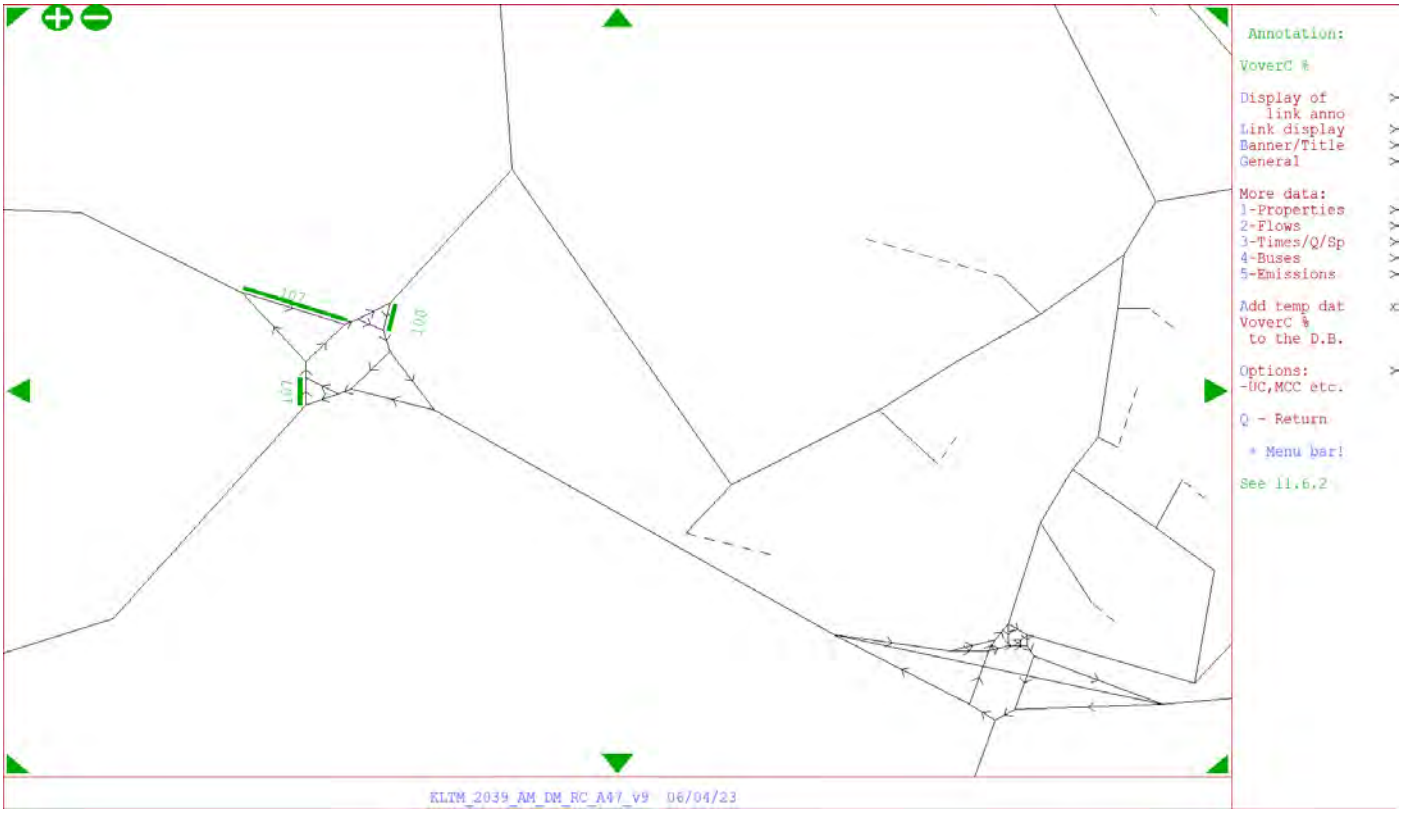
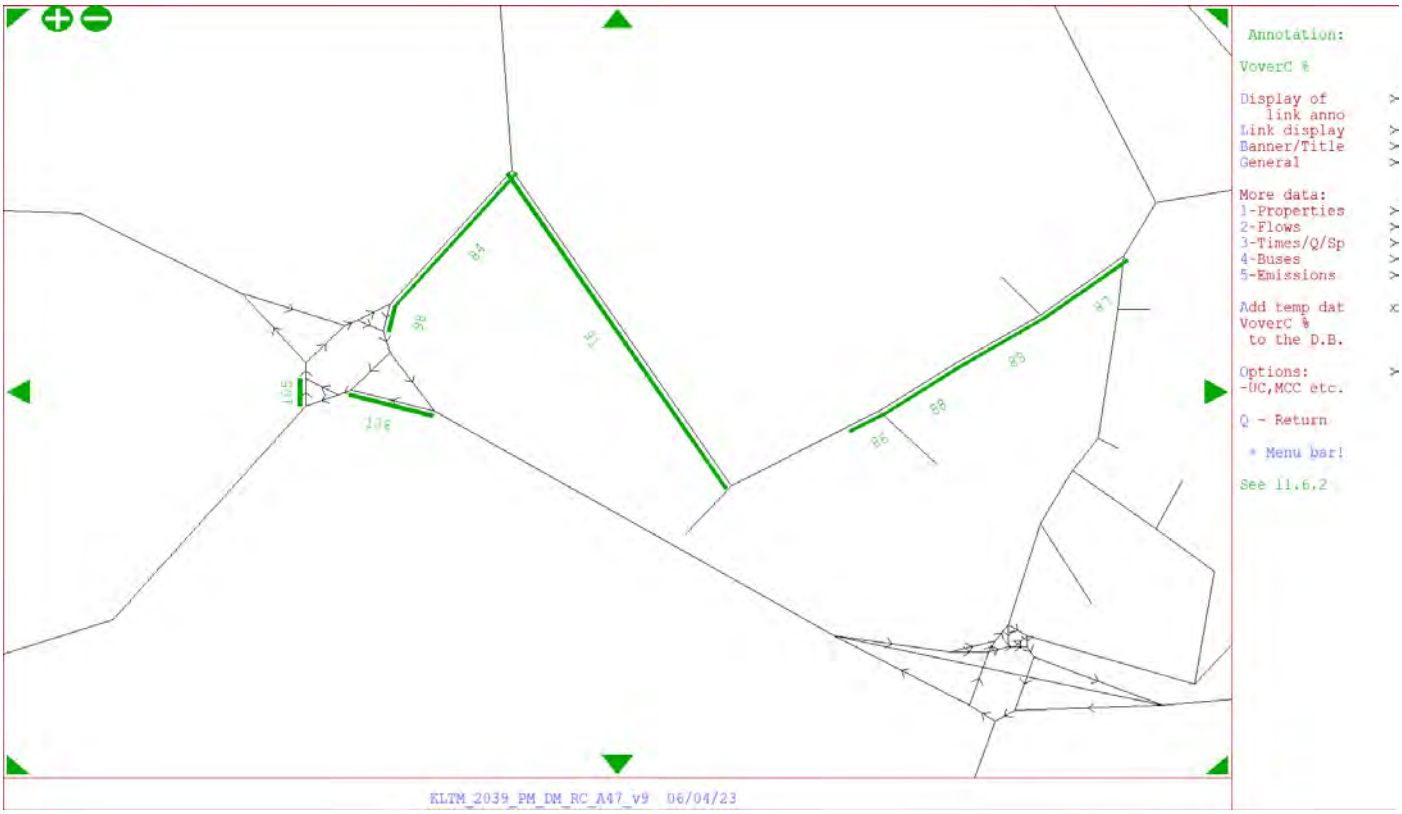


