Norfolk County Council

NORWICH WESTERN LINK

Traffic Forecasting Report

70067230-003
JUNE 2021

PUBLIC

Norfolk County Council

NORWICH WESTERN LINK

Traffic Forecasting Report

TYPE OF DOCUMENT (VERSION) PUBLIC

PROJECT NO. 70067230

OUR REF. NO. 70067230-003

DATE: JUNE 2021

WSP

Mountbatten House
Basing View
Basingstoke, Hampshire
RG21 4HJ

Phone: +44 1256 318 800

Fax: +44 1256 318 700

WSP.com

QUALITY CONTROL

Issue/revision	First issue	Revision 1	Revision 2	Revision 3
Remarks	3 March 2021	25 June 2021		
Date				
Prepared by	Mark Hill	Mark Hill		
Signature				
Checked by	Craig Drennan	Craig Drennan		
Signature				
Authorised by	Craig Drennan	Craig Drennan		
Signature				
Project number	70067230	70067230		
Report number	70067230-003	70067230-003		
File reference	\\uk.wspgroup.com\central data\Projects\700419xx\70041922 - Norwich Western Link\02 WIP\TP Transport planning\03 Document\Traffic Forecasting Report\NATS_2019_Traffic_Forecasting_Report_for_DfT_issue_25June2021.docx			

CONTENTS

TABLES

FIGURES

Figure 10-9: 2040 Low Growth DS scenario versus 2040 Low Growth DM scenario, Actual Flow Difference, in pcu's – Inter peak 113

APPENDICES

APPENDIX J

HIGH GROWTH: 2025 AND 2040 AADT FLOW PLOTS

APPENDIX K

TAG SENSITIVITY ASSESSMENT - GENERALISED COST

1

INTRODUCTION

1 INTRODUCTION

1.1 OVERVIEW

1.1.1. WSP was commissioned by Norfolk County Council (NCC) to undertake transport modelling to support the evidence base for the Norwich Western Link (NWL) Outline Business Case (OBC) and the planning application.

1.1.2. The Norwich Area Transport Studies (NATS) Model is a multi-modal model with a Base Year of 2019. The Base Year model development has been detailed in the NATS 2019 Local Model Validation Report[1], November 2020. Development of the model has been undertaken in accordance with Department for Transport (DfT) Transport Appraisal Guidance (TAG) and has been satisfactorily checked for accuracy against TAG criteria. The report concluded that the 2019 NATS model gives a sufficiently accurate overall representation of highway and public transport conditions that provides a robust foundation to project forecasts from.

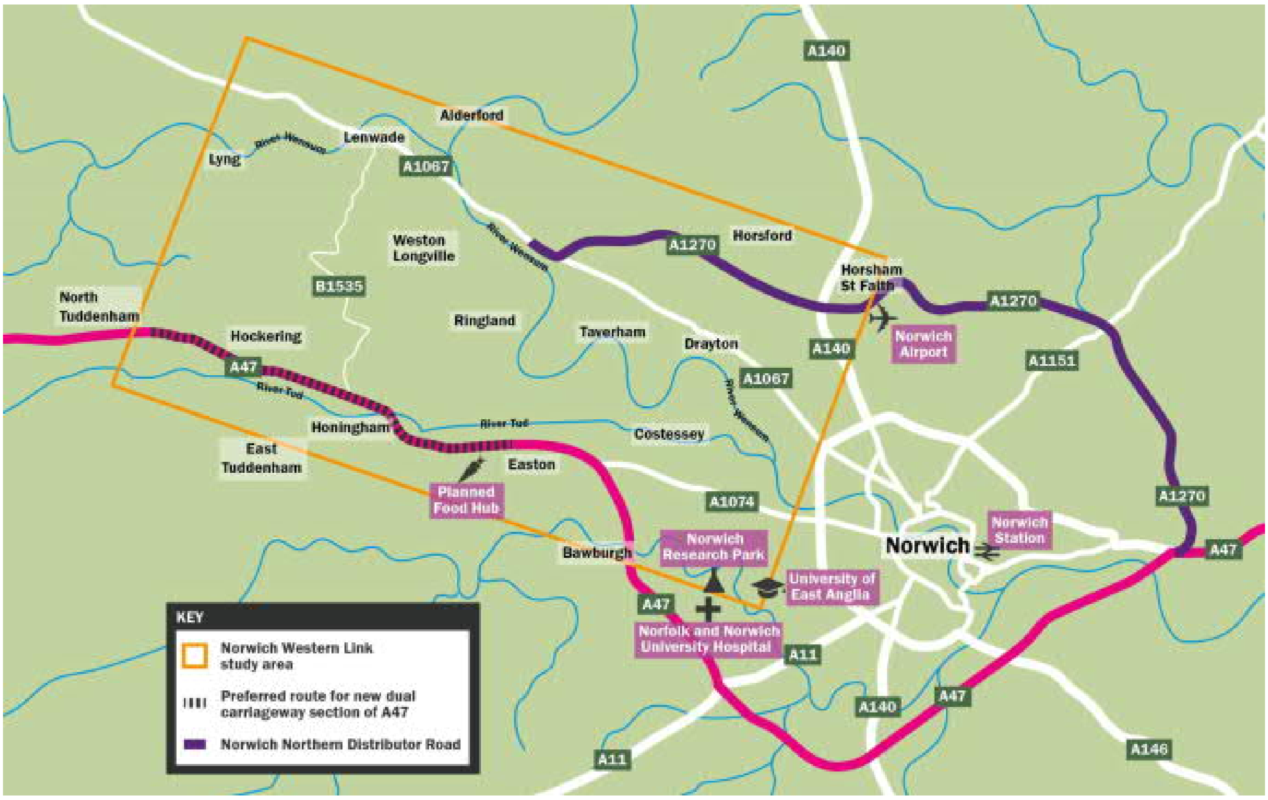
1.1.3. Future year scenarios, Do Minimum i.e. without NWL and Do Something i.e. with NWL have been developed from the 2019 base year for the 2025 and 2040 forecast years.

1.1.4. This Traffic Forecasting Report (TFR) provides an overview of the development of forecast year scenarios and the highway assignment results.

1.2 NORWICH WESTERN LINK ROAD SCHEME

1.2.1. The NWL scheme is located north-west of Norwich, in the Norwich Western Quadrant (NWQ) illustrated in Figure 1.1 The broad study area includes the key radial routes of the A47 trunk road, the A1074 (Dereham Road), and the A1067 (Drayton High Road / Fakenham Road).

[1] NATS 2019 Update LMVR – 70041922-LMVR-001



Source: About the Norwich Western Link, Location Map (Norfolk County Council)

Figure 1.1: NWL study area

1.2.2. Figure 1.2 shows the location of the Norwich Western Link route.

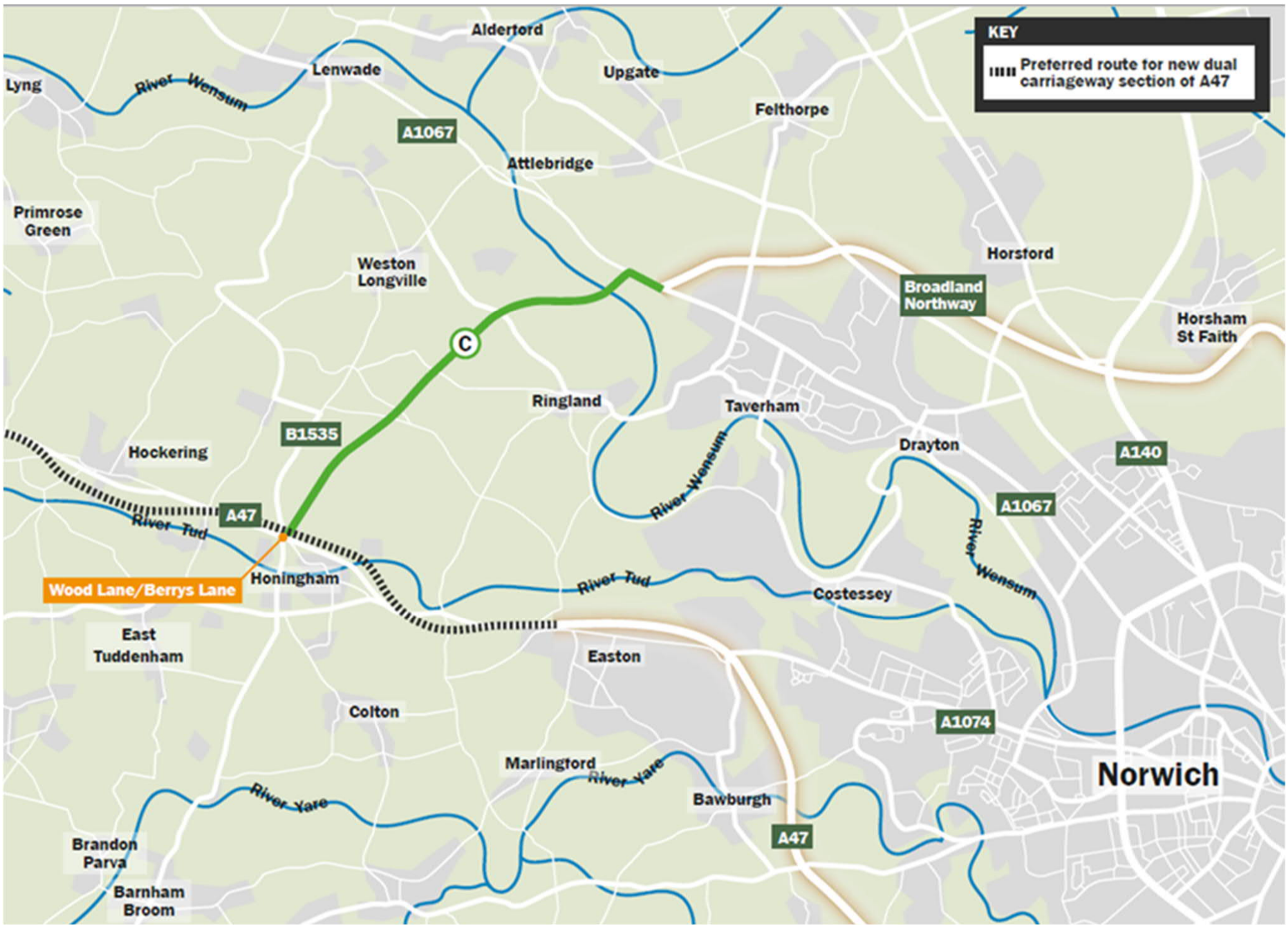


Figure 1.2: Norwich Western Link Route

1.2.3. The Norwich Western Link will comprise a new dual carriageway all-purpose road to the west of Norwich, from the A47 to the A1067/A1270, including a new viaduct bridge over the River Wensum and its floodplain. The scheme will provide a direct connection between the Strategic Road Network and the A1270 Broadland Northway through the west of Norwich. This will complete an orbital route around Norwich, which forms part of the Major Road Network.

1.2.4. The scheme is comprised of:

- A dual carriageway road, including a viaduct over the River Wensum and associated floodplain
- An “at grade” junction with the A1067
- Dualling of a section of the existing A1067 between the proposed NWL roundabout and existing A1270 roundabout
- Changes to local road network and Public Rights of Way (PRoW).

1.2.5. The scheme also includes landscaping, planting, ancillary works, environmental mitigation work and Biodiversity Net Gain measures.

1.3 PURPOSE OF THE REPORT

1.3.1. The purpose of this report is to document the details of the forecast modelling process used to assess the NWL proposed scheme. The report outlines the methodology used for the development of the forecast matrices and forecast networks along with describing the details of the scenarios modelled and their results.

1.3.2. This TFR outlines the results for:

- Core Growth scenario assessment
- Low Growth scenario assessment
- High Growth scenario assessment
- Core Growth (Sensitivity) scenario assessment.

1.4 SUMMARY OF THE FORECASTING PROCESS

1.4.1. To assess the NWL proposed scheme, it was necessary to build demand trip matrices in relation to the 2025 Opening Year and the 2040 Design Year. These have been determined using the following:

- **Committed developments:** Uncertainty Log produced and agreed with Norfolk County Council (NCC) using information provided to WSP by NCC and the four Norfolk district local planning authorities (Breckland, Broadland, Norwich and South Norfolk
- **Car Background Growth:** derived from the National Trip End Model (NTEM) forecasts via TEMPro (Trip End Model Presentation Program) Version 7.2 datasets. This was the most recent dataset available at the time of the forecast model development and committed development housing and employment were removed to avoid double counting
- **2018 National Road Traffic Forecasts (RTF):** informs the Light Goods Vehicle (LGV) and Heavy Goods Vehicle (HGV) forecast growth.

1.4.2. Network changes related to the transport scheme and associated development are presented in detail in Section 4. The forecasting methodology for assessing the proposed scheme was agreed with the Department for Transport (DfT) in the form of a Model Specification Report[2].

1.4.3. To inform the assessment of the NWL, forecast networks were developed that included committed infrastructure schemes assumed to be delivered between the 2019 model base year and the 2025 / 2040 forecast years respectively. These committed infrastructure improvements include the proposed Highways England A47 North Tuddenham to Easton scheme where the NWL is proposed to tie-in with at its southern end. The development of the forecast networks is discussed in detail within Section 4 and Section 5. The methodology for developing forecast matrices, and the inputs used, is discussed in detail within Section 6 and Section 7.

[2] *NWL_Model Specification Report_issued 17 Feb 2020.pdf (February 2020)*

1.5 STRUCTURE OF THE REPORT

1.5.1. Following this introductory section, this report is structured as follows:

- Section 2: Summary of Previous Work
- Section 3: Forecasting approach
- Section 4: Forecast Supply – Highways which describing the committed highway schemes that will be built between the base and future years and how these have been modelled
- Section 5: Forecast Supply Public Transport
- Section 6: Forecast Demand - Highway Model describes the development sites modelled and the predicted growth between the base and future years
- Section 7: Forecast Demand - Public Transport describes the predicted growth between the base and future years
- Section 8: Variable Demand Model describes the development of the forecast year VDM
- Section 9: Forecasting Assignment - Core Growth describing the traffic forecasts
- Section 10: Forecasting Assignment – Low Growth describing the traffic forecasts
- Section 11: Forecasting Assignment - High Growth describing the traffic forecasts
- Section 12: Forecasting Assignment – Sensitivity describing the Core Growth (Sensitivity Assessment) traffic forecasts
- Section 13: Summary and Conclusions – summarising the main findings of the report and key conclusions.

1.5.2. The following information sources have been referenced in the development of the models:

- Transport Analysis Guidance (TAG)
- SATURN, User Manual, (Atkins, 2015)
- Model Specification Report (February 2020)
- Norwich Western Link Road – Data Collection Report 70041922-ROS-001 (WSP, October 2020)
- NATS 2019 Update – Local Model Validation Report 70041922-LMVR-001 (WSP, November 2020).

2

SUMMARY OF PREVIOUS WORK

2 SUMMARY OF PREVIOUS WORK

2.1 OVERVIEW OF LOCAL MODEL VALIDATION REPORT

2.2 MODELLED AREA

2.2.1. The Fully Modelled Area (FMA) of the updated NATS model is shown in Figure 2-1. The FMA encompasses the area of Norfolk between King's Lynn in the west and Lowestoft in the south-east. The FMA was chosen as it covers a sufficient area to accurately model the reassignment and redistribution effects that are likely to be produced by new development and infrastructure schemes in Norwich, specifically the NWL.

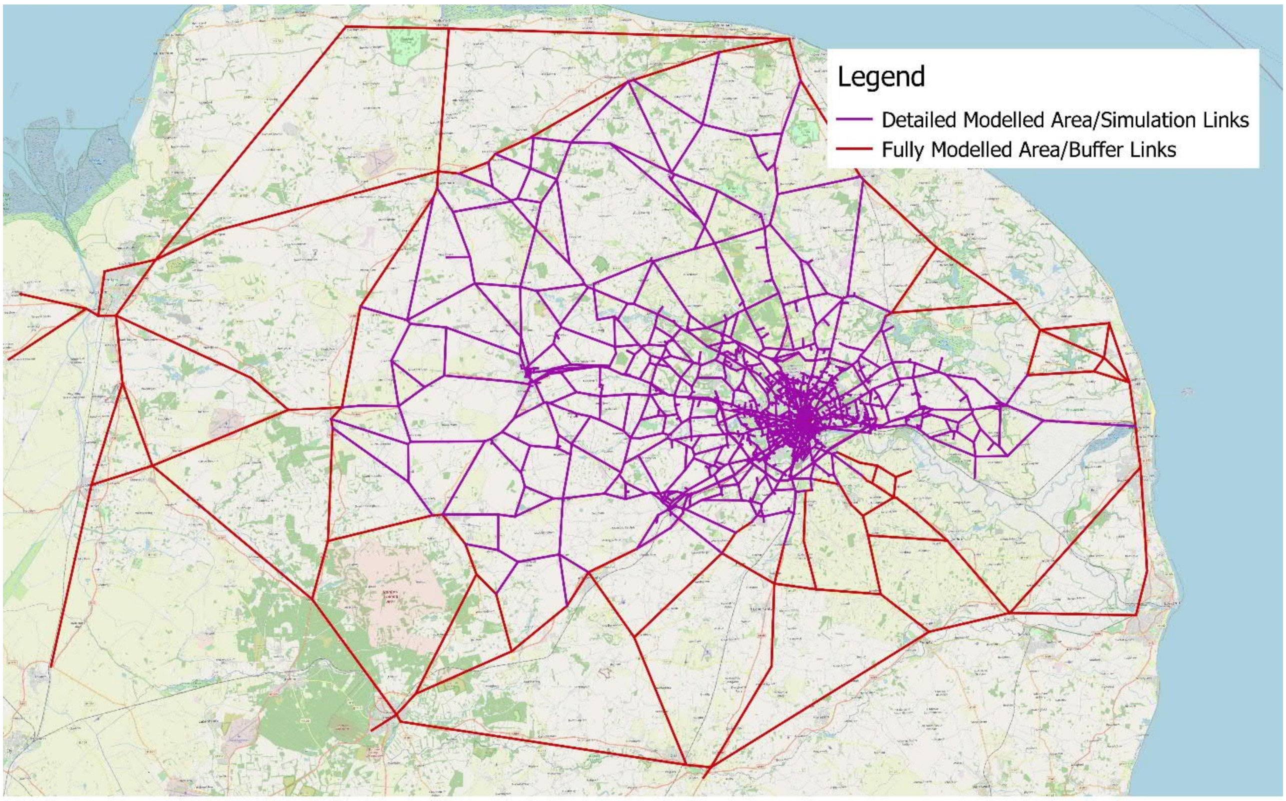


Figure 2-1: Detailed Modelling Area and Fully Modelled Area

2.2.2. The FMA is further subdivided into:

- The Detailed Modelling Area (DMA) as shown in Figure 2-1. This is the area over which significant impacts of interventions are certain. Modelling detail in this area is characterised by representation of all trip movements, small zones, very detailed networks and junction modelling. This area has sufficient model network and zoning detail to be able to assess the likely impact of the scheme to an appropriate level for the purposes of the scheme appraisal
- Rest of the Fully Modelled Area. This is the area over which the impacts of interventions are considered to be quite likely but relatively weak in magnitude. It is characterised by representation of all trip movements, somewhat larger zones and less network detail than for the DMA, and speed/flow modelling (primarily link-based but possibly also including a representation of strategically important junctions)
- The rest of the UK represents the External Area. In this area impacts of interventions are likely to be negligible. The External Area is characterised by skeletal networks and simple speed/flow relationships or fixed speed modelling and a partial representation of demand (trips to, from and through the FMA).

2.3 ZONING SYSTEM

2.3.1. The zone plan in the updated NATS model was devised to give a fine level of detail in the Norwich urban area. The zoning system is coarser outside of the DMA, and ultimately covers the whole of the UK (excluding Northern Ireland) in 542 zones.

2.3.2. In the DMA, Census Middle Super Output Areas (MSOA) have been split up into model zones based on land use. This enables more detailed representation of trips loading onto the network and enhances the model calibration and validation. The zoning system is coarser further away from the Norwich urban area, and MSOA have been grouped together for areas a significant distance away from the study area e.g. North of England and Scotland.

2.3.3. Park and Ride (P&R) sites in Norwich have been modelled as separate zones.

2.3.4. The updated NATS model zone boundaries are shown in Figure 2-2 with a more localised zoning diagram shown in Figure 2-3.

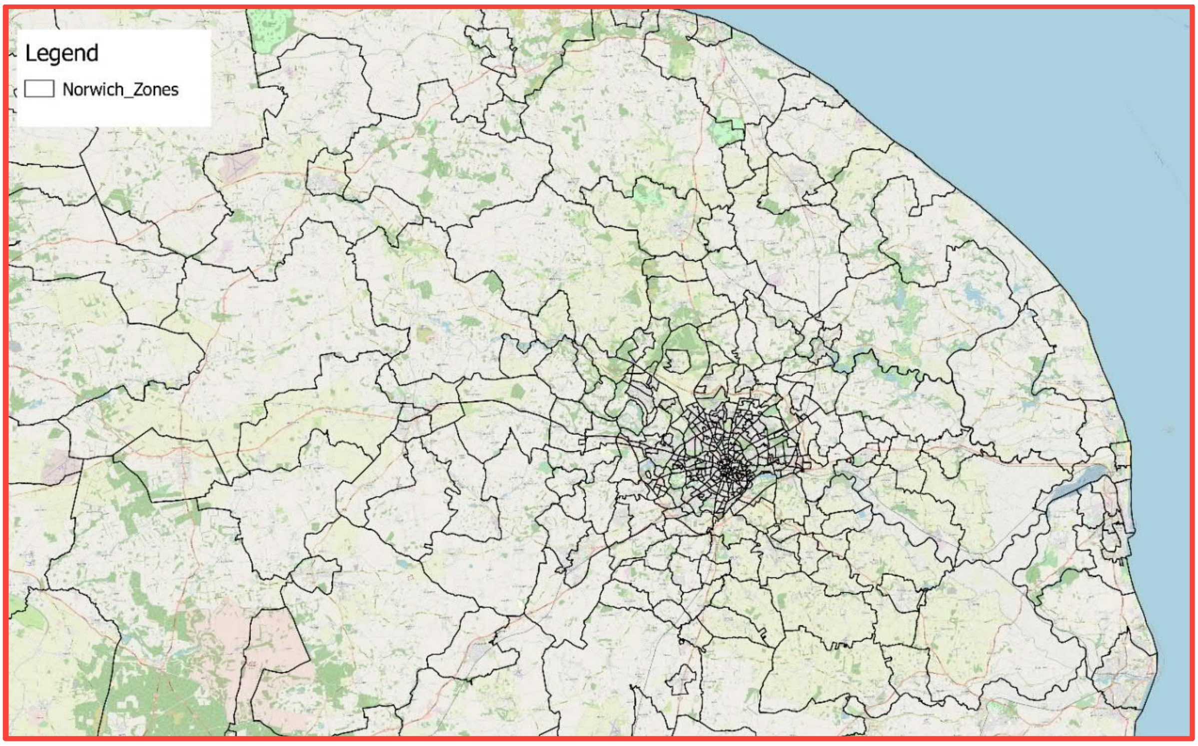


Figure 2-2: Zoning system

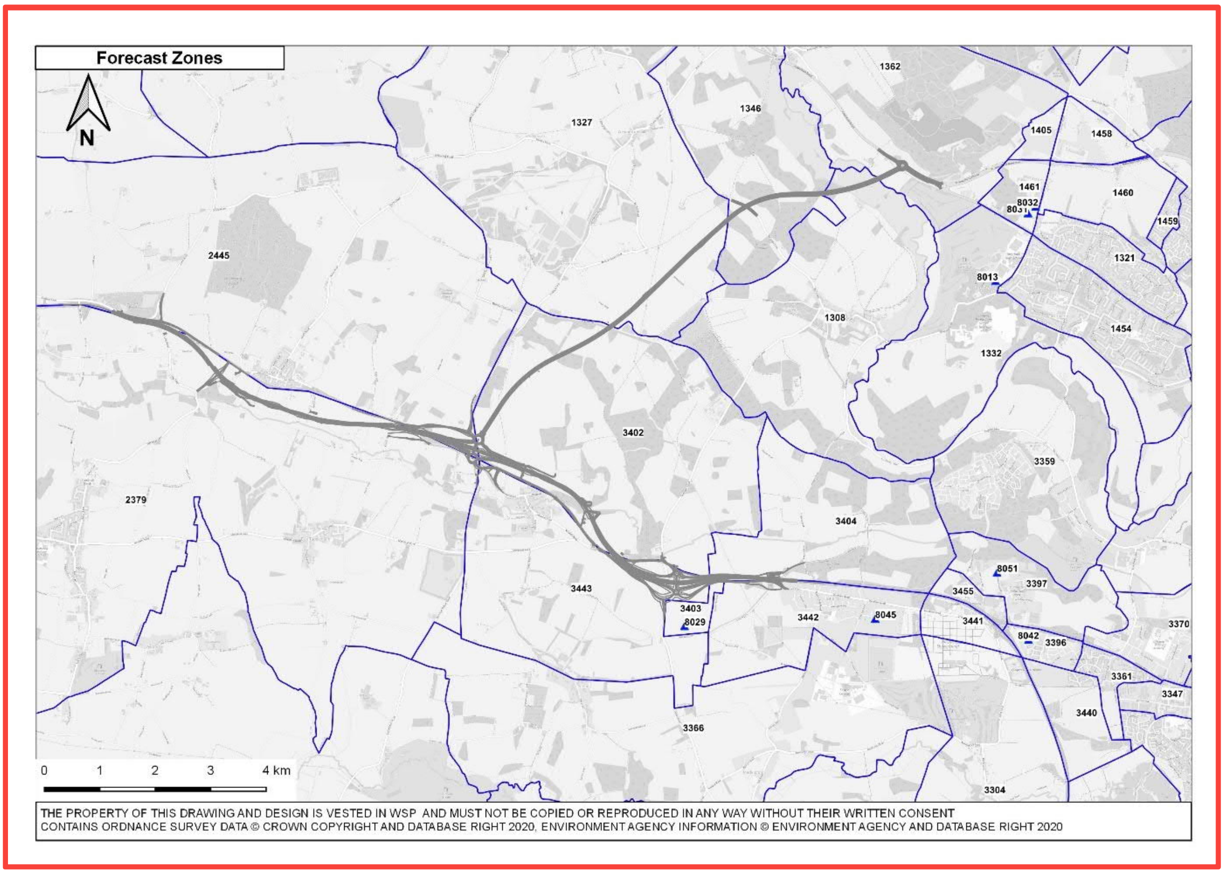


Figure 2-3: Localised zoning system

2.3.5. Figure 2-3 shows the zoning system in the vicinity of the scheme i.e. south-west to north-east indicative NWL). It is felt that given the more rural nature of the area in the vicinity of the proposed scheme that the transport model network has the appropriate level of detail. Zones within proximity to the scheme were checked and were disaggregated to a smaller area if deemed appropriate based on the likely level of trips travelling to and from this area.

