Shropshire Council

# SHREWSBURY NORTH WEST RELIEF ROAD

## Traffic Forecasting Report - FBC 2024



TR003C
DECEMBER 2024

CONFIDENTIAL

Shropshire Council

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# 1 INTRODUCTION

## 1.1 BACKGROUND

1.1.1. WSP was commissioned by Shropshire Council in 2024 to support the Full Business Case (FBC) preparation for the proposed North West Relief Road (NWRR) in Shrewsbury.

1.1.2. The Shrewsbury North West Relief Road (NWRR) together with the A5 and A49 bypasses, the A5124 Battlefield Link Road and the proposed OLR, will provide the 'missing link', completing the full ring of the outer bypass of Shrewsbury and providing a new, more direct route between the northern and western parts of Shrewsbury.

1.1.3. Currently, north-west corridor through traffic has to use one of five main route options involving one of two routes passing through the town centre, using the inner distributor ring road, using the full length of the existing A5 / A49 outer bypass, or using unsuitable and narrow local roads to the north-west of the town.

1.1.4. With north-west corridor through traffic transferring to the new NWRR, the existing route options will all experience lower flows and congestion levels, and other journeys within and around the town will also be able to transfer to more appropriate routes within the town's road hierarchy. In addition, with the outer bypass ring complete, all long distance through journeys between the SRN links in the west and the MRN and other local 'A' roads in the north will be able to bypass the town completely.

## 1.2 TRAFFIC MODELLING AND FORECASTING

1.2.1. A traffic model was developed to facilitate the robust assessment and appraisal of the proposed Shrewsbury North West Relief Road (NWRR). The 2017 base year model was developed using SATURN software and utilised data from a number of sources including the mobile phone network data. The development and validation of this 2017 base model is described in 'Shrewsbury NWRR, Local Model Validation Report' (TR002 - December 2017).

The 2017 base model was used to develop a set of traffic forecasts for scheme opening year of 2022 and design year of 2037, these forecast outputs were used in the environmental and economic assessments of the NWRR scheme at Outline Business Case (OBC) stage. Details around the forecasting assumptions and the forecasting results can be found in Shrewsbury Northwest Relief Road Forecast Report (TR003A - February 2018). Further for the purposes of Planning Application of the proposed scheme, a forecast update was conducted in May 2020 using updated forecast assumptions with a new scheme opening year of 2023 and design year of 2038. Details around the forecasting assumptions and the results are reported in Shrewsbury Northwest Relief Road Traffic Forecast Report - Update (TR003B - May 2020).

## 1.3 PURPOSE OF REPORT

1.3.1. This report describes the methodology of updated 2024 traffic forecasts developed as part of the Full Business Case (FBC) preparation for the NWRR scheme. This report details the methodology adopted with the traffic forecast updates including a base model verification and presents the results of the model forecasts for the proposed scheme and surrounding area.

# 2 TRAFFIC MODEL

## 2.1 INTRODUCTION

2.1.1. This section of the report provides a brief overview of the approach adopted for the FBC traffic modelling. This includes the model specifications and checks undertaken regarding the use of the existing 2017 base model for the proposed scheme assessment.

2.1.2. As outlined in Chapter 1, two sets of forecast models were developed for the scheme in the past: the 2017 OBC model and the 2020 Planning Application model forecasts. Both models were developed based on the Department for Transport (DfT) growth projections applicable at the time, along with the most up-to-date local development assumptions collected from Shropshire Council's development team. These forecasts were based on pre Covid-19 pandemic and the pandemic might have altered the transport user behaviour in the post-pandemic scenario.

2.1.3. To check and address this issue, DfT has set out possible options for the models developed pre pandemic to account for the changes caused by the pandemic. One of the options recommended by TAG is to adopt a Model Verification process to assess whether the current model forecasts are consistent with the traffic trends observed post pandemic in the modelled area and the level of uncertainties associated with the forecasts.

## 2.2 MODEL VERIFICATION

2.2.1. As part of the FBC traffic model development, following the DfT's recommendation, a model verification exercise was undertaken to assess the continued use of the NWRR base model for the scheme appraisal.

2.2.2. A 2023 Do-Minimum forecast model was developed using the latest forecasting assumptions applicable at the time of the model verification exercise. This 2023 forecast model data was compared against the observed traffic data gathered from the Shrewsbury Annual traffic surveys conducted in 2023.

2.2.3. The findings of this verification assessment showed that, across all explicitly modelled peak time periods, the model provides a relatively good match against the 2023 observed traffic flows. These results were presented to the DfT at the start of the FBC model development, and it was concluded that the use of the current base model and the associated variable demand modelling suite is a valid, robust, and appropriate tool to assess the likely impact of the NWRR scheme. A technical note detailing the approach adopted with the model verification and the results of the verification exercise is presented within Appendix A of this document.

## 2.3 MODEL SPECIFICATION

2.3.1. This section provides a brief description of the model specification. Further details of the model specification are provided in the Local Model Validation Report.

### i) Model Time Periods

An analysis of the traffic count data showed that 08:00 to 09:00 hours for AM period and 17:00 to 18:00 hours for PM period were consistently higher within the respective peak periods across all sites.

The model has therefore been developed to represent three distinct time periods for an average weekday in March 2017, using hourly peak periods as follows:

- AM peak hour (08:00-09:00)
- PM peak hour (17:00-18:00)
- Inter peak average hour (10:00-16:00)

### ii) Vehicle Types and Trip Purposes

In order to represent differential demand responses, for example varying growth rates for different vehicle types, the model represents 5 different trip categories. These are as follows:

- Cars – Journey from home to work, and vice versa ("Commute")
- Cars – Employers Business
- Cars – Other trip purposes
- Light Goods Vehicles
- Heavy Goods Vehicles (including Medium Goods Vehicles)

### iii) Passenger Car Unit Factors

The traffic assignment model requires trips to be specified in terms of passenger car units. For the purposes of developing the matrices PCU factors were applied in accordance with standard practice as given in TAG.

The PCU factors are set out in Table 2-1 below.

**Table 2-1 – Vehicle PCU Factors**

| Vehicle Type | PCU Factor |
|---|---|
| CAR | 1.00 |
| LGV | 1.00 |
| HGV | 2.40 |

# 3 FORECASTING FUTURE TRAFFIC LEVELS

## 3.1 OVERVIEW

3.1.1. The forecast model comprises a process of predicting the future flows on roads in the study area and includes the following main components:

- Estimate of future highway supply.
- Estimate of future travel demand.
- A procedure to estimate the behavioural responses as a result of changes in future travel costs;
- A consideration of factors contributing to uncertainty in the forecast of future demand; and
- A mechanism of assigning demand to the highway network.

3.1.2. The future highway networks represent the most likely highway network for scheme opening year 2027 and the forecast years 2042 and 2050 including other road projects expected to be completed by these dates.

3.1.3. Future year demand forecasts were also produced for the years 2027, 2042 and 2050. The demand forecasts made use of DfT's latest version of TEMPro and the most up to date local development assumptions collected from Shropshire council's development team. As recommended in TAG, the overall demands were constrained to the appropriate national and regional traffic growth estimates. The key forecasting assumptions were captured and reported in the updated Uncertainty Log (Appendix B) along with their associated level of uncertainty.

3.1.4. The demand forecasts feed into the future year highway assignment models which, using information on likely future travel costs, predict the traffic flows on highway links (in each time period) within the wider study area. This section details the development of traffic forecasts and presents the key assumptions and uncertainties underpinning them.

## 3.2 SCOPE OF FORECASTS

3.2.1. The forecasts presented in this report have been prepared for the forecast years 2027, 2042 and 2050.

3.2.2. Forecasts scenarios have been prepared utilising a 'variable demand' modelling approach that takes account of the change in demand in response to the change in the costs of travel due to the inclusion of the Scheme.

3.2.3. The forecasts have been prepared as per TAG Unit M4 (May 2024) for the Core growth scenario and for the following Common Analytical Scenarios (CAS):

- Low Economy
- High Economy
- Regional

Details on the development of the CAS are provided in Chapter 5.

## 3.3 FORECAST NETWORKS

### DO-MINIMUM (DM)

3.3.1. The Do-Minimum forecast networks represent the existing highway network and any schemes which are considered to be either committed or are expected to be implemented in the future. The list of all the local highway improvement scheme was collected from Shropshire council's development team at the start of the FBC model development. For any potential scheme to consider within the forecast, it is necessary to establish the level of uncertainty and when it is likely to be in place in order to include it in the appropriate forecast year network.

3.3.2. The list of highway schemes presented in Table 3-1 were added to the 2017 base year model to create the forecast Do-Minimum networks. These scheme locations are shown in Figure 3-1 below. In line with guidance set out in TAG Unit M4, all the highway schemes identified to include in the forecast models were classified as either 'near certain' or 'more than likely'.

**Table 3-1 – Do-Minimum highways interventions.**

| Scheme No. | Scheme | Base Year Coding | Future Years |
|---|---|---|---|
| 1 | Mytton Oak Rd next to Royal Shrewsbury Hospital | Single file traffic controlled by signals as eastbound lane was cut off due to roadworks. | Eastbound lane restored and signals removed. |
| 2 | London Road A5064 | Single file traffic controlled by signals as northbound lane was narrowed down due to roadworks | Northbound lane restored and signals removed. |
| 3 | Chester St A528 (Between Cross St and Benbow Quay) | Capacity and speed limits reduced in both ways as southbound lane was narrowed down. | Normal capacity and speed limits restored. |
| 4 | Welshpool Road | Coded as single file traffic controlled by signals to simulate manual traffic control due to roadworks. | Lane restored and signals removed. |
| 5 | Shelton Road B4380 | Single file traffic controlled by signals as Southbound lane was cut off due to roadworks. | Southbound lane restored and signals removed. |
| 6 | Frankwell Roundabout Exit - Copthorne Road | Due to roadworks, Frankwell Roundabout Exit though Copthorne Road was closed off. | Exit restored. |
| 7 | Meole Brace Roundabout | Roundabout. | Roundabout layout changed and traffic link added between Roman Road and the A5122 exit towards the A5 as part of Shrewsbury Integrated Transport Package. |
| 8 | Chester Street / Castle Gates gyratory | Cruise speeds as surveyed in March 2017. | Cruise speeds limited to 20mph throughout surrounding area associated with proposed 20mph zone extension in Shrewsbury Integrated Transport Package. |
| 9 | English Bridge | Old Potts Way approach with one lane. | Old Potts Way approach with 1 lane plus flare as recognised by Shrewsbury Integrated Transport Package. |

| | | | |
|---|---|---|---|
| 10 | Coleham Roundabout | Coded as crossroads. | Changed to mini roundabout as recognised by Shrewsbury Integrated Transport Package. |
| 11 | Reabrook Roundabout | Standard capacity roundabout. | Approaches widened and capacity increased as recognised by Shrewsbury Integrated Transport Package. |
| 12 | Crowmeole Lane | Normal two-way flow. | No Through Road. |
| 13 | Battlefield Roundabout and Battlefield Road | Roundabout. | Improvements to Battlefield Roundabout and Battlefield Road as result of new Aldi store. |
| 14 | Arlington Way and TRO | Signal in base | Improvements to traffic signals at Arlington Way and TRO. |
| 15 | Featherbed Lane | Cruise Speed at 30mph | Traffic calming scheme on Featherbed Lane. |
| 16 | Roundabout at Mytton Oak Road / Squinter Pip Way | Three Arm Roundabout | Addition of arm to at Roundabout Mytton Oak Road – Squinter Pip Way to became through road to Hanwood Road |
| 17 | New Street | Two-way Street. | Conversion to one-way street. |
| 18 | Hereford Road | Dual Carriageway separated by central reservation. | Addition of a Signalised junction in association to a new residential development near Meole Bace Retail Park. |
| 19 | Whelshpool Road | Two-way Street connecting to Churncote Roundabout to the West. | No Access to any vehicle West of Calcott Lane in the Do-Minimum Network only. |
| 20 | Oxon Link Road (OLR) | Non-existent. | Oxon Link Road is included, with a speed of 50mph. |