Figure 17 demonstrates that in the PM peak, the A47 southern and eastern approaches are over capacity, with the Clenchwarton Road approach also close to capacity.

**Figure 17 – 2039 Area Wide Modelling: Volume / Capacity: PM peak – A47 / A17 Pullover roundabout**




The issues presented for the A47 / A17 Pullover roundabout are known, existing issues on a key part of the SRN. These issues are not considered to be a consequence of the Local Plan growth in the borough. NCC have undertaken detailed studies of potential mitigation which could be implemented at this junction and have engaged with National Highways in relation to this. NCC are also seeking to ensure the proposals for improving this junction form part of central government's Major Road Network (MRN) fund.

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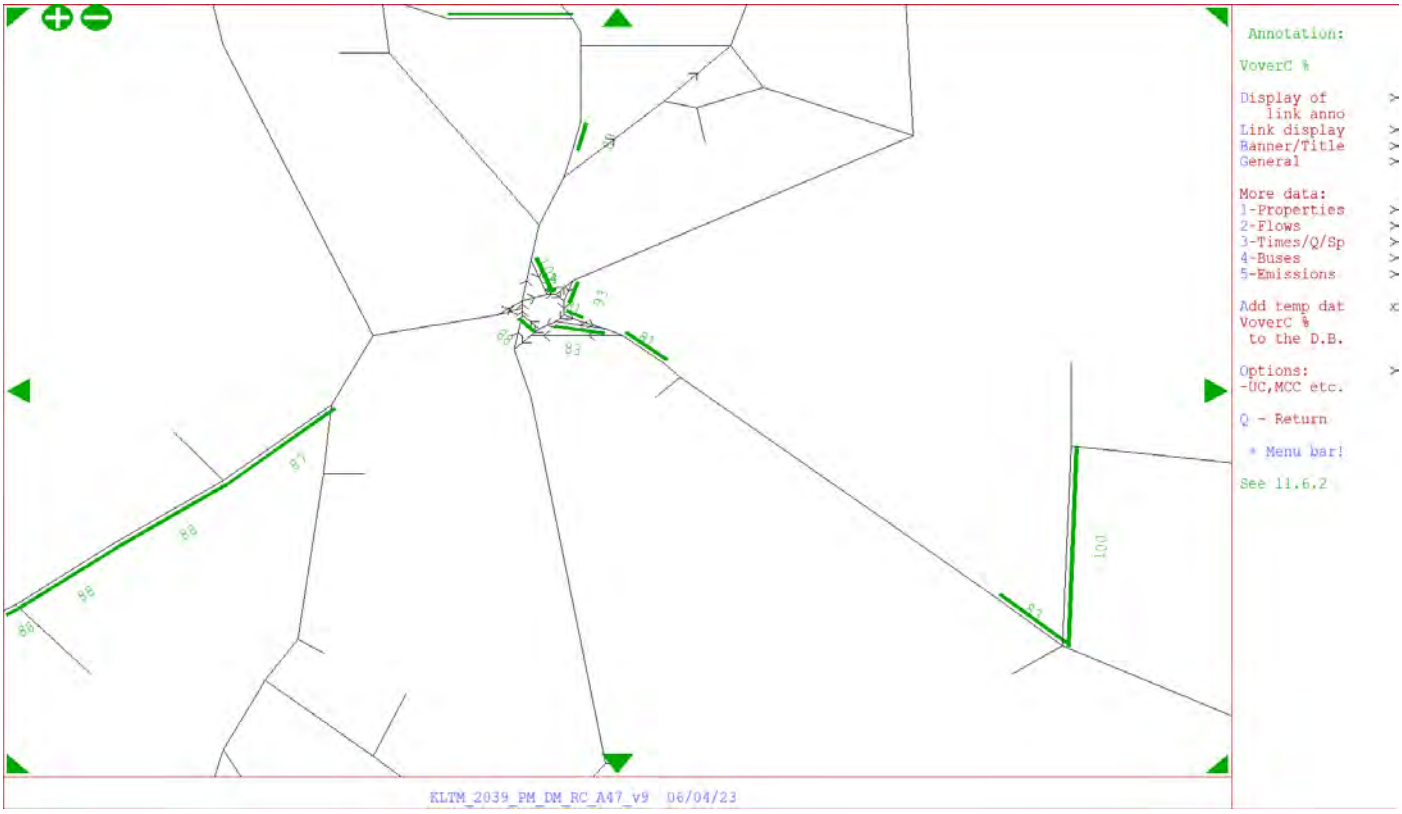
*Southgates roundabout*

Figure 18 presents the V/C issues in the PM peak at the Southgates roundabout within Kings Lynn. This demonstrates multiple arms of this junction are close to capacity and the northern A148 approach is over capacity with a V/C of 101%.

**Figure 18 – 2039 Area Wide Modelling: Volume / Capacity: PM peak – Southgates roundabout**




The Southgates roundabout forms part of the Southgates Masterplan and is also encompassed as part of the Sustainable Transport and Regeneration Scheme (STARS) scheme. The STARS scheme was recently successful in obtaining £24m in Levelling Up funding[2].

[2] https://www.norfolk.gov.uk/news/2023/01/kings-lynn-to-receive-24m-levelling-up-funding

*Kings Lynn town centre, A148 and A1076*

Figure 19 outlines the V/C issues in the AM within Kings Lynn town centre, as well as covering Tennyson Avenue, the A148 and A1076. This figure demonstrates these locations operate within capacity, though with some congestion apparent on the northbound A148 gyratory and on the A148 eastern approach to the Queen Mary Road signals.