2.3.6. As can be seen in the diagram any committed forecast year development has been allocated its own zone i.e. 8000 onwards which allows the impact of these on the proposed scheme to be taken into account more easily.

2.3.7. The proposed scheme is represented by the SW to NE line between the A47 and the A1067 in the diagram. The W to E scheme detail is the proposed Highways England A47 North Tuddenham to Easton scheme.

2.4 MODEL STRUCTURE AND DEMAND SEGMENTATION

2.4.1. The updated NATS model has inherited the structure of the previous NATS model which consists of the following sub-models:

- Highway model
- Public Transport (PT) model
- Variable Demand Model (VDM).

2.5 SOFTWARE PLATFORM

2.5.1. The NATS highway model has been developed in SATURN (Simulation and Assignment of Traffic in Urban Road Networks) version 11.5.05H MC N4. The NATS PT model has been developed using PTV's VISUM 2020. The VDM has been set up in DIADEM version 7.0.2.

2.6 PEAK HOURS AND DEMAND SEGMENTATION USED

2.6.1. The peak hour periods were based on the ATC data reviewed in the Data Collection Report 70041922-ROS-001 (WSP, October 2020).

2.6.2. The modelled peaks have been listed below:

- AM Peak hour (8:00am-9:00am)
- Interpeak hour (average hour for 10:00am until 4:00pm)
- PM Peak hour (5:00pm-6:00pm)

2.6.3. Highway trip matrices are disaggregated into multiple user classes by trip purpose and vehicle type as shown in Table 2-2. This procedure allows to distinguish the trips travelling within the network that have different perceived costs and values of time.

Table 2-1: Modelled Trip Purposes and Vehicle Types

User Class	Vehicle Type	Trip Purpose
1	Car	Commute [Home-Based Work] (HBW)
2	Car	Home based Employer's Business (HBEB)
3	Car	Home based Other (HBO)
4	Car	Non-home-based Employer's Business (NHBEB)
5	Car	Non-home based Other (NHBO)
6	Light Goods Vehicle	Employer's business (EB)
7	Heavy Goods Vehicle	Employer's business (EB)

2.7 BASE YEAR HIGHWAY MODEL CALIBRATION AND VALIDATION RESULTS

AM Peak Model

2.7.1. The modelled traffic flows have been demonstrated to provide a good fit with the observed flows with 86% of the calibration and 91% of the validation links meeting either the flow criteria or GEH criteria. This exceeds the required 85% benchmark of TAG.

2.7.2. 96% of the modelled journey times are within +/- 15% of the observed on the key routes. The journey time routes that are critical to demonstrate the likely impact of the proposed schemes provide a very good level of validation when compared to the observed journey times.

Interpeak Model

2.7.3. The modelled traffic flows have been demonstrated to provide a good fit with the observed flows with 98% of the calibration and 94% of the validation links meeting either the flow criteria or GEH criteria. This exceeds the required 85% benchmark of the TAG.

2.7.4. All of the modelled journey times were within +/- 15% of the observed on the key routes.

PM Peak Model

2.7.5. The modelled traffic flows have been demonstrated to provide a good fit with the observed flows with 89% of the calibration and 88% of the validation links meeting either the flow criteria or GEH criteria. This exceeds the required 85% benchmark of the TAG.

2.7.6. 98% of the modelled journey times were within +/- 15% of the observed on the key routes, which does not meet the TAG criteria. The routes that do fail are marginally outside the criteria.

2.7.7. The modelling calibration and validation techniques are detailed in the Local Model Validation Report (LMVR) 70041922-LMVR-001 (WSP, November 2020).

2.8 BASE YEAR PUBLIC TRANSPORT MODEL CALIBRATION AND VALIDATION RESULTS

2.8.1. Various checks have been undertaken on the base year public transport model to ensure that public transport trips in the area are accurately represented.

2.8.2. In all three time periods the total modelled boarders for bus and rail are within 9% of total observed boarders. The modelled boarders at bus stops are generally within 15% of observed boarders across a number of key routes and cordons, and Norwich railway station validates very well with modelled boarders and alighters within 8% of observed counts.

2.8.3. Modelled and observed journey times and routes through the network have been compared for a number of origin-destination pairs, and it has been concluded that the public transport model is able to closely match journey itineraries and times suggested by Google.

2.8.4. The public transport model validation is further detailed in the Local Model Validation Report (LMVR)[3] and has demonstrated that the public transport model is able to accurately reflect the volume, distribution and routing of trips through the network.

2.9 DEMAND MODEL

2.9.1. The Demand Model, which integrates the public transport and highway models and is a tool for predicting 'variable demand' or people's changing travel decisions in response to changing travel costs, has been satisfactorily configured and tested for 'realism'. This has confirmed that NATS is able to realistically predict how travellers may change trip frequency, change travel mode, change trip destination, or change highway route, as generalised travel costs (time and distance) rise and fall.

[3] *NATS_2019_LMVR_for_DfT_issue_10November2020.pdf*

3

FORECASTING APPROACH

3 FORECASTING APPROACH

3.1 OVERVIEW

3.1.1. Forecast transport modelling looks to predict of future flows and impacts of those of a highway/public transport network and includes the following main components:

- Estimate of future travel demand
- Estimate of future highway supply
- A mechanism of assigning demand to the highway network.

3.1.2. The development of forecast supply and demand will be based on the approach set out in DfT TAG Unit M4[4]. T

3.2 FORECAST YEARS

3.2.1. A minimum of two forecast years are required as per the TAG Unit M4, to enable the economic benefits of the scheme to be calculated. At the time of undertaking the transport modelling work the proposed scheme was forecast to open in 2025 and as such the final forecast year was consistent with the design year – 15 years after scheme opening.

3.2.2. The forecast years to be developed are as follows:

- 2025 (scheme opening year)
- 2040 (Design year – 15 years after scheme opening).

3.3 UNCERTAINTY LOG

3.3.1. An Uncertainty Log has been produced and agreed with Norfolk County Council (NCC) using information provided to WSP by NCC and the four Norfolk district local planning authorities (Breckland, Broadland, Norwich and South Norfolk).

3.3.2. This Uncertainty Log contains status of a series of housing and employment developments within each of the respective local authorities. These represent proposed developments for a period between 2019 and 2040 including developments with an uncertainty status of Near Certain, More Than Likely, Reasonably Foreseeable and Hypothetical as per TAG Unit M4 which are shown in Table 3-1.

[4] https://www.gov.uk/government/publications/tag-unit-m4-forecasting-and-uncertainty

Table 3-1: Uncertainty Log – definitions of uncertainty

Probability of the input	Status	Core Scenario Assumption
Near certain: The outcome will happen or there is a high probability that it will happen.	▪ Intent announced by proponent to regulatory agencies ▪ Approved development proposals ▪ Projects under construction	▪ This should form part of the core scenario.
More than likely: The outcome is likely to happen but there is some uncertainty.	▪ Submission of planning or consent application imminent ▪ Development application within the consent process	▪ This could form part of the core scenario
Reasonably foreseeable: The outcome may happen, but there is significant uncertainty	▪ Identified within a development plan ▪ Not directly associated with the transport strategy / scheme but may occur if the strategy/scheme is implemented ▪ Development conditional upon the transport strategy / scheme proceeding ▪ Committed policy goal, subject to tests (e.g. of deliverability) whose outcomes are subject to significant uncertainty	▪ These should be excluded from the core scenario but may form part of the alternative scenarios
Hypothetical: There is considerable uncertainty whether the outcome will ever happen	▪ Conjecture based upon currently available information. ▪ Discussed on a conceptual basis. ▪ One of a number of possible inputs in an initial consultation process. ▪ Policy aspiration	▪ These should be excluded from the core scenario but may form part of the alternative scenarios

3.3.3. In addition to development information, WSP were provided with a committed infrastructure log that detailed schemes to be included within the forecast network coding. The application of this information is discussed within more detail in Chapter 4. The building of forecast matrices, incorporating residential and commercial information from NCC Uncertainty Log, has been discussed in detail within Chapter 6.

3.4 FORECAST GROWTH SCENARIOS

3.4.1. A Core Scenario is intended to provide the best basis for decision making and has been produced in accordance with DfT TAG. Growth is constrained to NTEM V7.2 with schemes and proposed developments represented which have been identified as More Than Likely or Near Certain within the Uncertainty Log.

3.4.2. However, further growth scenarios are required to account for the uncertainty surrounding the levels of growth and to answer two key questions:

- Under high demand assumptions, is the intervention still effective in reducing congestion, or are there any adverse effects, e.g. on safety or environment
- Under low demand assumptions, is the intervention still economically viable?

3.4.3. High Growth and Low Growth scenarios have been developed in accordance with TAG as specified in TAG Unit M4:

- High Growth scenario should consist of forecasts that are based on a **proportion of base year demand** added to the demand from the **Core Growth scenario**
- High Growth scenario should consist of forecasts that are based on a **proportion of base year demand** below to the demand from the **Core Growth scenario**.

3.5 DEVELOPMENTS

3.5.1. Details of prospective developments were collated from the relevant documentation published by the local planning authorities and captured within the Uncertainty Log, along with their prescribed level of uncertainty.

3.5.2. Development information i.e. housing and jobs along with infrastructure was received from the four Norfolk district local planning authorities i.e. Breckland, Broadland, Norwich and South Norfolk based on following criteria:

- Only the applications within the districts of Breckland, Broadland, Norwich and South Norfolk were considered
- Applications were further removed based on Application status and Type codes. Only the applications considered relevant to the study were considered.
- Also, if the development consisted of less than 5 dwellings it was not considered in the Uncertainty Log.

3.5.3. Based on the above criteria, a total of 356 applications were recorded in the Uncertainty Log for further analysis.

3.5.4. Developments assessed to be either ‘near certain’ or ‘more than likely’ were considered in the demand forecasts for the Core scenario. In line with guidance from TAG Unit M4 Table A1, this comprised developments for which planning consent had been either granted or application submitted, or protected plots of land reserved for Local Plan development.

3.6 TEMPRO GROWTH TARGETS

3.6.1. The overarching level of traffic growth for each future year has been derived from the National Trip End Model (NTEM) forecasts via TEMPro (Trip End Model Presentation Program). Dataset version 7.2 has been used as this was the most recent dataset available at the time of the forecast model development.

3.6.2. Table 3-2 compares the number of new households and jobs created by the modelled developments with the planning assumptions in TEMPro.

Table 3-2: Uncertainty Log Core Scenario vs TEMPro

Districts	Year	Households		Jobs	
		Uncertainty Log (Core Scenario)	TEMPro	Uncertainty Log (Core Scenario)	TEMPro
Breckland	2025	4,277	7,179	168	1,313
	2040	13,678	24,896	928	3,828
Broadland	2025	5,575	8,108	2,162	1,274
	2040	12,422	28,069	6,104	3,624
Norwich	2025	2,897	5,234	668	2,352
	2040	4,425	17,632	1,686	6,809
South Norfolk	2025	5,957	6,312	882	1,496
	2040	9,670	21,453	2,045	4,201
Total	2025	18,706	26,833	3,879	6,435
	2040	40,195	92,050	10,763	18,462

3.7 GENERALISED COST COMPONENTS

3.7.1. The economic parameters used in the 2019 base year model assignment and the forecast year model assignments are shown in Table 3-3 and Table 3-4 for each year and time period. These are based on parameters from TAG Data Book, July 2020 v1.13.1 version.

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

Year	Time Period	Cars			Goods Vehicles	
		Commute	Business	Other	LGV	HGV
2019	AM	20.81	31.03	14.36	22.49	44.78
	IP	21.15	31.79	15.29	22.49	44.78
	PM	20.88	31.47	15.03	22.49	44.78
2025	AM	22.26	33.20	15.36	24.06	47.92
	IP	22.63	34.02	16.36	24.06	47.92
	PM	22.34	33.68	16.09	24.06	47.92
2040	AM	29.37	43.79	20.26	31.74	63.22
	IP	29.85	44.88	21.58	31.74	63.22
	PM	29.47	44.42	21.22	31.74	63.22

Table 3-4: Assignment Parameter – Vehicle Operating Cost (pence per kilometre)

Year	Time Period	Cars			Goods Vehicles	
		Commute	Business	Other	LGV	HGV
2019	AM	5.92	12.07	5.92	13.78	35.21
	IP	5.92	12.07	5.92	13.78	35.21
	PM	5.92	12.07	5.92	13.78	35.21
2025	AM	5.40	11.48	5.40	13.48	36.22
	IP	5.40	11.48	5.40	13.48	36.22
	PM	5.40	11.48	5.40	13.48	36.22
2040	AM	4.80	9.98	4.80	13.59	38.49
	IP	4.80	9.98	4.80	13.59	38.49
	PM	4.80	9.98	4.80	13.59	38.49

3.8 SOFTWARE PLATFORM

3.8.1. The NATS Highway model has used SATURN (**S**imulation and **A**ssignment of **T**raffic in **U**rban **R**oad **N**etworks) V11.5.05H MC N4 software. This was the latest version available to WSP at the time of development, was used for assigning the 2025 and 2040 forecast highway matrices as described above and is consistent with the version used in the production of the 2019 base year model. Assignment of traffic means the forecast traffic matrix demand defined as a series of zone origin-destination pairs was applied to the traffic model network. The SATURN software then routes the traffic within the matrix on the basis of the balance of delays and travel costs which the traffic faces when traversing the network to produce a final assignment of traffic flows by link.

3.8.2. The NATS Public Transport model has been developed using PTV's VISUM 2020 software.

3.8.3. The Variable Demand Model (VDM) has used DIADEM V7.0.2 software.

4

FORECAST SUPPLY - HIGHWAY

4 FORECAST SUPPLY - HIGHWAY

4.1 INTRODUCTION

4.1.1. This chapter outlines the highway network changes that were incorporated into the NATS model forecast networks for 2025 Opening Year and 2040 Design Year for the proposed scheme

4.1.2. Future year network changes outlined within this section were received in the Uncertainty Log for the respective local authorities and represent both proposed infrastructure scheme and development accesses coded for sites that are being explicitly modelled.

4.2 HIGHWAY NETWORK

4.2.1. The forecast highway networks were developed following the methodology set out in TAG Unit M4. The two key factors affecting the future supply are:

- Network wide changes in transport costs represented by economic parameters including values of time, vehicle operating costs and vehicle occupancies
- Local network changes resulting from other transport interventions identified within the Uncertainty Log

4.2.2. Values of time and vehicle operating costs are applied at user class level and are specific to each forecast year and modelled time period. Highway network interventions are identified within the Uncertainty Log and will generally be equally applicable to all time periods and all user classes but may differ across forecast years.

4.2.3. The assumptions surrounding both economic parameters and local highway interventions are discussed in turn within the rest of this section.

4.3 FORECAST YEARS VALUES OF TIME AND VEHICLE OPERATING COSTS

4.3.1. The economic parameters used during Base and Forecast assignment for each year and time period are displayed in Table 4-1 and Table 4-2. These are based on parameters from TAG Data Book, July 2020 v1.13.1.

Table 4-1: Assignment Parameter – Values of Time (pence per minute)

Year	Time Period	Cars			Goods Vehicles	
		Commute	Business	Other	LGV	HGV
2019	AM	20.81	31.03	14.36	22.49	44.78
	IP	21.15	31.79	15.29	22.49	44.78
	PM	20.88	31.47	15.03	22.49	44.78
2025	AM	22.26	33.20	15.36	24.06	47.92
	IP	22.63	34.02	16.36	24.06	47.92
	PM	22.34	33.68	16.09	24.06	47.92
2040	AM	29.37	43.79	20.26	31.74	63.22
	IP	29.85	44.88	21.58	31.74	63.22
	PM	29.47	44.42	21.22	31.74	63.22

Table 4-2: Assignment Parameter – Vehicle Operating Cost (pence per kilometre)

Year	Time Period	Cars			Goods Vehicles	
		Commute	Business	Other	LGV	HGV
2019	AM	5.92	12.07	5.92	13.78	35.21
	IP	5.92	12.07	5.92	13.78	35.21
	PM	5.92	12.07	5.92	13.78	35.21
2025	AM	5.40	11.48	5.40	13.48	36.22
	IP	5.40	11.48	5.40	13.48	36.22
	PM	5.40	11.48	5.40	13.48	36.22
2040	AM	4.80	9.98	4.80	13.59	38.49
	IP	4.80	9.98	4.80	13.59	38.49
	PM	4.80	9.98	4.80	13.59	38.49

4.4 DO MINIMUM

4.4.1. The base year network has been updated to include the following:

- Highway schemes with sufficient level of certainty (as per the Uncertainty Log included in Appendix A)
- Loading points for development zones
- Traffic signal timing changes.

COMMITTED HIGHWAY SCHEMES

4.4.2. Table 4-3, Table 4-4 and Figure 4-1 show all the highway schemes with sufficient level of certainty (i.e. 'near certain' or 'more than likely') to be included in the core scenario. Improvements were made to the highway network to include the schemes. Figure

4.4.3. Background growth in traffic and the resulting re-routings due to demand changes led to the need to optimise some of signals for predicted 2025 and 2040 traffic flow levels. The signalised junctions that were optimised when compared against the validated base year network.

4.4.4. The same optimised signal timing has been carried out from DM through all DS scenarios for both the model years.

Table 4-3: Signal Optimisation for Do-Minimum Networks

Node	Junction	DM 2025	DM 2040	DM 2050	Time Period
1	Longwater and Easton (Nodes 5130,5126,2135)	No	Yes	Yes	AM, IP and PM
2	Growth Triangle near Tesco Signal (2012,3627)	No	Yes	Yes	AM, IP and PM

Table 4-4: Reference Case Network

S.No	Scheme	Year	Uncertainty	Description	Saturn Node Reference
1	Daniels Road roundabout traffic flow improvements	2025	Near Certain	▪ Changes to the traffic light-controlled junction at South Park Avenue to improve the operation of the junction, including pedestrian facilities ▪ New pedestrian refuges near Highland Road and Unthank Road ▪ Replacement of the existing pedestrian crossings near Mornington Road and Waldeck Road with staggered, signalised pedestrian crossings ▪ Double yellow lines on the northern side of Colman Road with a combination of double yellow lines and limited waiting parking bays on the southern side ▪ Double yellow lines on both sides of Unthank Road with a parking bay on the northern side ▪ Extension of double yellow lines on north and south sides of South Park Avenue	▪ No modelling impact
2	Longwater and Easton	2025	Near Certain	▪ Part signalisation of the Longwater southern (Showground) roundabout	▪ Introduction of Signalised Node 3146
3	A47 improvements (Highways England)	2025	More than Likely	▪ Dualling the A47 North Tuddenham to Easton	▪ 7510 to 3006/3009
4	A47 improvements (Highways England)	2025	More than Likely	▪ Dualling the A47 Blofield to North Burlingham	▪ 2802,2830
5	A47 improvements (Highways England)	2025	More than Likely	▪ Improving the A47/A11 Thickthorn junction	▪ 2303,7802, 7807
6	Development Link Broadland Business Park to Plumstead Road and Speed Reduction on the Plumstead Road	2025	Near Certain	▪ Link Road to bypass narrow country road and Thorpe End connecting to Plumstead Road	▪ Nodes 9212,9213, 9215,9216
7	Salhouse Road - Wroxham Road Link Road	2025	Near Certain	▪ New Road through new housing estate Connecting Wroxham Road to Salhouse Road	Nodes 9205,9206,9207 and 9208
8	Thickthorn and Roundhouse Roundabout improvements	2040	Near Certain	▪ Thickthorn and Roundhouse developers' scheme. Signalisation of the junction	▪ Nodes 2309,5098 and 5099

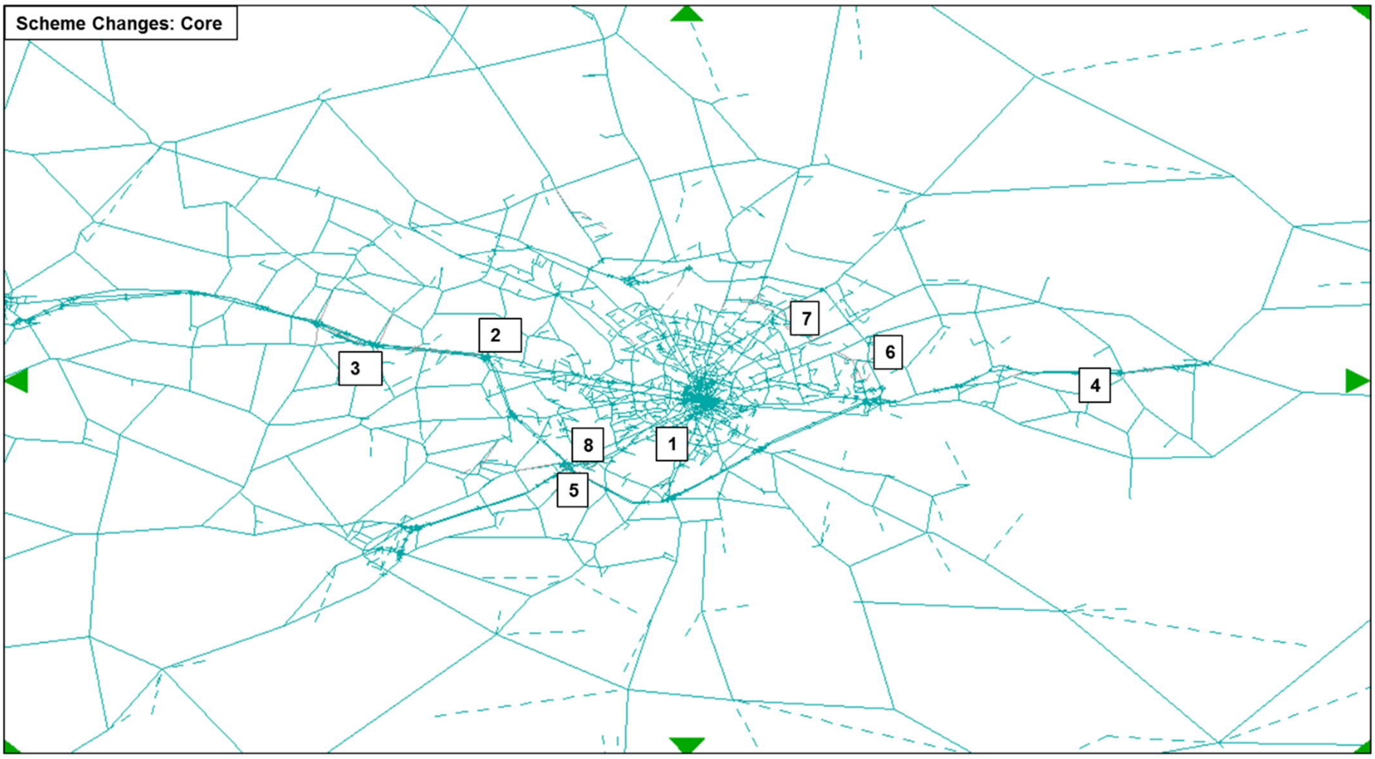


Figure 4-1: Committed Schemes

4.4.5. Figure 4.2 shows the Highways England A47 North Tuddenham to Easton scheme (No 3 reference in Figure 4-1) while Figure 4-3 shows the Highways England Thickthorn Junction scheme (No 5 reference in Figure 4-1)