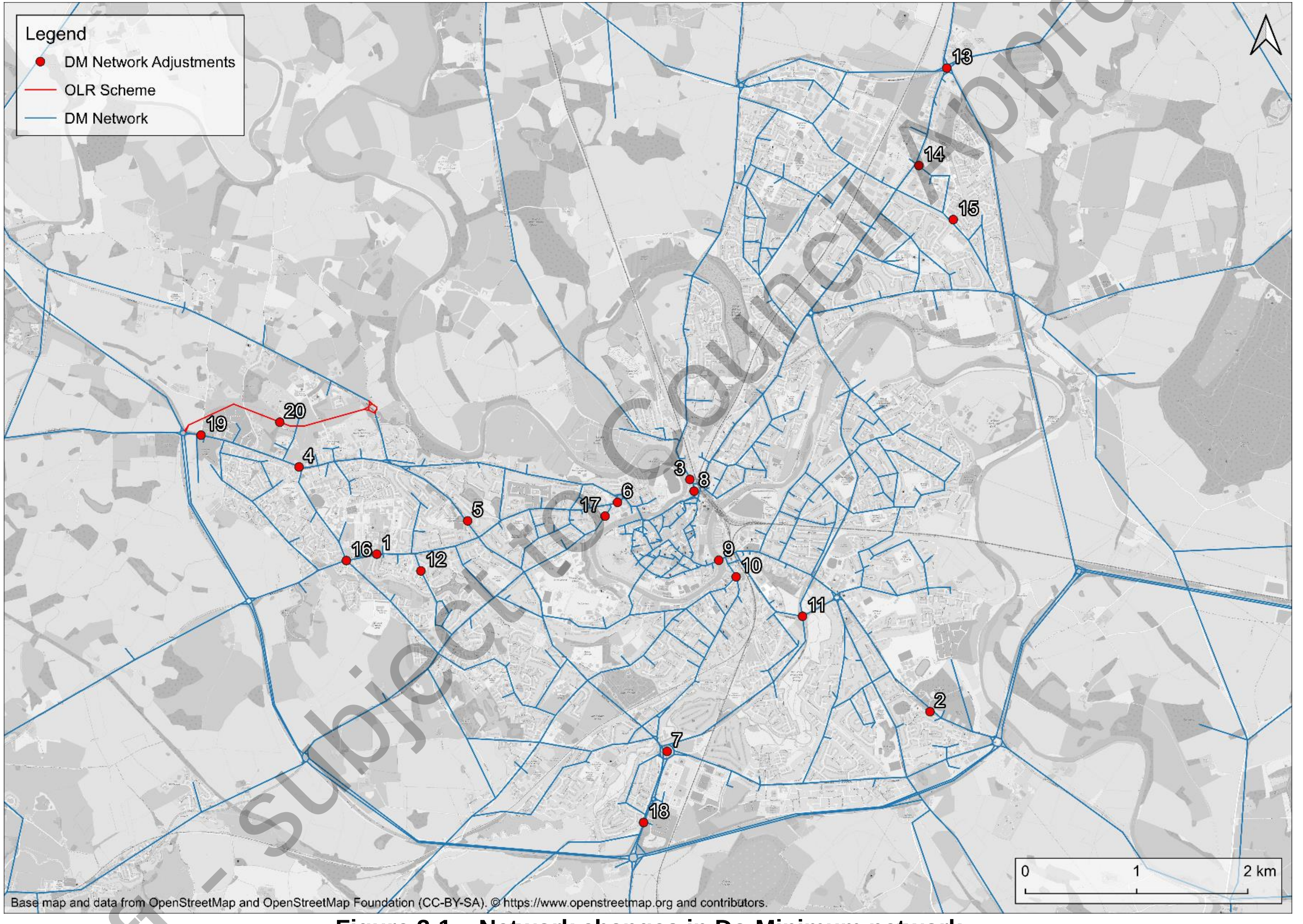


**Figure 3-1 – Network changes in Do-Minimum network**

### DO-SOMETHING (DS)

3.3.3. The Do-Something network has been built from the Do-Minimum by including the North West Relief Road (NWRR) corridor and removing the ban on Welshpool road (with 20mph speed restriction) as shown in Figure 3-2 below.


**Figure 3-2 – Network changes in Do-Something**

## 3.4 DEMAND FORECASTS

3.4.1. The forecasts of future year demand for the Shrewsbury NWRR model were based upon:

- national demographic, economic and behavioural trends, using the Department for Transports forecasts; and
- updated proposed local land use developments.

3.4.2. The derivation of growth forecasts for the study area, considering national and local growth factors, is described in the paragraphs below.

3.4.3. The same demand scenario was used for the Do-Minimum and Do-Something matrices.

## 3.5 TEMPRO GROWTH

3.5.1. TEMPro (Trip End Modelling PROgram) is the Department for Transport's computer model for predicting future trip end totals and hence the growth in travel demand. The current version is NTEM 8.1 and this has been used in the development of demand forecasts for 2027, 2042 and 2050.

3.5.2. TEMPro takes input of various demographic data, largely from population census data, together with forecasts of housing, jobs and population. From this information it estimates other demographic data for the future, car ownership levels and ultimately trip end growth, by mode, purpose and by time period.

3.5.3. TEMPro growth for all of Shropshire was extracted at the finest reported TEMPro zone level. Outside of Shropshire, a TEMPro growth factor was determined at the Region/County/Authority level based on the model zoning system. Growth was extracted for car drivers, by time period and by journey purpose.

3.5.4. The forecast change in trip ends across different TEMPro journey purposes were combined to align with the model user classes. Growth factors for each model user class were then calculated accordingly. The growth factors were applied at individual traffic model zone level, matched to the TEMPro zones, using a furnessing procedure.

3.5.5. A summary of the resultant TEMPro growth at a wider spatial level for Shrewsbury, Shropshire and GB is shown in Table 3-2 below for the modelled peak periods.

**Table 3-2 – TEMPro Growth Factors**

| TEMPro | 2017 to 2027 | | | 2017 to 2042 | | | 2017 to 2050 | | |
|---|---|---|---|---|---|---|---|---|---|
| **Car commute trips** | **AM** | **IP** | **PM** | **AM** | **IP** | **PM** | **AM** | **IP** | **PM** |
| Shrewsbury | 1.099 | 1.096 | 1.095 | 1.148 | 1.138 | 1.135 | 1.156 | 1.142 | 1.139 |
| Shropshire | 1.101 | 1.099 | 1.099 | 1.158 | 1.153 | 1.152 | 1.167 | 1.157 | 1.157 |
| GB | 1.084 | 1.078 | 1.080 | 1.143 | 1.129 | 1.133 | 1.155 | 1.136 | 1.141 |
| **Car business trips** | **AM** | **IP** | **PM** | **AM** | **IP** | **PM** | **AM** | **IP** | **PM** |
| Shrewsbury | 1.104 | 1.107 | 1.105 | 1.157 | 1.162 | 1.157 | 1.167 | 1.171 | 1.167 |
| Shropshire | 1.101 | 1.098 | 1.101 | 1.160 | 1.156 | 1.161 | 1.171 | 1.165 | 1.171 |
| GB | 1.085 | 1.082 | 1.084 | 1.147 | 1.141 | 1.144 | 1.161 | 1.153 | 1.157 |
| **Car other trips** | **AM** | **IP** | **PM** | **AM** | **IP** | **PM** | **AM** | **IP** | **PM** |
| Shrewsbury | 1.122 | 1.129 | 1.116 | 1.251 | 1.268 | 1.225 | 1.288 | 1.308 | 1.254 |
| Shropshire | 1.121 | 1.126 | 1.118 | 1.246 | 1.262 | 1.232 | 1.280 | 1.299 | 1.261 |
| GB | 1.092 | 1.095 | 1.090 | 1.170 | 1.177 | 1.163 | 1.197 | 1.206 | 1.186 |

3.5.6. Table 3-3 shows how the growth factors used for Shrewsbury compared to the growth forecasted in the region and in Great Britain for a typical 24-hour weekday. It can be observed that there is no significant difference in growth factors between Shrewsbury and Shropshire. Additionally, the growth forecasted in Shropshire is slightly higher than in the West Midlands and Great Britain. This trend is similar for all purposes.

**Table 3-3 - 24 Hour Weekday TEMPro Growth Factors**

| TEMPro | | Car commute trips | Car business trips | Car other trips | All purpose trips combined |
|---|---|---|---|---|---|
| 2017 to 2027 | Shrewsbury | 1.095 | 1.106 | 1.121 | 1.112 |
| | Shropshire | 1.098 | 1.101 | 1.122 | 1.113 |
| | West Midlands | 1.088 | 1.093 | 1.107 | 1.100 |
| | GB | 1.079 | 1.084 | 1.092 | 1.088 |
| 2017 to 2042 | Shrewsbury | 1.137 | 1.159 | 1.245 | 1.207 |
| | Shropshire | 1.149 | 1.159 | 1.246 | 1.209 |
| | West Midlands | 1.145 | 1.156 | 1.211 | 1.186 |
| | GB | 1.132 | 1.143 | 1.171 | 1.157 |
| 2017 to 2050 | Shrewsbury | 1.142 | 1.168 | 1.279 | 1.231 |
| | Shropshire | 1.154 | 1.168 | 1.279 | 1.232 |
| | West Midlands | 1.152 | 1.166 | 1.242 | 1.208 |
| | GB | 1.141 | 1.156 | 1.196 | 1.176 |

## 3.6 GOODS VEHICLE GROWTH

3.6.1. There are no available local data to support the calculation of HGV and LGV growth forecasts at the trip end level. Future LGV and HGV growth factors were derived in accordance with DfT TAG guidance (TAG Unit M4). The DfT's National Road Traffic Projections (NRTP 2022) for the growth in goods vehicle kilometres in England were used (https://www.gov.uk/government/publications/national-road-traffic-projections)

3.6.2. The forecast growth of freight vehicle km has been used to estimate growth in goods vehicle demand relative to the base year and is presented in Table 3-4 below. The growth factors were applied at individual traffic model zone level.

