



# Studies to support the development of a town masterplan

## Scheme Assessment Report

Knutsford Town Council

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## 1. Introduction

### 1.1 Commission

This study was funded by the UK Government through the Shared Prosperity Fund.

In January 2024 Knutsford Town Council (KTC) sought consultant support to undertake feasibility studies on different aspects of the From Top to Bottom Street report to ascertain their viability and costs. The outputs from the study will ultimately form part of the Town Centre Masterplan, which KTC would work with Cheshire East Council (CEC) to see delivered.

In 2019/20 KTC developed and consulted on the From Top to Bottom Street report. This proposed a limited vehicular accessibility system. The intention of this scheme was to control the flow and destination of traffic in the commercial heart of Knutsford and divide the town centre into three sectors which essentially for three loops - traffic cannot pass through the town centre, but can access the majority of the town centre. The From Top to Bottom Street report also proposed the creation of new public realm areas and changes to car parking arrangements. The principles of the report were supported at a public consultation. Eight work packages were set out in the KTC project brief for investigation by the appointed consultant, as follows:

- » TCMP1 - Traffic modelling of the proposed traffic flow changes to ascertain the impact (individually and cumulatively) on the local road network.
- » TCMP2a - Feasibility study on the works required to implement the traffic flow changes including estimated costs, timings and local impacts.
- » TCMP2b - Feasibility and cost estimate for the upgrade of the unadopted Moorside road.
- » TCMP2c - Feasibility and cost estimate for the creation of a new highway access to Princess Street King Edward Road.
- » TCMP3 - Feasibility study on the development of a multi-storey car park on the existing Tatton Street car park including estimated costs, management and outline business model.
- » TCMP4a - Feasibility study of the creation of public realm area at Canute Place and development of options for the public realm.
- » TCMP4b - Feasibility study of the creation of public realm area at Princess Street (Lost and Found) and development of options for the public realm for later consultation.
- » TCMP5 - Study on wider town centre public realm improvements to enable improved pedestrian movement developing options for later consultation.

Hydrock along with a team of partners (Urban Movement, Stephen George + Partners, and Pick Everard) has been appointed by Knutsford Town Council to deliver these eight work packages.

As part of the package TCMP1, Hydrock has developed an Aimsun microsimulation model covering Knutsford town centre. The Aimsun model will be used to test, develop and refine the proposed scheme options developed as part of the other work packages. The development, calibration and validation of the model is set out in the Local Model Validation Report<sup>1</sup>.

### 1.2 Purpose of this Report

This Option Modelling Technical Note details the Aimsun microsimulation modelling undertaken as part of the optioneering process by the project team, and provides detailed modelling outputs.

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<sup>1</sup> Knutsford Town Centre Aimsun Model Local Model Validation Report, Hydrock, May 2024

## 2. Future Year Modelling Methodology

This section sets out the future year Aimsun modelling methodology including details of the future year assessment scenario, relevant committed development sites likely to have an impact on the local highway network and NTM / TEMPro traffic growth factors.

### 2.1 2030 Do Minimum

#### 2.1.1 Committed Developments

As agreed with Knutsford Town Council, the following committed developments were initially considered in the future year assessment scenarios:

- » 17/3853M Land north of, Northwich Road - Outline planning application of up to 190 dwellings; the provision of serviced land for allotments; a community orchard, a playing pitch, landscaping and open space; new internal highways, car and cycle parking; sustainable drainage measures including surface water retention ponds, provision of utilities infrastructure; earthworks and all ancillary enabling works. (19/1392M - Reserved Matters approved January 2020).
- » 13/2935M Land north of Parkgate Industrial Estate, Parkgate Lane – Outline Application of 237 dwellings with associated woodland buffer, ecological mitigation and enhancements, and open spaces (18/2996M – Reserved Matters approved February 2021..
- » 19/0032M Land west of Manchester Road – Outline planning application for the erection of up to 60 dwellings; up to 7.5 hectare business park (Class B1); landscaping and open space; a new roundabout on Manchester Road, new internal highways, car parking and facilities for pedestrians and cyclists incorporating Public Right of Way (FP2); sustainable drainage measures; and all ancillary enabling works. (approved May 2020..
- » 18/3672M Tatton Bluebell Village – Outline application for a residential-led development, including a local/neighbourhood centre comprising of retail/commercial, takeaway, residential and community uses (Use Class E, Sui-Generis and C3 uses); and a care home/elderly accommodation (C2 Use); alongside any associated recreational space, car parking, cycle parking, landscaping and other works for all proposed uses. (revised application September 2022 - Yet to be Determined).

The committed developments and associated flows are provided in Table 1 for the peak hour. Note these have been factored to a two-hour demand profile in line with the modelled peak periods covering two hours.

Table 1: Committed Development Flows

Reference	Arrive	Depart	Two-Way	Arrive	Depart	Two-Way
<b>17/3853M</b>	24	69	93	57	28	85
<b>13/2935M</b>	31	68	99	70	40	110
<b>19/0032M</b>	107	29	136	27	104	131
<b>18/3672M</b>	62	42	104	80	89	169
<b>Total</b>	224	208	432	234	261	495

In total, in 2030 there are 432 trips associated with committed developments in the AM peak period and 495 in the PM peak period. The additional development trips were distributed as per the information included in the corresponding Transport Assessments submitted to accompany the respective planning applications.

### 2.1.2 Traffic Demand

The Do Minimum traffic demand was created by adding in trips associated with the above committed developments and applying TEMPro growth factors. The growth factors for cars were adjusted to account for the level of committed development included using the alternative assumptions within TEMPro. The factors extracted from TEMPro are shown in Table 2.

Table 2: TEMPro Factors (Cheshire East 009 and 010)

Peak Period	Initial Factor	Adjusted Factor
AM Peak	1.0606	0.9778
PM peak	1.063	0.9745

As shown the TEMPro factors presented are negative because the level of committed development is more than the assumptions within TEMPro. As such, TEMPro growth has been capped at 1, so that any future year traffic demand is capped at purely the approved committed developments.

### 2.1.3 Results

Model statistics have been extracted for the whole modelled network in order to understand the overall impacts of each option. The following information has been outputted from the Aimsun models:

- » **Travel time (unit: s/km):** mean time it takes for vehicles to travel through the network in the modelled time period.
- » **Delay time (unit: s/km per vehicle):** mean delay incurred by vehicles travelling through the network in the modelled time period and is calculated as the difference between actual travel time and free flow travel.
- » **Flow (unit: veh/h):** average number of vehicles per hour that have passed through the network during the simulation period. The vehicles are counted when leaving the network via an exit section.
- » **Speed (unit: km/h):** mean speed of vehicles in the network.
- » **Density (unit: veh/km):** the mean number of vehicles per km of road space and is an indicator of queuing and congestion.
- » **Mean Queue (unit: veh):** the mean number of vehicles in queuing in the model, averaged over the modelled period.

The network statistics are presented in Table 3 and Table 4.

Table 3: Network Statistics - 2023 Do Minimum AM Peak Period

Statistic	Units	Base	2030 Do Minimum
Travel Time	sec/km	219.0	261.6
Delay	sec/km per vehicle	140.2	183.3
Flow	veh/h	4,068.7	3,891.6
Speed	km/h	21.8	19.3
Density	veh/km	9.5	13.6
Mean Queue	veh	97.1	174.5
Vehicles Waiting to Enter	Veh	11.1	1,008.3

Table 4: Network Statistics - 2030 Do Minimum PM Peak Period

Statistic	Units	Base	2030 Do Minimum
Travel Time	sec/km	213.3	378.0
Delay	sec/km per vehicle	133.5	298.6
Flow	veh/h	4,502.3	4,278.2
Speed	km/h	21.5	14.4
Density	veh/km	9.9	18.6
Mean Queue	veh	93.5	256.0
Vehicles Waiting to Enter	Veh	7.0	1,209.1

The network statistics show that there is a significant increase in vehicles waiting to enter the model. From watching the model simulations, it can be seen that the suppressed demand is caused from an increase in queueing at Knutsford Roundabout. In the AM peak period, the queues generally extend back beyond the model study area at the A50 Manchester Road and Northwich Road (Figure 1), whilst in the PM peak period the congestion extends back to Brook Street, Toft Road and A50 Manchester Road (Figure 2).