**Figure 19 – 2039 Area Wide Modelling: Volume / Capacity: AM peak – Kings Lynn town centre, A148 and A1076**

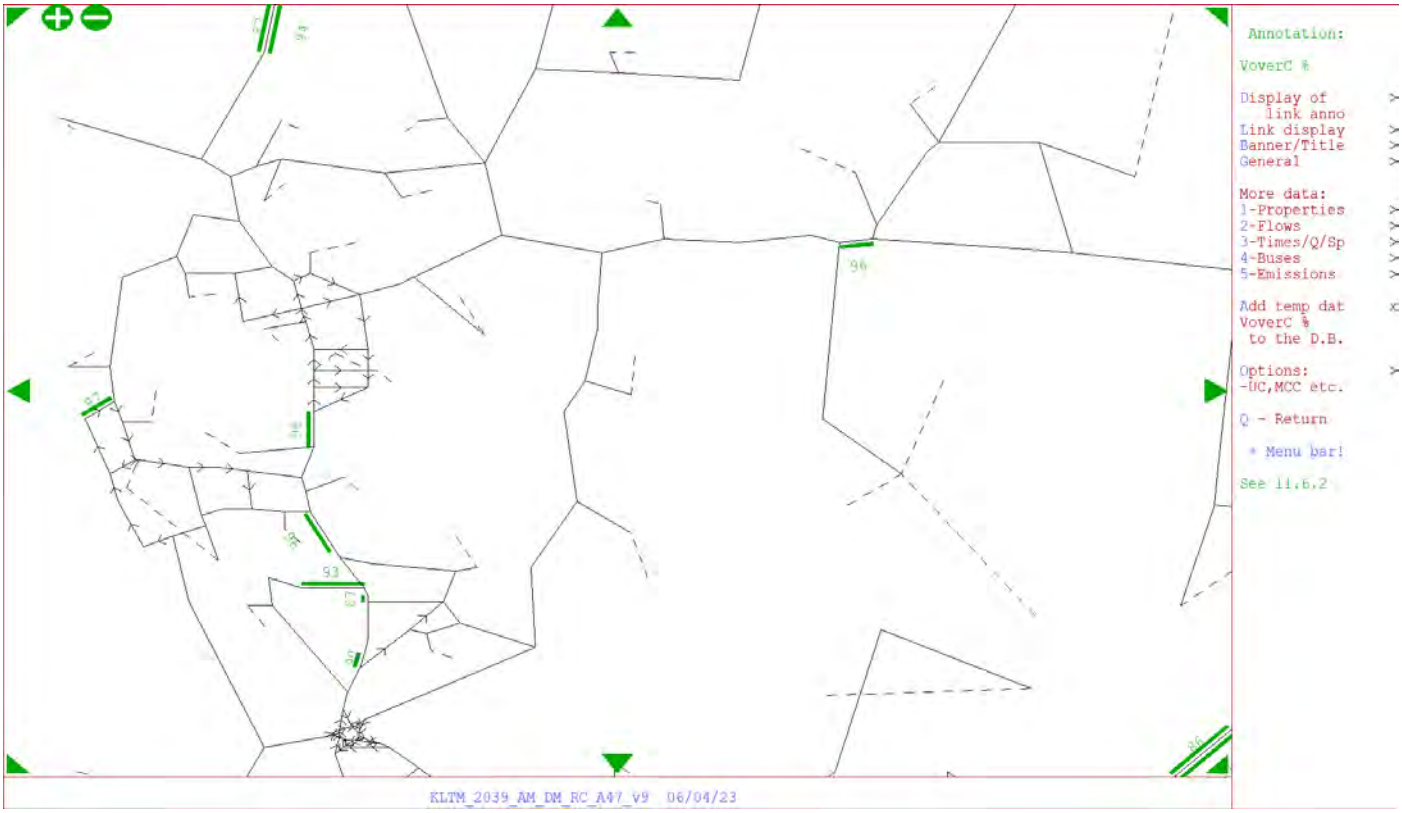
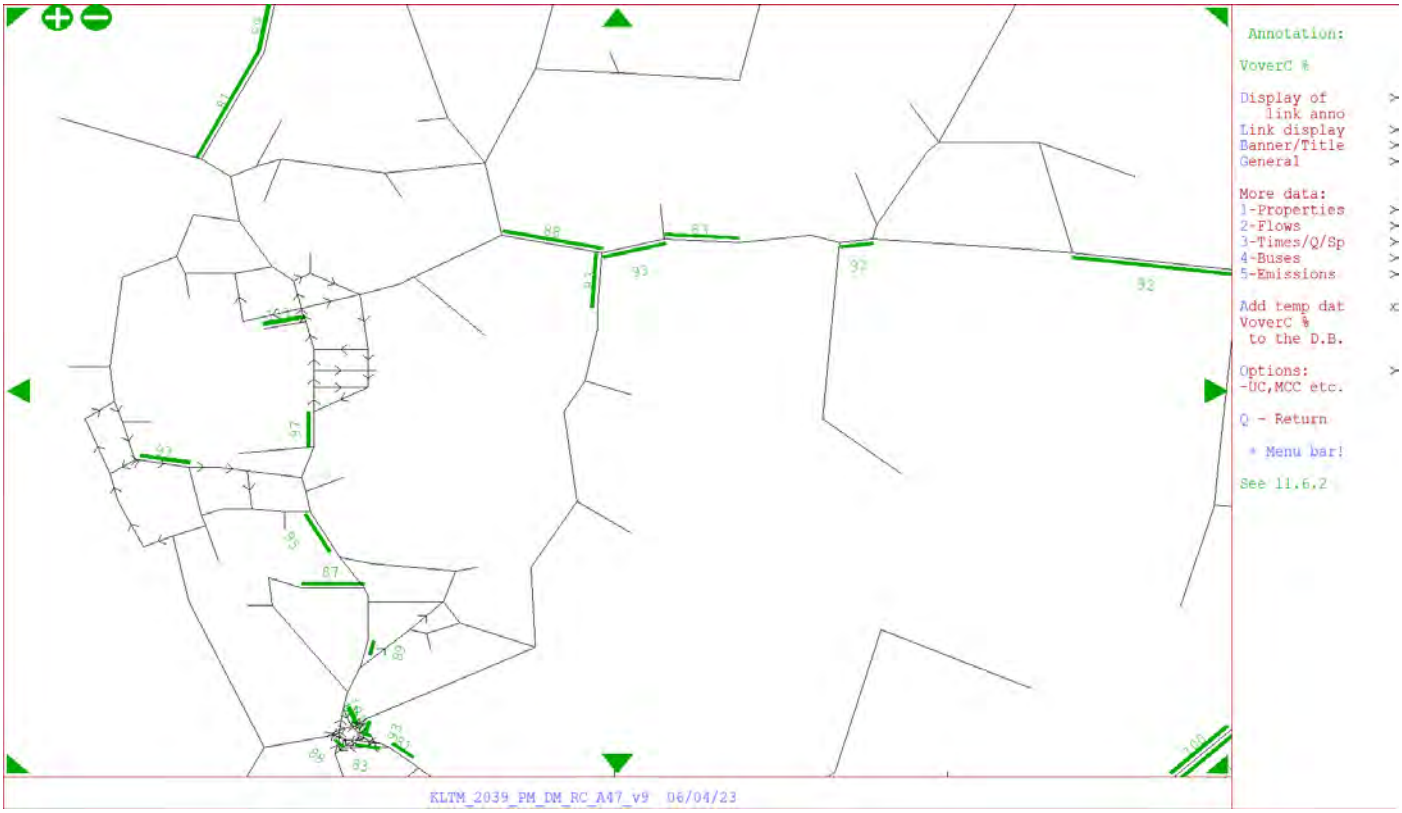