**Table 3-4 – Growth Factors for LGV and HGV**

| Year | Vehicle-km growth (NRTP 2022) | |
|---|---|---|
| | LGV | HGV |
| 2017 | 1.00 | 1.00 |
| 2027 | 1.206 | 1.047 |
| 2042 | 1.405 | 1.119 |
| 2050 | 1.510 | 1.149 |

## 3.7 LOCAL DEVELOPMENTS

3.7.1. Local developments located within the core study area were considered in the demand forecasts. In line with guidance from TAG unit M4 Table A2, this comprised developments for which planning consent had been either granted or application submitted, or those developments which have been allocated in Site Allocations and Management of Development (SAMDev) Plan for Shropshire.

3.7.2. The Uncertainty Log has been developed and finalised in consultation with the development team at Shropshire Council in advance of the FBC model development in March 2024 and is presented in Appendix B. Uncertainty Log data provided developments covering 2027 and 2038. For the forecast years 2042 and 2050, trip generation for these local developments is based on the 2038 data plus TEMPro background growth rates between 2038 and the corresponding forecast year.

3.7.3. All developments within the study area, irrespective of their size, were considered. However, in line with TAG guidance, only those developments assigned a likelihood level of 'near certain' or 'more than likely' were explicitly included in the demand forecasts as shown in Figure 3-3.

3.7.4. The relatively small developments, comprising less than 100 residential units or employment developments producing less than 100 trips (origin/destination combined) in any time period were incorporated within the existing model zone structure. The more significant developments, namely those exceeding the above thresholds, were allocated to separate model zones.

3.7.5. The locations of the updated significant developments and their site IDs, referenced in the Uncertainty Log in Appendix B, are shown in Figure 3-4 below.


**Figure 3-3 – Location of new Residential and Employment Developments**

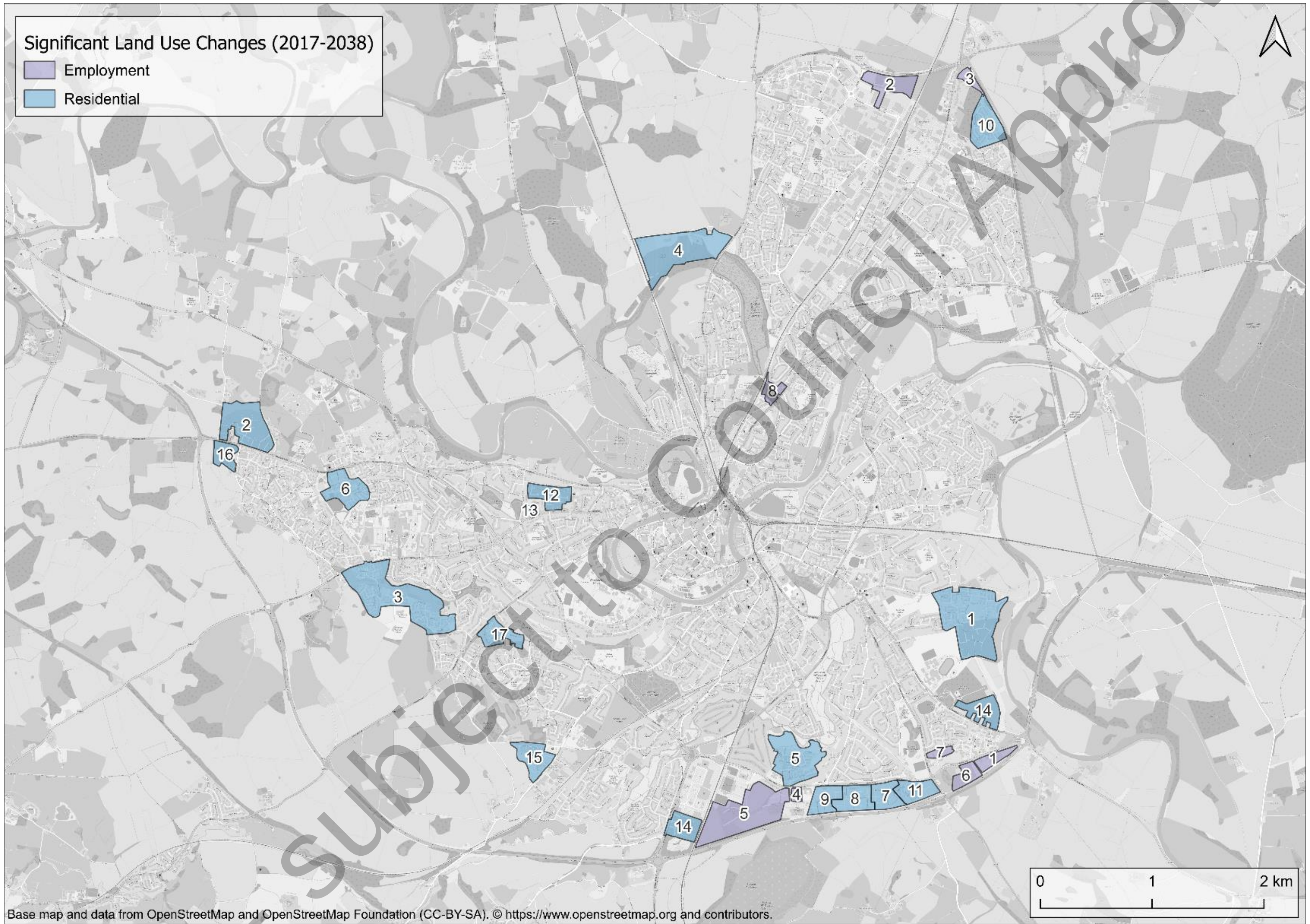


**Figure 3-4 – Location of Significantly major new Residential and Employment Developments**

## 3.8 DEVELOPMENT TRIP GENERATION

3.8.1. The trips from the new developments were estimated by applying relevant trip rate assumptions from the TRICS database corresponding to the landuse of the developments. To ensure robust estimates, a proportion of goods vehicle trips were also estimated and added separately based on the landuse of the new developments.

3.8.2. The resulting trip generation associated with the developments presented in the Uncertainty Log is shown for Cars, LGVs and HGVs in Table 3-5 and

3.8.3. Table 3-6. These tables presents the trip generation in terms of total volume of traffic generated by the combined development sites.

**Table 3-5 – Vehicle Growth associated with developments in Uncertainty Log (2027)**

| Vehicle Generation (pcu/h) | Production (AM) | Production (IP) | Production (PM) | Attraction (AM) | Attraction (IP) | Attraction (PM) |
|---|---|---|---|---|---|---|
| CAR | 2430 | 1433 | 2781 | 2442 | 1426 | 2416 |
| LGV | 25 | 55 | 59 | 75 | 31 | 24 |
| HGV | 18 | 36 | 15 | 29 | 21 | 11 |
| Total | 2473 | 1524 | 2855 | 2546 | 1478 | 2451 |

**Table 3-6 - Vehicle Growth associated with developments in Uncertainty Log (2042/2050)**

| Vehicle Generation (pcu/h) | Production (AM) | Production (IP) | Production (PM) | Attraction (AM) | Attraction (IP) | Attraction (PM) |
|---|---|---|---|---|---|---|
| CAR | 2496 | 1498 | 2989 | 2671 | 1485 | 2471 |
| LGV | 27 | 61 | 65 | 85 | 34 | 24 |
| HGV | 19 | 39 | 17 | 32 | 23 | 12 |
| Total | 2542 | 1598 | 3071 | 2788 | 1542 | 2507 |

3.8.4. As recommended in TAG, the overall trips were constrained to TEMPro growth factors at Shrewsbury district level to ensure that the overall growth did not exceed the growth predicted by the National Trip End Model.

Similar approach was adopted for LGVs and HGVs, controlling the totals to the growth forecasted by NRTP-22.

## 3.9 VARIABLE DEMAND

3.9.1. For the assessment of the Shrewsbury NWRR, a full variable demand approach was adopted whereby the behavioural responses to changes in travel costs were taken into account to redistribute the total predicted demand. Within the NWRR model, this was implemented using discrete choice models whereby total demand was split into smaller segments through a series of choice models.

3.9.2. The demand model was developed using a combination of two software platforms, SATURN for the highway assignment models and CUBE-Voyager for the bespoke demand models. The functions of the respective software platforms were as follows:

3.9.3. SATURN provided assignment functionality where trip matrices were assigned to a highway network. The resultant traffic volumes impacted on traffic speeds, queues and delays and the associated cost information was fed back to the demand model.

3.9.4. The cost skims from the SATURN highway assignments were also used to derive a fixed cost function to represent public transport costs as per TAG M2 guidance.

3.9.5. CUBE-Voyager provided the demand model structure. Costs from individual time periods of the model were combined to reflect daily costs. The costs govern choice of frequency (how often to travel) and distribution (where to travel to). The resultant travel demand matrices were fed back to SATURN to assign and generate new costs. The process was iterated until stable convergence solution was reached.

3.9.6. The Shrewsbury VDM employed a pivot-point model. This involved incremental cost change to derive changes in demand from a reference trip matrix (i.e. forecast demand matrix prior to adjustment by travel cost).

3.9.7. The change in generalised costs was produced by calculating the difference between the 'Pivot-Point Cost' (from the validated 2017 Base Year model) and 'reference costs' from assignment of the matrix which was to be adjusted. The costs were composite (inclusive of all perceived elements) and were calculated for each level of the choice hierarchy to reflect the choice made at a lower level in the hierarchy. TAG M2 sets out the main choice response mechanisms and their hierarchical order that may be considered in variable demand models. The responses are as follows:

- Trip frequency;
- Mode choice;
- Time of day choice (macro and/or micro time period choice);
- Destination choice (trip distribution); and
- Route choice (assignments)

3.9.8. A choice mechanism placed higher in the hierarchy should reflect the composite costs of choices lower in the hierarchy.

3.9.9. The model adopted a looping procedure to achieve stability. During each cycle, the composite costs were calculated for each level in the hierarchy, since each level requires combinations of cost in relation to the choices made lower in the hierarchy.

3.9.10. In the hierarchy, the composite cost calculation weights costs by choices made according to the parameters used. Choice calculations were then made down the hierarchy and the whole cycle was recalculated until an acceptable degree of convergence was achieved.

3.9.11. A full description of the development of the variable demand modelling procedures has been documented in Shrewsbury North West Relief Road Demand Model Report (Ref TR005, - February 2018), which covers the need for variable demand, the scope and form of the model and the results of the model calibration, model convergence statistics and sensitivity tests.

## 3.10 UNCERTAINTY IN FORECASTING PROCESS

3.10.1. It is recognised that forecasts are subject to uncertainty with the accuracy of forecasts decreasing in the later years in the forecast period.

3.10.2. Uncertainty can be at a national or local level. National uncertainty is associated with forecasting in the NTM, as reported through TEMPro. The factors under consideration include GDP growth, fuel prices, vehicle efficiency and other national trends. The use of TEMPro growth within the demand forecasting process has been discussed in Section 3.5 above. Local uncertainty depends on whether developments or other planned transport schemes go ahead in the vicinity of the scheme being built.

3.10.3. Uncertainty has a bearing on forecast traffic volumes, patterns of traffic flows with a consequential impact on the economic and environmental assessments.

3.10.4. The key consideration in the assessment of uncertainty in local demand is the nature of development, together with its location, size and timing for becoming occupied.

3.10.5. As noted above, details of prospective developments were collated from local planning authorities and captured within the Uncertainty Log presented in Appendix B. Only those developments located within the core study area and whose likelihood was assessed to be either 'near certain' or 'more than likely' were considered in the demand forecasts.