Figure 1: 2030 Do Minimum AM Peak - Model Screenshot



Figure 2: 2030 Do Minimum PM Peak - Model Screenshot



In order to analyse the 2030 Do Minimum network results further assigned volume difference plots have been output from the model. Figure 3 presents the assigned volume difference plots between the Do Minimum and 2024 Base which highlight the increases in flow as a result of the committed development traffic flows. Figure 4 and Figure 5 present simulated density plots for the 2023 Base and 2030 Do Minimum scenarios. The density plots show the number of vehicles per km on each link in the model and highlight the areas of congestion. Table 5 and Table 6 present the assigned volume flows at Knutsford Roundabout.

Figure 3: Assigned Volume Comparison - AM Peak

PM Peak

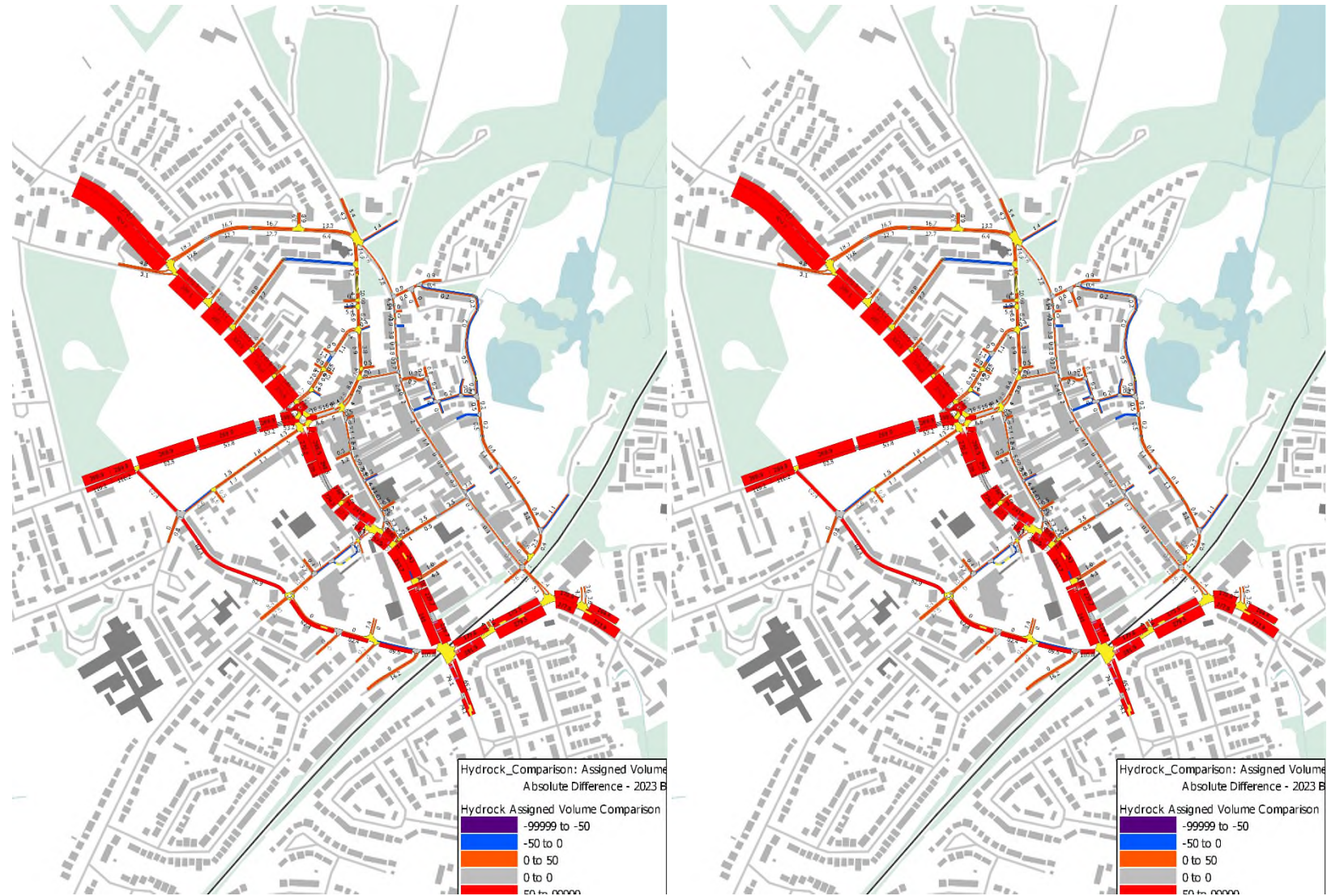


Figure 4: Simulated Density - 2024 Base - AM Peak



PM Peak



Figure 5: Simulated Density 2030 - Do Minimum - AM Peak



PM Peak



Table 5: Assigned Volume - Knutsford Roundabout AM Peak Period

Approach	Base	Do Minimum	Difference
A50 Manchester Road	965	1,114	+149
Canute Place	437	443	+6
A50 King Edward Road	1,671	1,941	+270
Gaskell Avenue	143	148	+5
Northwich Road	1,019	1,289	+270
<b>Total</b>	<b>4,235</b>	<b>4,935</b>	<b>700</b>

Table 6: Assigned Volume - Knutsford Roundabout PM Peak Period

Approach	Base	Do Minimum	Difference
A50 Manchester Road	1,185	1,593	+408
Canute Place	710	773	+63
A50 King Edward Road	2,005	2,202	+197
Gaskell Avenue	138	141	+3
Northwich Road	473	915	+172
<b>Total</b>	<b>4,781</b>	<b>5,624</b>	<b>+843</b>

As shown Figure 3 the committed development flows cause significant cumulative increases in traffic flows along the A50 and, in particular, through Knutsford Roundabout. This is reflected on the simulated density plots, particularly in the PM peak period which shows how the congestion spreads across the network from Knutsford Roundabout. Table 5 and Table 6 show that in total there are estimated to be 700 and 843 two-way trips associated with committed developments passing through Knutsford Roundabout, in the AM and PM peak periods (two hour), respectively. This equates to a 17% and 18% increase in flows at the roundabout during the peak periods, representing a significant increase in flow at a location that currently operates at, or close to, capacity.

## 2.1.4 Summary

As shown, the committed developments cause significant congestion in Knutsford, mainly as a result of the increase in traffic flows through Knutsford Roundabout. It is understood that a scheme is being developed for the roundabout which would seek to mitigate the cumulative impact of these committed and planned developments. However, given the scheme has not been developed in detail at this stage, it is not included in the modelling leading the extensive congestion shown and an unrealistic future year scenario. In order to assess the impacts of the proposed highway schemes against a realistic baseline position, the committed developments have not been included in the scenario options. As such, the base year traffic demand has been used and the impacts of the scenario options are therefore compared against the base year model outputs.

## 2.2 Option Modelling

Each initial option has been coded into the model in order to assess how the option would respond to existing flow levels. As detailed above no future year assessment has been undertaken at this stage due to the high levels of committed development traffic flows and the ongoing development of an appropriate mitigation scheme. A number of outputs were created from the model including:

- » Network statistics showing the overall performance of the option and its impact on the city centre highway network.
- » Plots of the changes in assigned volume from the macroscopic model, showing how assigned traffic volumes would change on the highway network as a result of the option. Assigned volume effectively shows the traffic demand on the network. On these plots, oranges and reds shows increases in assigned volume and blues and purples show decreases, with the width of the line being proportional to the size of the change.
- » Simulated density plots from the microsimulation, showing how simulated density would change on the highway network as a result of the option. Simulated density measures the number of vehicles per kilometre on a section of road, with higher densities representing more congestion. Large increases in density suggest increases in congestion on the network, whilst decreases in density show areas where the network benefits.