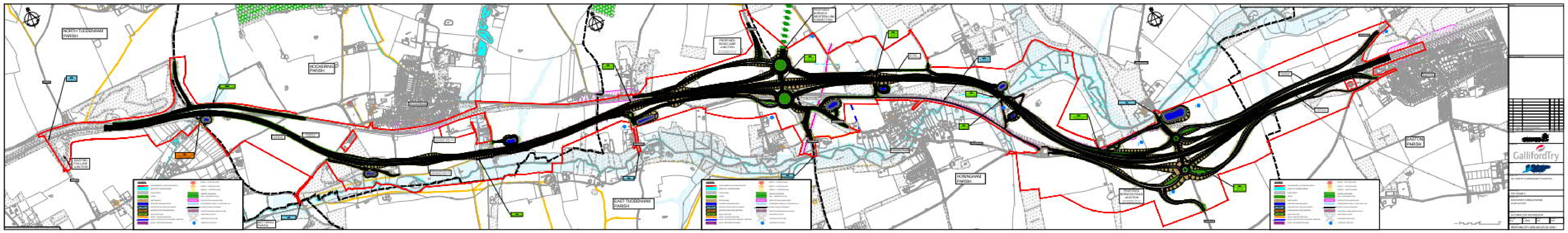


Figure 4-2: Highways England A47 North Tuddenham to Easton scheme

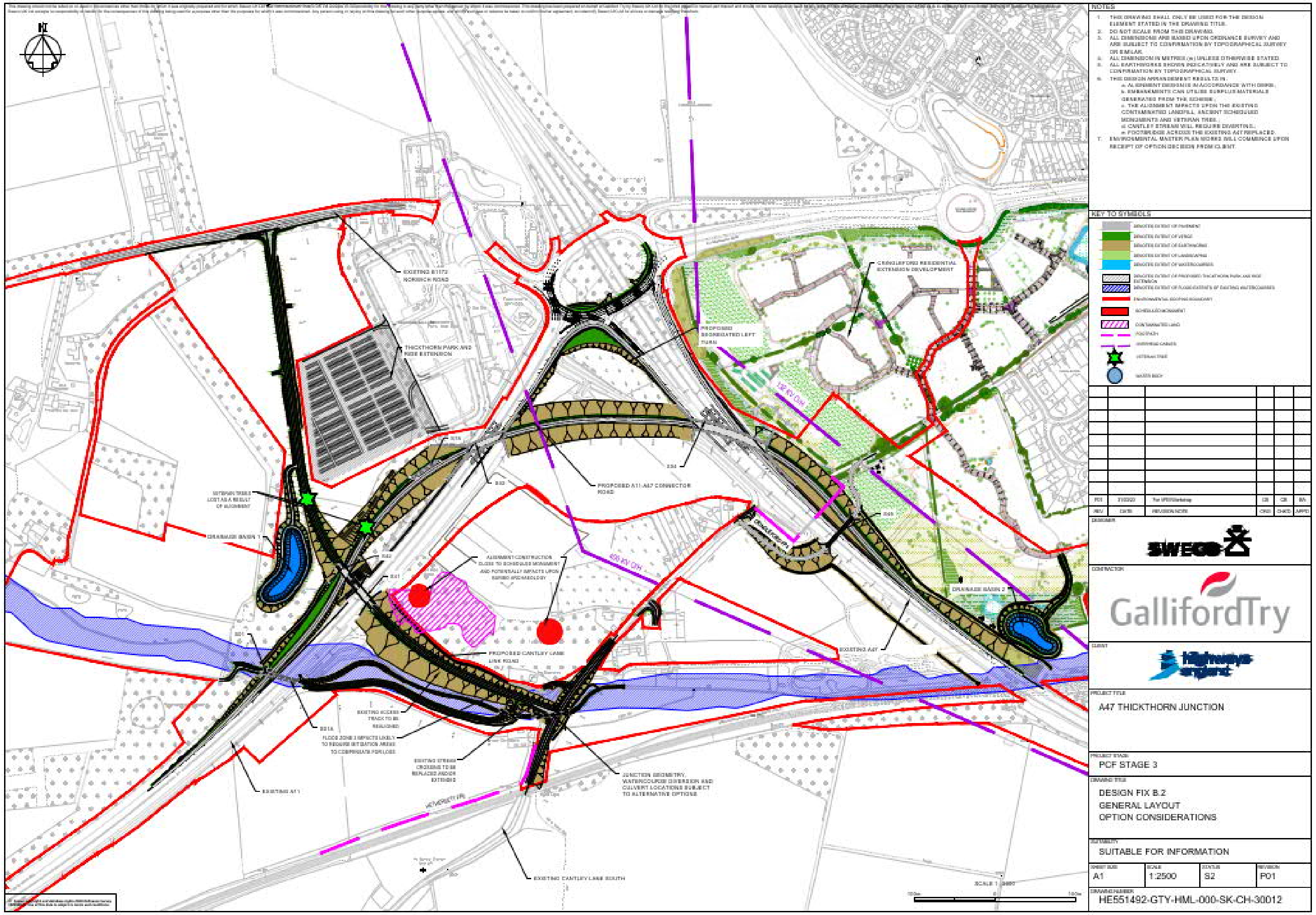


Figure 4-3: Highways England Thickthorn Junction

4.5 DO SOMETHING

4.5.1. The Norwich Western Link Road (NWLR) referred to as “Do-Something” scheme provides a higher standard route between the western end of Broadland Northway and the A47 and aims to significantly improve travel between these two major roads.

4.5.1. Figure 4-4 shows the indicative scheme layout for the Norwich Western Link scheme with Figure 4-5 showing the scheme coding that has been included within the SATURN model to represent the Norwich Western Link scheme.

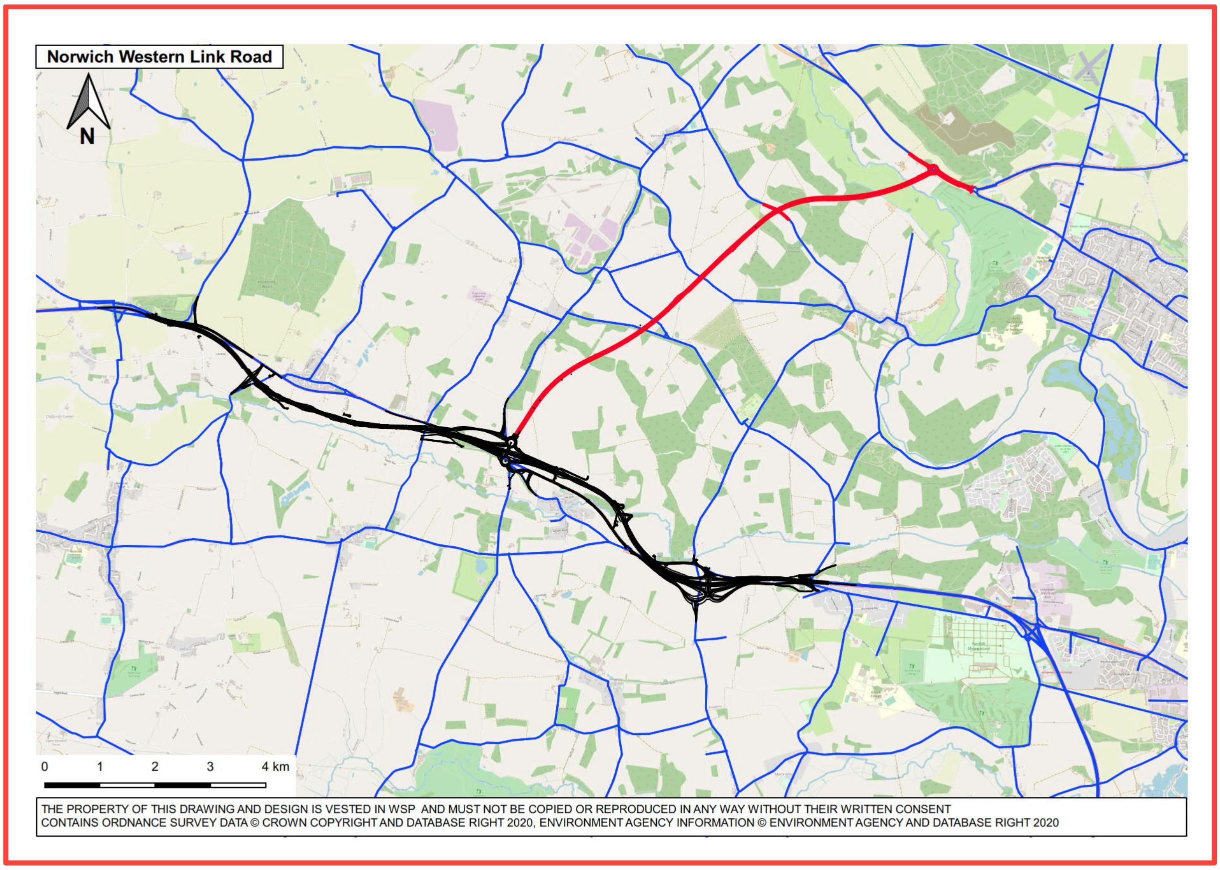


Figure 4-4: NWL Scheme

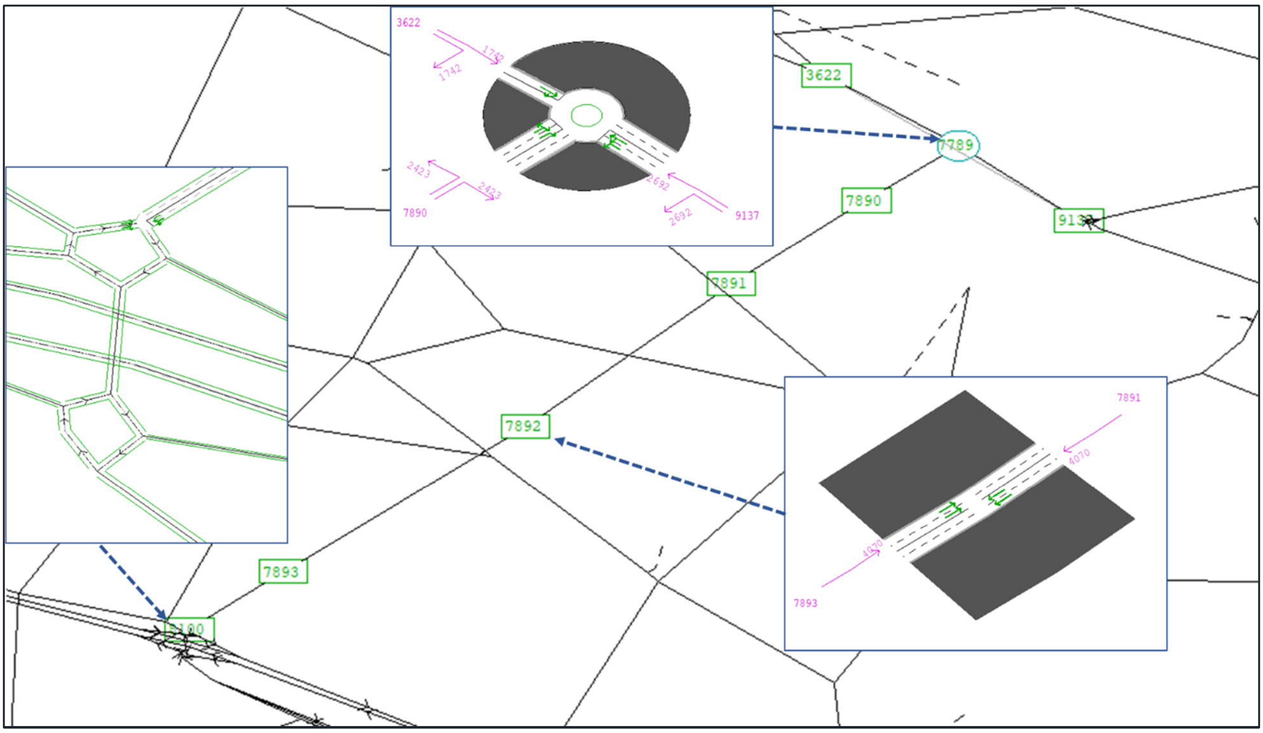


Figure 4-5: Do Something Scheme Coding in SATURN

5

FORECAST SUPPLY - PUBLIC TRANSPORT

5 FORECAST SUPPLY - PUBLIC TRANSPORT

5.1 NETWORK DEVELOPMENT

5.1.1. The 2019 base year public transport network was used as the basis for producing forecast year public transport networks.

5.1.2. In the absence of information regarding future year public transport services, the impact of 'near certain' and 'more than likely' highway schemes on existing bus frequencies and journey times has been considered. The impact of these highway schemes on bus frequencies and journey times has been considered negligible, so no service changes have made to the Core public transport forecast networks.

5.1.3. The fare coefficients were updated based on the values of time from the July 2020 TAG Databook (v1.13.1). The values of time and fare coefficients for each forecast year are shown in Table 5-1 and Table 5-2.

Table 5-1: 2025 VOT and fare coefficient

Purpose	VOT (pence per minute)			Fare coefficient (minutes per £)		
	AM	IP	PM	AM	IP	PM
Work	40.22	40.22	40.22	2.49	2.49	2.49
Commute	19.66	19.66	19.66	5.09	5.09	5.09
Other	8.97	8.97	8.97	11.14	11.14	11.14

Table 5-2: 2040 VOT and fare coefficient

Purpose	VOT (pence per minute)			Fare coefficient (minutes per £)		
	AM	IP	AM	AM	IP	PM
Work	53.06	53.06	53.06	1.88	1.88	1.88
Commute	25.93	25.93	25.93	3.86	3.86	3.86
Other	11.84	11.84	11.84	8.45	8.45	8.45

5.1.4. The public transport fares were also updated. Bus fares were based on 1.8% annual growth, and rail fares were based on 1.0% annual growth. This is consistent with previous PT forecasting work for Norwich.

6

FORECAST DEMAND – HIGHWAY MODEL

6 FORECAST DEMAND – HIGHWAY MODEL

6.1 INTRODUCTION

6.1.1. This chapter sets out the information provided to WSP to inform the development of forecast matrices representing the expected growth in trips between the 2019 base year and the 2025 and 2040 scheme assessment years. This includes information on residential and commercial developments received from Norfolk County Council (NCC) and the four Norfolk district local planning authorities (Breckland, Broadland, Norwich and South Norfolk).

6.1.2. Trip generation associated with specifically modelled developments in addition to background growth for Car, LGV and HGV user classes is outlined within this chapter to summarise all matrix inputs and present the overall growth in trips between 2019 and the forecast years

6.2 METHODOLOGY

6.2.1. In order to develop the modelling scenarios outlined in Section 3.4, it was necessary to build demand trip matrices in relation to the forecast years 2025 (scheme opening year) and 2040 (scheme opening year + 15 years). The methodology to derive the forecast trip matrices is described below.

6.2.2. There are two key elements to the forecast demand development which will be discussed in this Chapter, as follows:

- Committed development trip generation
- Background Growth.

6.2.3. Committed development trip generation will establish the forecast trips that will be generated by specifically known developments, which either have planning consent ('Near Certain') or are going through the planning process ('More Than Likely'). The processing of these sites is as follows:

- **Uncertainty Log:** Establish an uncertainty log of site-specific developments within the study area, whereby the term development refers to either residential or commercial site use;
- **Allocation to Model Zones:** Allocate these site-specific developments a corresponding SATURN zone
- **Trip Rates:** Calculate trip rates to convert the number of dwellings/jobs into peak hour trips in the forecast years; and
- **Proportion of Trips Amongst Car User Classes:** Proportion out these development trips across the five car-based user classes.

6.2.4. Background growth establishes the forecast trips that will be generated by residual housing and employment growth, once the specifically modelled sites have been removed. Background growth comes from the following:

- **Car Growth Factors**: Obtain the unadjusted growth factors (constraint) from TEMPro. Determine the adjusted growth factors via the application of alternative planning assumptions; and
- **LGV and HGV Growth factors**: Apply 2018 National Road Traffic Forecast (NRTF) factors to account for user class (UC) 6 (LGV) and UC7 (HGV) growth in a respective forecast year model.

6.2.5. The committed development and background growth are combined and distributed using a Furness method to produce a set of forecast year matrices for the respective model years and peak periods. A TEMPro capacity constraint is applied to cap the total number of forecast trips.

6.2.6. **Figure 6-1** shows a diagram of the matrix forecasting process.

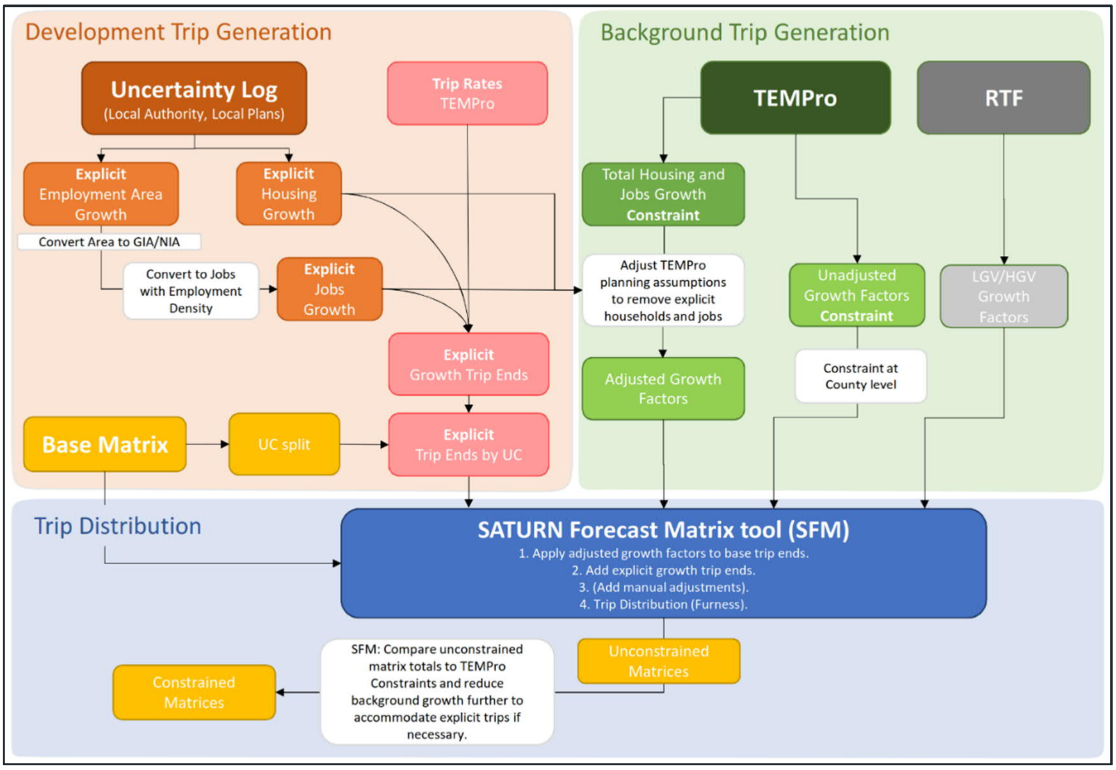


Figure 6-1: Matrix Forecasting Process

6.3 COMMITTED DEVELOPMENTS

6.3.1. Residential and commercial developments which are 'Near Certain' or 'More Than Likely' have been included within the forecast matrices.

6.3.2. Details of prospective developments were collated from the relevant documentation published by the local planning authorities and captured within the Uncertainty Log, along with their prescribed level of uncertainty.

6.3.3. Development information i.e. housing and jobs along with infrastructure was received from the four Norfolk district local planning authorities i.e. Breckland, Broadland, Norwich and South Norfolk based on following criteria:

- Only the applications within the districts of Breckland, Broadland, Norwich and South Norfolk were considered
- Applications were further removed based on Application status and Type codes. Only the applications considered relevant to the study were considered.
- Also, if the development consisted of less than 5 dwellings it was not considered in the Uncertainty Log.

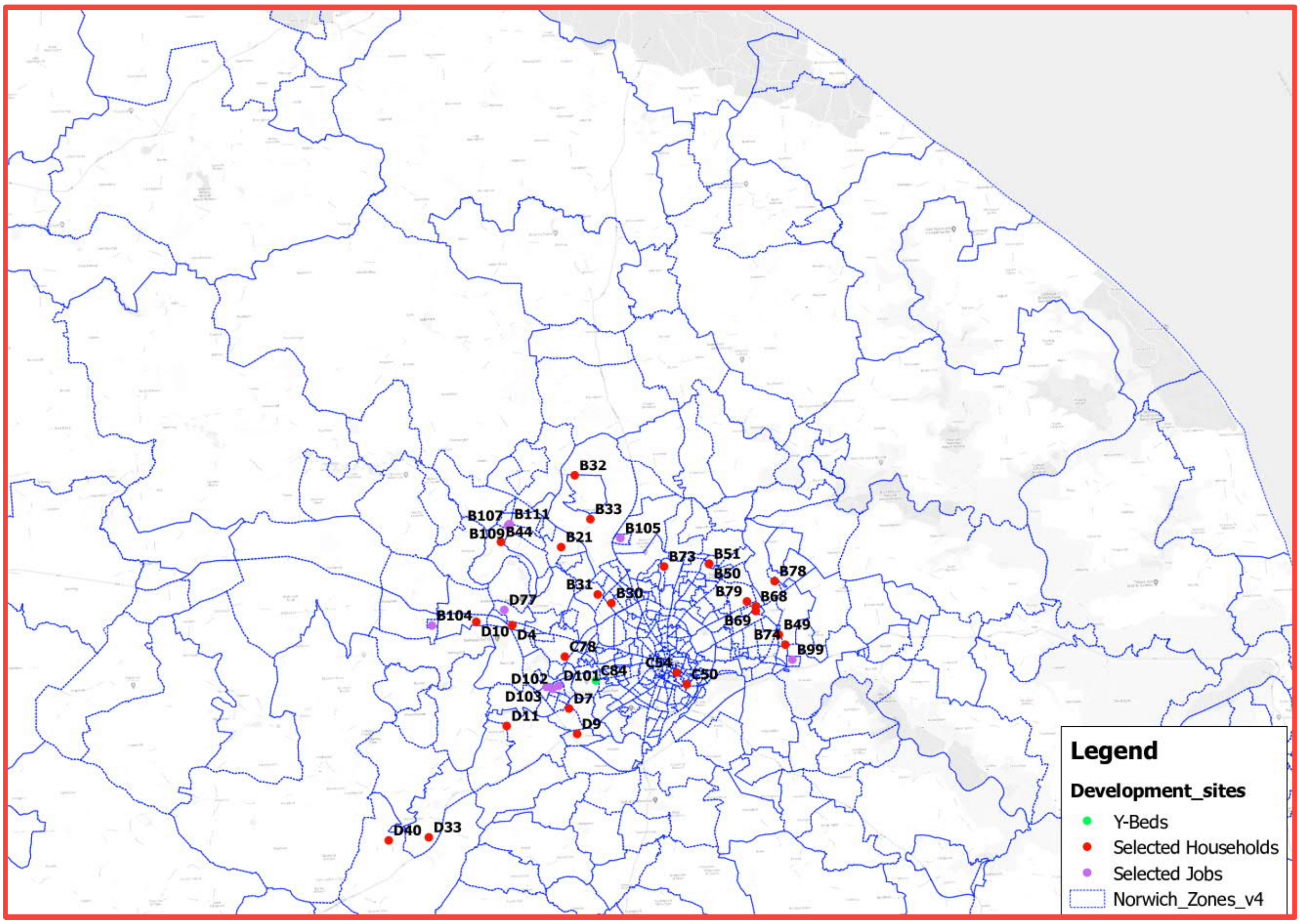
6.3.4. Based on the above criteria, a total of 356 applications were recorded in the Uncertainty Log for further analysis.

6.3.5. Developments assessed to be either 'near certain' or 'more than likely' were considered in the demand forecasts for the Core scenario. In line with guidance from TAG unit M4 Table A1, this comprised developments for which planning consent had been either granted or application submitted, or protected plots of land reserved for Local Plan development.

6.3.6. The Uncertainty Log has been developed in consultation with the development team at Norfolk County Council. The final version of the Uncertainty Log representing the demand increase in forecast scenarios is presented in Appendix A.

6.3.7. Figure 6-2 represents the new developments zones considered exclusively based on development trips from the Uncertainty log. Individual development sites contributing more than 150 trips were added as separate zones to the model to accurately account for the large increase of trips and ensure trips are added to the network in the correct location. This also allows for the trips into and out of those development zones to match that calculated using the TRICS trip rates and the quantum of development.