3.10.6. Since there was no scheme dependent development, the same demand growth assumptions were applied in both the Do-Minimum and the Do-Something scenarios. In line with TAG guidance, the overall growth in demand was constrained to TEMPro forecast, hence the local planning data informed the spatial distribution, rather than the precise quantum of the total demand growth. The impact of uncertainty around any particular local development coming forward was therefore minimised. Consequently, no further sensitivity testing was carried out with respect to local land use proposals.

3.10.7. Forecasts have been prepared for a Core scenario and sensitivity tests have been undertaken following DfT's Common Analytical Scenario (CAS) approach for Low economy, High economy and Regional growth scenarios.

## 3.11 FORECAST SUMMARY

3.11.1. The trip end growth forecasts were used to factor the base year trip matrices using growth factors for each time period, trip purpose, and vehicle type. An iterative Furness process was applied to alternately factor row and column totals to match the target trip end totals. A balancing factor was applied to make the target row and column totals equal to ensure the Furness process would converge.

3.11.2. The matrices were then assigned through the Variable Demand Model. Table 3-7 and

Table 3-8 below shows the resulting hourly totals for the Do-Minimum and the Do-Something scenario as a result of the VDM. The matrix totals are presented for each purpose, vehicle category and time period for the three forecast years. The 2017 Base year totals are also presented for comparison.

### Table 3-7 - Summary of Matrix Totals – Do-Minimum (pcu/h)

| Year | Time Period | Cars | | | Good Vehicles | | Total |
|---|---|---|---|---|---|---|---|
| | | Commuter | Business | Other | LGV | HGV | |
| 2017 | AM | 21,960 | 6,450 | 19,671 | 4,165 | 1,527 | 53,773 |
| | IP | 4,309 | 5,580 | 27,328 | 3,435 | 1,300 | 41,952 |
| | PM | 11,685 | 6,058 | 29,169 | 3,403 | 779 | 51,094 |
| 2027 | AM | 23,842 | 7,089 | 21,724 | 5,040 | 1,603 | 59,299 |
| | IP | 4,687 | 6,118 | 30,538 | 4,157 | 1,365 | 46,865 |
| | PM | 12,677 | 6,646 | 32,265 | 4,117 | 818 | 56,523 |
| 2042 | AM | 25,819 | 7,470 | 24,690 | 5,873 | 1,710 | 65,563 |
| | IP | 5,014 | 6,420 | 34,579 | 4,844 | 1,457 | 52,313 |
| | PM | 13,555 | 7,002 | 36,148 | 4,798 | 872 | 62,375 |
| 2050 | AM | 26,160 | 7,539 | 25,490 | 6,290 | 1,756 | 67,234 |
| | IP | 5,053 | 6,466 | 35,701 | 5,187 | 1,496 | 53,903 |
| | PM | 13,673 | 7,059 | 37,131 | 5,138 | 896 | 63,896 |

### Table 3-8 - Summary of Matrix Totals – Do-Something (pcu/h)

| Year | Time Period | Cars | | | Good Vehicles | | Total |
|---|---|---|---|---|---|---|---|
| | | Commuter | Business | Other | LGV | HGV | |
| 2017 | AM | 21,960 | 6,450 | 19,671 | 4,165 | 1,527 | 53,773 |
| | IP | 4,309 | 5,580 | 27,328 | 3,435 | 1,300 | 41,952 |
| | PM | 11,685 | 6,058 | 29,169 | 3,403 | 779 | 51,094 |
| 2027 | AM | 23,976 | 7,098 | 21,804 | 5,040 | 1,603 | 59,521 |
| | IP | 4,693 | 6,112 | 30,559 | 4,157 | 1,365 | 46,886 |
| | PM | 12,720 | 6,652 | 32,333 | 4,117 | 818 | 56,639 |
| 2042 | AM | 25,968 | 7,478 | 24,781 | 5,873 | 1,710 | 65,810 |
| | IP | 5,025 | 6,414 | 34,606 | 4,844 | 1,457 | 52,345 |
| | PM | 13,615 | 7,009 | 36,257 | 4,798 | 872 | 62,551 |
| 2050 | AM | 26,308 | 7,547 | 25,581 | 6,290 | 1,756 | 67,482 |
| | IP | 5,065 | 6,460 | 35,731 | 5,187 | 1,496 | 53,938 |
| | PM | 13,735 | 7,066 | 37,250 | 5,138 | 896 | 64,085 |

3.11.3. Table 3-9 below shows the difference between the Do-Minimum and the Do-Something matrices. As expected, the changes in costs and the better connectivity produced by the NWRR generates an increase in the demand. However, this increase is not significant, and it remains below the 0.5% in all the time periods and scenarios modelled.

**Table 3-9 – Comparison between Do-Something and Do-Minimum matrices after the VDM (pcu/h)**

| Year | Time Period | Cars | | | Good Vehicles | | Total |
|---|---|---|---|---|---|---|---|
| | | Commuter | Business | Other | LGV | HGV | |
| 2027 | AM | 134 | 8 | 80 | 0 | 0 | 222 (+0.4%) |
| | IP | 6 | -6 | 21 | 0 | 0 | 21 (+0.0%) |
| | PM | 43 | 5 | 68 | 0 | 0 | 116 (+0.2%) |
| 2042 | AM | 149 | 8 | 91 | 0 | 0 | 248 (+0.4%) |
| | IP | 11 | -6 | 27 | 0 | 0 | 32 (+0.1%) |
| | PM | 60 | 7 | 109 | 0 | 0 | 176 (+0.3%) |
| 2050 | AM | 148 | 8 | 92 | 0 | 0 | 247 (+0.4%) |
| | IP | 12 | -6 | 30 | 0 | 0 | 35 (+0.1%) |
| | PM | 62 | 8 | 120 | 0 | 0 | 189 (+0.3%) |

3.11.4. The proportions of vehicle types and trip purposes based on the Do-Minimum matrix trip totals for the core scenario are presented in Table 3-10. The NWRR scheme is not expected to affect these vehicle and trip purpose splits, as demonstrated by the equivalent data shown in Table 3-11, based on the Do-Something matrix trip totals.

**Table 3-10 - Vehicle Proportions (percentage of total trips) – Do-Minimum**

| Year | Time Period | Cars | | | Good Vehicles | | Total |
|---|---|---|---|---|---|---|---|
| | | Commuter | Business | Other | LGV | HGV | |
| 2017 | AM | 41% | 12% | 37% | 8% | 3% | 100% |
| | IP | 10% | 13% | 65% | 8% | 3% | 100% |
| | PM | 23% | 12% | 57% | 7% | 1% | 100% |
| 2027 | AM | 40% | 12% | 37% | 8% | 3% | 100% |
| | IP | 10% | 13% | 65% | 9% | 3% | 100% |
| | PM | 22% | 12% | 57% | 7% | 1% | 100% |
| 2042 | AM | 39% | 11% | 38% | 9% | 3% | 100% |
| | IP | 10% | 12% | 66% | 9% | 3% | 100% |
| | PM | 22% | 11% | 58% | 8% | 1% | 100% |
| 2050 | AM | 39% | 11% | 38% | 9% | 3% | 100% |
| | IP | 9% | 12% | 66% | 10% | 3% | 100% |
| | PM | 21% | 11% | 58% | 8% | 1% | 100% |

Table 3-11 - Vehicle Proportions (percentage of total trips) – Do-Something

| Year | Time Period | Cars | | | Good Vehicles | | Total |
|---|---|---|---|---|---|---|---|
| | | Commuter | Business | Other | LGV | HGV | |
| 2017 | AM | 41% | 12% | 37% | 8% | 3% | 100% |
| | IP | 10% | 13% | 65% | 8% | 3% | 100% |
| | PM | 23% | 12% | 57% | 7% | 1% | 100% |
| 2027 | AM | 40% | 12% | 37% | 8% | 3% | 100% |
| | IP | 10% | 13% | 65% | 9% | 3% | 100% |
| | PM | 22% | 12% | 57% | 7% | 1% | 100% |
| 2042 | AM | 39% | 11% | 38% | 9% | 3% | 100% |
| | IP | 10% | 12% | 66% | 9% | 3% | 100% |
| | PM | 22% | 11% | 58% | 8% | 1% | 100% |
| 2050 | AM | 39% | 11% | 38% | 9% | 3% | 100% |
| | IP | 9% | 12% | 66% | 10% | 3% | 100% |
| | PM | 21% | 11% | 58% | 8% | 1% | 100% |

3.11.5. Table 3-10 and Table 3-11 show that for the Do-Minimum and Do-Something, commuter trips are predominant during the AM period and are lower during the Inter peak period and PM period. Other purpose trips are predominant during the Inter peak period. The proportions of HGVs are similar during the AM and Inter peak periods and lowest during the PM period. The proportions of each trip purpose remain similar in Do Minimum and Do Something scenarios and between each of the forecast years.

## 3.12 ASSIGNMENT MODEL

3.12.1. The future trip demand matrices were assigned to the highways network and an equilibrium process applied which enabled the traffic to seek alternative routes according to cost between each origin and destination. This is designed to represent drivers' choice of routes.

3.12.2. TAG Unit M3-1 (May 2024) provides the convergence criteria that transport models should aim to achieve in order to provide stable, consistent and robust results. Table 3-12 below shows the convergence measures. The model achieved required level of convergence for each of the modelled time period across all the scenarios, details are presented in Appendix C.

Table 3-12 - TAG Convergence Measures

| Measure of convergence | Base Model Acceptable Values |
|---|---|
| Delta and %Gap | Less than 0.1% or at least with convergence fully documented and all other criteria met |
| Percentage of links with flow change < 1% | Four consecutive iterations greater than 98% |

3.12.3. Each trip matrix was assigned separately (by user class and time period) as the values of time and vehicle operating costs used in the assignment vary by vehicle type and trip purpose. The assignment parameters were a combination of time and operational costs and were calculated using TAG databook v1.23, May 2024 issue, latest version available at the period of assessment.

3.12.4. The highway assignment parameters are presented in Table 3-13 and Table 3-14 below for time and vehicle operating costs respectively.