### 3. Option Modelling Results

#### 3.1 Initial Option 1: Old Town Square

##### 3.1.1 Description

The Old Town Square scheme is a public realm proposal taken from the Top to Bottom Street report. The scheme creates a new public realm area at the south end of Princess Street. This would involve the closure of a stretch of the highway to create a new plaza between an existing public realm area and the Lost and Found.

The scheme creates a re-designed junction for the A50 / Princess Street / Bexton Road Junction, forming a four arm signal controlled junction with pedestrian crossings. The scheme also removes the access from Princess Street onto Church Hill.

In order to assess the scheme it has been modelled alongside a second scheme which relocates the Princess Street car park access from Princess Street onto the A50. This reduces demand on Princess Street and allows more green time to be allocated to the A50.

##### 3.1.2 Traffic Modelling

The scheme has been tested in the Knutsford Aimsun Model and results are presented in Figure 6 to Figure 9.

The assigned volume plots show that there are not significant changes in flow at the new junction, with any changes limited to those associated with the Princess Street access car park re-alignment. However, as shown on the density plots, the new junction causes significant issues on the network with increases to queueing and congestion compared to the existing layout. Figure 8 and Figure 9 provide screenshots of the model, comparing the Option 1 with the Base Scenario. The screenshots show how the proposed new junctions causes queueing back from the Old Town Square in both peak hours as result of the scheme.

The existing layout uses a highly efficient a two-stage signal plan. However, the proposed layout requires a four-stage signal plan and in line with best practice for signal controlled junctions with pedestrian crossings, the cycle time has been capped at 90 seconds. This combination means that the green time for the A50 approaches is reduced leading the junction operating over capacity with significant queueing an delay.

##### 3.1.3 Recommendations

The modelling has shown that the introduction of four-stage signalised operation at the A50 / Princess Street / Bexton Road creates significant congestion on the A50. This could be mitigated by reducing the number of stages through one or more of the following options:

- » Making Princess Street northbound only.
- » Maintaining access from Princess Street onto Church Hill only.
- » Removal of the single stage crossings on the A50 and Bexton Road and maintaining the current arrangement where the crossing operate in parallel to the vehicle stages.

Figure 6: Assigned Volume Comparison - AM Peak

PM Peak



Figure 7: Density Plot - AM Peak

PM Peak



Figure 8: Screenshot AM Peak (08:30): Option 1: Old Town Square

2024 Base



Figure 9: Screenshot PM Peak (17:00): Option 1: Old Town Square

2024 Base



## 3.2 Initial Option 2: King Street

### 3.2.1 Description

Option 2 seeks to remove through traffic through King Street and improve the street for pedestrians, cyclists and end users. The scheme maximises public realm space by removing the majority of on street parking. This saves space for more footway widening and provision of street furniture and greenery. The car parking spaces retained are to the north of King Street and could include accessible parking bays.

The scheme removes on street parking along King Street, as such this has been re-assigned to existing town centre car parks as outlined in Table 7. It should be noted this represents a worst-case scenario, in reality it is likely that the removal of parking will remove some vehicle trips from the network with a mode shift towards walking and cycling as a result of the active travel improvements.

Table 7: King Street and Princess Street Parking Re-assignment

Car Park	Re-assigned Parking Trips
King Street Car Park	5%
Moorside on-street	5%
Tatton Street Car Park	25%
Booths Car Park	55%
Princess Street Car Park	10%

### 3.2.2 Traffic Modelling

The scheme has been tested in the Knutsford Aimsun Model and results are presented in Figure 10 to Figure 13. The assigned volume difference plots show the significant changes in flow across the network as a result of the closure of through traffic on King Street and the re-assigned on-street car parking. The resulting impact of the changes in traffic flow are shown on Figure 11 which highlights increases in density along the major traffic routes through Knutsford in the PM peak period. In the AM peak period the impacts are more limited.

Figure 12 and Figure 13 provide screenshots of the model, comparing the Option 2 with the Base scenario. The screenshots show that in the AM peak hour the impacts of the scheme are limited, however in the PM peak hour congestion is shown building up across the network, especially impacting Adams Hill, Bexton Road and Stanley Road due to rerouting associated with car parking and reduced access on King Street.

### 3.2.3 Recommendations

The modelling shows that the proposal to remove all through traffic from King Street causes significant congestion on the existing highway network in the PM peak period. Opportunities for taking the scheme forward include allowing some access onto King Street to alleviate congestion along the A50 and / or upgrading junctions along the A50 (particularly Knutsford Roundabout) in order to accommodate the reassigned traffic flows.