Figure 20 presents a similar picture for the PM peak whereby the northbound A148 gyratory within Kings Lynn operates close to, but within capacity. The eastern approach to the A148 / Queen Mary Road signals again show congestion, whilst the A148 / Tennyson Avenue signals are also congested, most notably on the A148 eastern approach. However, all strategic routes are shown to operate within capacity.

**Figure 20 – 2039 Area Wide Modelling: Volume / Capacity: PM peak – Kings Lynn town centre, A148 and A1076**




The Kings Lynn town centre gyratory forms part of the Sustainable Transport and Regeneration Scheme (STARS) scheme, which as previously outlined obtained £24m in Levelling Up funding[3]. The scheme will be transformative in terms of increasing bus and active travel provision and will result in a reconfiguration of the existing gyratory system.

[3] https://www.norfolk.gov.uk/news/2023/01/kings-lynn-to-receive-24m-levelling-up-funding

*A148 North and A1078*

Figure 21 outlines the Castle Rising Road approach to the A148 / Castle Rising Road / A1078 signals is operating close to capacity in the AM peak. Congestion is also apparent on the A1078 Edward Benefer Way, in particular southbound on the approach to the signalised junction for the retail park along this corridor. However, all of these locations continue to operate within capacity.

**Figure 21 – 2039 Area Wide Modelling: Volume / Capacity: AM peak – A148 North and A1078**

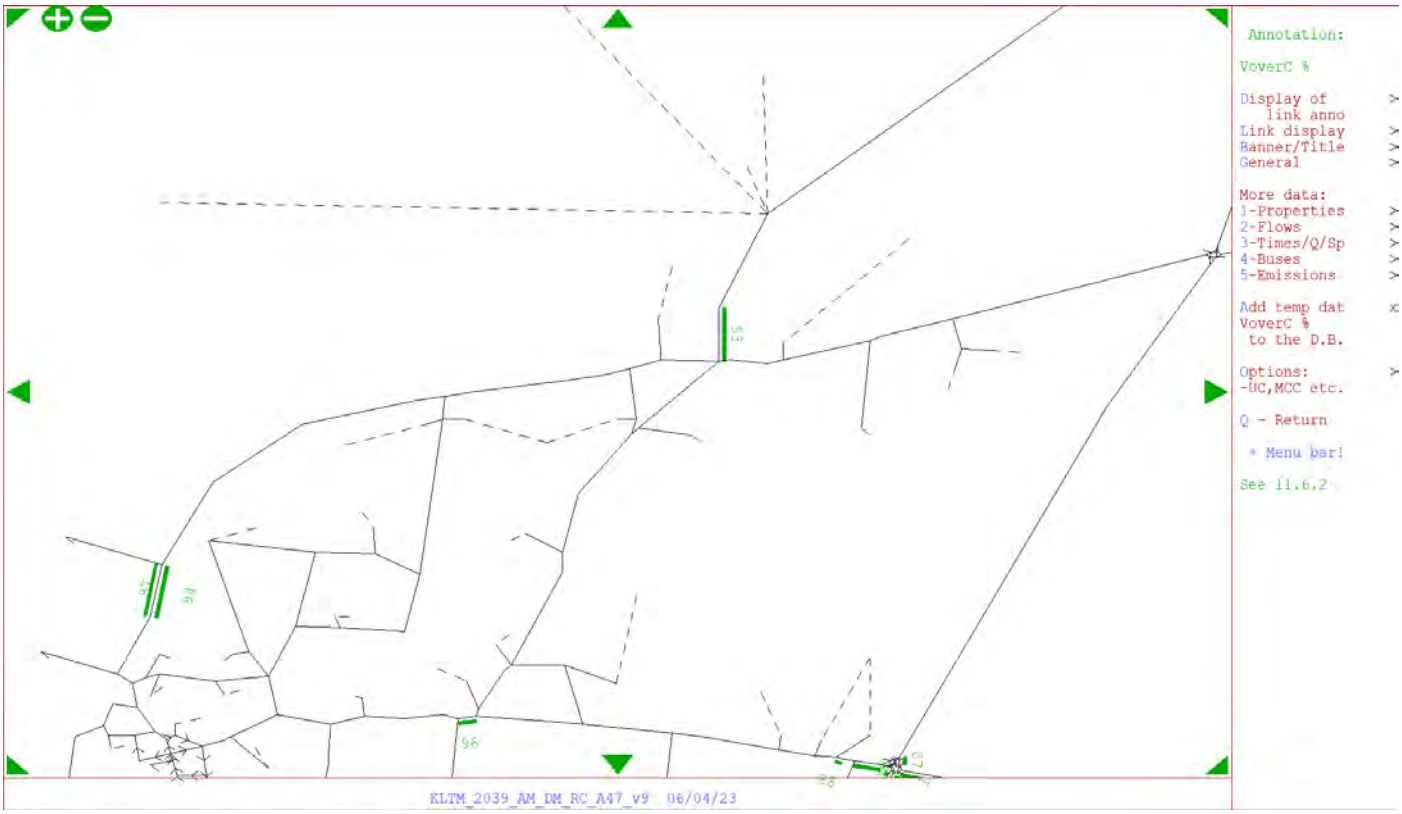


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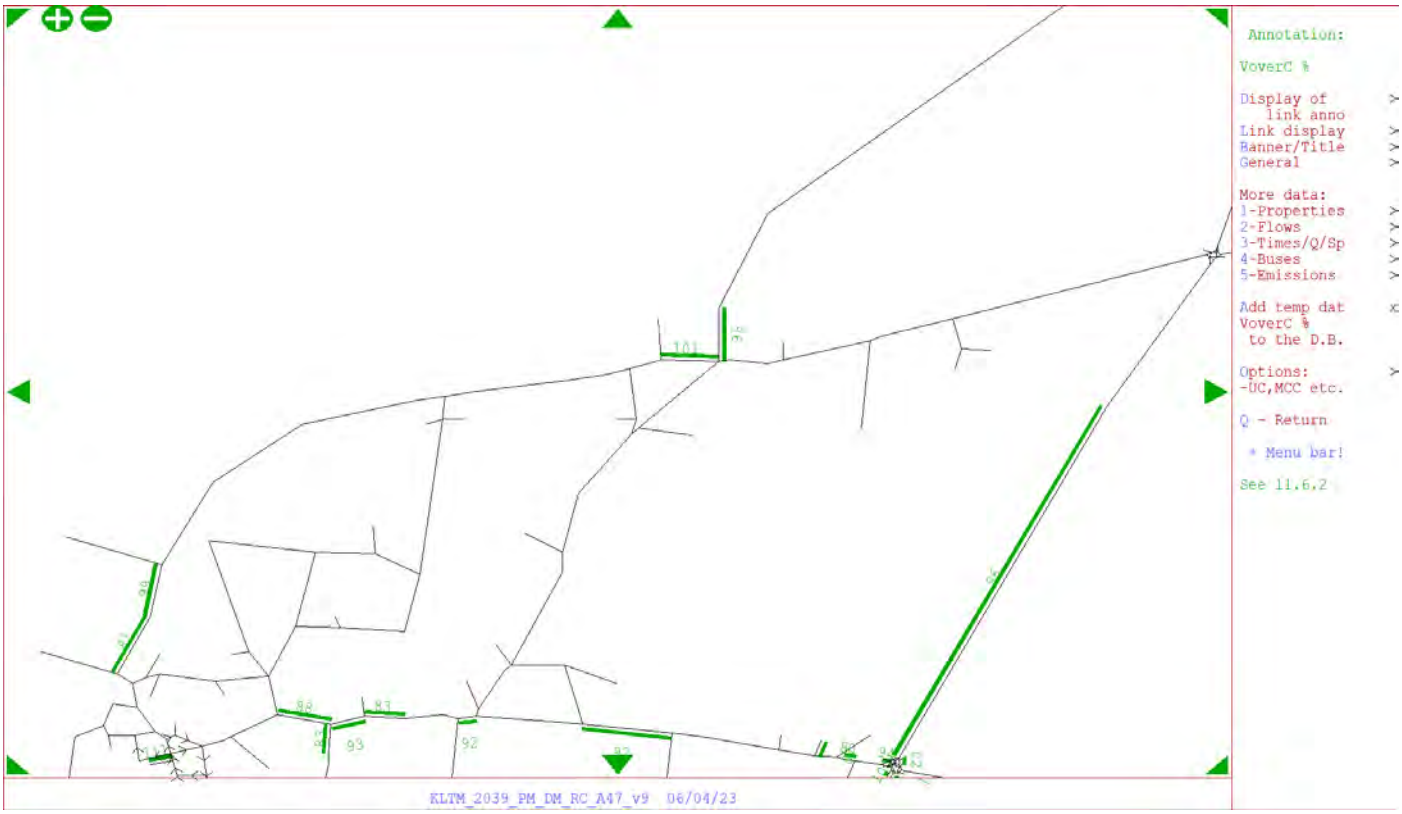
Figure 22 outlines the A148 / Castle Rising Road / A1078 signals are operating over capacity in the PM peak, with the A148 western approach being above capacity and the Castle Rising Road approach being close to capacity. The A1078 Edward Benefer Way shows congestion northbound, reaching close to capacity on the southern approach to the Estuary Road signals.