Figure 6-2: Location of New Development Zones in Core Scenario

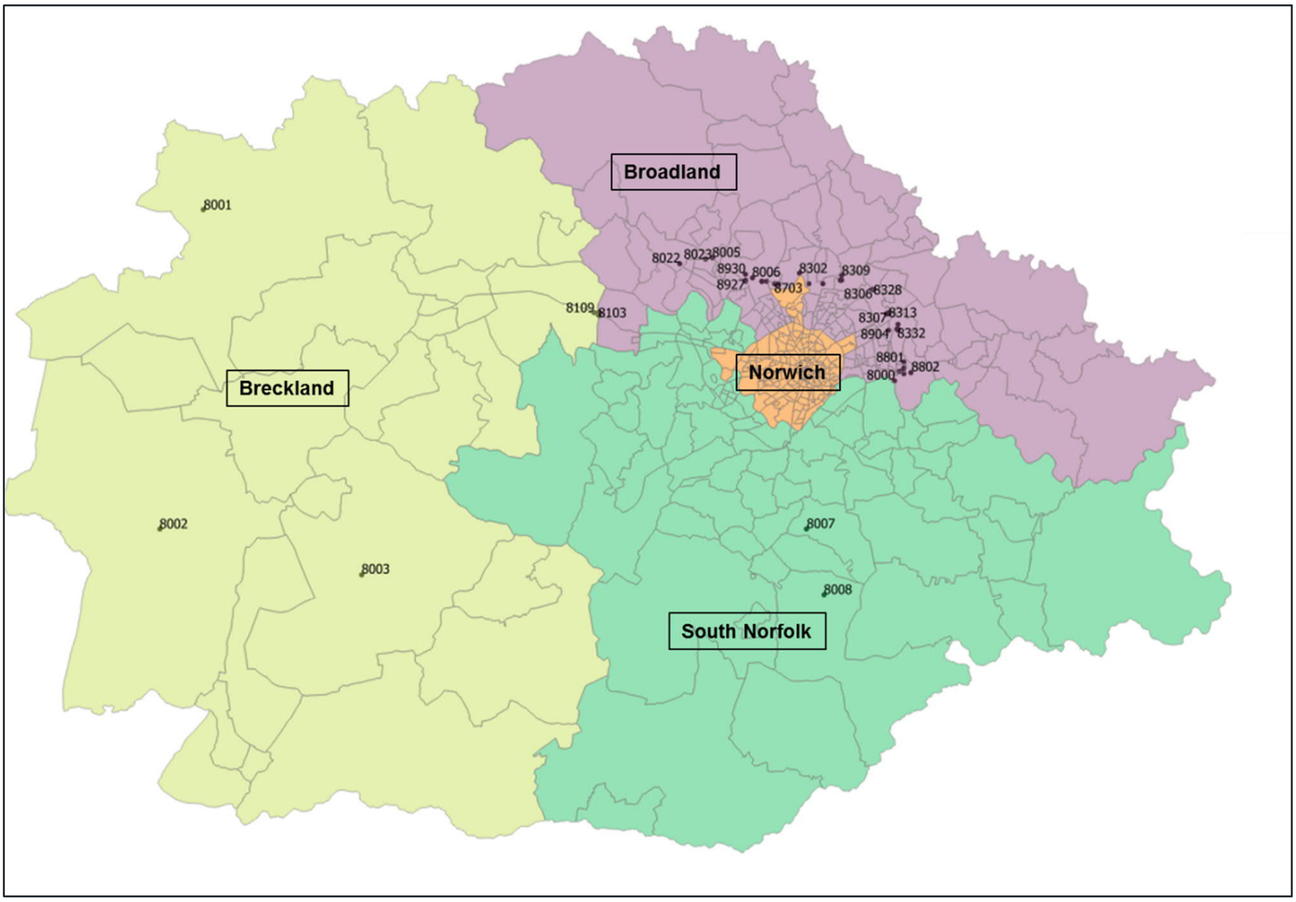


6.3.8. All the development sites that are independently represented in the model fall within the following districts which are each represented as separate zones within NTEM / TEMPro. Table 6-1 shows the total number of jobs and dwelling as taken from the Uncertainty Log for the forecast years of 2025 and 2040.

Table 6-1: Uncertainty Log – total jobs and dwelling (2025 and 2040)

TEMPro Zone	Development Zone No	Total Jobs	Total Dwelling Units	Total Jobs	Total Dwelling Units
		2025		2040	
Breckland	8001-8007	168	4,277	928	13,678
Broadland	8008-8032	2,162	5,575	6,104	12,422
Norwich	8033-8041	668	2,897	1,686	4,425
South Norfolk	8042-8057	882	5,957	2,045	9,670
Total		**3,879**	**18,706**	**10,763**	**40,195**

Figure 6-3: TEMPro zones in Norwich



6.4 NATIONAL TRIP END FORECASTS

6.4.1. The overarching level of traffic growth for each future year has been derived from the National Trip End Model (NTEM) forecasts via TEMPro (Trip End Model Presentation Program). Dataset version 7.2 has been used as this was the most recent dataset available at the time of the forecast model development.

6.4.2. Table 6-2 compares the number of new households and jobs created by the modelled developments with the planning assumptions in TEMPro.

Table 6-2: Uncertainty Log Core Scenario vs TEMPro

Districts	Year	Households		Jobs	
		Uncertainty Log (Core Scenario)	TEMPro	Uncertainty Log (Core Scenario)	TEMPro
Breckland	2025	4,277	7,179	168	1,313
	2040	13,678	24,896	928	3,828
Broadland	2025	5,575	8,108	2,162	1,274
	2040	12,422	28,069	6,104	3,624
Norwich	2025	2,897	5,234	668	2,352
	2040	4,425	17,632	1,686	6,809
South Norfolk	2025	5,957	6,312	882	1,496
	2040	9,670	21,453	2,045	4,201
Total	2025	18,706	26,833	3,879	6,435
	2040	40,195	92,050	10,763	18,462

6.4.3. The estimated number of jobs created by each development site is based on employment density rates within the Employment Density Guide produced by the Homes and Communities Agency[5] (Table 4). These rates have been shown in Figure 6-4.

[5] *Employment Density Guide, Homes and Communities Agency, November 2015, 3rd Edition*

Figure 6-4: Employment Density Rates

Use Class	Sub-Category	Sub-Sector	Density (sqm)	Notes
B1a Offices	General Office	Corporate	13	NIA
		Professional Services	12	NIA
		Public Sector	12	NIA
		TMT	11	NIA
		Finance & Insurance	10	NIA
	Call Centres		8	NIA
B1b	R&D Space		40-60	NIA lower densities will be achieved in units with higher provision of shared or communal spaces
B1c	Light Industrial		47	NIA
B2	Industrial & Manufacturing		36	GIA
B8	Storage & Distribution	National Distribution Centre	95	GEA
		Regional Distribution Centre	77	GEA
		'Final Mile' Distribution Centre	70	GEA
Mixed B Class	Small Business Workspace	Incubator	30-60	B1a, B1b – the density will relate to balance between spaces, as the share of B1a increases so too will employment densities.
		Maker Spaces	15-40	B1c, B2, B8 - Difference between 'planned space' density and utilisation due to membership model
		Studio	20-40	B1c, B8
		Co-Working	10-15	B1a - Difference between 'planned space' density and utilisation due to membership model
		Managed Workspace	12-47	B1a, b, c
B8 / Sui Generis	Data Centres	Wholesale	200-950	
		Wholesale Dark Site	440-1,400	
		Co-location Facility	180-540	
A1	Retail	High Street	15-20	NIA
		Foodstore	15-20	NIA
		Retail Warehouse	90	NIA
A2	Finance & Professional Services		16	NIA
A3	Restaurants & Cafes		15-20	NIA
C1	Hotels	Limited Service / Budget	1 per 5 beds	FTE per bed
		Mid-scale	1 per 3 beds	FTE per bed
		Upscale	1 per 2 beds	FTE per bed
		Luxury	1 per 1 bed	FTE per bed
D2	Fitness Centres	Budget	100	GIA
		Mid Market	65	GIA – both types tend to generate between 40-50 jobs per gym
		Family		
	Cinema		200	GIA
	Visitor & Cultural Attractions		30-300	The diversity of the cultural attraction sector means a very wide range exists
	Amusement & Entertainment Centres		70	Potential range of 20-100sqm

CAR GROWTH FACTORS

6.4.4. TEMPro growth factors were applied at a study area level within the NATS model as defined in Section 6.3. For external zones outside of Norfolk, a growth rate was based on the East of England (excluding Suffolk and Norfolk). The growth factors were derived from the latest version of TEMPro (V7.2).

6.4.5. Table 6-3 to Table 6-5 presents the background factors that have been applied to the various study areas within the model between 2019 and 2025 for each User Class for the AM peak, Inter peak and PM peak respectively.

Table 6-3: Adjusted TEMPro Growth Factors, 2019 to 2025 – AM peak

Study Area	UC1		UC2		UC3		UC4		UC5	
	Origin	Dest	Origin	Dest	Origin	Dest	Origin	Dest	Origin	Dest
Broadland	1.0872	1.0415	1.097	1.0466	1.1244	1.1002	1.0406	1.0399	1.0663	1.0659
Breckland	1.0712	1.0396	1.0793	1.0437	1.1116	1.0942	1.038	1.0386	1.0634	1.0637
South Norfolk	1.0490	1.0396	1.0571	1.0440	1.0939	1.0891	1.0405	1.0400	1.0698	1.0653
Norwich	1.0677	1.0395	1.0768	1.0428	1.1015	1.0863	1.0389	1.0396	1.0637	1.0644
London	1.0568	1.0461	1.0588	1.0485	1.0916	1.0891	1.0452	1.0452	1.0689	1.0667
GB	1.0449	1.0449	1.0485	1.0485	1.0684	1.0684	1.0425	1.0425	1.0559	1.0559
Norfolk	1.0605	1.0406	1.0677	1.0448	1.1020	1.0935	1.0416	1.0411	1.0699	1.0692

Table 6-4: Adjusted TEMPro Growth Factors, 2019 to 2025 – Inter peak

Study Area	UC1		UC2		UC3		UC4		UC5	
	Origin	Dest	Origin	Dest	Origin	Dest	Origin	Dest	Origin	Dest
Broadland	1.0581	1.0655	1.0735	1.0729	1.1181	1.119	1.0398	1.0402	1.0678	1.0674
Breckland	1.0488	1.0546	1.0637	1.0623	1.109	1.1095	1.0384	1.0387	1.0651	1.0666
South Norfolk	1.0398	1.0416	1.0511	1.0507	1.0968	1.0973	1.0403	1.0408	1.0698	1.0677
Norwich	1.0455	1.0488	1.055	1.0549	1.0978	1.0993	1.0389	1.0391	1.0659	1.0665
London	1.0487	1.0498	1.0552	1.0543	1.0928	1.0938	1.0452	1.0453	1.0693	1.067
GB	1.0394	1.0394	1.0477	1.0477	1.0717	1.0717	1.0426	1.0426	1.0567	1.0567
Norfolk	1.0452	1.0482	1.0561	1.0556	1.1026	1.1033	1.0414	1.0411	1.0712	1.0703

Table 6-5: Adjusted TEMPro Growth Factors, 2019 to 2025 – PM peak

Study Area	UC1		UC2		UC3		UC4		UC5	
	Origin	Dest	Origin	Dest	Origin	Dest	Origin	Dest	Origin	Dest
Broadland	1.0408	1.0852	1.0523	1.0914	1.1	1.1115	1.0402	1.0397	1.0678	1.0672
Breckland	1.0372	1.0687	1.0468	1.0758	1.0918	1.0995	1.039	1.0384	1.0648	1.0657
South Norfolk	1.036	1.0459	1.0445	1.0549	1.081	1.0835	1.0398	1.0409	1.0693	1.0678
Norwich	1.038	1.0634	1.0453	1.0691	1.0803	1.0844	1.0383	1.0393	1.0661	1.066
London	1.044	1.0545	1.0489	1.0571	1.0818	1.0805	1.0449	1.0452	1.0687	1.0667
GB	1.0407	1.0407	1.0468	1.0468	1.0619	1.0619	1.0426	1.0426	1.0565	1.0565
Norfolk	1.0382	1.0573	1.0467	1.0642	1.0859	1.0891	1.0414	1.041	1.0711	1.0699

Table 6-6 to Table 6-8 presents the background factors that have been applied to the various study areas within the model between 2019 and 2040 for each User Class for the AM peak, Inter peak and PM peak respectively.

Table 6-6: Adjusted TEMPro Growth Factors, 2019 to 2040 – PM peak

Study Area	UC1		UC2		UC3		UC4		UC5	
	Origin	Dest	Origin	Dest	Origin	Dest	Origin	Dest	Origin	Dest
Broadland	1.2981	1.1351	1.3311	1.1492	1.4024	1.3154	1.1277	1.1282	1.2075	1.2066
Breckland	1.2386	1.1303	1.2652	1.1434	1.3636	1.298	1.1252	1.1278	1.2008	1.2055
South Norfolk	1.1718	1.1279	1.1958	1.1405	1.2986	1.2778	1.1291	1.1294	1.2117	1.206
Norwich	1.2056	1.1278	1.2336	1.1394	1.3211	1.2713	1.126	1.1281	1.2018	1.2042
London	1.1672	1.1307	1.1754	1.1379	1.285	1.2707	1.1298	1.1295	1.2053	1.1992
GB	1.1333	1.1333	1.1438	1.1438	1.2071	1.2071	1.1274	1.1274	1.1691	1.1691
Norfolk	1.202	1.1301	1.2257	1.1431	1.3243	1.2886	1.1312	1.1301	1.2135	1.2117

Table 6-7: Adjusted TEMPro Growth Factors, 2019 to 2040 – PM peak

Study Area	UC1		UC2		UC3		UC4		UC5	
	Origin	Dest	Origin	Dest	Origin	Dest	Origin	Dest	Origin	Dest
Broadland	1.1923	1.2196	1.2459	1.2435	1.3711	1.3755	1.1275	1.1288	1.2092	1.2088
Breckland	1.1621	1.1816	1.2105	1.207	1.3457	1.348	1.1256	1.127	1.2045	1.2083
South Norfolk	1.1346	1.1422	1.1702	1.1681	1.3003	1.3023	1.1292	1.1292	1.214	1.2091
Norwich	1.1422	1.1509	1.1713	1.171	1.3042	1.3075	1.1259	1.1271	1.2057	1.2075
London	1.1419	1.1462	1.1602	1.1574	1.2853	1.2884	1.1296	1.1296	1.206	1.1995
GB	1.1181	1.1181	1.141	1.141	1.2149	1.2149	1.1276	1.1276	1.1705	1.1705
Norfolk	1.1469	1.1582	1.1828	1.1813	1.3173	1.3194	1.1311	1.1301	1.2162	1.2142

Table 6-8: Adjusted TEMPro Growth Factors, 2019 to 2040 – PM peak

Study Area	UC1		UC2		UC3		UC4		UC5	
	Origin	Dest	Origin	Dest	Origin	Dest	Origin	Dest	Origin	Dest
Broadland	1.132	1.2898	1.1703	1.3091	1.3247	1.3636	1.1279	1.1289	1.2094	1.209
Breckland	1.1223	1.2298	1.1545	1.2518	1.2991	1.3267	1.1257	1.127	1.204	1.2073
South Norfolk	1.117	1.162	1.1449	1.1872	1.26	1.2705	1.1297	1.1287	1.2131	1.2095
Norwich	1.1211	1.1901	1.1444	1.211	1.2534	1.2689	1.1256	1.1273	1.2064	1.2066
London	1.1241	1.1604	1.1404	1.1692	1.2501	1.2483	1.1291	1.1294	1.2041	1.1982
GB	1.1209	1.1209	1.1389	1.1389	1.1883	1.1883	1.1277	1.1277	1.1699	1.1699
Norfolk	1.1219	1.1912	1.1497	1.2128	1.2721	1.2862	1.1313	1.1302	1.2161	1.2135

GROWTH IN FREIGHT TRAFFIC

6.4.6. Department for Transport (DfT) Road Traffic Forecasts (2018)[6] of vehicle mileage have been used to derive growth factors for Light Goods Vehicle (LGV) and Heavy Goods Vehicle (HGV) trips in each modelled future year. These are set out in Table 6-9 and Table 6-10.

Table 6-9: Traffic - Billion Vehicle miles (bvm) from RTF

Region	Road Type	Vehicle Type	2015	2020	2025	2030	2035	2040
Eastern England	All	LGV	5.6	6.1	6.4	6.8	7.2	7.7
Eastern England	All	HGV	2.0	2.1	2.1	2.2	2.2	2.3
London	All	LGV	2.6	2.9	3.1	3.3	3.5	3.7
London	All	HGV	0.7	0.6	0.6	0.6	0.7	0.7
All	All	LGV	42.6	46.9	49.4	52.1	55.7	59.3
All	All	HGV	15.1	15.1	15.1	15.3	15.6	15.9

Table 6-10: Calculated Growth Factor for Freight Trips

Region	Road Type	Vehicle Type	2019 - 2025	2019 - 2040
Eastern England	All	LGV	1.067	1.279
London	All	LGV	1.096	1.320

[6] https://www.gov.uk/government/publications/road-traffic-forecasts-2018

England and Wales	All	LGV	1.073	1.289
Eastern England	All	HGV	1.019	1.104
London	All	HGV	0.996	1.028
England and Wales	All	HGV	1.003	1.051

6.4.7. These forecasts are derived from National Transport Model (NTM) Scenario 1 because this was the most central forecast out of the scenarios available and includes a level of growth which is robust but not extreme. This scenario is based on historic average trip rates, a positive and declining income relationship and a central macroeconomic forecast. The Road Traffic Forecasts 2018 report does not indicate that the use of any one scenario is preferable.

6.4.8. Factors are provided regionally at five-year intervals, so growth rates have been calculated by interpolation (e.g. a factor for 2019 is calculated by linear interpolation between 2015 and 2020) for the regions listed in Table 6-9 and Table 6-10.

CONTROL TO NTEM /TEMPRO GROWTH

6.4.9. As per the guidelines in TAG[7], the growth in car travel demand has been controlled to the growth in the NTEM dataset over a suitable spatial area. In this case, the total growth over the NTEM zones where development has been explicitly modelled has been adjusted to avoid double counting growth. Alternative planning assumptions have been applied within the Tempro program to create adjusted factors.

6.4.10. The adjusted factors have applied to existing model zones and then explicitly modelled tips were then added on top of this. The resultant growth in the matrix is then 'constrained to Tempro'. Adjustment factors have then been applied to all model zones within the NTEM area to ensure that the overall growth in this area is consistent with NTEM. This method ensures that unrealistic levels of growth are avoided across NTEM areas.

6.4.11. Section 6.4 covers the preparation of the Core Growth forecast matrices in detail and provides a summary of the level of constraint that has been applied to the modelled growth in car trips to bring it in line with TEMPro.

[7] *WebTAG Unit M4, paragraph 7.1.7*

6.5 FUTURE YEAR TRIP ENDS

DEVELOPMENT ZONES

6.5.1. Trip ends for the development zones were created by applying the car trip rates. These trip rates were derived from the TRICS database (version 7.5.3). The TRICS database was used to estimate the arrival and departure profile for each proposed development which are set out in Table 6-11 and Table 6-12.

Table 6-11: TRICS Trip Rates for Future Developments (Lights)

Code	Type	Arrivals			Departures			Total		
		08:00-09:00	10:00-16:00	17:00-18:00	08:00-09:00	10:00-16:00	17:00-18:00	08:00-09:00	10:00-16:00	17:00-18:00
		AM	IP	PM	AM	IP	PM	AM	IP	PM
1	A1_Retail	0.6620	1.0642	1.3110	0.5270	1.0698	1.1930	1.1890	2.1340	2.5040
2	A2_Financial	0.4180	0.0600	0.0240	0.0340	0.0867	0.3320	0.4520	0.1467	0.3560
3	A5_Food_Jobs	0.0000	0.1675	0.2340	0.0000	0.1150	0.0270	0.0000	0.2825	0.2610
4	B1_Business_Jobs	0.4180	0.0600	0.0240	0.0340	0.0867	0.3320	0.4520	0.1467	0.3560
5	B1b_R&D_Jobs	0.4180	0.0600	0.0240	0.0340	0.0867	0.3320	0.4520	0.1467	0.3560
6	B2_Industrial_Jobs	0.1960	0.1053	0.0450	0.0750	0.1118	0.2040	0.2710	0.2172	0.2490
7	C3_Residential	0.1210	0.1443	0.3290	0.3560	0.1387	0.1470	0.4770	0.2830	0.4760
8	Sui Generis	0.0520	0.0852	0.0570	0.0520	0.0877	0.0620	0.1040	0.1728	0.1190

Table 6-12: TRICS Trip Rates for Future Developments (Heavies)

Code	Type	Arrivals			Departures			Total		
		08:00-09:00	10:00-16:00	17:00-18:00	08:00-09:00	10:00-16:00	17:00-18:00	08:00-09:00	10:00-16:00	17:00-18:00
		AM	IP	PM	AM	IP	PM	AM	IP	PM
1	A1_Retail	0.0040	0.0062	0.0070	0.0070	0.0063	0.0040	0.0110	0.0125	0.0110
2	A2_Financial	0.0040	0.0023	0.0030	0.0040	0.0023	0.0020	0.0080	0.0047	0.0050
3	A5_Food_Jobs	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
4	B1_Business_Jobs	0.0040	0.0023	0.0030	0.0040	0.0023	0.0020	0.0080	0.0047	0.0050
5	B1b_R&D_Jobs	0.0040	0.0023	0.0030	0.0040	0.0023	0.0020	0.0080	0.0047	0.0050
6	B2_Industrial_Jobs	0.0140	0.0152	0.0040	0.0070	0.0148	0.0050	0.0210	0.0300	0.0090
7	C3_Residential	0.0040	0.0030	0.0030	0.0030	0.0030	0.0020	0.0070	0.0060	0.0050
8	Sui Generis	0.0000	0.0025	0.0000	0.0050	0.0025	0.0000	0.0050	0.0050	0.0000

6.5.2. Individual development sites contributing more than 150 trips were added as separate zones to the model to accurately account for the large increase of trips and ensure trips are added to the network in the correct location. This also allows for the trips into and out of those development zones to match that calculated using the TRICS trip rates and the quantum of development.

6.5.3. LGV trips at the development sites have not been explicitly modelled. This is because trip rates for LGVs were not readily available from TRICS and, whilst rates are available for HGVs, they indicate that amount of HGV trips generated in the modelled hours would be negligible. It is noted that, whilst no goods vehicle trips have been explicitly modelled at development sites, a background growth rate for LGV and HGV has been applied to non-development zones based on National Road Traffic Forecasts (as described previously in Section 6.5). This is in line with TAG which advocates the use of National Road Traffic Forecasts (NRTF) for applying growth to freight matrices.

6.5.4. The total number of car trips generated at each development has been divided amongst the trip purposes in the model using TEMPro data. Trip purpose proportions were calculated based on the base year trip matrix trip purpose proportions. The adjusted TEMPro growth factors shown previously were applied to all non-development zones within the modelled area. Outside these areas (i.e. where no development sites exist) unadjusted TEMPro factors were applied.

6.6 SUMMARY OF DEVELOPMENTS MODELLED

6.6.1. Table 6-13 to Table 6-15 presents the quantum of development trips within the various study areas in the model between 2019 and 2025 for each User Class for the AM peak, Inter peak and PM peak respectively. Appendix A contains trip generation per site for the forecast year of 2025.

Table 6-13: Development trips, 2019 to 2025 – AM peak

	AM peak													
	UC1		UC2		UC3		UC4		UC5		UC6		UC7	
	Org	Dest	Org	Dest	Org	Dest	Org	Dest	Org	Dest	Org	Dest	Org	Dest
Broadland	1,233	662	126	71	649	370	81	49	94	66	156	94	37	51
Breckland	774	271	82	30	402	150	66	27	71	27	138	50	15	20
South Norfolk	993	487	101	54	502	278	91	43	91	47	150	78	20	26
Norwich	494	278	56	27	307	137	52	18	98	32	43	17	17	24

Table 6-14: Development trips, 2019 to 2025 – Inter peak

	Inter peak													
	UC1		UC2		UC3		UC4		UC5		UC6		UC7	
	Org	Dest	Org	Dest	Org	Dest	Org	Dest	Org	Dest	Org	Dest	Org	Dest
Broadland	265	281	47	47	871	878	95	98	137	138	109	108	37	33
Breckland	116	129	18	18	321	324	50	50	56	57	54	58	15	14
South Norfolk	142	145	24	24	444	447	64	66	80	76	60	64	19	19
Norwich	86	78	15	16	275	287	35	37	59	63	23	21	17	15

Table 6-15: Development trips, 2019 to 2025 – PM peak

	PM peak													
	UC1		UC2		UC3		UC4		UC5		UC6		UC7	
	Org	Dest	Org	Dest	Org	Dest	Org	Dest	Org	Dest	Org	Dest	Org	Dest
Broadland	772	1,283	73	118	681	968	62	87	87	112	83	126	19	27
Breckland	319	742	27	53	226	432	31	59	30	61	36	75	9	13
South Norfolk	496	857	43	71	370	576	45	87	54	84	51	100	13	19
Norwich	283	384	26	43	206	417	22	45	39	85	18	29	8	11

6.6.2. Table 6-16 to Table 6-18 presents the quantum of development trips within the various study areas in the model between 2019 and 2040 for each User Class for the AM peak, Inter peak and PM peak respectively. Appendix A contains trip generation per site for the forecast year of 2040.