**Table 3-13 - Assignment Parameter – Values of Time (pence per minute)**

| Year | Time Period | Cars | | | Goods Vehicles | |
|---|---|---|---|---|---|---|
| | | Commuter | Business | Other | LGV | HGV |
| 2017 | AM | 20.55 | 30.65 | 14.18 | 21.66 | 50.58 |
| | IP | 20.89 | 31.41 | 15.11 | 21.66 | 50.58 |
| | PM | 20.62 | 31.09 | 14.85 | 21.66 | 50.58 |
| 2027 | AM | 21.75 | 32.43 | 15.00 | 24.12 | 57.94 |
| | IP | 22.10 | 33.23 | 15.98 | 24.12 | 57.94 |
| | PM | 21.82 | 32.90 | 15.71 | 24.12 | 57.94 |
| 2042 | AM | 27.21 | 40.58 | 18.77 | 30.17 | 72.49 |
| | IP | 27.65 | 41.58 | 20.00 | 30.17 | 72.49 |
| | PM | 27.30 | 41.16 | 19.66 | 30.17 | 72.49 |
| 2050 | AM | 30.25 | 45.11 | 20.87 | 33.54 | 80.59 |
| | IP | 30.74 | 46.22 | 22.23 | 33.54 | 80.59 |
| | PM | 30.36 | 45.76 | 21.86 | 33.54 | 80.59 |

**Table 3-14 - Assignment Parameters – Vehicle Operating Costs (pence per km)**

| Year | Cars | | | Goods Vehicles | |
|---|---|---|---|---|---|
| | Commuter | Business | Other | LGV | HGV |
| 2017 | 5.53 | 12.07 | 5.53 | 12.61 | 47.10 |
| 2027 | 6.24 | 12.52 | 6.24 | 13.75 | 38.22 |
| 2042 | 4.25 | 9.41 | 4.25 | 12.20 | 33.49 |
| 2050 | 3.91 | 8.98 | 3.91 | 11.87 | 32.94 |

# 4 TRAFFIC FORECASTS

## 4.1 FORECAST TRAFFIC PATTERNS

4.1.1. The forecasts presented in this chapter have been produced utilising a ‘variable demand’ modelling approach that takes account of the change in demand in response to the change in the costs of travel due to the inclusion of the Scheme.

4.1.2. Do Minimum and Do Something forecast scenarios have been prepared for the three forecast years 2027, 2042 and 2050.

4.1.3. Forecast year trip matrices were assigned to respective networks and detailed traffic flows are presented and discussed in Section 4.2 below.

4.1.4. Table 4-1 below summarises the changes in traffic levels between the 2017 base and the future Do-Minimum core scenario for each forecast year.

4.1.5. Table 4-2 summarises the changes in travel time and travel distance per vehicle and Table 4-3 summarises the change in average speed between the Do-Minimum (DM) and Do-Something (DS).

**Table 4-1 – Change in Vehicle Kilometres and Vehicle Hours between 2017 Base and DM**

| Time Period | PCU Kms | | | PCU Hours | | |
|---|---|---|---|---|---|---|
| | 2017-2027 | 2017-2042 | 2017-2050 | 2017-2027 | 2017-2042 | 2017-2050 |
| AM | 8.0% | 23.7% | 27.4% | 11.7% | 34.2% | 39.9% |
| IP | 11.2% | 31.8% | 37.1% | 11.2% | 34.8% | 41.5% |
| PM | 8.7% | 24.1% | 27.8% | 11.2% | 32.7% | 38.3% |

**Table 4-2 - Change in Vehicle Kilometres and Vehicle Hours between DM and DS**

| Time Period | PCU Kms | | | PCU Hours | | |
|---|---|---|---|---|---|---|
| | 2027 | 2042 | 2050 | 2027 | 2042 | 2050 |
| AM | 0.6% | 0.4% | 0.5% | -2.6% | -2.2% | -2.1% |
| IP | 0.2% | 0.3% | 0.4% | -1.6% | -2.0% | -1.9% |
| PM | 0.4% | 1.0% | 1.1% | -2.2% | -2.1% | -2.2% |

**Table 4-3 - Model Average Speed for DM and DS**

| Time Period | DM (kph) | | | DS (kph) | | | DS - DM | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2027 | 2042 | 2050 | 2027 | 2042 | 2050 | 2027 | 2042 | 2050 |
| AM | 57.4 | 54.8 | 54.1 | 59.3 | 56.3 | 55.5 | +1.9 | +1.5 | +1.4 |
| IP | 64.9 | 63.5 | 63.0 | 66.2 | 65.0 | 64.5 | +1.3 | +1.5 | +1.5 |
| PM | 58.1 | 55.6 | 55.0 | 59.7 | 57.4 | 56.8 | +1.6 | +1.8 | +1.8 |

4.1.6. Table 4-1 shows the net increases in vehicle kilometres travelled and vehicle hours in Do-Minimum scenario compared to 2017 Base scenario. This is the result of the increased demand over the forecast years.

Table 4-2 shows a slight increase in vehicle kilometres and a significant reduction in travel time between Do-Minimum and Do-Something. This is the result of the improved traffic conditions and delay reduction produced by the NWRR Scheme. This is confirmed by the increase in average speed in Do-Something shown in Table 4-3.

## 4.2 TRAFFIC FORECASTS

4.2.1. The daily traffic forecasts prepared are presented in Figure 4-1 for 2027, Figure 4-2 for 2042 and Figure 4-3 for 2050.

4.2.2. The traffic forecasts in Figure 4-1 to Figure 4-3 are expressed in Annual Average Daily flow Totals (AADT) and show directional flows. The top box shows the predicted Do Minimum flow (i.e. without the proposed scheme) the second box shows the Do Something flow (expressed as the absolute flow change compared to the Do Minimum) and the third box shows the percentage change in flow between the Do Something and Do Minimum.

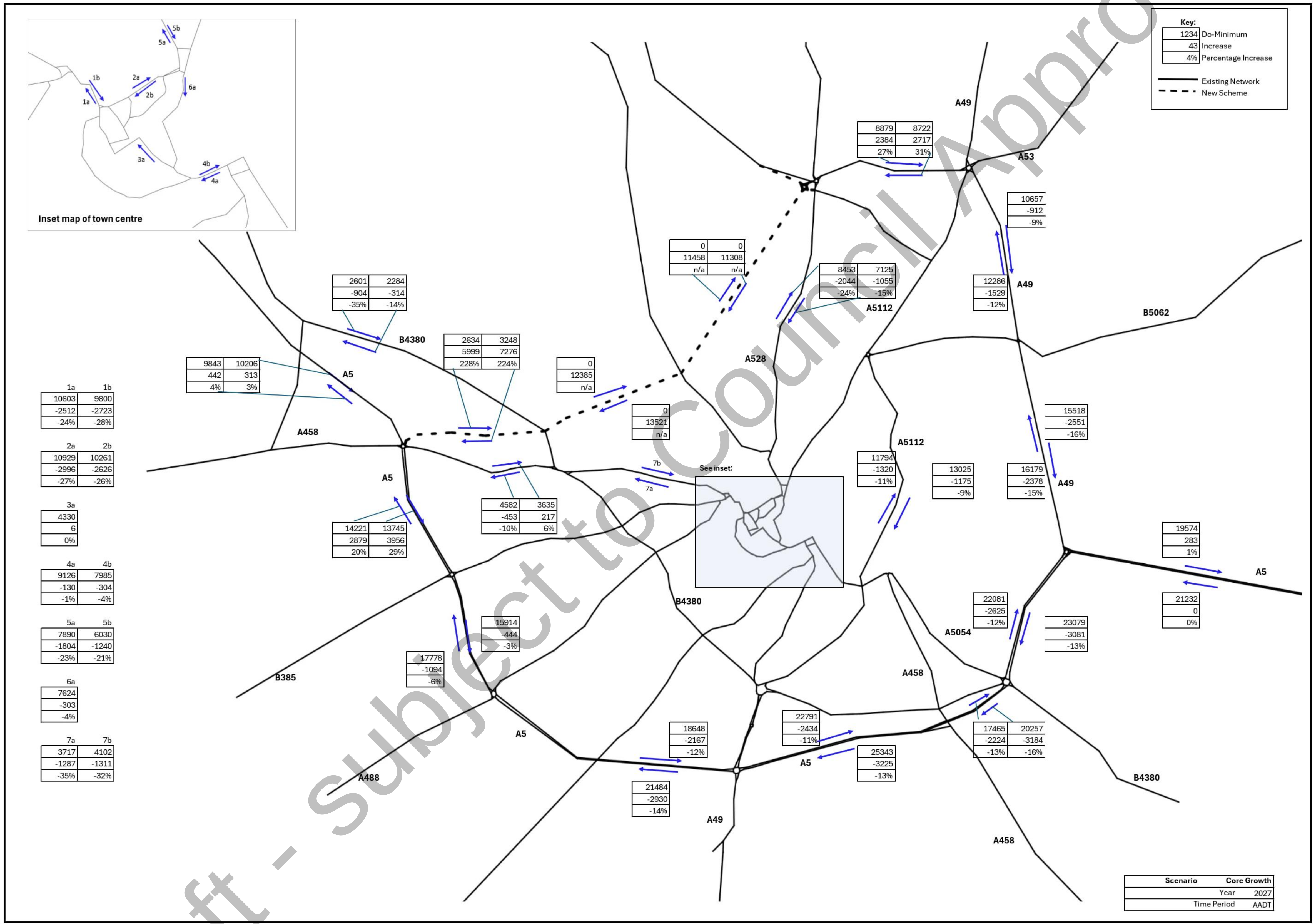


**Figure 4-1 – 2027 Forecasts (AADT)**

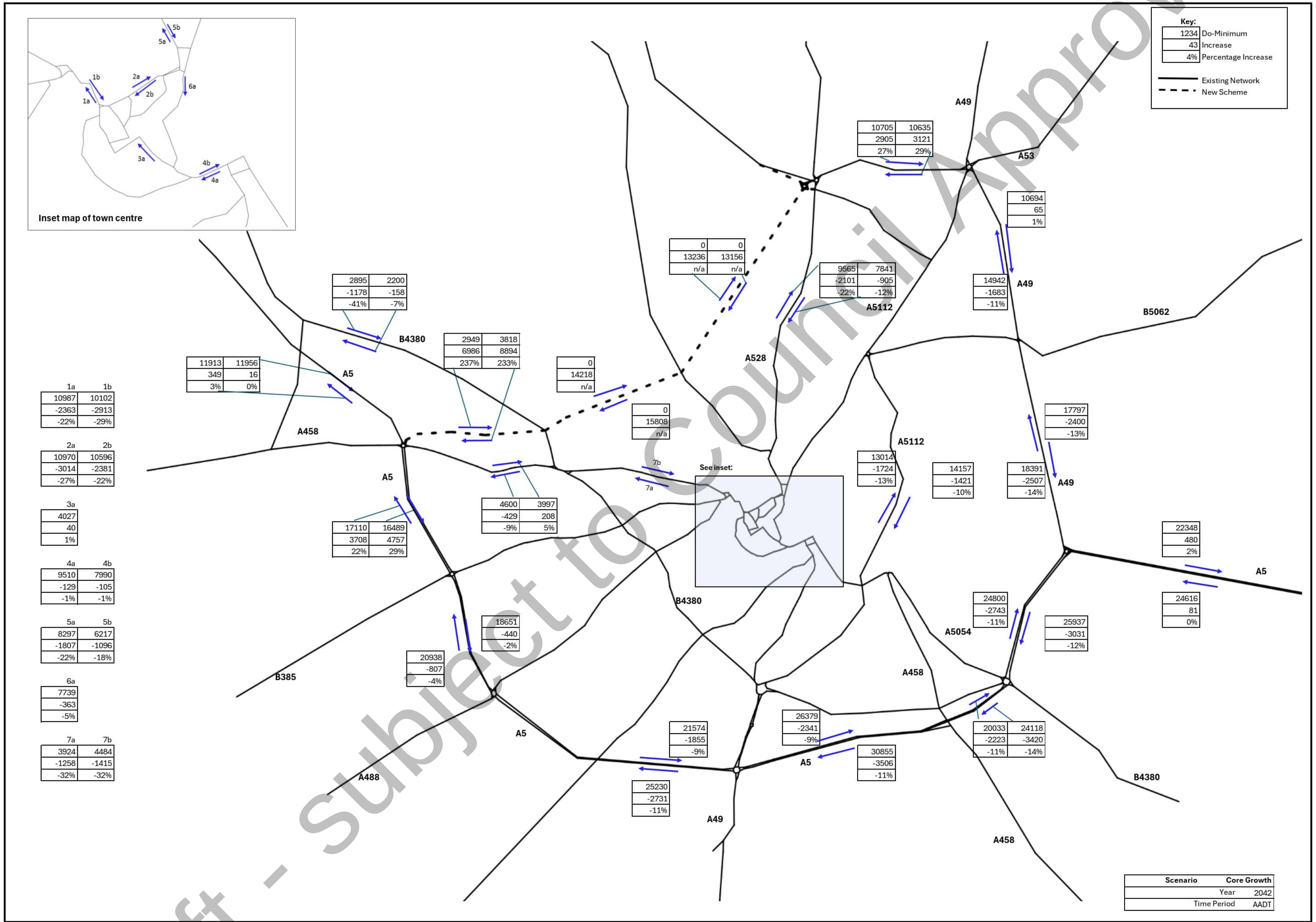


Figure 4-2 - 2042 Forecasts (AADT)