Figure 10: Assigned Volume Comparison - AM Peak

PM Peak

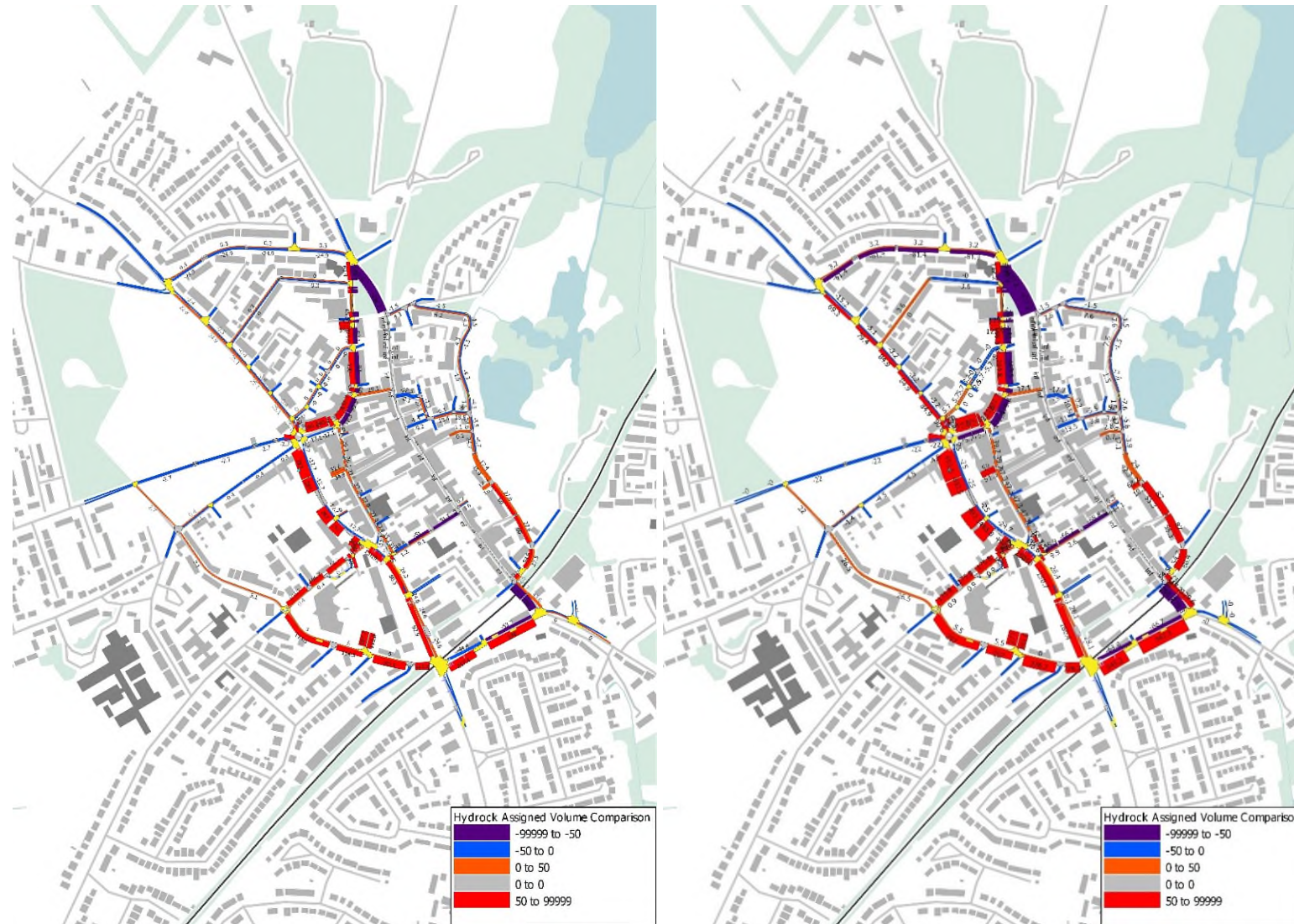


Figure 11: Density Plot - AM Peak



PM Peak



Figure 12: Screenshot AM Peak (08:30): Option 2: King Street

2024 Base



Figure 13: Screenshot PM Peak (17:00): Option 2: King Street

2024 Base



### 3.3 Initial Option 3: Canute Place One-Way (Including Princess Street)

#### 3.3.1 Description

Option 3 builds upon proposals included in the From Top to Bottom Street report with the creation of a new public realm area in Canute Place. This necessitates the closure of the southern section of Canute Place and the construction of a new pedestrian plaza and associated parking. Option 3 consists of a one-way eastbound configuration to Canute Place, creating an additional 90m<sup>2</sup> of public space including three pedestrian crossings across Canute Place.

This scheme also ties in with changes to Princess Street. Similar to King Street, these seek to remove through traffic and improve the street for pedestrians, cyclists and end users. The scheme maximises public realm space by removing the majority of on-street parking. This saves space for more footway widening and provision of street furniture and greenery. The Princess Street car park access is removed from Princess Street and re-located onto King Edward Road, this enables the downgrading of Princess Street to significantly reduce vehicle movements. The scheme also removes on-street parking along Princess Street, as such this has been re-assigned to existing town centre car parks as outlined in Table 7.

#### 3.3.2 Traffic Modelling

The scheme has been tested in the Knutsford Aimsun Model and results are presented in Figure 14 to Figure 17. The assigned volume difference plots show the changes in flow as a result of the closure of westbound access on Canute Place to Knutsford Roundabout and the downgrading of Princess Street with limited through traffic and removal of on-street parking. There are increases in traffic flows along Green Street caused by the removal of Canute Place westbound, whilst the removal of car parking creates increases in demand along Stanley Road into Booths car park. The simulated density plots show the resulting impact of these changes, with increases in density across the network. Figure 16 and Figure 17 provide screenshots of the model, comparing the Option 3 with the Base scenario. In line with the density plots the screenshots show that in both peak hours congestion increases with queues blocking back through junctions across the network.

#### 3.3.3 Recommendation

The modelling shows that the proposal to make Canute Place one-way causes significant congestion to the north of Knutsford Town Centre on the existing highway network as a result of pushing more traffic onto Manchester Road through Knutsford Roundabout.

It is therefore recommended that proposals to retain Canute Place with two-way operation are considered (see section 3.4, below).

Figure 14: Assigned Volume Comparison - AM Peak

PM Peak

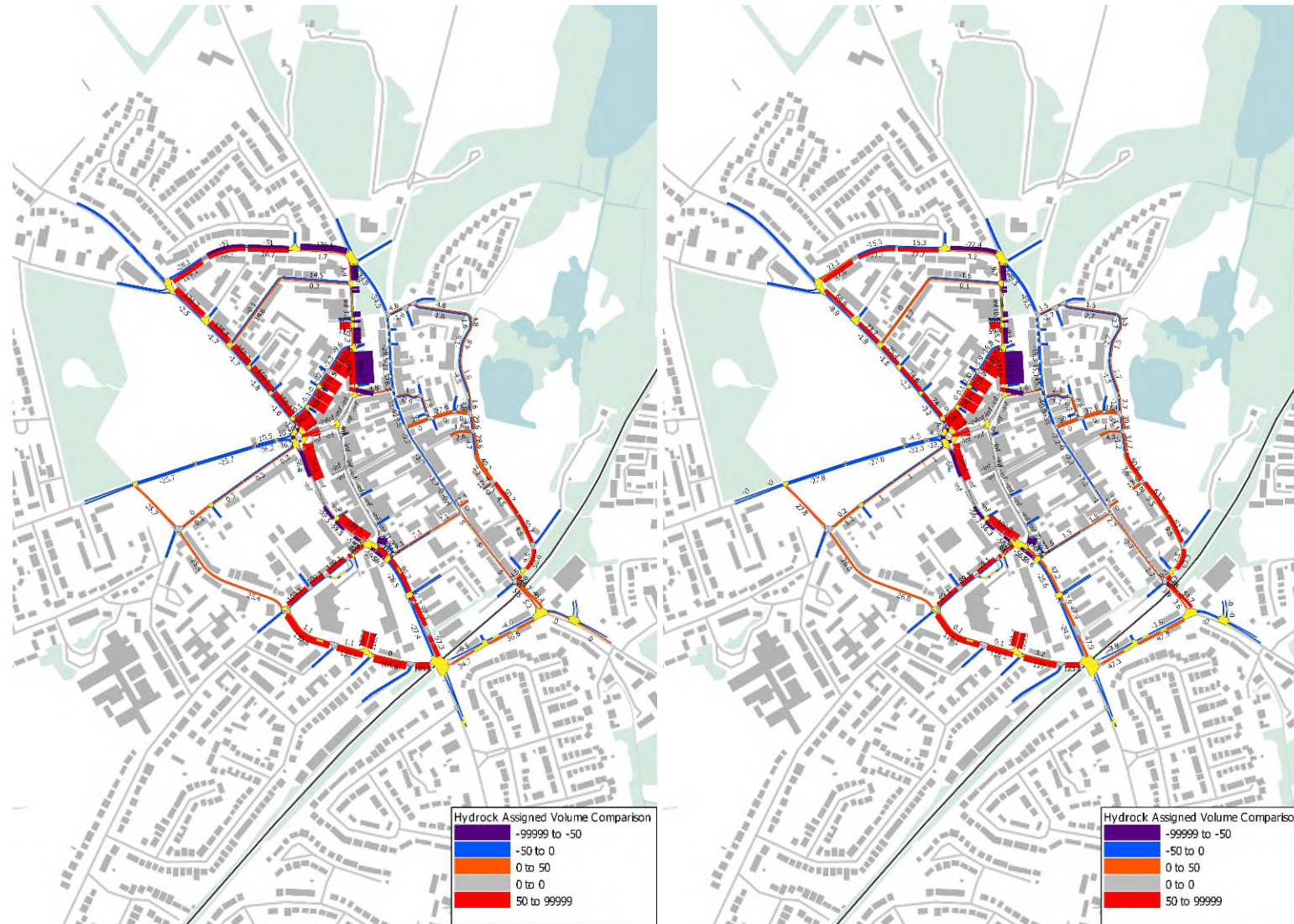


Figure 15: Density Plot - AM Peak



PM Peak



Figure 16: Screenshot AM Peak (08:30): Option 3: Canute Place One-Way

2024 Base



Figure 17: Screenshot PM Peak (17:00: Option 3: Canute Place One-Way

2024 Base



## 3.4 Initial Option 4: Canute Place Two-Way (Including Princess Street)

### 3.4.1 Description

Option 4 presents an alternative layout to Canute Place by keeping the two-way operation on Canute Place. In the two-way option this new public space is around 5 – 7m wide compared to 6 – 8m wide in the one-way option. Vehicular access is provided, where necessary, across pedestrian priority single surface spaces, to help create a townscape character that is less dominated by a highway aesthetic.

The scheme also ties in with changes to Princess Street. Similar to King Street, these seek to remove through traffic and improve the street for pedestrians, cyclists and end users. The scheme maximises public realm space by removing the majority of on street parking. This saves space for more footway widening and provision of street furniture and greenery. The Princess Street car park access is removed from Princess Street and re-located onto King Edward Road, this enables the downgrading of Princess Street to significantly reduce vehicle movements. The scheme also removes on street parking along Princess Street, as such this has been re-assigned to existing town centre car parks as outlined in Table 7.