Table 6-16: Development trips, 2019 to 2040 – AM peak

	AM peak													
	UC1		UC2		UC3		UC4		UC5		UC6		UC7	
	Org	Dest	Org	Dest	Org	Dest	Org	Dest	Org	Dest	Org	Dest	Org	Dest
Broadland	2,593	1,481	265	160	1,364	828	170	110	197	147	329	211	106	159
Breckland	2,530	958	269	108	1,314	529	216	94	231	96	449	177	50	68
South Norfolk	1,694	908	172	101	856	519	155	81	156	88	256	146	39	51
Norwich	680	476	77	47	424	235	71	32	135	54	59	29	35	48

Table 6-17: Development trips, 2019 to 2040 – Inter peak

	Inter peak													
	UC1		UC2		UC3		UC4		UC5		UC6		UC7	
	Org	Dest	Org	Dest	Org	Dest	Org	Dest	Org	Dest	Org	Dest	Org	Dest
Broadland	479	502	85	84	1,574	1,572	172	175	248	247	197	193	108	92
Breckland	411	457	63	63	1,141	1,144	176	176	199	203	191	205	50	48
South Norfolk	248	252	43	42	777	776	112	115	139	132	105	112	37	35
Norwich	131	117	22	23	418	428	53	55	90	95	36	32	34	30

Table 6-18: Development trips, 2019 to 2040 – PM peak

	PM peak													
	UC1		UC2		UC3		UC4		UC5		UC6		UC7	
	Org	Dest	Org	Dest	Org	Dest	Org	Dest	Org	Dest	Org	Dest	Org	Dest
Broadland	1529	2399	145	221	1349	1810	123	163	173	210	165	235	50	64
Breckland	1150	2503	96	180	815	1459	113	198	107	207	129	255	31	45
South Norfolk	906	1460	79	121	676	982	83	149	98	143	94	170	23	34
Norwich	460	522	42	59	333	567	36	61	63	116	29	39	15	19

6.7 TRIP DISTRIBUTION

6.7.1. For most development sites, which were not modelled as independent zones, the trips were distributed based on the original distribution of zone in the base year model. The planning data however included several 'greenfield' sites where development is planned on currently unused sites. For these zones, the base year trip matrices were "seeded" with a trip distribution for the relevant 'greenfield' sites. Greenfield sites were assigned to the zone which was geographically the nearest with similar land use characteristics.

6.8 CONSTRAINT TO TEMPRO

6.8.1. The amount of growth in the model has been adjusted so that it is equivalent to the unadjusted growth rate in the TEMPro dataset for the area where developments have been explicitly modelled.

6.8.2. Table 6-19 shows the overall growth in car trips before and after growth was controlled to TEMPro.

Table 6-19: TEMPro Constraint

Time Period	Growth period	Growth (%)	
		Unconstrained	Constrained
AM peak	2019-2025	111%	106%
	2019-2040	131%	120%
Inter peak	2019-2025	111%	107%
	2019-2040	132%	122%
PM peak	2019-2025	111%	106%
	2019-2040	130%	119%

6.9 MATRIX DEVELOPMENT

6.9.1. The existing trip distribution from the 2019 base year matrices was used as the starting point for the trip distribution process, then scaling via a Furness methodology to distribute forecast trips between origins and destinations while controlling the trip end totals. The trip distribution process is detailed below:

- **Background Growth**: The adjusted growth factors have been applied to the row and column totals of the base year matrix to obtain the background trip ends and then have been distributed using the Furness method to generate the background growth matrix;
- **Development Growth**: The location of the explicitly modelled development sites was reviewed and SATURN zones with similar land use and location where assigned as the source for its distribution. Similar to the background growth, the trip ends obtained in the trip generation process have been distributed using a Furness method to generate the development growth matrix;
- **Unconstrained Matrix**: The background growth and development trip matrices have been added to generate the unconstrained matrix;
- **TEMPro Constraint Matrix**: Similar to the background growth, the unadjusted growth factors have been applied to the base year trip ends and distributed using the Furness method to generate the constraint matrix; and
- **Final Forecast Matrix**: A final forecast matrix has been produced by capping the unconstrained matrix OD values where they exceed those of the TEMPro constraint matrix.

6.10 CORE SCENARIO MATRIX TOTALS

6.10.1. Table 6-20, Table 6-21 and Table 6-22 shows the Core Growth scenario matrix totals by assignment user class for the 2025 and 2040 forecast years for the AM peak, Inter peak and PM peak periods.

Table 6-20: AM peak Core Scenario Trip Matrix Totals

User Class / Trip Purpose	Vehicle Class	Base: 2019	2025	2040	Growth 2019-2025	Growth 2019-2040
1 – HBW	Car	47,915	50,350	55,655	105.1%	116.2%
2 – HBEB	Car	5,450	5,753	6,405	105.6%	117.5%
3 – HBO)	Car	28,834	31,311	36,569	108.6%	126.8%
4 – NHBEB	Car	4,161	4,331	4,692	104.1%	112.8%
5 –NHBO	Car	5,655	6,001	6,726	106.1%	118.9%
6 – LGV	LGV	7,372	7,863	9,425	106.7%	127.8%
7– HGV	HGV	5,918	6,030	6,531	101.9%	110.4%
All		**105,305**	**111,639**	**126,003**	**106.0%**	**119.7%**
Great Britain					**105.3%**	**115.9%**

Table 6-21: Inter peak Core Scenario Trip Matrix Totals

User Class / Trip Purpose	Vehicle Class	Base: 2019	2025	2040	Growth 2019-2025	Growth 2019-2040
1 – HBW	Car	12,663	13,242	14,501	104.6%	114.5%
2 – HBEB	Car	2,098	2,213	2,460	105.5%	117.3%
3 – HBO)	Car	40,204	43,840	51,416	109.0%	127.9%
4 – NHBEB	Car	5,247	5,461	5,916	104.1%	112.8%
5 –NHBO	Car	8,187	8,694	9,739	106.2%	119.0%
6 – LGV	LGV	6,233	6,648	7,968	106.7%	127.8%
7– HGV	HGV	6,066	6,181	6,695	101.9%	110.4%
All		**80,698**	**86,280**	**98,697**	**106.9%**	**122.3%**
Great Britain					**106.3%**	**118.9%**

Table 6-22: PM peak Core Scenario Trip Matrix Totals

User Class / Trip Purpose	Vehicle Class	Base: 2019	2025	2040	Growth 2019-2025	Growth 2019-2040
1 – HBW	Car	47,209	49,448	54,294	104.70%	115.01%
2 – HBEB	Car	4,175	4,403	4,894	105.50%	117.22%
3 – HBO)	Car	36,539	39,410	45,622	107.90%	124.86%
4 – NHBEB	Car	4,242	4,415	4,783	104.10%	112.75%
5 –NHBO	Car	6,146	6,526	7,312	106.20%	118.97%
6 – LGV	LGV	5,159	5,502	6,595	106.70%	127.83%
7– HGV	HGV	3,716	3,786	4,101	101.90%	110.36%
All		**107,184**	**113,490**	**127,601**	**105.88%**	**119.05%**
Great Britain					**105.23%**	**115.77%**

6.11 LOW GROWTH SCENARIO AND HIGH GROWTH SCENARIO MATRIX TOTALS

6.11.1. In accordance with TAG Unit M4 Forecasting and Uncertainty (May 2018), sensitivity tests have been undertaken to address the following questions:

- Under high demand assumptions, is the intervention still effective in reducing congestion or crowding, or are there any adverse effects, e.g. on safety or the environment?
- Under low demand assumptions, is the intervention still economically viable?

6.11.2. High and Low growth highway demand matrices have been prepared for 2020 and 2036 as set out in Table 6-23.

Table 6-23: Adjustment factors - Low Growth scenario and High Growth scenario matrices

Growth % to forecast						
	Base year	Forecast year	Difference	SQRT	‘P’ parameter	Adjustment factor
Highway	2019	2025	6	2.449	2.5	± 6.124%
	2019	2040	21	4.583	2.5	± 11.456%

6.11.3. To generate the Low Growth scenario and Low Growth scenario matrices the percentages of the base year matrices shown in Table 6-23 were added to or subtracted from the Core Growth forecast matrices on a cell by cell basis.

6.11.4. Table 6-24 and Table 6-25 show the Low Growth scenario and High Growth scenario matrix totals compared to the Core Growth scenario matrix totals by assignment user class for the 2025 and 2040 forecast years for the AM peak, Inter peak and PM peak periods.

Table 6-24: 2025 Trip Matrix Totals

User Class / Trip Purpose	Vehicle Class	Core Growth			Low Growth		
		AM peak	Inter peak	PM peak	AM peak	Inter peak	PM peak
1 – HBW	Car	50,350	13,242	49,448	47,423	12,477	46,712
2 – HBEB	Car	5,753	2,213	4,403	5,432	2,084	4,151
3 – HBO)	Car	31,311	43,840	39,410	29,786	41,392	37,282
4 – NHBEB	Car	4,331	5,461	4,415	4,085	5,152	4,162
5 –NHBO	Car	6,001	8,694	6,526	5,669	8,223	6,159
6 – LGV	LGV	7,863	6,648	5,502	7,415	6,269	5,189
7– HGV	HGV	6,030	6,181	3,786	5,686	5,829	3,570
All		111,639	86,280	107,184	105,496	81,426	107,225

Table 6-25: 2040 Matrix Totals

User Class / Trip Purpose	Vehicle Class	Core Growth			Low Growth		
		AM peak	Inter peak	PM peak	AM peak	Inter peak	PM peak
1 – HBW	Car	55,655	14,501	54,294	50,286	13,112	49,218
2 – HBEB	Car	6,405	2,460	4,894	5,806	2,224	4,424
3 – HBO)	Car	36,569	51,416	45,622	33,579	46,737	41,484
4 – NHBEB	Car	4,692	5,916	4,783	4,253	5,366	4,332
5 –NHBO	Car	6,726	9,739	7,312	6,110	8,886	6,627
6 – LGV	LGV	9,425	7,968	6,595	8,539	7,219	5,975
7– HGV	HGV	6,531	6,695	4,101	5,917	6,066	3,715
All		126,003	98,697	127,601	114,490	89,611	115,776

6.11.5. Table 6-26 and Table 6-27 show the High Growth scenario matrix totals compared to the Core Growth scenario matrix totals by assignment user class for the 2025 and 2040 forecast years for the AM peak, Inter peak and PM peak periods.

Table 6-26: 2025 Trip Matrix Totals

User Class / Trip Purpose	Vehicle Class	Core Growth			High Growth		
		AM peak	Inter peak	PM peak	AM peak	Inter peak	PM peak
1 – HBW	Car	50,350	13,242	49,448	53,306	13,972	52,508
2 – HBEB	Car	5,753	2,213	4,403	6,105	2,334	4,666
3 – HBO)	Car	31,311	43,840	39,410	33,481	46,352	41,908
4 – NHBEB	Car	4,331	5,461	4,415	4,592	5,769	4,678
5 –NHBO	Car	6,001	8,694	6,526	6,373	9,208	6,923
6 – LGV	LGV	7,863	6,648	5,502	8,335	7,020	5,833
7– HGV	HGV	6,030	6,181	3,786	6,391	6,528	4,013
All		111,639	86,280	107,184	118,585	91,183	120.529

Table 6-27: 2040 Matrix Totals

User Class / Trip Purpose	Vehicle Class	Core Growth			High Growth		
					AM peak	Inter peak	PM peak
1 – HBW	Car	55,655	14,501	54,294	61,054	15,919	59,757
2 – HBEB	Car	6,405	2,460	4,894	7,050	2,700	5,371
3 – HBO)	Car	36,569	51,416	45,622	40,769	56,745	50,367
4 – NHBEB	Car	4,692	5,916	4,783	5,163	6,515	5,260
5 –NHBO	Car	6,726	9,739	7,312	7,418	10,789	8,046
6 – LGV	LGV	9,425	7,968	6,595	10.368	8,765	7,255
7– HGV	HGV	6,531	6,695	4,101	7,184	7,265	4,511
All		126,003	98,697	127,601	139,006	108,799	140,567

7

FORECAST DEMAND – PUBLIC TRANSPORT

7 FORECAST DEMAND – PUBLIC TRANSPORT

7.1 INTRODUCTION

7.1.1. The same process was followed to develop forecast year public transport matrices as forecast year highway matrices.

7.2 METHODOLOGY

7.2.1. Public transport trip rates were extracted from TRICS and used to calculate the public transport trip generation arising from the committed development sites. The trip generation was split across the different purposes (commuting, work and other) as per the split in the 2019 base year matrices. The trips were distributed based on the distribution of appropriate base year zones.

7.2.2. TEMPRO Version 7.2 was used to derive the background growth in public transport trips. The alternative planning assumptions facility was utilised to ensure there was no double-counting of development trips.

7.2.3. The public transport demand matrix totals were then constrained to unadjusted TEMPro Version 7.2 trip ends to maintain consistency with national forecasts. The public transport matrix totals for each forecast year and time period are summarised in Table 7-1, Table 7-2 and Table 7-3. The forecast year matrix totals are also compared against the 2019 base year matrix totals.

Table 7-1: AM Peak Core Scenario Public Transport Matrix Totals

User Class / Trip Purpose	Vehicle Class	Base: 2019	2025	2040	Growth 2019-2025	Growth 2019-2040
Commute	PT	2,569	2,580	2,574	100.4%	100.2%
Work	PT	624	635	650	101.8%	104.3%
Other	PT	4,612	4,632	4,791	100.4%	103.9%
All		7,805	7,846	8,015	100.5%	102.7%

Table 7-2: Inter Peak Core Scenario Public Transport Matrix Totals

User Class / Trip Purpose	Vehicle Class	Base: 2019	2025	2040	Growth 2019-2025	Growth 2019-2040
Commute	PT	600	601	593	100.2%	98.9%
Work	PT	377	387	398	102.5%	105.6%
Other	PT	5,223	5,354	5,625	102.5%	107.7%
All		6,200	6,342	6,617	102.3%	106.7%

Table 7-3: PM Peak Core Scenario Public Transport Matrix Totals

User Class / Trip Purpose	Vehicle Class	Base: 2019	2025	2040	Growth 2019-2025	Growth 2019-2040
Commute	PT	2,687	2,691	2,669	100.1%	99.3%
Work	PT	655	667	681	101.8%	103.9%
Other	PT	3,505	3,574	3,736	102.0%	106.6%
All		6,847	6,932	7,086	101.2%	103.5%

7.3 LOW GROWTH MATRIX TOTALS

7.3.1. The public transport Low Growth matrix totals for each forecast year and time period are summarised in Table 7-4, Table 7-5 and Table 7-6. The forecast year matrix totals are also compared against the 2019 base year matrix totals.

Table 7-4: AM Peak Low Growth Scenario Public Transport Matrix Totals

User Class / Trip Purpose	Vehicle Class	Base: 2019	2025	2040	Growth 2019-2025	Growth 2019-2040
Commute	PT	2,569	2,460	2,356	95.76%	91.71%
Work	PT	624	599	591	95.99%	94.71%
Other	PT	4,612	4,422	4,410	95.88%	95.62%
All		7,805	7,481	8,325	95.85%	106.66%

Table 7-5: Inter Peak Low Growth Scenario Public Transport Matrix Totals

User Class / Trip Purpose	Vehicle Class	Base: 2019	2025	2040	Growth 2019-2025	Growth 2019-2040
Commute	PT	600	571	542	95.17%	90.33%
Work	PT	377	364	362	96.55%	96.02%
Other	PT	5,223	5,131	5,210	98.24%	99.75%
All		6,200	6,066	6,115	97.84%	98.63%

Table 7-6: PM Peak Low Growth Scenario Public Transport Matrix Totals

User Class / Trip Purpose	Vehicle Class	Base: 2019	2025	2040	Growth 2019-2025	Growth 2019-2040
Commute	PT	2,687	2,572	2,451	95.72%	91.22%
Work	PT	655	634	623	96.79%	95.11%
Other	PT	3,505	3,423	3,457	97.66%	98.63%
All		6,847	6,629	6,532	96.82%	95.40%

7.4 HIGH GROWTH MATRIX TOTALS

7.4.1. The public transport High Growth matrix totals for each forecast year and time period are summarised in Table 7-7, Table 7-8 and Table 7-9. The forecast year matrix totals are also compared against the 2019 base year matrix totals.

Table 7-7: AM Peak High Growth Scenario Public Transport Matrix Totals

User Class / Trip Purpose	Vehicle Class	Base: 2019	2025	2040	Growth 2019-2025	Growth 2019-2040
Commute	PT	2,569	2,681	2,770	104.36%	107.82%
Work	PT	624	653	692	104.65%	110.90%
Other	PT	4,612	4,819	5,152	104.49%	111.71%
All		7,805	8,153	8,613	104.46%	110.35%

Table 7-8: Inter Peak High Growth Scenario Public Transport Matrix Totals

User Class / Trip Purpose	Vehicle Class	Base: 2019	2025	2040	Growth 2019-2025	Growth 2019-2040
Commute	PT	600	610	622	101.67%	103.67%
Work	PT	377	388	412	102.92%	109.28%
Other	PT	5,223	5,559	6,024	106.43%	115.34%
All		6,200	6,557	7,058	105.76%	113.84%

Table 7-9: PM Peak High Growth Scenario Public Transport Matrix Totals

User Class / Trip Purpose	Vehicle Class	Base: 2019	2025	2040	Growth 2019-2025	Growth 2019-2040
Commute	PT	2,687	2,791	2,869	103.87%	106.77%
Work	PT	655	682	718	104.12%	109.62%
Other	PT	3,505	3,706	3,997	105.73%	114.04%
All		6,847	7,179	7,584	104.85%	110.76%

8

VARIABLE DEMAND MODEL

8 VARIABLE DEMAND MODEL

8.1 OVERVIEW

8.1.1. DfT's TAG Unit M2 (July 2020) states that "any change to transport conditions will, in principle, cause a change in demand. The purpose of VDM is to predict and quantify these changes.

8.1.2. Any transport improvement that reduces journey times and costs will, in principle, affect the level of demand for travel. Schemes that improve travel conditions can encourage travellers to make trips they did not make before the improvement, to change to a different mode, or to travel further to different destinations. This additional demand for travel mainly appears as induced traffic either through or around the scheme. To take into account these impacts, a variable demand model was developed to estimate the future year traffic matrices.

8.1.3. The calibration of the demand model parameters are shown in detailed within the Local Model Validation Report[8]. The process involved calibrating demand response parameters that replicated a change in fuel cost called 'Demand Realism Testing'.

8.2 GUIDANCE

8.2.1. TAG guidance on VDM (M2 - Variable Demand Modelling, Section 2.2) recommends that all assessments of government funded investments in highway/transport schemes need to consider the effects of variable demand, especially, if the capital cost is expected to be in excess of £5 million and that there would be congestion on the network in the forecast years in the absence of the scheme.

8.2.2. The Norwich Western Link (NWL) scheme could have a significant impact on the journey times and travel costs thus influencing the level of travel demand on the highway network. Therefore, the assessment of the NWL scheme should include the application of VDM.

8.3 MODEL FORM AND CHOICE RESPONSES

8.3.1. TAG Unit M2 (May 2020) states that while for large and complex schemes a full variable demand approach is likely to be required, not all schemes require this, and it is important that the model is appropriate for the interventions that it would be used to test.

[8] *NATS_2019_LMVR_for_DfT_issue_10November2020.pdf*

8.3.2. The demand responses that are considered in variable demand model are as follows:

- Trip Frequency
- Mode Choice
- Trip Distribution (Destination choice).

8.4 VDM METHODOLOGY

8.4.1. The NWL demand model uses the DIADEM software (v7) issued on behalf of the DfT for the purpose of producing the traffic forecasts. DIADEM is an incremental hierarchical logit model and works by adjusting an input reference demand matrix according to changes between forecast travel costs and input reference travel costs.

8.4.2. The VDM process consists of a series of iterations between DIADEM and SATURN (assignment model) during which demand matrices are assigned, skimmed cost matrices are extracted and, based on comparative travel costs, the demand matrices are updated;

8.4.3. DIADEM provides a means of achieving convergence between the assignment (supply) and demand models. It is to be noted that equilibrium between the demand and supply models is not found exactly and therefore, a TAG specified convergence criterion is used to determine when the solution is close enough to equilibrium. The VDM for the NWL traffic model uses trip matrices in the Origin-Destination (OD) and Production-Attraction (PA) format.

8.5 POST VDM MATRIX TOTALS

8.5.1. The impact of the variable demand responses on the trip totals can be seen in Table 8-1 and Table 8-2. The overall impact is very small with the largest change being smaller than 0.3%. However, this does not reflect the redistribution of trips within the matrices and this is likely to have the biggest impact on the model results. The redistribution has been described in more detail in Section **Error! Reference source not found.**.

Table 8-1: DM Core Growth matrix totals (pcu)

Peak	2025 Fixed	2025	2025	2040 Fixed	2040	2040
	(Future Year)	(Future Year)	(% change Fixed/VDM)	(Future Year)	(Future Year)	(% change Fixed/VDM)
AM	111,639	111,872	0.21%	126,003	126,369	0.29%
IP	86,280	86,347	0.08%	98,697	98,908	0.21%
PM	113,490	113,706	0.19%	127,601	127,788	0.15%

Table 8-2: DS Core Growth matrix totals (pcu)

Peak	2025 Fixed (Future Year)	2025 VDM (Future Year)	2025 (% change Fixed/VDM)	2040 Fixed (Future Year)	2040 (Future Year)	2040 (% change Fixed/VDM)
AM	111,639	111,689	0.04%	126,003	126,015	-0.23%
IP	86,280	86,317	0.04%	98,697	98,745	0.05%
PM	113,490	113,706	0.19%	127,601	127,513	-0.07%

8.6 DIADEM CONVERGENCE

8.6.1. As set out in the Local Model Validation Report[9] (LMVR) DIADEM has been satisfactorily configured and tested for 'realism' and integrated with the public transport and highway models, as a tool for predicting 'variable demand' or people's changing travel decisions in response to changing travel costs. The VDM convergence statistics for the fuel cost and public transport fare realism tests show that a %GAP of 0.10% was achieved.

8.6.2. This enables a realistic picture of how travellers may change trip frequency, change travel mode, change trip destination, or change highway route, as generalised travel costs (time and distance) rise and fall.

8.6.3. TAG Unit M2.1 (May 2020) states that it is important to demonstrate that the whole model system converges to a satisfactory degree to have confidence that the model results are as free from error and 'noise' as possible.

8.6.4. Tests indicate that gap values, which measure how far the current flow is from the equilibrium point, of less than 0.1% can be achieved in many cases, although in more problematic systems this may be nearer to 0.2%.

8.6.5. Table 8-3 shows that convergence in the DM and DS networks has achieved convergence in the 2025 forecast year of less than 0.1% with convergence being less than 0.2% in the 2040 forecast year this meeting TAG criteria.

Table 8-3: 2025 and 2040 DM / DS convergence statistics

	Forecast Years	
	2025	2040
DM	0.09%	0.19%
DS	0.09%	0.19%

[9] *NATS_2019_LMVR_for_DfT_issue_10November2020.pdf*

8.7 IMPACT OF THE VARIABLE DEMAND MODEL – 2025 FORECAST YEAR

8.7.1. The impact of the Variable Demand Model (VDM) can be seen in Figure 8-1 to Figure 804 where the origin and destination of trips has been adjusted with the introduction of the Norwich Western Link scheme.

8.7.2. Figure 8-1 and Figure 8-2 shows the difference in the Origin of trips respectively to the west of Norwich along the A47 between the Do Minimum (DM) and Do Something (DS) in the AM peak and PM peak respectively. The red bars show a decrease in trips from zones while the green bars show an increase in trips from zones. As can be seen the western area of the 2025 forecast year model show a decrease in origin of trips with the VDM process showing an increase in the origin of trips closer to and in Norwich itself.

8.7.3. Figure 8-3 and Figure 8-4 shows the difference in the Destination of trips respectively in the model area between the Do Minimum (DM) and Do Something (DS) in the AM peak and PM peak respectively. The blue bars show a decrease in trips from zones while the magenta bars show an increase in trips from zones. As can be seen the western area of the 2025 forecast year model shows a decrease in the destination of trips with the VDM process showing an increase in the destination of trips closer to and in Norwich itself.