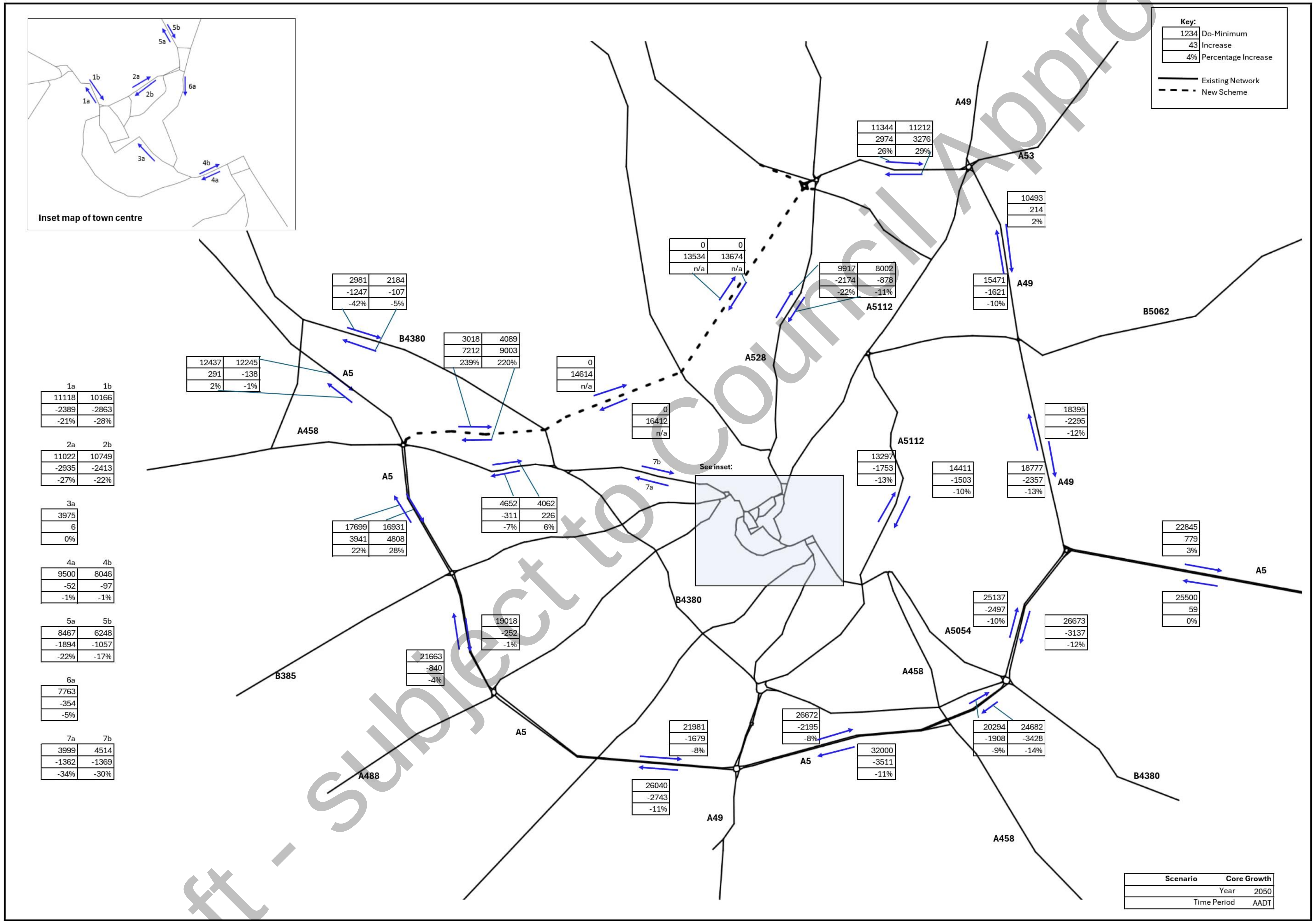


Figure 4-3 - 2050 Forecasts (AADT)

4.2.3. An analysis of the Do-Something 2027 daily forecast flows presented in Figure 4-1 highlights the following:

- Forecast flows on the proposed North West Relief Road (NWRR) are predicted to range between 22,700 vehicles per day between the A528 and the B5067 (Ellesmere Road and Berwick Road roundabouts); 25,900 vehicles per day between the B5067 and the B4380 (Berwick Road and Holyhead Road roundabouts); and 19,100 vehicles per day between the B4380 and the A5 (Holyhead Road and Churncote roundabouts respectively).
- Traffic flows on a section of the A5 (outer ring road), between Woodcote and Churncote roundabouts, increase by 24% as a result of the NWRR scheme.
- Traffic flows on the remaining section of the A5 outer ring road reduces as a result of the NWRR scheme, these reductions ranges between 3% and 16%.
- Traffic flows on the A49 (Outer ring road between A5 and B5062, Preston Island and Sundorne roundabouts) are reduced by approximately 16%.
- Traffic flows reductions on the corridors from the city centre to the north of Shrewsbury: 20% reduction on the A528 (Ellesmere Road).
- Traffic flow reductions in the city centre access: approximately 26% reduction on the Welsh Bridge and Smithfield Road.

4.2.4. An analysis of the Do-Something 2042 daily forecast flows presented in Figure 4-2 highlights the following:

- Forecast flows on the proposed North West Relief Road (NWRR) are predicted to range between 26,300 vehicles per day between the A528 and the B5067 (Ellesmere Road and Berwick Road roundabouts); 30,000 vehicles per day between the B5067 and the B4380 (Berwick Road and Holyhead Road roundabouts); and 22,600 vehicles per day between the B4380 and the A5 (Holyhead Road and Churncote roundabouts respectively).
- Traffic flows on a section of the A5 (outer ring road), between Woodcote and Churncote roundabouts, increase by 25% as a result of the NWRR scheme.
- Traffic flows on the remaining section of the A5 outer ring road reduces as a result of the NWRR scheme, these reductions ranges between 2% and 14%.
- Traffic flows on the A49 (Outer ring road between A5 and B5062 – Preston Island and Sundorne roundabouts) are reduced approximately by 14%.
- Traffic flows reductions on the corridors from the city centre to the north of Shrewsbury: 17% reduction on the A528 (Ellesmere Road).
- Traffic flow reductions in the city centre access: approximately 25% reduction on the Welsh Bridge and Smithfield Road.

4.2.5. An analysis of the Do-Something 2050 daily forecast flows presented in Figure 4-3 highlights the following:

- Forecast flows on the proposed North West Relief Road (NWRR) are predicted to range between 27,200 vehicles per day between the A528 and the B5067 (Ellesmere Road and Berwick Road roundabouts); 31,000 vehicles per day between the B5067 and the B4380 (Berwick Road and Holyhead Road roundabouts); and 23,300 vehicles per day between the B4380 and the A5 (Holyhead Road and Churncote roundabouts respectively).
- Traffic flows on a section of the A5 (outer ring road), between Woodcote and Churncote roundabouts, increase by 25% as a result of the NWRR scheme.

- Traffic flows on the remaining section of the A5 outer ring road reduces as a result of the NWRR scheme, these reductions ranges between 1% and 14%.
- Traffic flows on the A49 (Outer ring road between A5 and B5062 – Preston Island and Sundorne roundabouts) are reduced approximately by 13%.
- Traffic flows reductions on the corridors from the city centre to the north of Shrewsbury: 17% reduction on the A528 (Ellesmere Road).
- Traffic flow reductions in the city centre access: approximately 25% reduction on the Welsh Bridge and Smithfield Road.

4.2.6. Further analysis on the impact of the NWRR is provided in Appendix F, which presents the select link analysis plots. These confirm how the NWRR scheme will act as a bypass link connecting the north-south traffic. NWRR will help reduce the traffic using Shrewsbury city centre roads and the A5/A49 ring road, thus providing relief in journey times, as shown in section 4.3.

## 4.3 JOURNEY TIMES

4.3.1. The impact of the Scheme on journey times was derived from the 2027, 2042, 2050 Do-Minimum and Do-Something traffic forecasts. Table 4-4 to Table 4-6 below compare the journey times for a trip between the A5/A458 Churncote Roundabout to the west of Shrewsbury and the A49/A53 Battlefield Roundabout to the north, using different routes (shown in Figure 4-4) with and without the NWRR, for the forecast years 2027, 2042 and 2050:

- Via the northwest minor Road
- Via the outer bypass
- Via the inner distributor ring road
- Via the town centre and A5191
- Via the town centre and A528
- Via the NWRR


**Figure 4-4 - Major Routes Between A5/A458 Churncote Roundabout and A49/A53 Battlefield Roundabout.**

### Table 4-4 – Journey Time Comparison (2027) – in Minutes

| Route | AM-peak | | | IP-peak | | | PM-peak | | |
|---|---|---|---|---|---|---|---|---|---|
| | DM | DS | Time Saving | DM | DS | Time Saving | DM | DS | Time Saving |
| North-west minor road (NB) | 16.6 | 16.4 | -0.2 | 15.8 | 15.9 | 0.1 | 16.0 | 16.2 | 0.2 |
| North-west minor road (SB) | 16.3 | 16.3 | 0.0 | 15.9 | 16.0 | 0.1 | 16.9 | 16.7 | -0.2 |
| Outer bypass (NB) | 15.5 | 13.8 | -1.7 | 12.5 | 12.1 | -0.4 | 14.1 | 13.5 | -0.6 |
| Outer bypass (SB) | 13.8 | 13.0 | -0.8 | 12.4 | 11.8 | -0.6 | 15.1 | 13.1 | -2.1 |
| Inner Distributor ring road (NB) | 22.4 | 21.3 | -1.1 | 20.3 | 20.0 | -0.3 | 21.7 | 21.8 | 0.1 |
| Inner Distributor ring road (SB) | 22.3 | 21.7 | -0.6 | 20.5 | 19.9 | -0.5 | 22.3 | 21.3 | -1.0 |
| Town centre and A5191 (NB) | 23.2 | 20.3 | -2.9 | 20.9 | 19.7 | -1.2 | 21.9 | 21.1 | -0.9 |
| Town centre and A5191 (SB) | 22.2 | 20.4 | -1.8 | 21.2 | 19.5 | -1.7 | 22.8 | 20.2 | -2.7 |
| Town centre and A528 (NB) | 19.3 | 16.4 | -2.9 | 16.7 | 15.7 | -1.0 | 16.9 | 16.9 | 0.0 |
| Town centre and A528 (SB) | 21.4 | 18.6 | -2.9 | 19.4 | 17.6 | -1.8 | 22.1 | 18.9 | -3.3 |
| North West Relief Road (NB) | - | 8.1 | - | - | 6.9 | - | - | 7.0 | - |
| North West Relief Road (SB) | - | 7.4 | - | - | 6.9 | - | - | 8.1 | - |