### 3.4.2 Traffic Modelling

The scheme has been tested in the Knutsford Aimsun Model and results are presented in Figure 18 to Figure 21. The assigned volume difference plots show the changes in flow as a result of the changes to Princess Street. There are increases in flow around the Booths car park and the new Princess Street car park access onto the A50, however elsewhere there are no significant changes in flow.

The simulated density plots show that the impact of the changes are limited. The plots highlight increases in congestion around Knutsford Roundabout however this doesn't extend significantly downstream. Figure 20 and Figure 21 provide screenshots of the model and also highlight this pattern, showing queues forming around Knutsford Roundabout but not to a significant extent and to similar levels as the 2024 base scenario.

### 3.4.3 Recommendation

The modelling shows that the proposal to make Canute Place two-way along with changes to Princess Street do not severely impact the local highway network, although further mitigation could be considered to minimise the traffic impact.

Figure 18: Assigned Volume Comparison - AM Peak

PM Peak

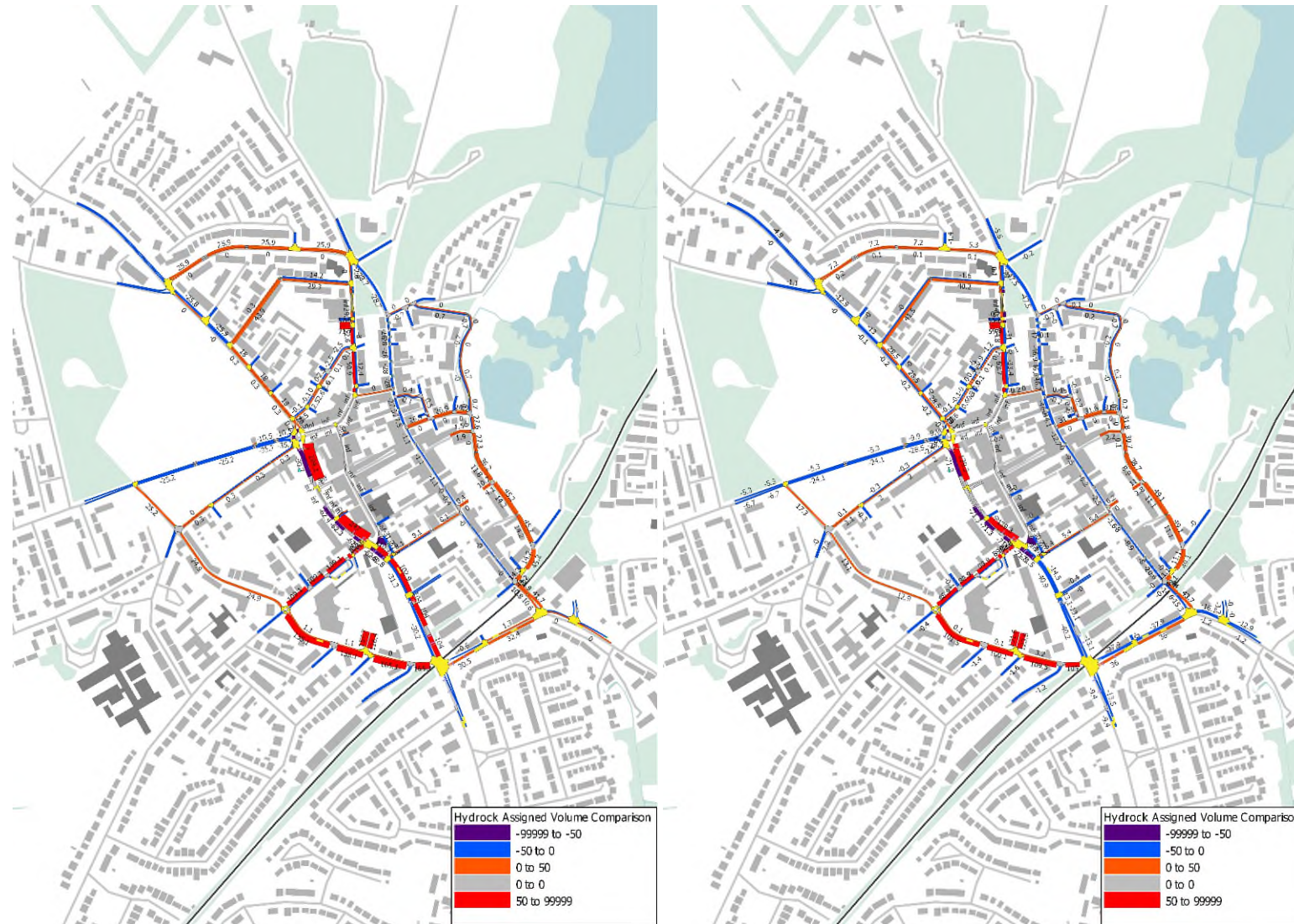


Figure 19: Density Plot - AM Peak



PM Peak



Figure 20: Screenshot AM Peak (08:30): Option 4: Canute Place Two-Way

2024 Base



Figure 21: Screenshot PM Peak (17:00): Option 4: Canute Place Two-Way

2024 Base



### 3.4.4 Princess Street Car Park

As detailed, Option 4 is a combination of Canute Place two-way scheme and Princess street car park. Given the Canute Place scheme retains two-way access on Canute Place, the impact of this scheme on the highway network is minimal. As such, the isolated impact of the Princess Street car park can be assessed from Option 4 scenario modelling results.

From the model replications it can be seen that in isolation the new Princess Street car park access operates satisfactorily with the existing demand. The northbound right turning traffic into the car park is accommodated in the right turn flare and doesn't block ahead movements.

As shown on Figure 22 the new pedestrian controlled signals, immediately south of the new car park access, can caused ripple queues back onto Knutsford roundabout, however this impact is temporary. For the purposes of the modelling the pedestrian crossing is called once every 90 seconds.

### 3.4.5 Recommendation

The requirement for a new additional controlled pedestrian crossing should be considered further to seek to minimise the impact on traffic on the A50. This should however be balanced with the improved accessibility and connectivity it could provide for pedestrians and cyclists.

Additionally, to further assess the impact of the car park access, existing car park demand (movements) should be surveyed and compare with the data assumed to date in the modelling which is derived from mobile phone ticket data and factored up using overall car park capacity.

Figure 22: Princess Street Car Park - AM Peak

PM Peak



## 3.5 Initial Option 5: Full Scenario

### 3.5.1 Description

Option 5 presents a "full scenario" option based upon the modelling results presented above. The full scenario option combines the following schemes:

- » Canute Place Two-Way
- » Princess Street Urban Realm Scheme (Including Car Park access onto the A50)
- » King Street Urban Realm Scheme

### 3.5.2 Traffic Modelling

The scheme has been tested in the Knutsford Aimsun Model and results are presented in Figure 23 to Figure 26. The assigned volume difference plots show the significant changes in flow across the network as a result of the package of schemes, in particular the closure of King Street to through traffic. The simulated density plots and screenshots show that in the AM peak the impact of the scheme is not significant, whilst in the PM peak there are network wide increases in congestion.

Figure 25 and 26 provide screenshots of the model and show that the PM peak has queuing issues impacting Adams Hill, Bexton Road and Stanley Road due to rerouting associated with car parking re-assignment and reduced access on Princess Street, and especially King Street.