8.7.4. A similar pattern in terms of the Origin and Destination of trips is evident in the 2040 forecast year as well.

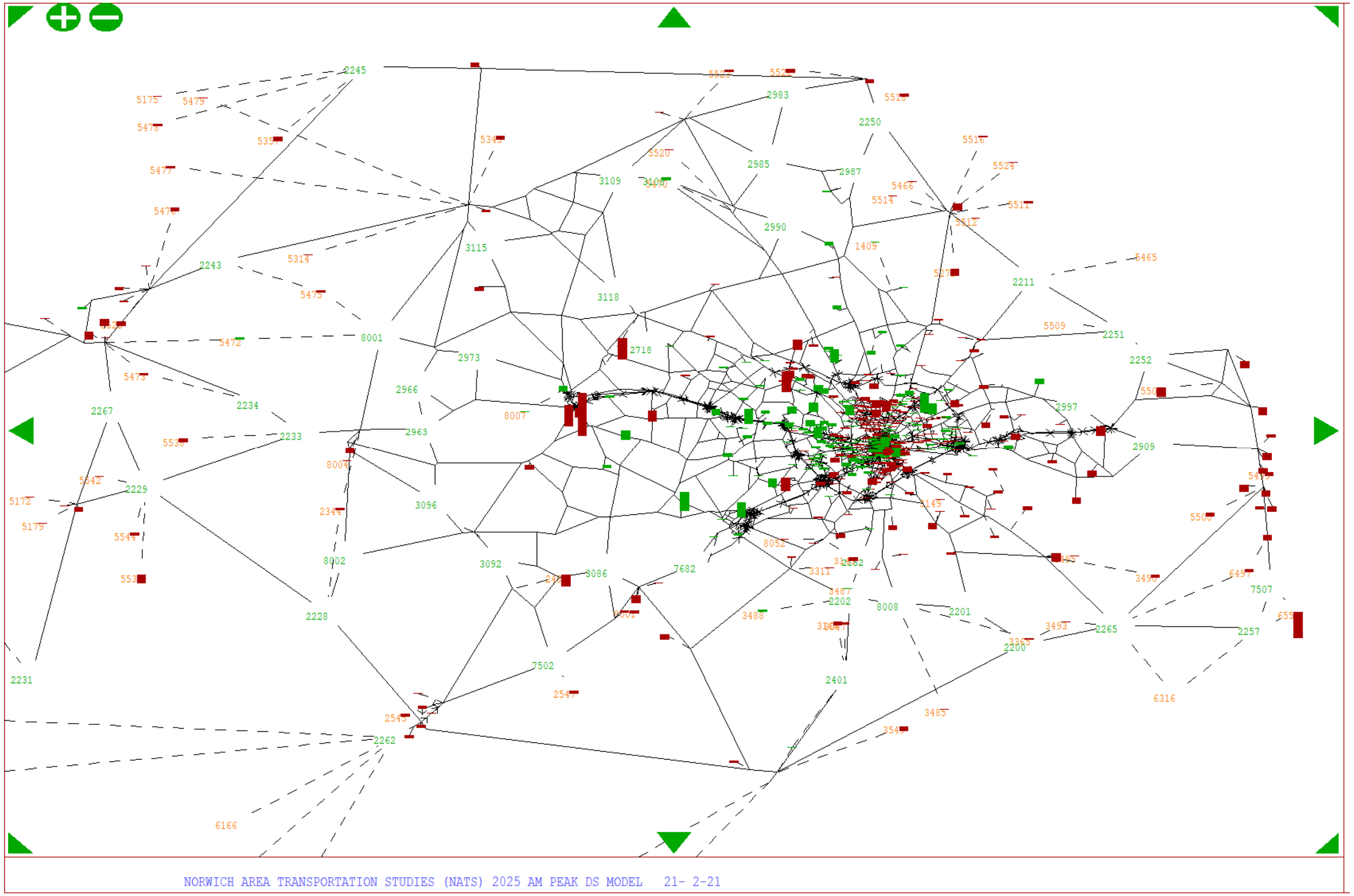


Figure 8-1: 2025 DS minus DM – Origin of trips (AM peak)

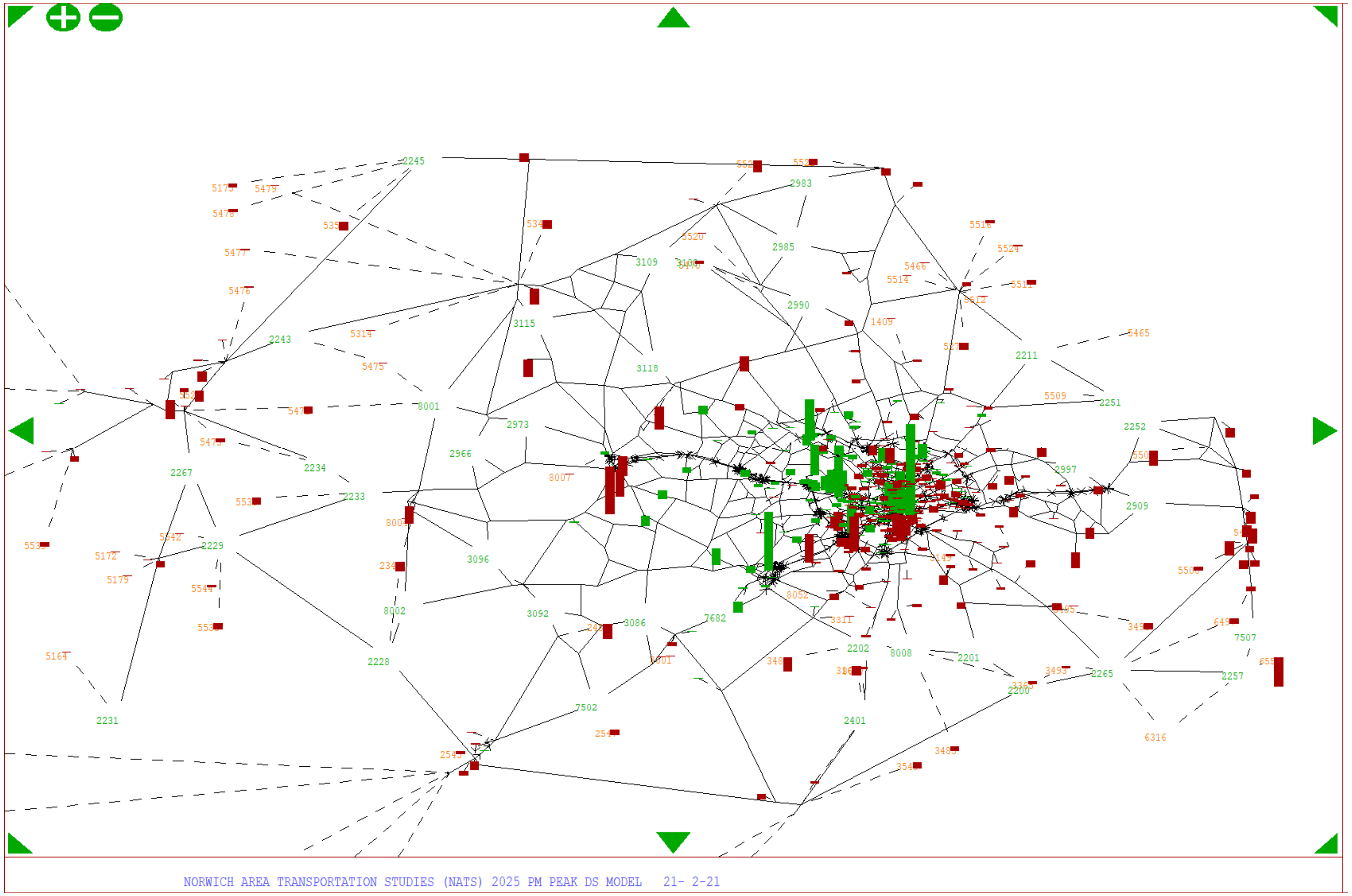


Figure 8-2: 2025 DS minus DM – Origin of trips (PM peak)

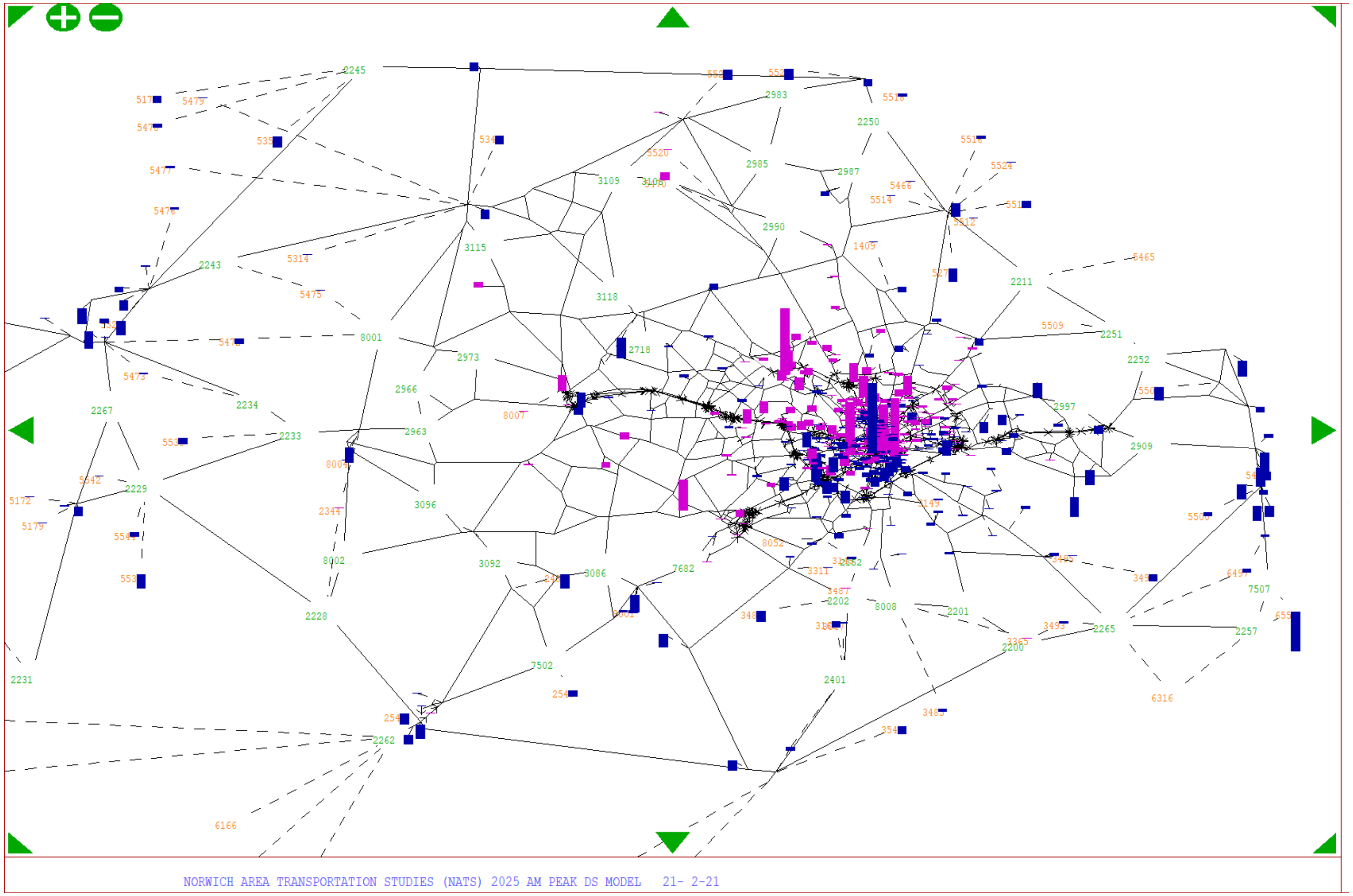


Figure 8-3: 2025 DS minus DM – Destination of trips (AM peak)

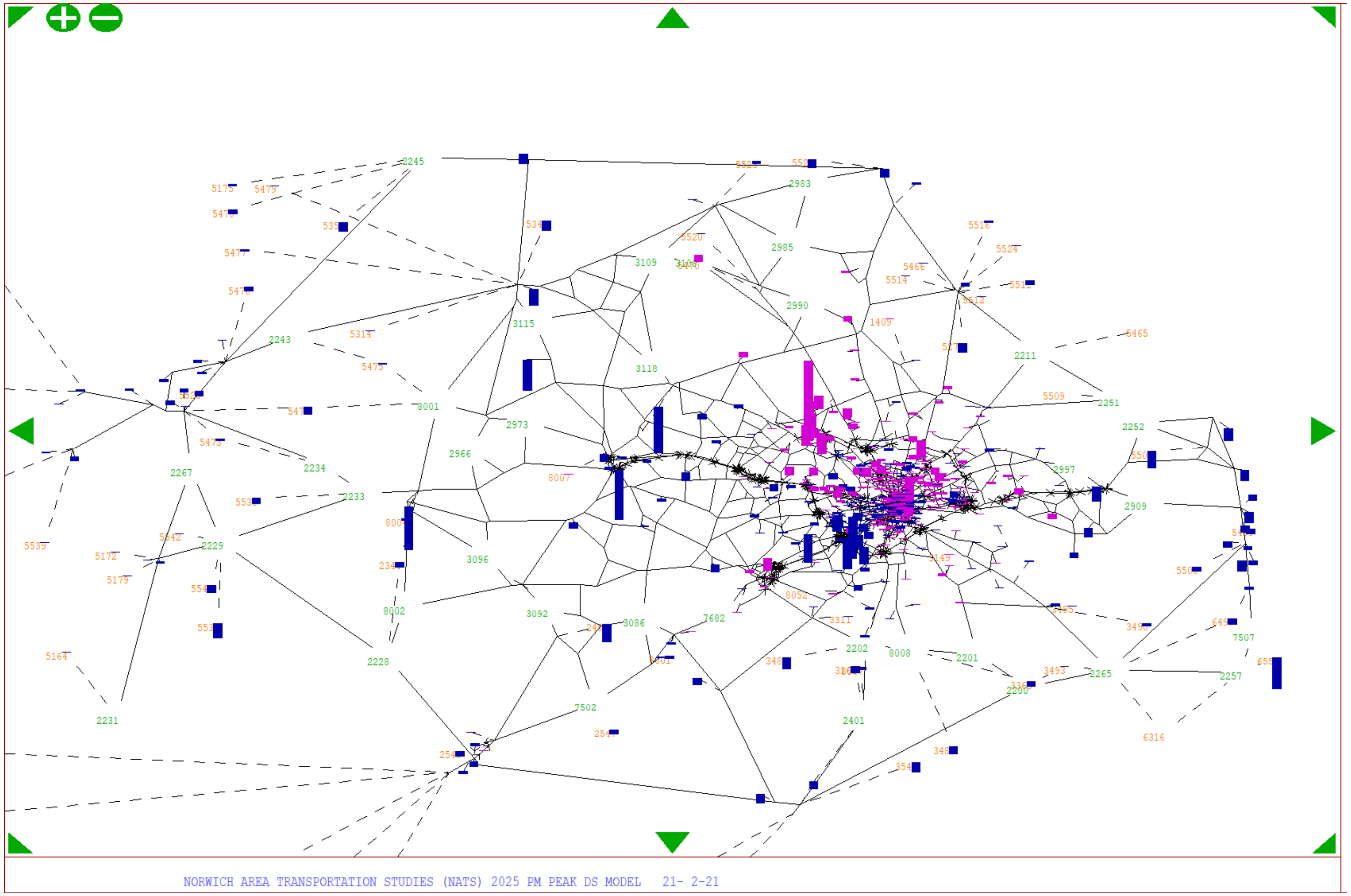


Figure 8-4: 2025 DS minus DM – Destination of trips (PM peak)

9

FORECASTING ASSIGNMENT – CORE GROWTH

9 FORECASTING ASSIGNMENT – CORE GROWTH

9.1 INTRODUCTION

9.1.1. This chapter looks at the network statistics, assignment and converge of the Core Growth forecast scenarios, with and without the NWL scheme, in the 2025 Opening Year and the 2040 Design Year.

9.1.2. These impacts are considered in terms of actual flow changes and differences in delay. Flow difference plots have been produced to demonstrate the volume of vehicle comparisons between the 2019 base year, 2025 Opening Year and 2040 Design Year and any re-routing that occurs as a result of the implementation of the proposed infrastructure.

9.2 ASSIGNMENT CONVERGENCE

9.2.1. Convergence results portray the level of stability within the model, whereby the trip and route distribution do not alter substantially between runs and the model is in equilibrium. This is particularly important when model outputs are used to inform the economic benefits of the scheme appraisal, as it is critical that calculated benefits arise from the impact of the scheme and not as a result of difference in convergence.

9.2.2. In accordance with criteria set out in TAG Unit M3.1 (January 2014), the parameters %Flow, %GAP and Delta (d) have been monitored to determine the level of convergence. %Flow measures the proportion of links in the network with flows changing by less than 1% from the previous iteration; d is the difference between costs on chosen routes and costs on minimum cost paths; %GAP is a generalisation of d function to include the interaction effects within the simulation.

9.2.3. The convergence criteria, as set out in Table 4 of TAG Unit M3.1, is used to assess when a model is considered to have converged is shown in table 9-1.

Table 9-1: TAG Convergence Criteria (TAG Unit M3.1, Table 4)

Measure of Convergence	Acceptable Value
'Delta' and % GAP	Less than 0.1% or at least stable with convergence fully documented and all other criteria met
Percentage of links with flow changes < 1% ('P')	Four consecutive iterations greater than 98%
Percentage of links with cost change (P2) < 1%	Four consecutive iterations greater than 98%
Percentage change in total user costs (V)	Four consecutive iterations less than 0l1% (SUE only)

9.2.4. Table 9-2 shows the convergence of the Post VDM Core DIADEM assignments. These results confirm the assignments which have been taken forward to the economic appraisal have met the TAG convergence criteria for highway assignment models (TAG Unit 3.1, Table 4). They have shown that all assignments in both scenarios have conformed to the criteria set out by TAG.

Table 9-2: Convergence statistics for Core Growth forecast assignments (DM and DS)

Year	Scenario	Time Period	Relative Gap (%)	Final Four Iterations > 98%* - flow change (P)<1%			
				Final Iteration	N-1	N-2	N-3
Base		AM	0.006	99.4	99.1	99.4	99.3
		IP	0	99.2	99.5	99	99.5
		PM	0.005	99.7	99.3	99.1	99.4
2025 DM	Core	AM	0.005	99.2	99.4	99.2	99.1
		IP	0	99.4	99.4	99.2	99.5
		PM	0.002	99.6	99.4	99.5	98.5
2040 DM	Core	AM	0.006	99.4	99.4	99.4	98.9
		IP	0.001	99.3	99.4	99	99.3
		PM	0.004	99.5	99	99.6	98.6
2025 DS	Core	AM	0.005	99.3	99.1	99.1	99
		IP	0	99.1	99.4	99.6	99.6
		PM	0.006	99.7	99.1	99.4	98.4
2040 DS	Core	AM	0.005	99.3	99.3	99	99.3
		IP	0.001	99.2	99.2	99	99
		PM	0.006	99.1	99.2	99.1	99.2

9.3 NETWORK STATISTICS

9.3.1. Network statistics for each of the forecast models are presented within this section. The results presented include the total number of kilometres travelled and the total number of vehicle hours travelled.

9.3.2. Table 9-3 presents the network statistics, simulation network, for the 2025 Core Growth scenario comparing the Do Minimum (DM) assignment with the Do Something (DS) assignment. The comparison shows that implementation of the NWL scheme reduces transient queueing in the Inter peak and PM peak but it increases in the AM peak.

9.3.3. The total travel time and total travel distance decreases in the AM peak, Inter peak and PM peak. The average speed marginally increases in AM peak, Inter peak and PM peak by the inclusion of the proposed NWL transport scheme.

Table 9-3: 2025 Network Statistics, Core Growth

Statistic	Unit	DM			DS		
		AM Peak	Inter Peak	PM Peak	AM Peak	Inter Peak	PM Peak
Transient Queues	PCU / Hrs	3,898	2,289	3,741	3,929	2,239	3,651
Over-Capacity Queues	PCU / Hrs	454	92	367	403	112	394
Link Cruise Time	PCU / Hrs	16,814	11,929	16,559	16,585	11,722	16,274
Total Travel Time	PCU / Hrs	21,166	14,309	20,666	20,816	14,072	20,318
Total Travel Distance	PCU / KMs	1,013,794	748,258	1,005,740	1,007,743	736,872	995,171
Average Speed	kph	47.9	52.3	48.7	48.4	52.4	49.0

9.3.4. Table 9-4 presents the network statistics, simulation network, for the 2040 Core Growth scenario comparing the Do Minimum (DM) assignment with the Do Something (DS) assignment. The comparison shows that implementation of the NWL scheme reduces transient queueing in the Inter peak and PM peak but it increases in the AM peak.

9.3.5. The total travel time and total travel distance decreases in the AM peak, Inter peak and PM peak. The average speed marginally increases in AM peak but marginally decreases in the Inter peak and PM peak by the inclusion of the proposed NWL transport scheme.

Table 9-4: 2040 Network Statistics, Core Growth

Statistic	Unit	DM			DS		
		AM Peak	Inter Peak	PM Peak	AM Peak	Inter Peak	PM Peak
Transient Queues	PCU / Hrs	4,964	2,870	4,779	4,966	2,291	4,775
Over-Capacity Queues	PCU / Hrs	1,333	143	961	1,444	158	1,104
Link Cruise Time	PCU / Hrs	19,902	14,486	19,510	19,373	13,881	18,974
Total Travel Time	PCU / Hrs	26,199	17,499	25,250	25,784	16,831	24,854
Total Travel Distance	PCU / KMs	1,169,846	906,116	1,155,982	1,150,916	871,261	1,113,316
Average Speed	kph	44.7	51.8	45.8	44.6	51.8	45.6

9.4 CORE GROWTH ASSESSMENT RESULTS

Do Minimum scenario versus Base Year model

9.4.1. Appendix B contains flow difference and delay difference plots for the AM peak, Inter peak and PM peak respectively for the 2025 Core Growth DM scenario versus the 2019 Base Year model to demonstrate the impact of the committed developments and background growth. Traffic flows and delays generally increase in all three time periods and it must be remembered that the Highways England A47 North Tuddenham to Easton scheme has been included within the Do Minimum scenario. The impact of this, in all three peak hours, can be seen along the A47 in the North Tuddenam to Honingham section where the transport model shows reductions along the old A47 route with traffic switching to the new dual carriageway scheme.

9.4.2. Figure 9-1 to Figure 9-6 present flow difference and delay difference plots for the AM peak, Inter peak and PM peak respectively for the 2040 Core Growth DM scenario versus the 2019 Base year model to demonstrate the impact of committed developments and background growth up to the 2040 Design Year.

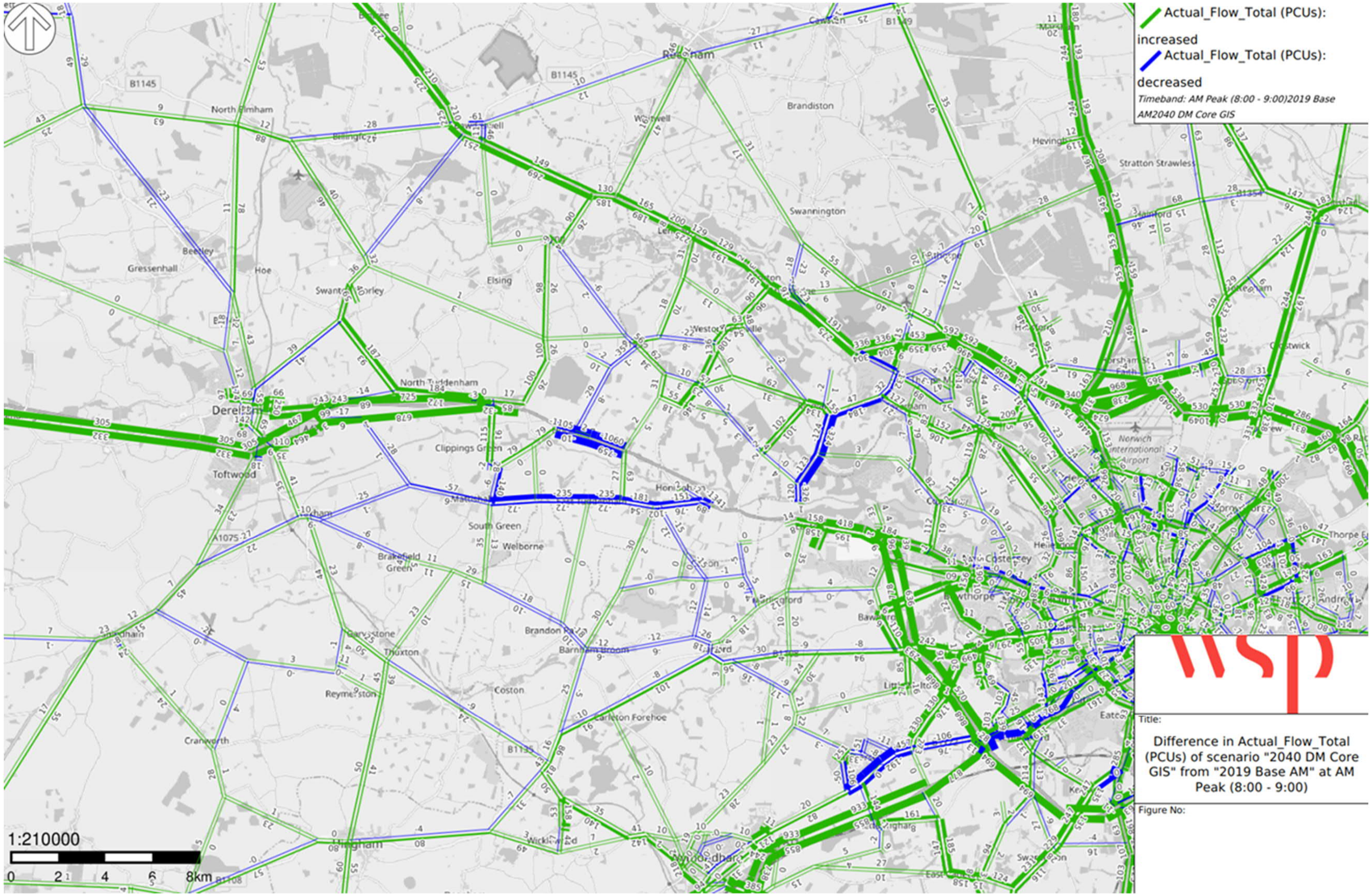


Figure 9-1: 2040 Core Growth scenario versus 2019 Base Year model, Actual Flow Difference, in pcu's - AM peak