**Figure 22 – 2039 Area Wide Modelling: Volume / Capacity: PM peak – A148 North and A1078**




The issues presented for the A148 / Castle Rising Road / A1078 signals and the A1078 Edward Benefer Way could be resolved as a result of signal optimisation. The KLTM 2039 forecasts have not undergone any signal optimisation across the wider model network and therefore in general remain consistent with the signal timings in the 2018 base year model. Further to this both this signalised junction and the A1078 Benefer Way are subject to proposals for off-site improvement works associated with planning applications.

In summary, the Area Wide Modelling has identified various locations across KLWN which experience congestion issues. It is considered all of the locations which are flagged will either have proposals in place to deal with future traffic growth or are locations which show congestion but would continue to operate within capacity. The Area Wide Modelling is considered to demonstrate that the highway traffic growth associated with the developments within the KLWN Local Plan can be accommodated. Table 6 presents a

summary of the transport issues discussed following analysis of the KLWN forecasts and the solutions for the issues which have been raised.

**Table 5 – Summary of transport issues within KLWN**

| Location | Issues shown in Area Wide Modelling | Solution |
|---|---|---|
| A149 Queen Elizabeth Way | A149 itself and junctions between Hardwick Interchange and A1076 are close to or at capacity | Study of A149 corridor is currently being scoped. This study will determine potential improvements and linkages to area-wide sustainable transport strategies which can be implemented in order to ease any potential future congestion along this corridor |
| A47 / A17 Pullover roundabout | All arms of this junction are shown to be over capacity in either the AM or PM | Proposed mitigation solutions are being considered by NCC at this location in consultation with National Highways. Seeking to ensure improvements at this junction form part of the Major Road Network (MRN) fund |
| Southgates roundabout | Capacity issues shown | Part of STARS scheme which secured £24m in Levelling Up funding. Scheme will lead to reconfiguration of the existing junction layout |
| Kings Lynn town centre gyratory | Operates within but close to capacity northbound within the gyratory | Part of STARS scheme which secured £24m in Levelling Up funding. |
| Tennyson Avenue and A148 | Close to capacity on the A148 | Shown to operate within capacity and will benefit from wider shift to sustainable modes |
| A148 / Castle Rising Road / A1078 signals | Close to or over capacity in the AM & PM | Improvements proposed at this junction related to off-site works associated with planning applications |
| A1078 Edward Benefer Way | Two sets of signals are close to capacity in either the AM or PM peak | Improvements proposed along this corridor related to off-site works associated with planning applications |