### 3.5.3 Recommendation

Alternative scenarios could be investigated that bring in the recommendations identified the scheme components in isolation including:

- » Reducing the number of stages at the A50 / Bexton Road junction
- » Allowing some traffic to use King Street to reduce pressure on the A50 and Knutsford Roundabout
- » Mitigation for junctions on the A50 including Knutsford Roundabout

Figure 23: Assigned Volume Comparison - AM Peak

PM Peak

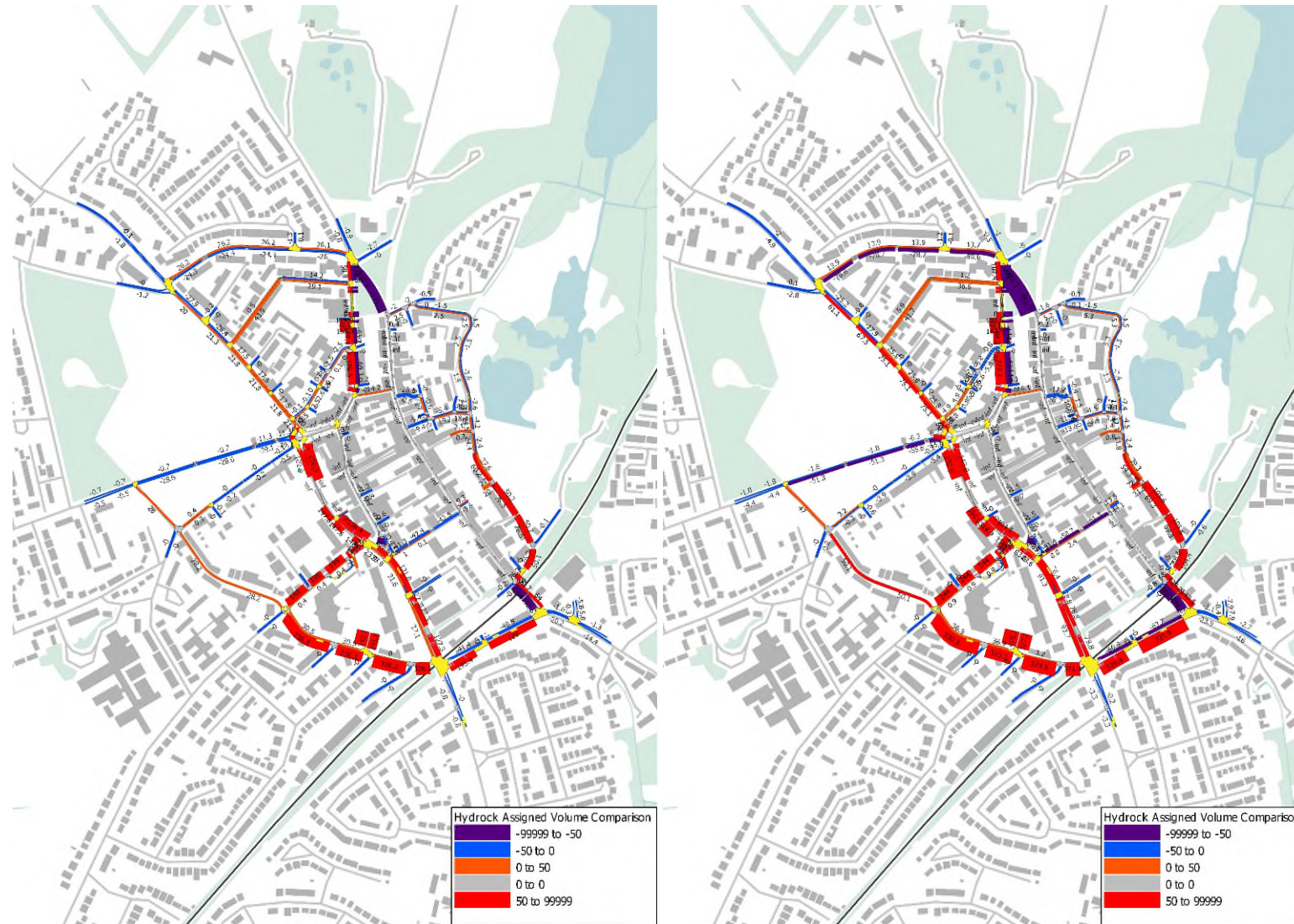


Figure 24: Density Plot - AM Peak



PM Peak



Figure 25: Screenshot AM Peak (08:30): Option 5: Full Scenario

2024 Base



Figure 26: Screenshot PM Peak (17:00): Option 5: Full Scenario

2024 Base



## 3.6 Initial Option 6: King Street Loop

### 3.6.1 Description

Option 6 presents an alternative layout for King Street which was noted in the From Top to Bottom Report. The layout allows for the cessation of through traffic on King Street and the creation of two circular systems providing access. To the north the loop is created by making Minshull Street westbound only and to the north of this King Street southbound only. Whilst the southern loop is created by providing a formal route through King Street car park between King Street and Moorside.

### 3.6.2 Traffic Modelling

The scheme has been tested in the Knutsford Aimsun Model and results are presented in Figure 27 to Figure 30.

The assigned volume difference plots show the significant changes in flow at the northern end of Knutsford Town, along Manchester Road, Green Street and Tatton Street. In general, this is caused by trips from Mareheath Lane which are re-assigned down Green Street.

The effect of this is an increase in congestion back from Knutsford Roundabout. Traffic flows on Mareheath Lane from the traffic surveys shows 357 and 311 vehicles in the two hour AM and PM peak periods, respectively. Given the model study area, all of this traffic is required to re-assigned down Green Street. However, in practice there may be wider re-assignment that is unable to be picked up in the model.

Figure 30 shows the wider network congestion in the PM peak associated with the proposal. Knutsford Roundabout is significantly impacted, with queuing and congestion also affecting A50 Manchester Road, Garden Road, Tatton Street.

### 3.6.3 Recommendation

If this option is to be taken forward, it is recommended that further measures are investigated to address the impact on the highway network, including mitigation at Knutsford Roundabout.