### Table 4-5 – Journey Time Comparison (2042) – in Minutes

| Route | AM-peak | | | IP-peak | | | PM-peak | | |
|---|---|---|---|---|---|---|---|---|---|
| | DM | DS | Time Saving | DM | DS | Time Saving | DM | DS | Time Saving |
| North-west minor road (NB) | 17.2 | 16.8 | -0.4 | 16.1 | 16.2 | 0.1 | 16.3 | 16.6 | 0.2 |
| North-west minor road (SB) | 16.7 | 16.6 | -0.1 | 16.1 | 16.2 | 0.1 | 17.7 | 17.1 | -0.7 |
| Outer bypass (NB) | 17.6 | 16.1 | -1.6 | 13.4 | 12.7 | -0.8 | 15.7 | 14.3 | -1.4 |
| Outer bypass (SB) | 16.6 | 15.8 | -0.8 | 14.2 | 12.5 | -1.7 | 18.1 | 14.9 | -3.2 |
| Inner Distributor ring road (NB) | 23.5 | 23.3 | -0.2 | 20.8 | 20.3 | -0.5 | 22.4 | 22.4 | 0.0 |
| Inner Distributor ring road (SB) | 23.5 | 22.9 | -0.6 | 21.3 | 20.5 | -0.8 | 23.7 | 22.4 | -1.3 |
| Town centre and A5191 (NB) | 23.9 | 21.7 | -2.2 | 21.5 | 20.0 | -1.5 | 22.8 | 21.7 | -1.1 |
| Town centre and A5191 (SB) | 23.3 | 21.1 | -2.2 | 22.0 | 19.9 | -2.1 | 24.1 | 20.9 | -3.2 |
| Town centre and A528 (NB) | 19.8 | 17.6 | -2.2 | 17.0 | 16.0 | -1.0 | 17.4 | 17.4 | 0.0 |
| Town centre and A528 (SB) | 22.7 | 19.3 | -3.4 | 20.2 | 18.0 | -2.2 | 23.4 | 19.7 | -3.7 |
| North West Relief Road (NB) | - | 8.8 | - | - | 7.2 | - | - | 7.3 | - |
| North West Relief Road (SB) | - | 7.9 | - | - | 7.3 | - | - | 9.0 | - |

Table 4-6 - Journey Time Comparison (2050) – in Minutes

| Route | AM-peak | | | IP-peak | | | PM-peak | | |
|---|---|---|---|---|---|---|---|---|---|
| | DM | DS | Time Saving | DM | DS | Time Saving | DM | DS | Time Saving |
| North-west minor road (NB) | 17.4 | 16.9 | -0.5 | 16.2 | 16.2 | 0.0 | 16.5 | 16.7 | 0.2 |
| North-west minor road (SB) | 16.9 | 16.7 | -0.2 | 16.2 | 16.2 | 0.0 | 18.0 | 17.2 | -0.7 |
| Outer bypass (NB) | 18.2 | 16.8 | -1.4 | 13.8 | 12.9 | -0.9 | 16.3 | 14.6 | -1.6 |
| Outer bypass (SB) | 17.1 | 16.5 | -0.6 | 14.8 | 12.8 | -1.9 | 18.9 | 15.6 | -3.2 |
| Inner Distributor ring road (NB) | 23.9 | 23.7 | -0.2 | 20.9 | 20.4 | -0.5 | 22.8 | 22.6 | -0.1 |
| Inner Distributor ring road (SB) | 23.7 | 23.2 | -0.6 | 21.6 | 20.6 | -1.0 | 24.2 | 22.7 | -1.5 |
| Town centre and A5191 (NB) | 24.4 | 21.9 | -2.6 | 21.5 | 20.1 | -1.4 | 23.2 | 21.9 | -1.3 |
| Town centre and A5191 (SB) | 23.5 | 21.3 | -2.2 | 22.2 | 20.0 | -2.2 | 24.5 | 21.1 | -3.3 |
| Town centre and A528 (NB) | 20.2 | 17.7 | -2.5 | 17.0 | 16.0 | -1.0 | 17.7 | 17.5 | -0.2 |
| Town centre and A528 (SB) | 22.8 | 19.6 | -3.3 | 20.4 | 18.1 | -2.3 | 23.8 | 19.9 | -3.9 |
| North West Relief Road (NB) | - | 9.0 | - | - | 7.3 | - | - | 7.4 | - |
| North West Relief Road (SB) | - | 8.0 | - | - | 7.4 | - | - | 9.2 | - |

4.3.2. Table 4-4 to Table 4-6 demonstrate that the journey time between Churncote and Battlefield will be noticeably shorter via the NWRR (approximately between 7 to 10 minutes) than through any of the alternative routes.

4.3.3. The NWRR will also cause a reduction in journey times along a number of existing routes. The largest reductions (around 3 to 4 minutes in AM/PM peaks) are forecast on the routes leading into, through and out of the town centre. On other routes except the outer bypass in SB direction in PM the time savings are lower.

4.3.4. It is noted that although these time savings are smaller than those experienced by traffic diverting to the NWRR, they are significant because these savings accrue to all users of the existing routes.

## 4.4 LINK DELAY AND LINK V/C

4.4.1. Plots presenting link delay and link V/C (flow/capacity) for each scenario for AM and PM time periods are provided in Appendix E.

4.4.2. The link delay comparisons between Do-Minimum and Do-Something, shows that with the introduction of scheme in Do-Something, the link delays in the city centre, A49 and A5 ring road reduce significantly in all the forecast years.

4.4.3. The analysis of the Link V/C (flow/capacity) shows confirms the reduction of the traffic congestion in Shrewsbury, with V/C decreasing significantly in the city centre, A49 and A5 ring road.

# 5 SENSITIVITY TEST

5.1.1. In line with the current guidance set out in TAG Unit M4 (May 2024), the following Common Analytical Scenarios (CAS) have been developed to investigate the Proposed scheme's robustness in the light of uncertainty in demand levels:

- Low Economy
- High Economy
- Regional

5.1.2. The tests comprise applying the Low Economy, High Economy and Regional growth assumptions calculated from NTEM version 8.1. Low, High and Regional factors are also extracted from NRTP-22 for LGV and HGV. The factors derived are applied to the base year demand to develop the Low, High and Regional demands respectively. The matrix development is line with the demand forecast process described in Section 3.4. The overall trips were constrained to TEMPro growth factors at Shrewsbury district level of the respective CAS scenario Trip ends to ensure that the overall growth did not exceed the growth predicted by the National Trip End Model.

5.1.3. In line with TAG, the network ( supply side) for Low economy, High economy and Regional scenario tests have not been changed from the Core scenario.

5.1.4. Table 5-1 and Table 5-2 presents the total demand for Do-Minimum and Do-Something for the Low economy, Table 5-3 and Table 5-4 presents the total demand for Do-Minimum and Do-Something for the High economy, Table 5-5 and Table 5-6 presents the total demand for Do-Minimum and Do-Something for the Regional scenario (post VDM).

**Table 5-1 - Summary of Matrix Totals – Low Economy Do-Minimum (pcu/h)**

| Year | Time Period | Cars | | | Good Vehicles | | Total |
|---|---|---|---|---|---|---|---|
| | | Commuter | Business | Other | LGV | HGV | |
| 2027 | AM | 23,662 | 7,029 | 21,453 | 4,913 | 1,598 | 58,655 |
| | IP | 4,655 | 6,067 | 30,154 | 4,052 | 1,361 | 46,288 |
| | PM | 12,592 | 6,587 | 31,908 | 4,013 | 815 | 55,915 |
| 2042 | AM | 24,843 | 7,137 | 23,439 | 5,203 | 1,660 | 62,281 |
| | IP | 4,834 | 6,144 | 32,848 | 4,291 | 1,414 | 49,531 |
| | PM | 13,078 | 6,701 | 34,476 | 4,250 | 847 | 59,352 |
| 2050 | AM | 24,463 | 6,984 | 23,569 | 5,377 | 1,673 | 62,066 |
| | IP | 4,736 | 6,001 | 33,041 | 4,435 | 1,424 | 49,637 |
| | PM | 12,830 | 6,553 | 34,480 | 4,393 | 853 | 59,109 |

**Table 5-2 - Summary of Matrix Totals – Low Economy Do-Something (pcu/h)**

| Year | Time Period | Cars | | | Good Vehicles | | Total |
|---|---|---|---|---|---|---|---|
| | | Commuter | Business | Other | LGV | HGV | |
| 2027 | AM | 23,793 | 7,038 | 21,533 | 4,913 | 1,598 | 58,874 |
| | IP | 4,661 | 6,062 | 30,174 | 4,052 | 1,361 | 46,308 |
| | PM | 12,634 | 6,592 | 31,973 | 4,013 | 815 | 56,028 |
| 2042 | AM | 24,979 | 7,144 | 23,523 | 5,203 | 1,660 | 62,509 |
| | IP | 4,843 | 6,138 | 32,873 | 4,291 | 1,414 | 49,559 |
| | PM | 13,132 | 6,708 | 34,573 | 4,250 | 847 | 59,510 |
| 2050 | AM | 24,597 | 6,991 | 23,652 | 5,377 | 1,673 | 62,290 |
| | IP | 4,745 | 5,995 | 33,064 | 4,435 | 1,424 | 49,663 |
| | PM | 12,881 | 6,559 | 34,580 | 4,393 | 853 | 59,267 |

**Table 5-3 - Summary of Matrix Totals – High Economy Do-Minimum (pcu/h)**

| Year | Time Period | Cars | | | Good Vehicles | | Total |
|---|---|---|---|---|---|---|---|
| | | Commuter | Business | Other | LGV | HGV | |
| 2027 | AM | 24,087 | 7,177 | 22,223 | 5,172 | 1,637 | 60,297 |
| | IP | 4,736 | 6,195 | 31,264 | 4,266 | 1,394 | 47,855 |
| | PM | 12,799 | 6,725 | 32,907 | 4,225 | 835 | 57,491 |
| 2042 | AM | 27,652 | 8,077 | 26,657 | 6,749 | 1,833 | 70,968 |
| | IP | 5,369 | 6,937 | 37,305 | 5,566 | 1,561 | 56,738 |
| | PM | 14,179 | 7,509 | 38,900 | 5,514 | 935 | 67,037 |
| 2050 | AM | 28,996 | 8,479 | 28,482 | 7,572 | 1,932 | 75,462 |
| | IP | 5,609 | 7,273 | 39,861 | 6,245 | 1,645 | 60,633 |
| | PM | 15,127 | 7,940 | 41,378 | 6,186 | 985 | 71,617 |