# APPENDIX A – GLOSSARY

- **Adjusted Planning Data** – TEMPro (see below) allows for the use of alternative assumptions which are different to the standard set of assumptions. This allows for specific allocated developments to be discounted from the assumptions or to adjust the overall assumptions to tie in with alternative data sources.
- **AM Peak** – the morning peak hour (08:00 – 09:00)
- **ANPR** – Automatic Number Plate Recognition, utilised in traffic surveys in order to help determine the routing and travel time of individual vehicles between specific locations on the highway network by tracking when a vehicle number plate is captured
- **Assignment** – A Traffic Assignment Model, in this case SATURN, has been used. An assignment model requires two general inputs – a "trip matrix" and a "network" (thought of as the "demand" and "supply" inputs – provided by the user). These are input into a "route choice" model which allocates or assigns trips to "routes" through the network, as a result total flows along links in the network may be summed and the corresponding network "costs" (e.g. times) calculated.
- **ATC** – Automatic Traffic Count, a count of traffic data typically undertaken using rubber tubes laid across the highway to collected data over a 24 hour period for multiple days
- **Delay** – within the context of SATURN software, this is a metric used to determine the average delay per Passenger Car Unit which is experienced on a particular section of road in an average hour
- **KLTM** – Kings Lynn Transport Model, a strategic highway assignment model based in SATURN software
- **KLWN** – Kings Lynn & West Norfolk
- **KLWNBC / KLWN** – Kings Lynn & West Norfolk Borough Council
- **Links** – Connect nodes together and represent the road network within the model
- **LinSig** – Industry standard software used to assess Signal-Controlled junctions
- **LPA** – Local Planning Authority
- **Matrix** – see Trip Matrix
- **MCTC** – Manual Classified Turning Count, typically a single day traffic observation which focuses on turning movements at key junctions and accurately determining the types of vehicles travelling through the survey location
- **National Road Traffic Projections (NRTP22)** – a set of national traffic forecasts, which can be disaggregated down to region, produced by the NTM which were released in December 2022
- **NCC** – Norfolk County Council
- **Network** – specifies the physical structure of the roads, etc upon which trips take place and the parameters within it. In this report, parameters is being used as a generic descriptor of all of the pieces of information / options that go into the Saturn network, it is not a specific modelling term.
- **NH** – National Highways
- **Nodes** – Nodes represent a change in speed or direction; most often they represent a junction.
- **NTEM** – National Trip End Model, version 7.2 used for modelling in this note. The latest version is 8.0. The National Trip End Model produces estimates of person travel by all modes based on 2011 Census boundaries. The model outputs trip productions (e.g. homes) and trip attractions (e.g. sites of employment) in each zone (collectively known as trip-ends), which may be separated by mode, journey purpose, household car ownership category and time period.
- **NTM** – National Transport Model provides a means of comparing the consequences of national transport policies or widely-applied local transport policies, against a range of background scenarios which consider the major factors affecting future patterns of travel. The model produces future forecasts of road traffic growth, vehicle tailpipe emissions, congestion and journey time (Department for Transport website).
- **Road Traffic Forecasts (RTF18)** – a set of national traffic forecasts, which can be disaggregated down to region, produced by the NTM which were released in 2018
- **Paramics** – Software used for local area transport modelling, also referred to as micro-simulation and/or operational modelling, which takes more detailed account of interactions between vehicles than a strategic transport model
- **PCU – Passenger Car Unit**, is a method used in Transport Modelling to allow for the different vehicle types within a traffic flow group to be assessed in a consistent manner. Measured to be 5.75 m. Factors used in the SCTM are 1 for a car or light goods vehicle and 2.3 for heavy goods vehicle. Therefore assumed average length of HGVs is 13.23m
- **PM Peak** – Afternoon Peak (17:00 – 18:00)

- **SATURN** – Simulation and Assignment of Traffic to Urban Road Networks is a suite of network analysis programs used to assess the impact of road-investment schemes. Version 11.4.07H. used for the modelling detailed within this note. See also assignment. Further information can be found here: https://saturnsoftware2.co.uk/
- **SRN –** Strategic Road Network
- **STARS –** Sustainable Transport and Regeneration Scheme, related to improvements to Kings Lynn Town Centre gyratory and Southgates roundabout
- **TAG** – Transport Analysis Guidance. Documentation produced by the Department for Transport (DfT) to assist in transport analysis, appraisal and modelling to ensure consistency and robustness
- **TEMPro** - TEMPro is the Trip End Model Presentation Program. The National Trip End Model (NTEM) forecasts and the TEMPro software are used for transport planning purposes. The forecast includes: population, employment, households by car ownership, trip ends, and simple traffic growth factors based on data from the National Transport Model. The current version, and the version used for this work, is NTEM 7.2. Further information can be found at: https://www.gov.uk/government/collections/tempro
- **Trip Matrix** – the "Trip Matrix" Tij specifies the number of trips from zone i to zone j
- **V/C Ratio** – Volume / Capacity Ratio. The assigned model flow is the volume of traffic in PCUs per hour, with the V/C percentage calculated as the volume relative to the capacity in percentage terms.
- **WWGA** – West Winch Growth Area, policy E2.1 in Local Plan
- **WWHAR** – West Winch Housing Access Road
- **Windfall Sites** – sites for housing that have yet to be identified, accounted for through background growth.
- **Zone Loading Point** – the origins (start of a vehicular journey) and destinations (end of a vehicular journey) of trips within a network

A further glossary of planning terms can be found here:
https://www.planningportal.co.uk/directory/4/glossary