Figure 27: Assigned Volume Comparison - AM Peak

PM Peak

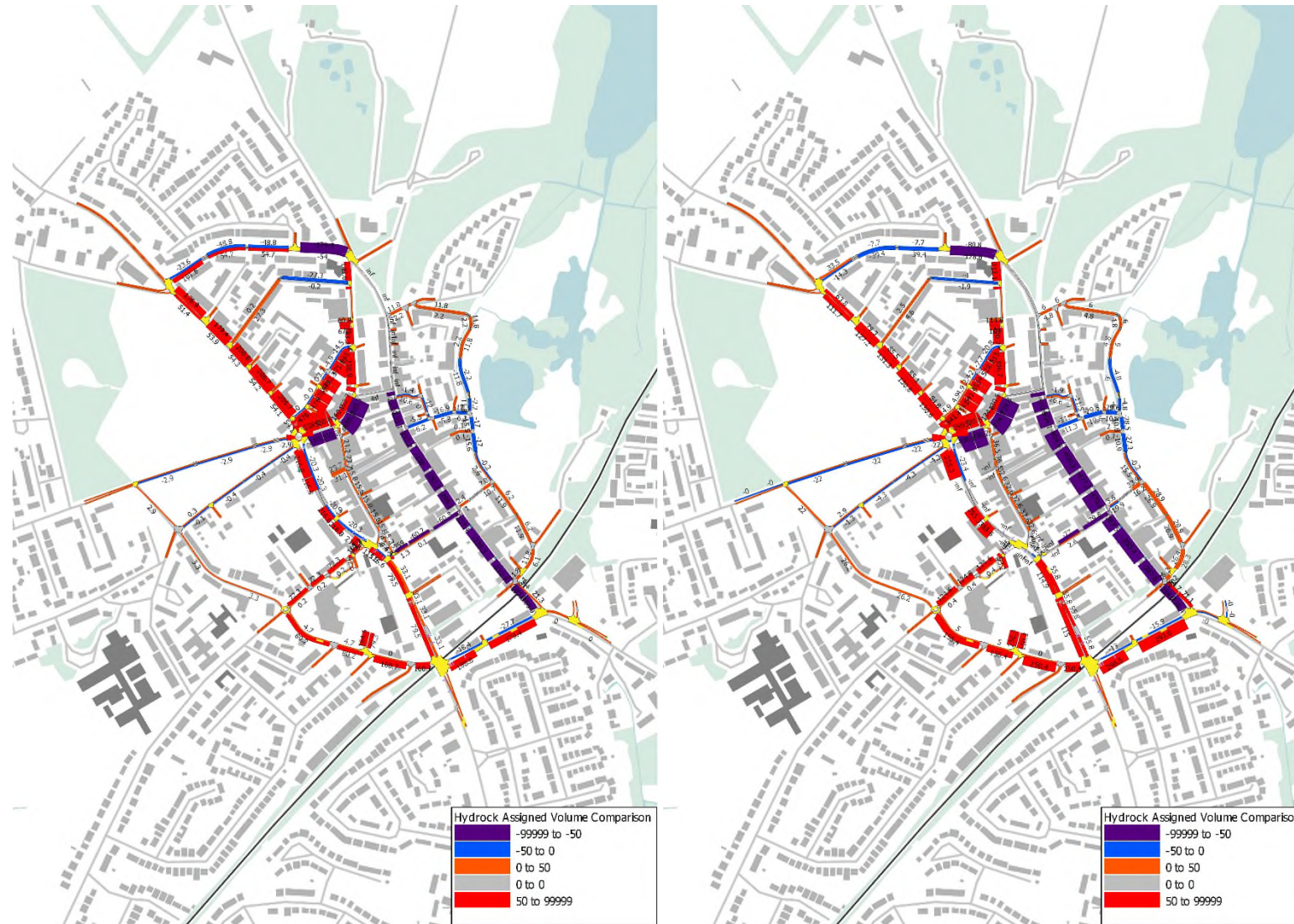


Figure 28: Density Plot - AM Peak

PM Peak



Figure 29: Screenshot AM Peak (08:30): Option 6: King Street Loop

2024 Base



Figure 30: Screenshot PM Peak (17:00): Option 6: King Street Loop

2024 Base



### 3.7 Overall Comparison

Network statistics provide a strategic overview of the performance of the whole network. These statistics have been extracted for each option tested to allow a high level quantitative comparison between the options. The following statistics are reported:

- » **Travel Time (unit: sec/km):** average time a vehicle needs to travel one kilometre inside the network. This is the mean of all the single travel times (exit time - entrance time) for every vehicle that has crossed the network, converted into time per kilometre.
- » **Delay time (unit: s/km):** mean delay incurred by vehicles travelling through the network in the modelled time period and is calculated as the difference between actual travel time and free flow travel.
- » **Flow (unit: veh/h):** mean number of vehicles that pass through the network in the modelled time period.
- » **Speed (unit: km/h):** mean speed of vehicles in the network.
- » **Density (unit: veh/km):** the mean number of vehicles per km of road space and is an indicator of queuing and congestion.
- » **Mean Queue (unit: veh):** the mean number of vehicles in queuing in the model, averaged over the modelled period.
- » **Vehicles Waiting to Enter (unit: Veh):** number of vehicles that are waiting to enter the network.

The network wide model statistics for each scenario are summarised in Table 8 and Table 9. Figure 31 and Figure 32 present the mean queue statistic graphically. As shown in the AM peak period, the modelled mean queue rises significantly in the Old Town Square, Canute Place One-way and King Street Loop options. In the PM peak period, generally there are increases in all options compared to the Do Minimum scenario, except for Canute Place Two-Way option which experiences less mean queuing than the Do Minimum scenario.

Table 8: Network Statistics AM Peak

Statistic	Units	Base	2030 Do Minimum	Option 1 - Old Town Square	Option 2 - King Street	Option 3 - Canute Place One-Way	Option 4 - Canute Place Two-Way	Option 5 - Full Scenario	Option 6 - King Street Loop
Travel Time	sec/km	219	262	447	253	279	291	309	378
Delay	sec/km per vehicle	140	183	368	176	201	213	233	301
Flow	veh/h	4,069	3,892	2,766	3,885	2,008	3,889	3,772	2,187
Speed	km/h	22	19	16	20	22	19	18	19
Density	veh/km	9	14	20	11	23	12	13	22
Mean Queue	veh	97	174	335	126	389	156	170	370
Vehicles Waiting to Enter	Veh	11	1,008	2,198	214	3,469	185	356	3,193

Table 9: Network Statistics PM Peak

Statistic	Units	Base	2030 Do Minimum	Option 1 - Old Town Square	Option 2 - King Street	Option 3 - Canute Place One-Way	Option 4 - Canute Place Two-Way	Option 5 - Full Scenario	Option 6 - King Street Loop
<b>Travel Time</b>	sec/km	213	378	509	412	230	254	417	294
<b>Delay</b>	sec/km per vehicle	134	299	429	336	152	174	340	217
<b>Flow</b>	veh/h	4,502	4,278	2,329	2,997	1,360	4,434	2,812	1,224
<b>Speed</b>	km/h	22	14	13	15	22	20	15	19
<b>Density</b>	veh/km	10	19	27	21	33	12	23	31
<b>Mean Queue</b>	veh	94	256	460	331	582	135	360	554
<b>Vehicles Waiting to Enter</b>	Veh	7	1,209	3,794	2,556	5,534	83	2,858	5,909