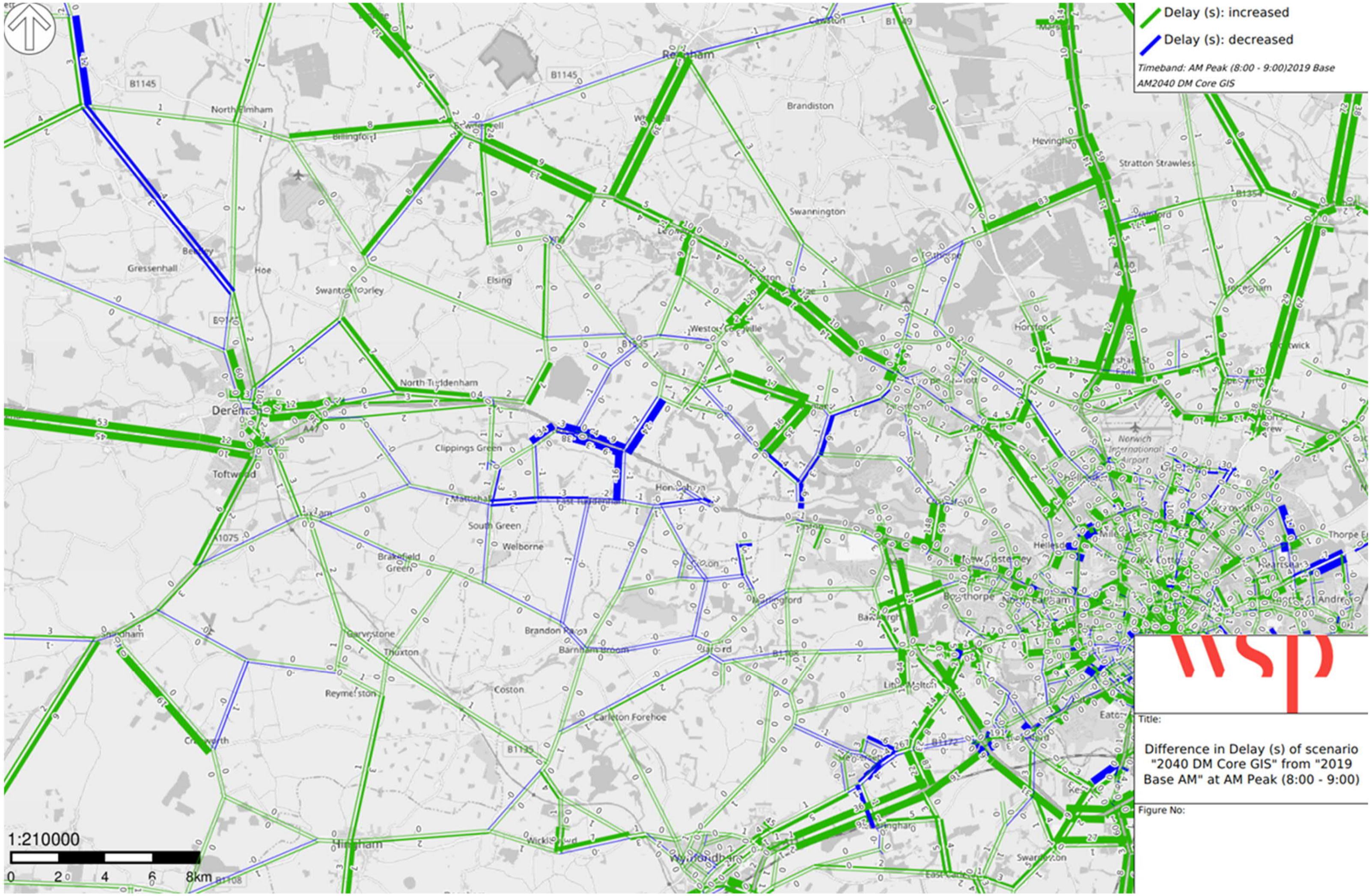


Figure 9-2: 2040 Core Growth scenario versus 2019 Base Year model, Delay Difference, in secs - AM peak

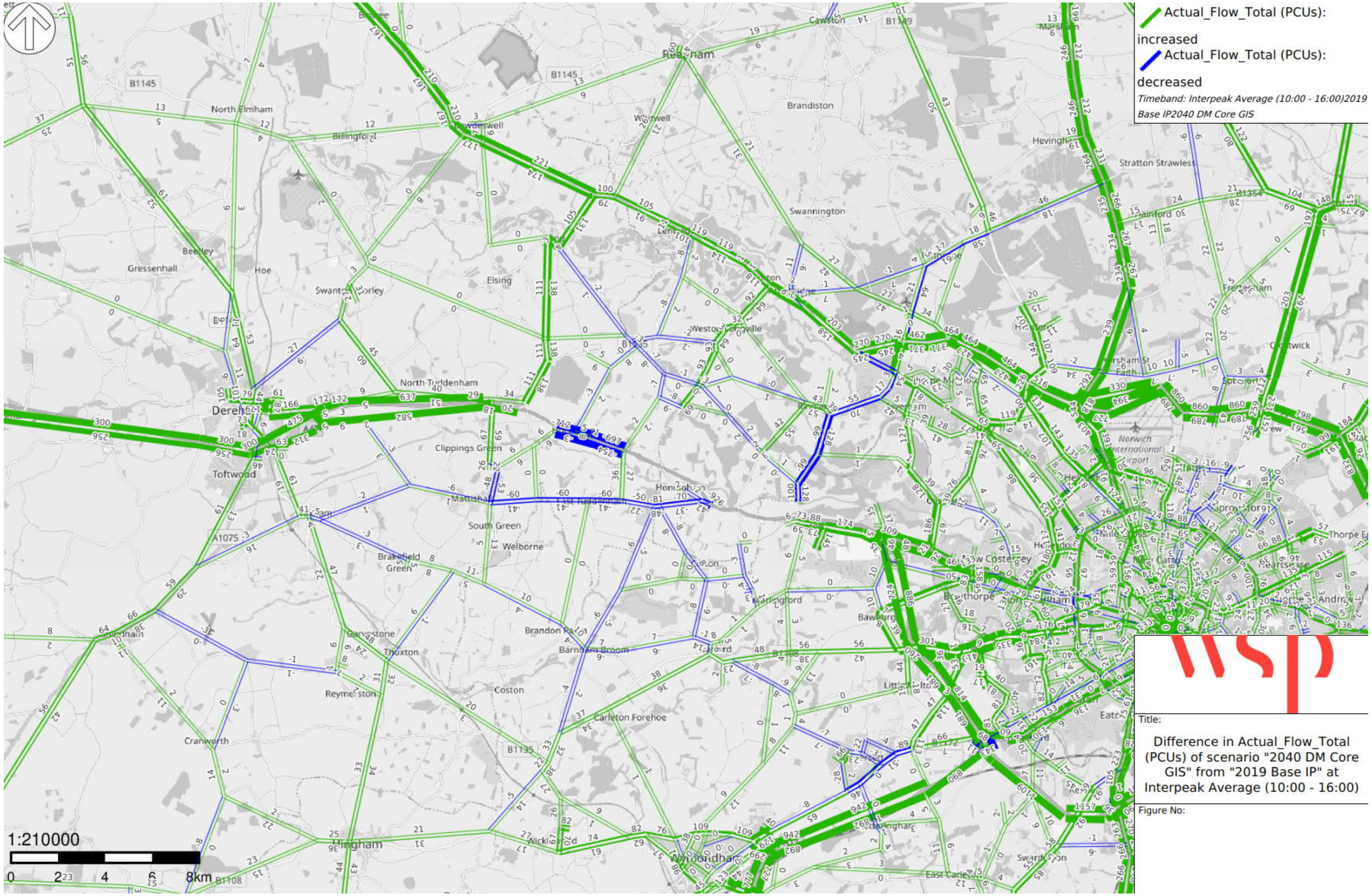


Figure 9-3: 2040 Core Growth scenario versus 2019 Base Year model, Actual Flow Difference, in pcu's – Inter peak

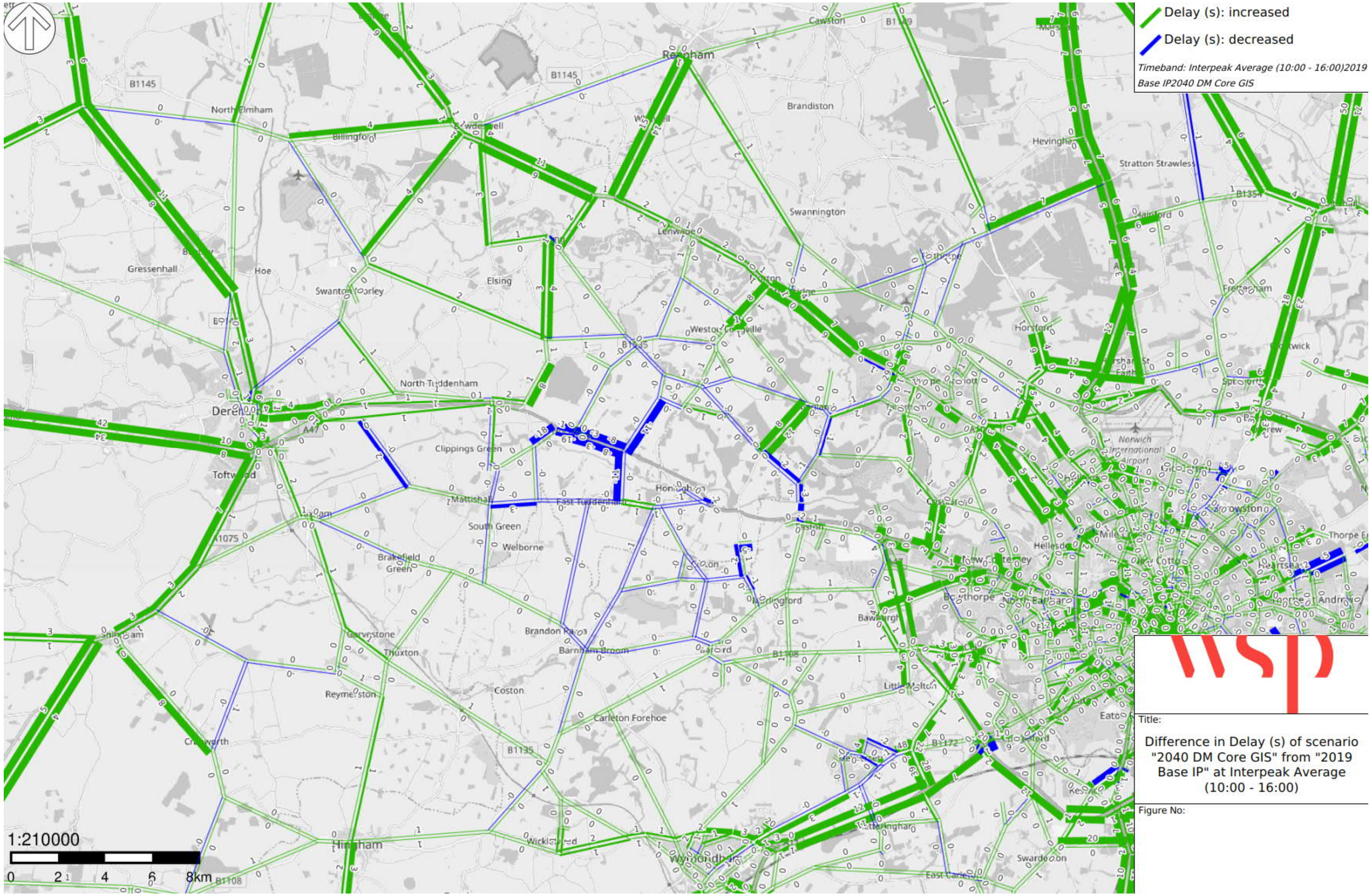


Figure 9-4: 2040 Core Growth scenario versus 2019 Base Year model, Delay Flow Difference, in secs - Inter peak

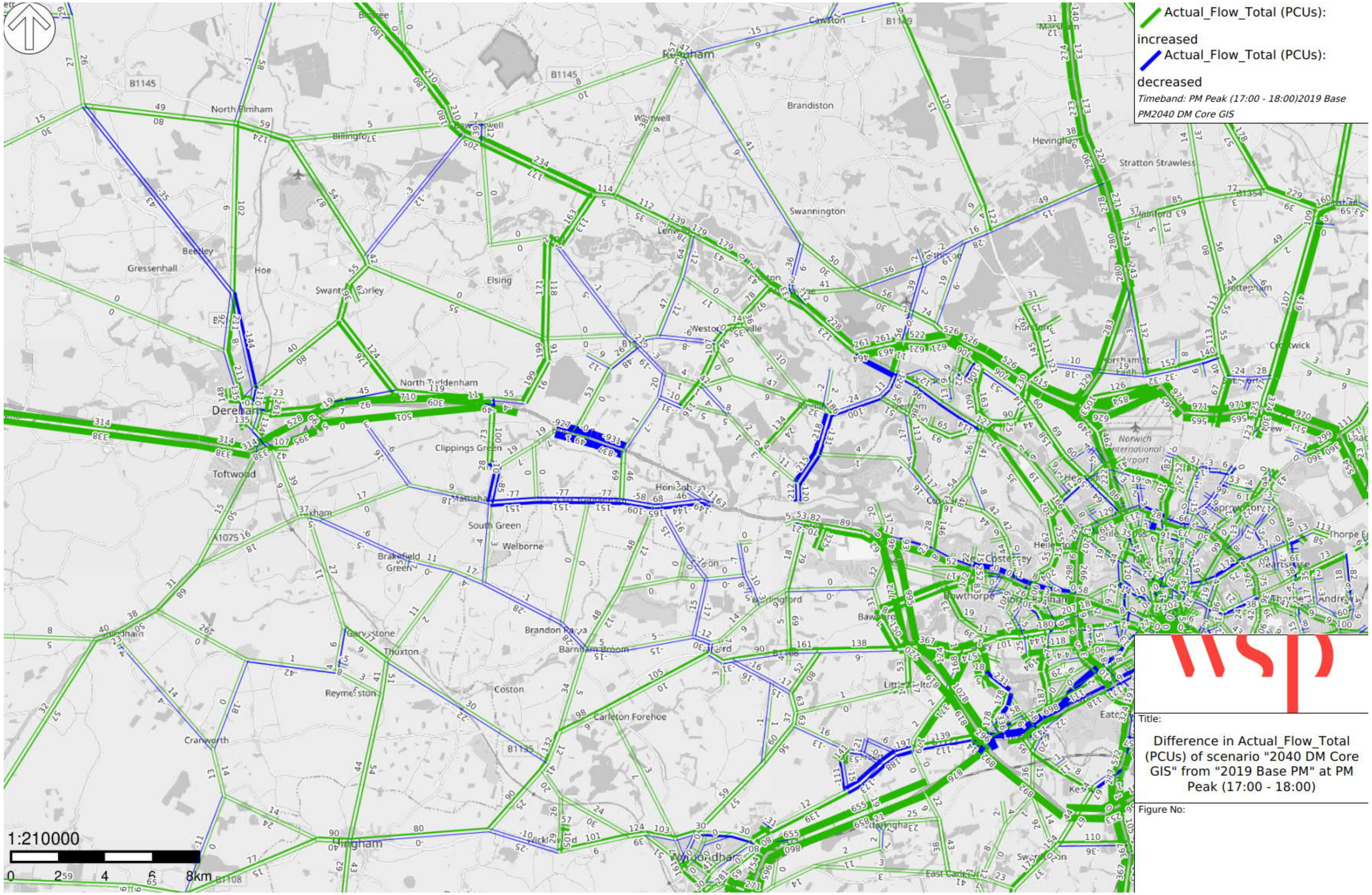


Figure 9-5: 2040 Core Growth scenario versus 2019 Base Year model, Actual Flow Difference, in pcu's - PM peak

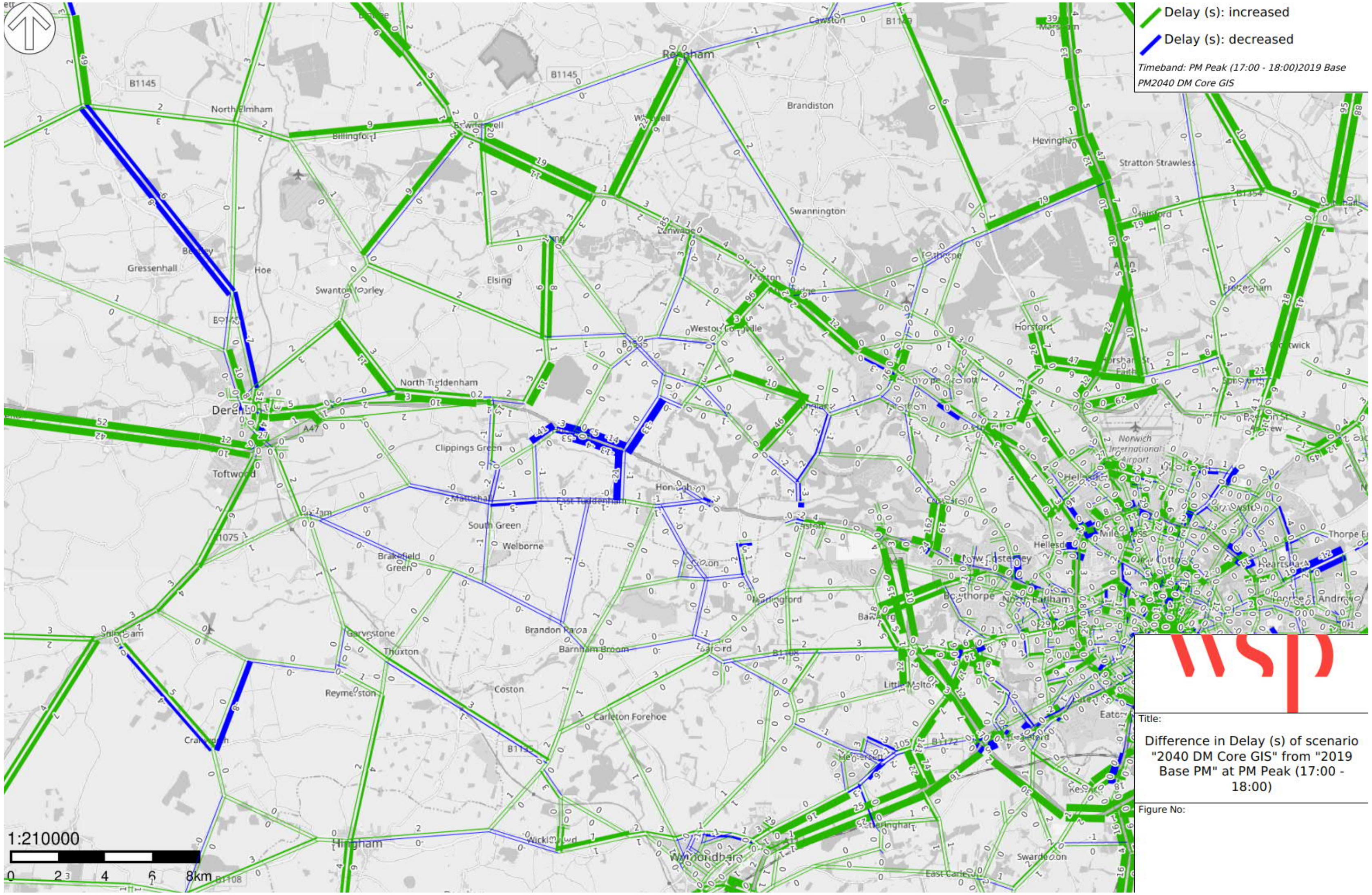


Figure 9-6: 2040 Core Growth scenario versus 2019 Base Year model, Delay Difference, in secs - PM peak

Impact of Norwich Western Link scheme

9.4.3. Appendix C contains flow difference and delay difference plots for the AM peak, Inter peak and PM peak respectively for the 2025 Core Growth DS scenario versus the 2025 Core Growth DM scenario to demonstrate the impact of the Norwich Western Link scheme.

9.4.4. Figure 9-7 to Figure 9-12 present flow difference and delay difference plots for the AM peak, Inter peak and PM peak respectively for the 2040 Core Growth DS scenario versus the 2040 Core Growth DM scenario to demonstrate the impact of the Norwich Western Link scheme up to the 2040 Design Year.

9.4.5. Figure 9-7, Figure 9-9 and Figure 9-11 for the AM peak, Inter peak and PM peak hour time periods respectively all show that north-south routes between the A47 and the A1067 Fakenham Road e.g. B1535 Wood Lane, Heath Road, Church Street (through Weston Longville) and Taverham Road all show reductions in actual flow across all three peak hour time periods

9.4.6. Barnham Broom Road shows an increase in actual flow of 167 pcu's in the AM peak, 84 pcu's in the Inter peak and 111 pcu's in the PM peak.

9.4.7. Figure 9-7, Figure 9-19 and Figure 9-11 for the AM peak, Inter peak and PM peak hour time periods respectively all show that as a consequence of the introduction of the Norwich Western Link scheme traffic has switched from using the A47 around the south of Norwich to the A1270 Broadland Northway around the north of Norwich.

9.5 IMPACT ON THE STRATEGIC ROAD NETWORK

9.5.1. Figure 9-7, Figure 9-9 and Figure 9-11 present flow difference and delay difference plots for the AM peak, Inter peak and PM peak respectively for the 2040 Core Growth DS scenario versus the 2040 Core Growth DM scenario to demonstrate the impact of the Norwich Western Link scheme on the Strategic Road Network (SRN).

9.5.2. There is predicted to be a decrease in traffic on the SRN with the introduction of the Norwich Western Link as traffic is switching to use the A1270 Broadland Northway route to the north of Norwich rather than use the A47 to the south of Norwich.

9.5.3. This is a consequence of the introduction of the Norwich Western Link but also of the Variable Demand Model (VDM) where the Origin and Destination of trips has changed as shown in Figure 8-1 to Figure 8-4.

Figure 9-7: 2040 Core Growth DS scenario versus 2040 Core Growth DM scenario, Actual Flow Difference, in pcu's - AM peak

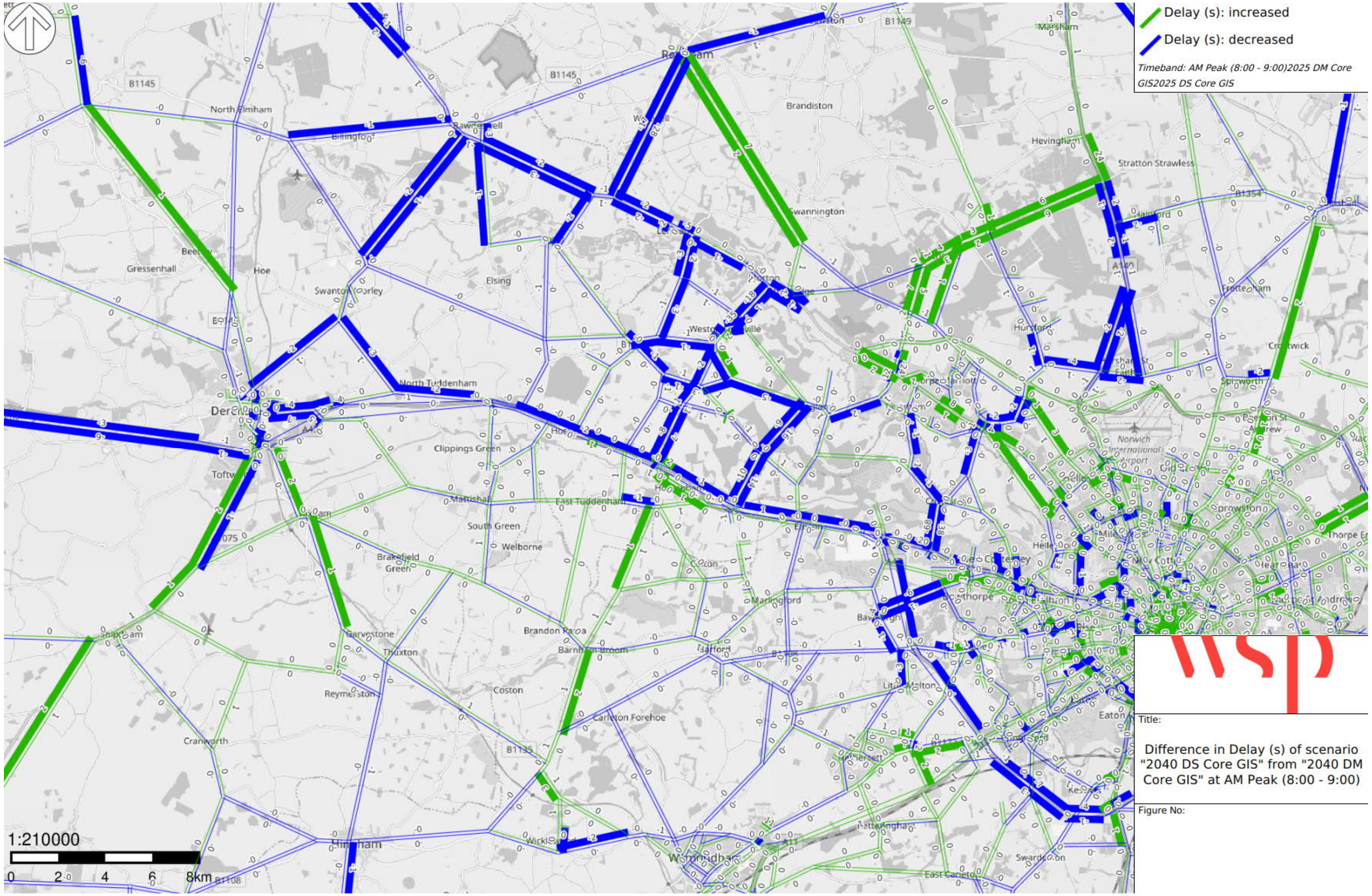


Figure 9-8: 2040 Core Growth DS scenario versus 2040 Core Growth DM scenario, Delay Difference, in secs - AM peak