**Table 5-4 - Summary of Matrix Totals – High Economy Do-Something (pcu/h)**

| Year | Time Period | Cars | | | Good Vehicles | | Total |
|---|---|---|---|---|---|---|---|
| | | Commuter | Business | Other | LGV | HGV | |
| 2027 | AM | 24,227 | 7,186 | 22,309 | 5,172 | 1,637 | 60,531 |
| | IP | 4,743 | 6,189 | 31,284 | 4,266 | 1,394 | 47,876 |
| | PM | 12,845 | 6,730 | 32,981 | 4,225 | 835 | 57,616 |
| 2042 | AM | 27,823 | 8,087 | 26,762 | 6,749 | 1,833 | 71,254 |
| | IP | 5,383 | 6,930 | 37,345 | 5,566 | 1,561 | 56,785 |
| | PM | 14,248 | 7,517 | 39,020 | 5,514 | 935 | 67,234 |
| 2050 | AM | 29,184 | 8,490 | 28,602 | 7,572 | 1,932 | 75,779 |
| | IP | 5,624 | 7,265 | 39,907 | 6,245 | 1,645 | 60,687 |
| | PM | 15,210 | 7,947 | 41,510 | 6,186 | 985 | 71,840 |

### Table 5-5 - Summary of Matrix Totals – Regional Do-Minimum (pcu/h)

| Year | Time Period | Cars | | | Good Vehicles | | Total |
|---|---|---|---|---|---|---|---|
| | | Commuter | Business | Other | LGV | HGV | |
| 2027 | AM | 23,858 | 7,095 | 21,738 | 5,022 | 1,599 | 59,312 |
| | IP | 4,689 | 6,123 | 30,561 | 4,142 | 1,362 | 46,877 |
| | PM | 12,683 | 6,651 | 32,285 | 4,103 | 816 | 56,537 |
| 2042 | AM | 25,875 | 7,493 | 24,748 | 5,853 | 1,710 | 65,678 |
| | IP | 5,024 | 6,440 | 34,668 | 4,827 | 1,456 | 52,415 |
| | PM | 13,575 | 7,022 | 36,232 | 4,781 | 872 | 62,482 |
| 2050 | AM | 26,239 | 7,574 | 25,570 | 6,290 | 1,755 | 67,429 |
| | IP | 5,067 | 6,496 | 35,825 | 5,188 | 1,495 | 54,071 |
| | PM | 13,702 | 7,088 | 37,252 | 5,139 | 895 | 64,076 |

### Table 5-6 - Summary of Matrix Totals – Regional Do-Something (pcu/h)

| Year | Time Period | Cars | | | Good Vehicles | | Total |
|---|---|---|---|---|---|---|---|
| | | Commuter | Business | Other | LGV | HGV | |
| 2027 | AM | 23,991 | 7,103 | 21,818 | 5,022 | 1,599 | 59,534 |
| | IP | 4,696 | 6,117 | 30,582 | 4,142 | 1,362 | 46,899 |
| | PM | 12,726 | 6,656 | 32,352 | 4,103 | 816 | 56,652 |
| 2042 | AM | 26,025 | 7,500 | 24,839 | 5,853 | 1,710 | 65,926 |
| | IP | 5,035 | 6,434 | 34,696 | 4,827 | 1,456 | 52,448 |
| | PM | 13,636 | 7,030 | 36,342 | 4,781 | 872 | 62,660 |
| 2050 | AM | 26,387 | 7,581 | 25,662 | 6,290 | 1,755 | 67,676 |
| | IP | 5,079 | 6,489 | 35,856 | 5,188 | 1,495 | 54,107 |

5.1.5. Table 5-7 and Table 5-8 shows the post VDM matrix total comparison between Core and the different CAS scenarios for Do-Minimum and Do-Something respectively. It can be observed that the demand in Core is higher than Low Economy, lower than High Economy and close to Regional Scenario.

**Table 5-7 - Comparison of Do-Minimum matrix total between Core and CAS (pcu/h)**

| Year | Peak | Core Minus Low Economy | | Core Minus High Economy | | Core Minus Regional | |
|---|---|---|---|---|---|---|---|
| | | Total | % Change | Total | % Change | Total | % Change |
| 2027 | AM | 644 | 1.1% | -998 | -1.7% | -13 | -0.0% |
| | IP | 577 | 1.2% | -990 | -2.1% | -12 | -0.0% |
| | PM | 608 | 1.1% | -968 | -1.7% | -14 | -0.0% |
| 2042 | AM | 3,282 | 5.0% | -5,405 | -8.2% | -115 | -0.2% |
| | IP | 2,782 | 5.3% | -4,424 | -8.5% | -101 | -0.2% |
| | PM | 3,023 | 4.9% | -4,662 | -7.5% | -107 | -0.2% |
| 2050 | AM | 5,169 | 7.1% | -8,227 | -12.2% | -194 | -0.3% |
| | IP | 4,266 | 7.9% | -6,731 | -12.5% | -168 | -0.3% |
| | PM | 4,787 | 7.5% | -7,721 | -12.1% | -180 | -0.3% |

**Table 5-8 - Comparison of Do-Something matrix total between Core and CAS (pcu/h)**

| Year | Peak | Core Minus Low Economy | | Core Minus High Economy | | Core Minus Regional | |
|---|---|---|---|---|---|---|---|
| | | Total | % Change | Total | % Change | Total | % Change |
| 2027 | AM | 647 | 1.1% | -1,010 | -1.7% | -14 | -0.0% |
| | IP | 578 | 1.2% | -990 | -2.1% | -12 | -0.0% |
| | PM | 612 | 1.1% | -977 | -1.7% | -13 | -0.0% |
| 2042 | AM | 3,301 | 5.0% | -5,444 | -8.3% | -116 | -0.2% |
| | IP | 2,787 | 5.3% | -4,439 | -8.5% | -102 | -0.2% |
| | PM | 3,041 | 4.9% | -4,683 | -7.5% | -109 | -0.2% |
| 2050 | AM | 5,192 | 7.7% | -8,298 | -12.3% | -194 | -0.3% |
| | IP | 4,275 | 7.9% | -6,749 | -12.5% | -169 | -0.3% |
| | PM | 4,819 | 7.5% | -7,754 | -12.1% | -180 | -0.3% |

5.1.6. Table 5-9 below shows the changes in vehicle-kilometres (Veh-kms) and vehicle-hours (Veh-hrs) between the Do-Minimum and Do-Something scenarios for Core, Low economy, High economy and Regional for the AM, IP and PM periods in each forecast year. The Common Analytical Scenarios confirm the same trend observed for the Core scenario.

**Table 5-9 - Change in Vehicle Kilometres and Vehicle Hours between CAS DM and DS**

| Year | Peak | Core | | Low Economy | | High Economy | | Regional | |
|---|---|---|---|---|---|---|---|---|---|
| | | PCU-Kms | PCU-Hrs | PCU-Kms | PCU-Hrs | PCU-Kms | PCU-Hrs | PCU-Kms | PCU-Hrs |
| **2027** | AM | 0.6% | -2.6% | 0.5% | -2.5% | 0.6% | -2.5% | 0.5% | -2.5% |
| | IP | 0.2% | -1.6% | 0.2% | -1.6% | 0.2% | -1.6% | 0.2% | -1.6% |
| | PM | 0.4% | -2.2% | 0.4% | -2.1% | 0.5% | -2.2% | 0.5% | -2.1% |
| **2042** | AM | 0.4% | -2.2% | 0.5% | -2.3% | 0.5% | -2.2% | 0.4% | -2.2% |
| | IP | 0.3% | -2.0% | 0.2% | -1.8% | 0.3% | -2.1% | 0.3% | -1.9% |
| | PM | 1.0% | -2.1% | 0.8% | -2.2% | 1.2% | -2.0% | 1.0% | -2.2% |
| **2050** | AM | 0.5% | -2.1% | 0.4% | -2.2% | 0.6% | -2.1% | 0.6% | -2.2% |
| | IP | 0.4% | -1.9% | 0.3% | -1.8% | 0.6% | -2.2% | 0.4% | -2.0% |
| | PM | 1.1% | -2.2% | 0.8% | -2.2% | 1.2% | -1.8% | 1.1% | -2.2% |

5.1.7. The traffic forecasts expressed in Annual Average Daily flow Totals (AADT) and bi-directional flows for Low economy, High economy and Regional are presented in Appendix D. The AADT flow patterns observed for the Sensitivity tests are very similar to Core scenario.

# 6 SUMMARY AND CONCLUSIONS

6.1.1. At the start of the North West Relief Road (NWRR) Full Business Case traffic model development, a model verification exercise was undertaken to check the robustness of the 2017 base model. The model verification exercise concluded that, the current base model and the associated variable demand modelling suite is still a valid tool to assess the likely impact of the NWRR scheme.

6.1.2. Following this, traffic forecast have been developed for the anticipated opening year (2027) and forecast years 2042 and 2050. The model forecasts take account of the most recent projections of future traffic growth derived from TEMPro that includes the latest forecasts of population and employment and car ownership to provide estimates of trip ends. The growth forecast for the goods vehicles was derived in accordance with DfT TAG Unit M4, using DfT's National Road Traffic Projections from 2022.

6.1.3. The model forecasts utilise a variable demand modelling methodology, details of which are provided in the Demand Model Report.

6.1.4. Forecasts have been prepared for a Core scenario in accordance with DfT TAG, which includes local information on expected traffic generation from the proposed new developments within Shrewsbury.

6.1.5. Additionally, Common Analytical Scenario based sensitivity tests for Low economy, High economy and Regional scenarios have also been carried out in accordance with DfT TAG Unit M4 (May 2024).

6.1.6. The traffic forecasts presented in Chapter 4 demonstrate that the NWRR, by providing a direct route from the A5/A458 north west of Shrewsbury to A49/A53 north east of Shrewsbury would provide significant relief to the outer ring road, typically reducing traffic by 15%.

6.1.7. There would also be significant reductions on the A528 to the north of Shrewsbury and Smithfield Road and Welsh Bridge, immediately north of the town centre.

6.1.8. The relief in traffic on the outer ring road would lead to a significant reduction in congestion and delays at the major junctions on the A5 and A49 to the south and west of Shrewsbury.

6.1.9. The scheme will lead to a significant reduction in journey times across the road network in Shrewsbury. Journey times between Churncote and Battlefield will be noticeably shorter via the proposed Shrewsbury NWRR (typically 7 to 10 minutes) than travelling through other alternative routes (about 16 minutes through existing rat-runs, and about 22 minutes on the distributor ring or town centre routes).

6.1.10. People driving the full length of the NWRR will typically save at least 10 minutes on their journey. Due to the shift in traffic, the NWRR will also reduce journey times along a number of existing routes including through and out of the town centre, the distributor ring road, outer bypass and rural lanes.

6.1.11. The sensitivity tests have also demonstrated that the scheme would achieve net reductions in total network travel time under Low economy, High Economy and Regional sensitivity assumptions, providing further confidence in the robustness of the traffic forecasts with respect to uncertainty surrounding future demand levels.

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