Figure 31: Network Flow - AM Peak Period

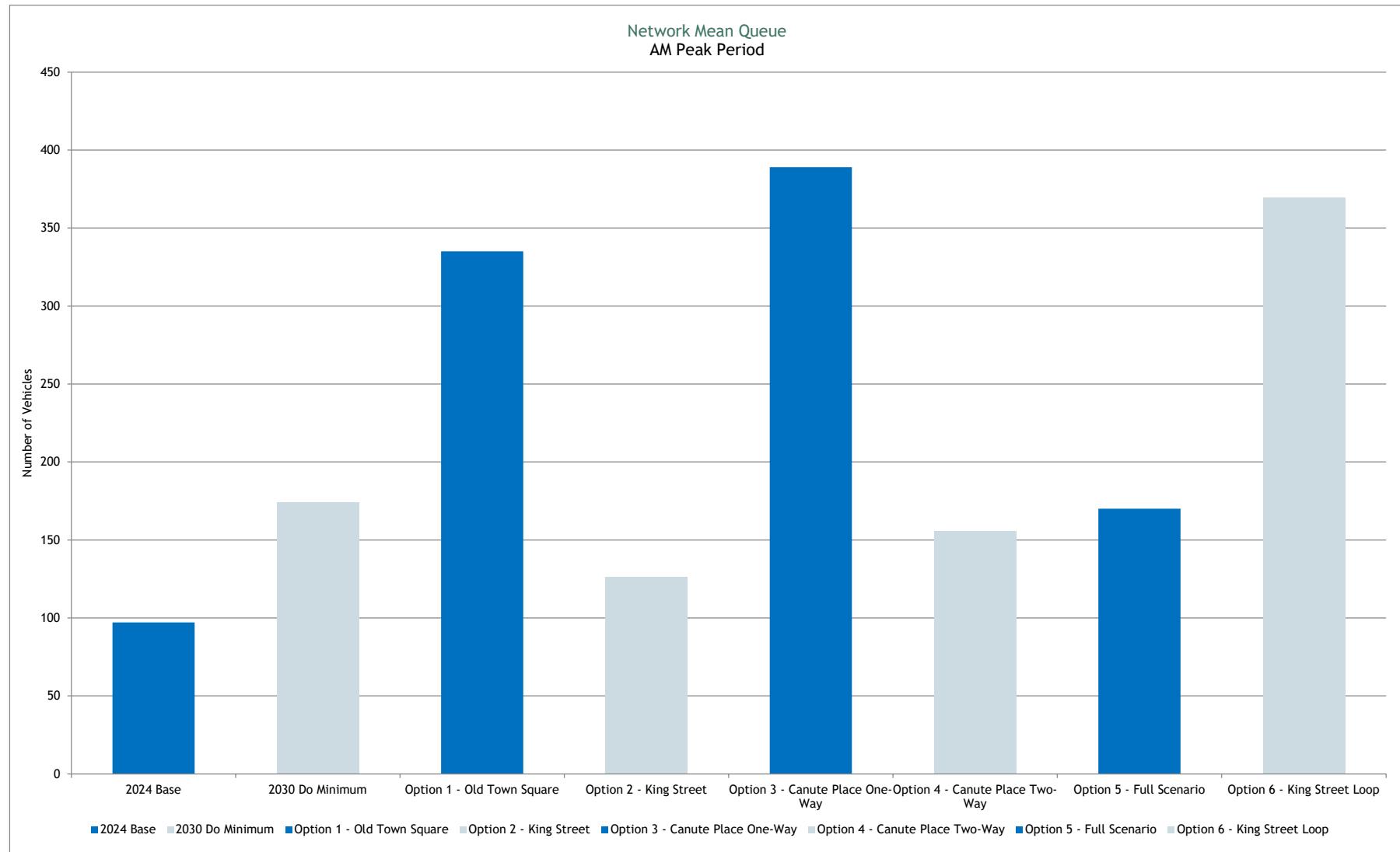
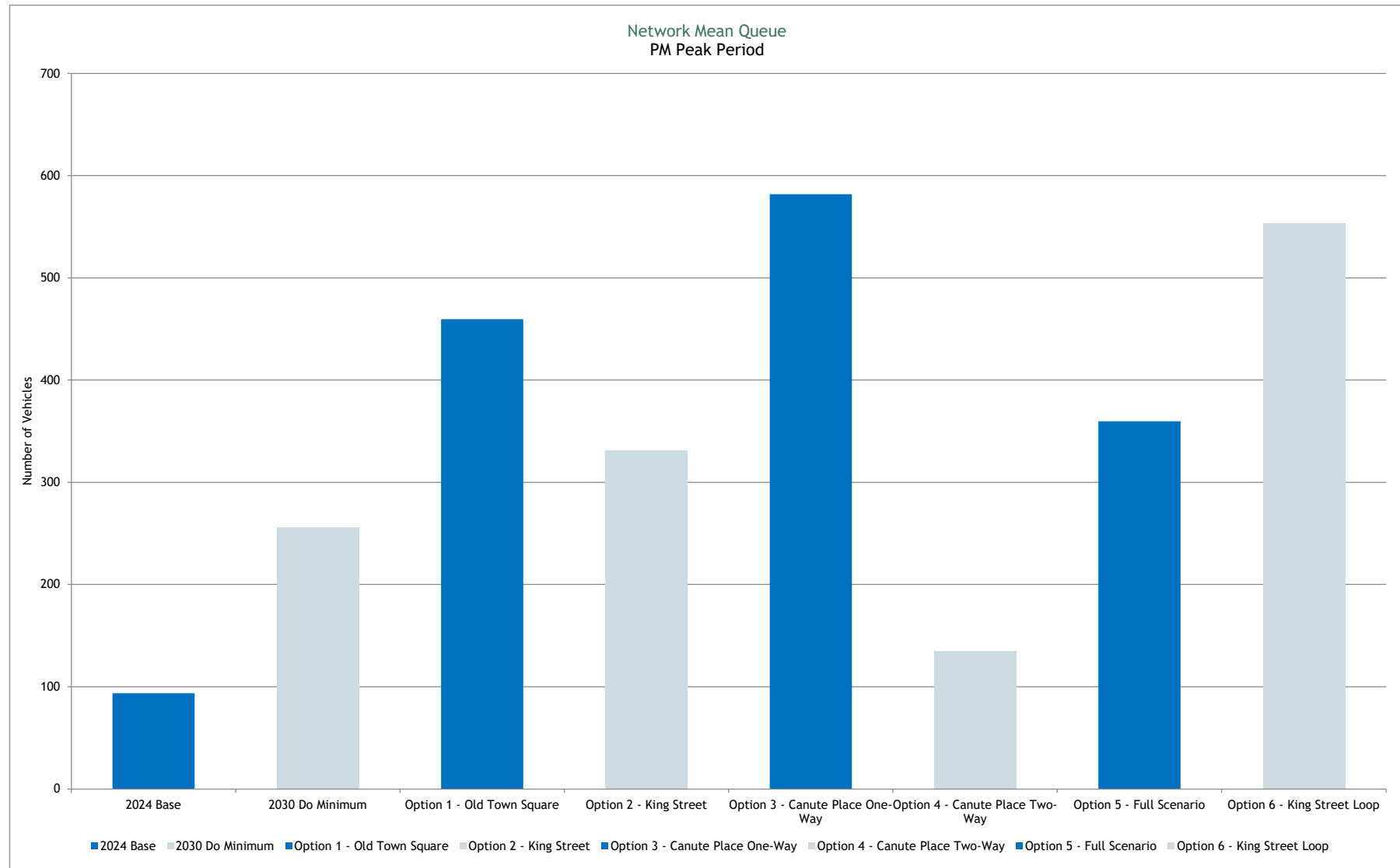


Figure 32: Network Flow - PM Peak Period



## 4. Traffic Demand Profile

As the Aimsun modelling undertaken to date only represents the AM and PM peak periods, an assessment of the available traffic data have been undertaken to demonstrate how traffic volumes typically vary across the day in Knutsford, and therefore allow consideration of potential time restricted interventions based on the results for options tested in Section 3 above.

Table 10 presents the total average hourly flow from three ATC's in Knutsford (Northwich Road, Toft Road and Manchester Road). The data provides a profile of hourly traffic flows through Knutsford between 7am and 7pm.

As shown, the AM peak period traffic is lower than the PM peak, which reflects the modelling results that generally show the schemes to work better in the AM peak period when flows and congestion are lower. As shown, the volume of traffic generally increases throughout the day, peaking between 4pm and 6pm.

Table 10: ATC Hourly traffic data

Time	Total Vehicles
07:00-08:00	2,022
08:00-09:00	2,652
09:00-10:00	2,756
10:00-11:00	2,837
11:00-12:00	3,023
12:00-13:00	3,209
13:00-14:00	3,127
14:00-15:00	3,222
15:00-16:00	3,485
16:00-17:00	3,776
17:00-18:00	3,628
18:00-19:00	2,557

The data presented above indicates that off-peak, or interpeak, implementation of potential interventions, such as restrictions to traffic movement on King Street, may not be viable due to the traffic volumes being more akin to the PM peak which is already shown in the modelling assessed in Section 3 to result in congested network operation.

## 5. Summary and Recommendations

### 5.1 Introduction

Hydrock have been commissioned by Knutsford Town Council to undertake Aimsun modelling in relation to feasibility studies on different aspects of the From Top to Bottom Street report to assess the viability of schemes.

This Modelling Report provides the detailed Aimsun modelling results for the possible scheme options. The assessment has been undertaken using the Knutsford Town Centre Model.

### 5.2 Summary

The Aimsun modelling shows that the existing highway network will struggle to cope with the increase in demand at Knutsford roundabout as a result of the cumulative committed development, however it is known that a scheme is being development to mitigate this impact.

In terms of the option assessment, modelling the results show that generally the movement of traffic away from the town centre streets (Kings Street and Princess Street) will put pressure on the existing A50 road network and in particular Knutsford Roundabout. The results show that some schemes work better than others, for example the impact of the Canute Place Two-Way option is comparable to the Do Minimum scenario. However overall further refinement of schemes is likely to be required in order to limit their impact on the highway network, particularly with the A50 forming a key route for traffic in the local and surrounding area.

### 5.3 Next Steps

The initial option modelling undertaken has shown that, the most deliverable scheme without any further changes to the highway network is the Canute Place Two-way option along with Princess Street.

Whilst the other schemes are shown to have impacts on the highway network this is expected given the removal of highway capacity and the concentration of traffic onto the A50 and through Knutsford Roundabout. However, the existing modelling does not take into account any reduction in vehicle demand that would occur from providing public realm improvements and therefore this represents a worst case scenario. Notwithstanding this, recommendations have been made within this report to enable the deliver, or partial delivery of these schemes.