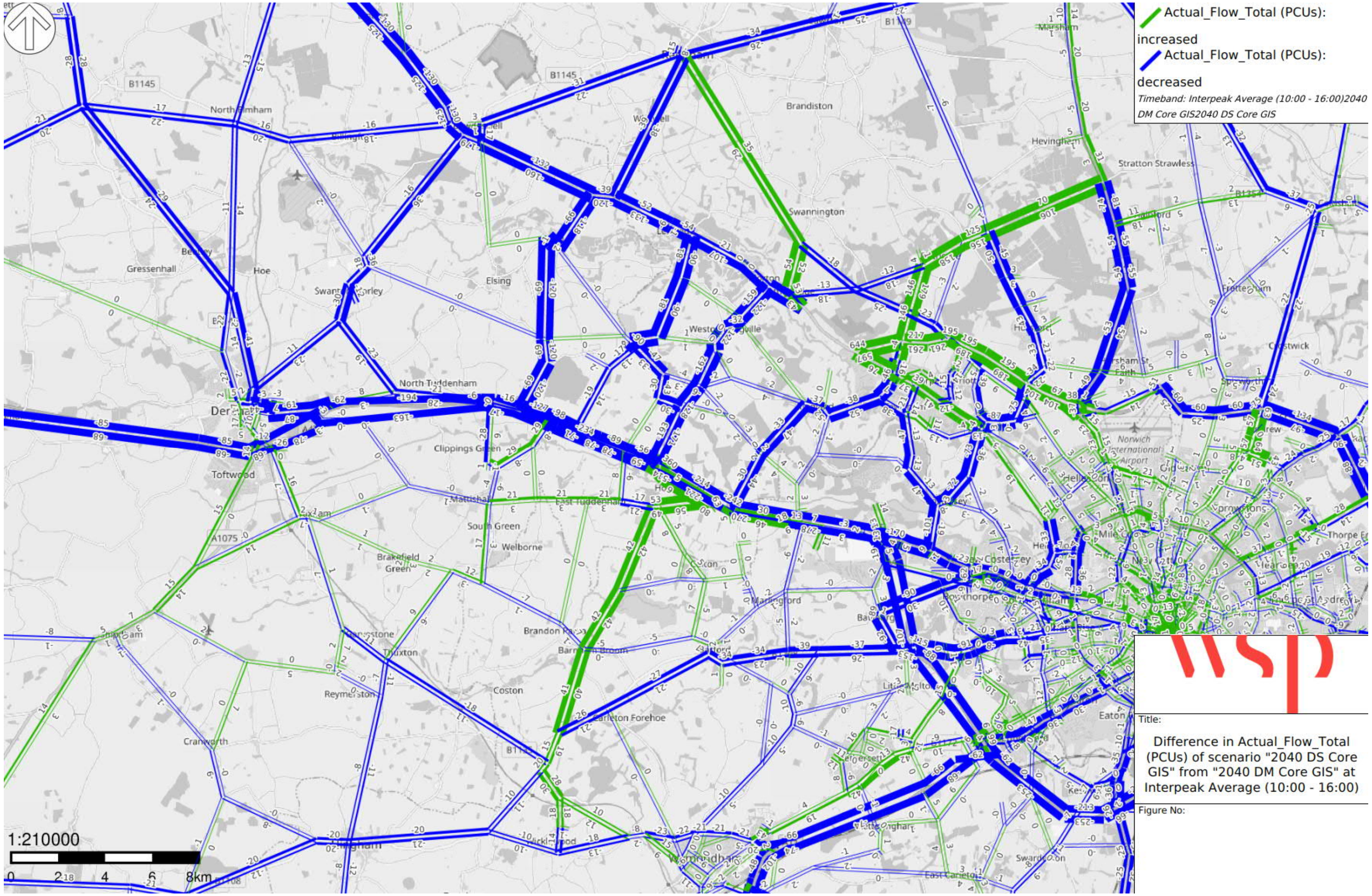


Figure 9-9: 2040 Core Growth DS scenario versus 2040 Core Growth DM scenario, Actual Flow Difference, in pcu's – Inter peak

wsp

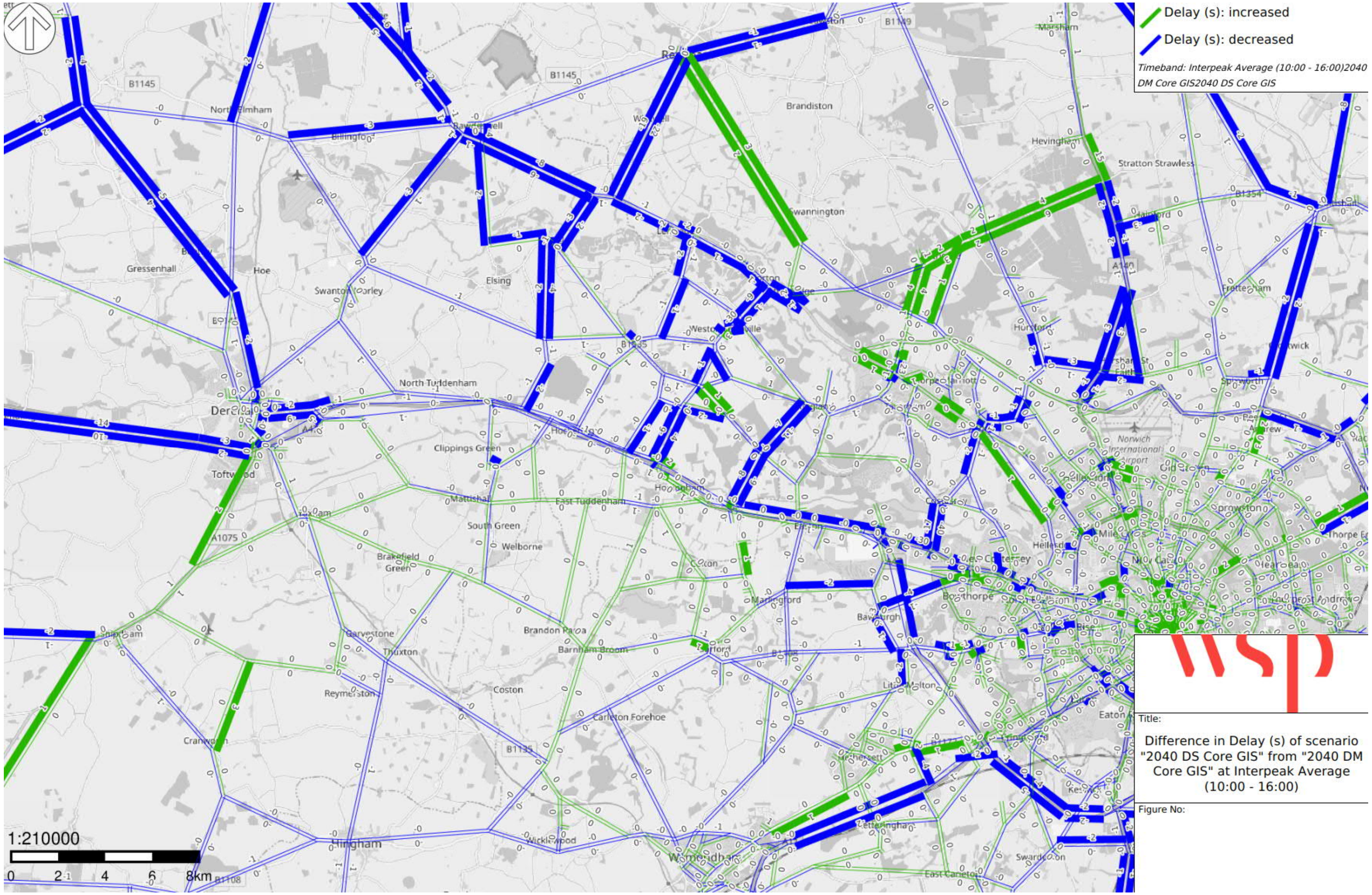


Figure 9-10: 2040 Core Growth DS scenario versus 2040 Core Growth DM scenario, Delay Flow Difference, in secs - Inter peak

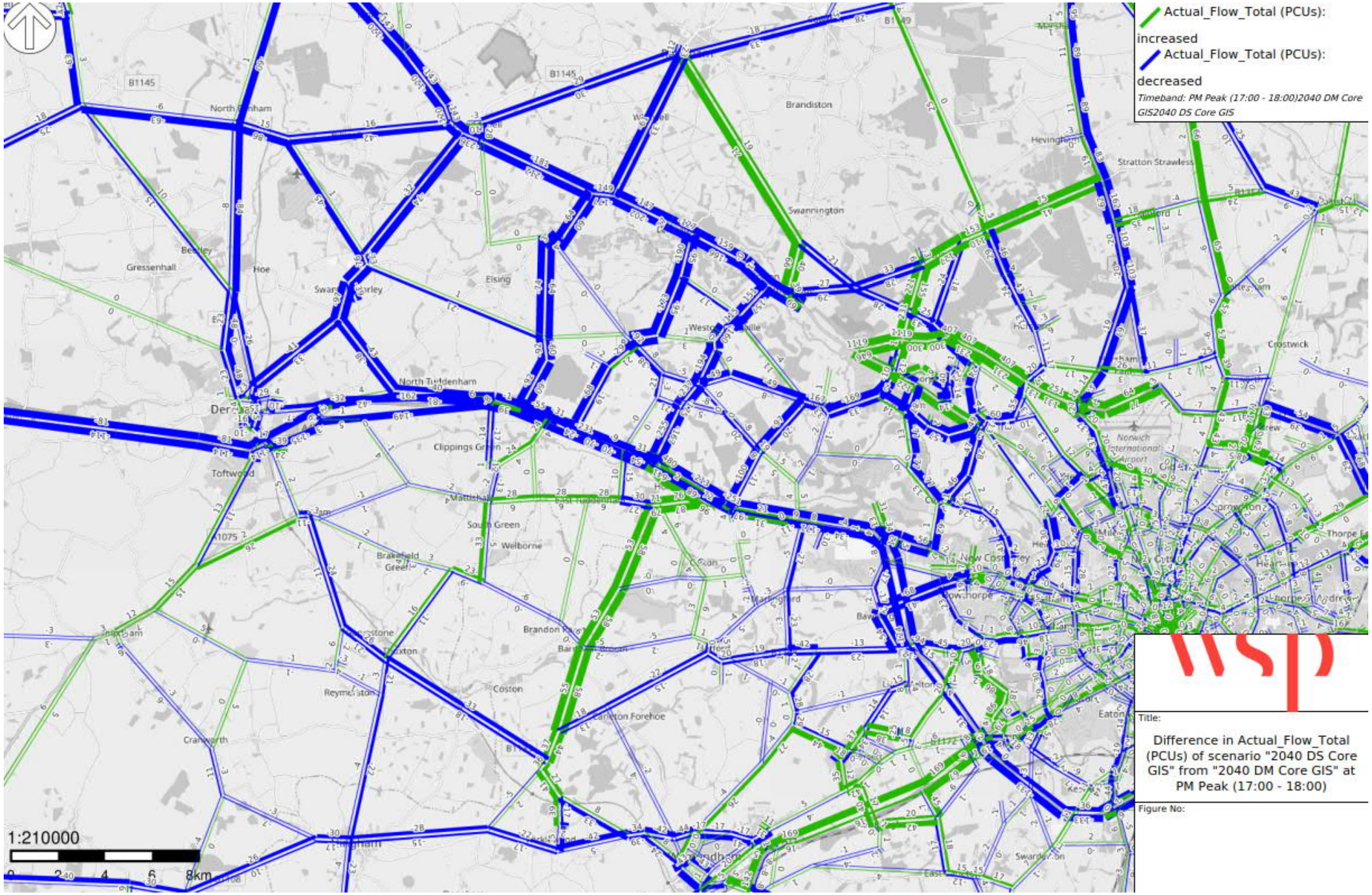


Figure 9-11: 2040 Core Growth DS scenario versus 2040 Core Growth DM scenario, Actual Flow Difference, in pcu's - PM peak

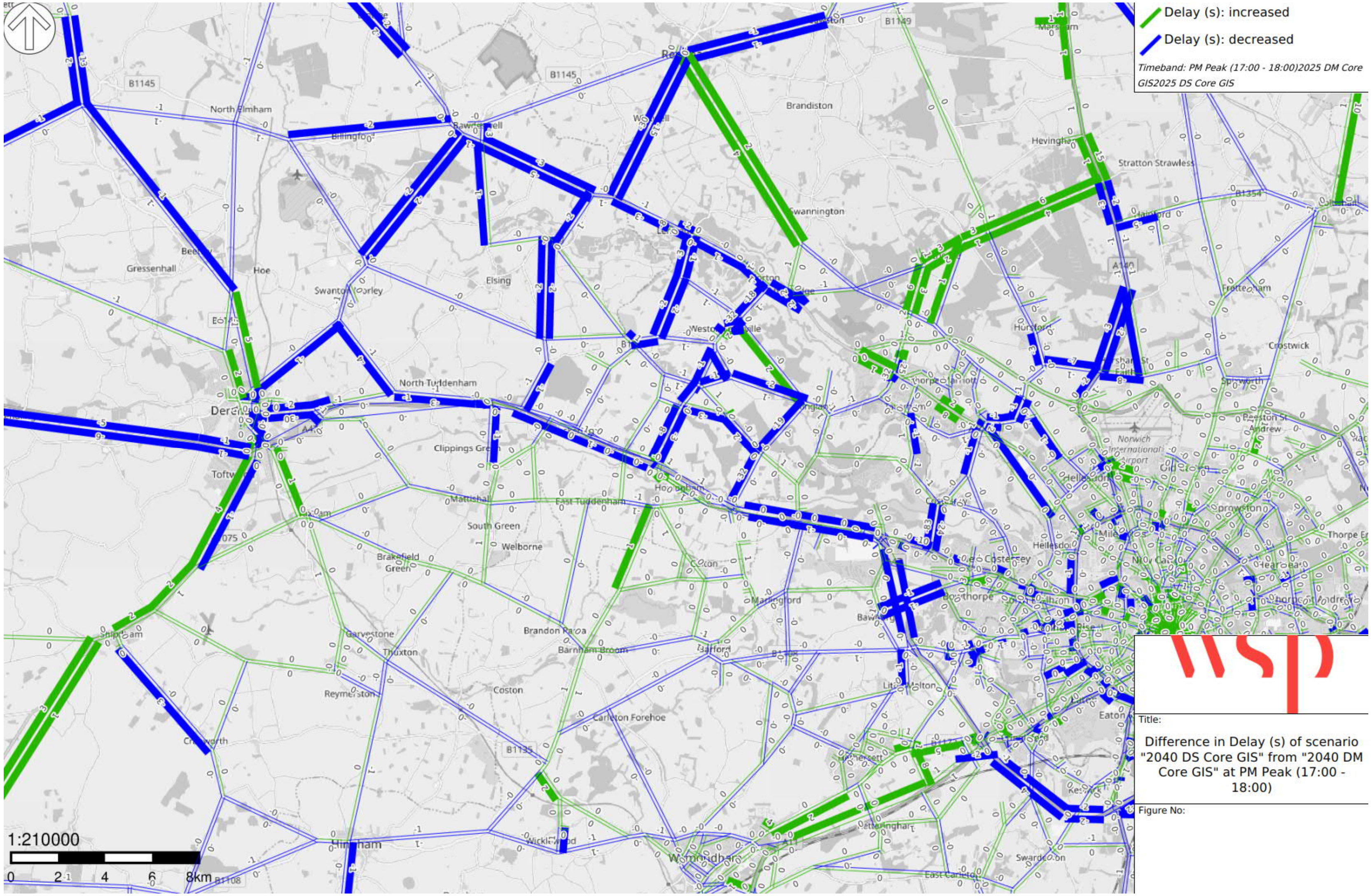


Figure 9-12: 2040 Core Growth DS scenario versus 2040 Core Growth DM scenario, Delay Difference, in seconds - PM peak

9.5.4. Appendix D contains the 2-way Annual Average Daily Traffic (AADT) flows for the 2025 Opening Year and 2040 Design Year. Table 9-11 shows the 2019 Base Year, DM and DS AADT Core Growth flows for the 2025 and 2040 forecast years.

Table 9-5: AADT base year and forecast year flow – Core Growth

Road Name	2019	2025		2040	
	Base	DM	DS	DM	DS
A47 west of Lyng Road	25,400	39,400	36,000	47,200	41,200
The Street (west of Heath Road	1,600	3,600	3,200	5,200	3,100
Heath Road	1,700	1,400	1,100	1,700	1,100
Sandy Lane	100	100	100	100	100
A47 west of A47 / Sandy Lane junction	23,900	39,400	36,000	47,200	41,200
A47 west of A47 / Wood Lane junction	23,900	39,400	36,000	47,200	41,200
B1535 Wood Lane	4,600	6,000	1,400	7,800	2,100
Berry's Lane	1,400	-	-	-	-
A47 / Wood Lane junction: eastbound off-slip	-	1,700	6,100	2,200	7,800
A47 / Wood Lane junction: westbound on-slip	-	1,100	4,600	1,500	6,300
Link between A47 roundabouts at Wood Lane	-	4,500	12,100	6,200	17,700
A47 / Wood Lane junction: eastbound on-slip	-	2,300	6,100	3,000	9,000
A47 / Wood Lane junction: westbound off-slip	-	2,200	5,900	3,100	8,700
A47 east of A47 / Wood Lane junction	24,300	41,100	37,300	49,600	44,800
Norwich Road (east of Mattishall Road)	3,600	1,200	2,700	1,500	3,600
Taverham road	200	1,800	1,100	2,600	1,200
Honingham Lane	500	1,500	800	2,400	900
Blind Lane	200	-	-	#N/A	#N/A
A47 / Taverham Road junction: eastbound off-slip	-	600	800	900	1,300
A47 / Taverham Road junction: westbound on-slip	-	400	800	600	1,500
Link between A47 roundabouts at Taverham Road	-	2,000	1,500	2,900	2,100
A47 / Taverham Road junction: eastbound on-slip	-	700	500	1,100	600
A47 east of A47 / Taverham Road junction	-	800	700	1,300	800
Church Lane	5,300	-	-	-	-

Road Name	2019	2025		2040	
	Base	DM	DS	DM	DS
Weston Road	400	400	500	500	600
Ringland Road (North of Weston Road)	4,600	400	300	400	400
A47 east of A47 / Church Lane junction	31,900	41,600	36,900	50,400	43,500
Dereham Road (east of A47 / Church Lane roundabout)	3,000	900	1,400	1,400	2,500
Costessey Road (Taverham Bridge)	6,300	8,000	7,200	8,000	7,300
Honingham Road (Weston Longville)	2,600	4,100	700	5,000	800
Ringland (The Street)	800	2,000	900	3,200	1,000
Norwich Western Link	-	-	24,700	-	34,600

9.5.5. It is predicted that the Norwich Western Link will have an AADT flow of 24,700 vehicles in the Core Growth 2025 Opening Year and an AADT flow of 34,600 vehicles in the Core Growth 2040 Design Year.

9.6 JOURNEY TIME RELIABILITY

9.6.1. To assess the extent to which journey time variation impacts network users, open access mapping data was used to compare journey times across the local road network at different times of the day. Journey times were found to be significantly longer during peak periods than in the off-peak.

9.6.2. Modelled journey time data has been extracted from the 2019 base year model for the morning peak and evening peak periods for the routes shown in Figure 9-13. The three routes shown are:

- JT1: The A47 at Easton (junction of Dereham Road and Marlingford Road to Fir Covert Road roundabout on the A1270 via Ringland Hills and Taverham
- JT2: South of Honingham (junction of Berrys Lane and Mattishall Road) to Fir Covert Road roundabout on the A1270 via Weston Longville
- JT3: The A47 junction north-west of Honingham to the Cromer Road roundabout on the A1270 via Dereham Road and the A140.

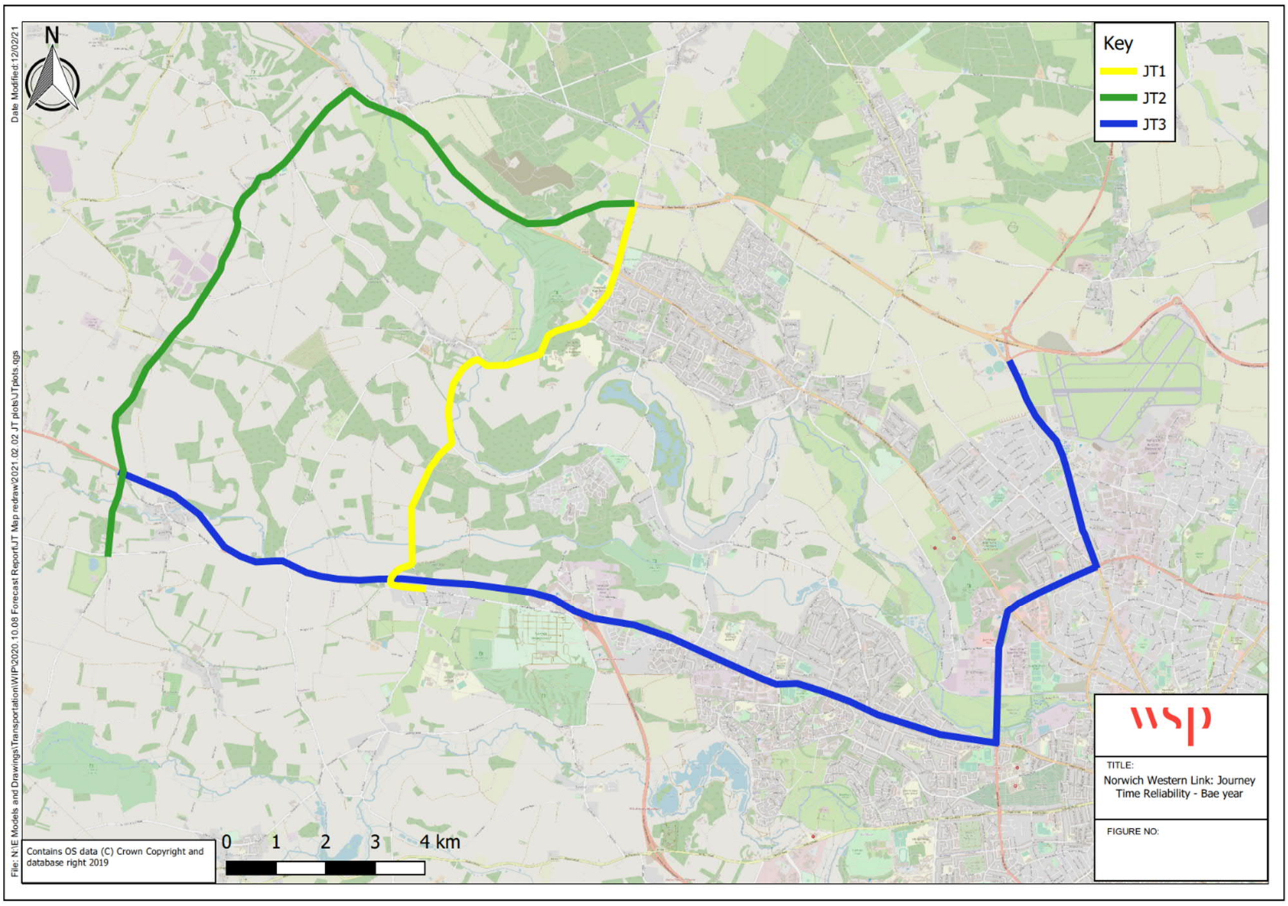


Figure 9-13: Journey Time Reliability 2019

9.6.3. In Table 9-6, the journey times during the AM peak and PM peak periods have been compared to the off-peak period to show the delay experienced by vehicles due to the congestion. Where the difference between peak and off-peak exceeds a minute, it has been marked in red.

Table 9-6: Journey times within NWQ for north-south routes 2019

Name	Distance (m)	AM peak (s)	PM peak (s)	Off-peak (s)	Variation between AM peak and Off-peak (s)	Variation between PM peak and Off-peak (s)
JT1: Northbound	6,747	647	643	585	62	58
JT1: Southbound	6.747	618	637	587	31	50
JT2: Northbound	11,036	771	780	647	124	133
JT2: Southbound	11,036	773	780	647	126	133
JT3: Eastbound	17,341	1,771	1,463	1,200	571	263
JT3: Westbound	17,341	1,653	1,525	1,279	374	246

9.6.4. As of 2019, the JT1 route in the northbound direction experienced approximately 1 minute of delay in the AM peak and PM peak when compared to the off-peak i.e. free flow conditions. JT2 experienced over two minutes delay in both the northbound and southbound directions in the AM peak and PM peak periods.

9.6.5. JT3 experienced between 4 minutes of delay on the westbound direction in the PM peak to approximately 9.5 minutes of delay in the eastbound direction in the AM peak. This route terminates at Norwich Airport and Imperial Park, a key employment site for the region.

9.6.6. Journey times have been extracted from the 2025 model for those routes set out in Figure 9-14. JT1 and JT2 are slightly different in the 2025 forecast year as compared to the 2019 base year due to the introduction of the Highways England A47 North Tuddenham to Easton scheme where there are junction layout changes affecting some road access to the A47.

9.6.7. As with the 2019 data, journey times during the morning and evening peak periods have been compared to the off-peak period to demonstrate the delay experienced by vehicles as a result of congestion. The variation between the off-peak and peak periods is shown in Table 9-7. Where the difference between peak and off-peak exceeds a minute, it has been highlighted in red.

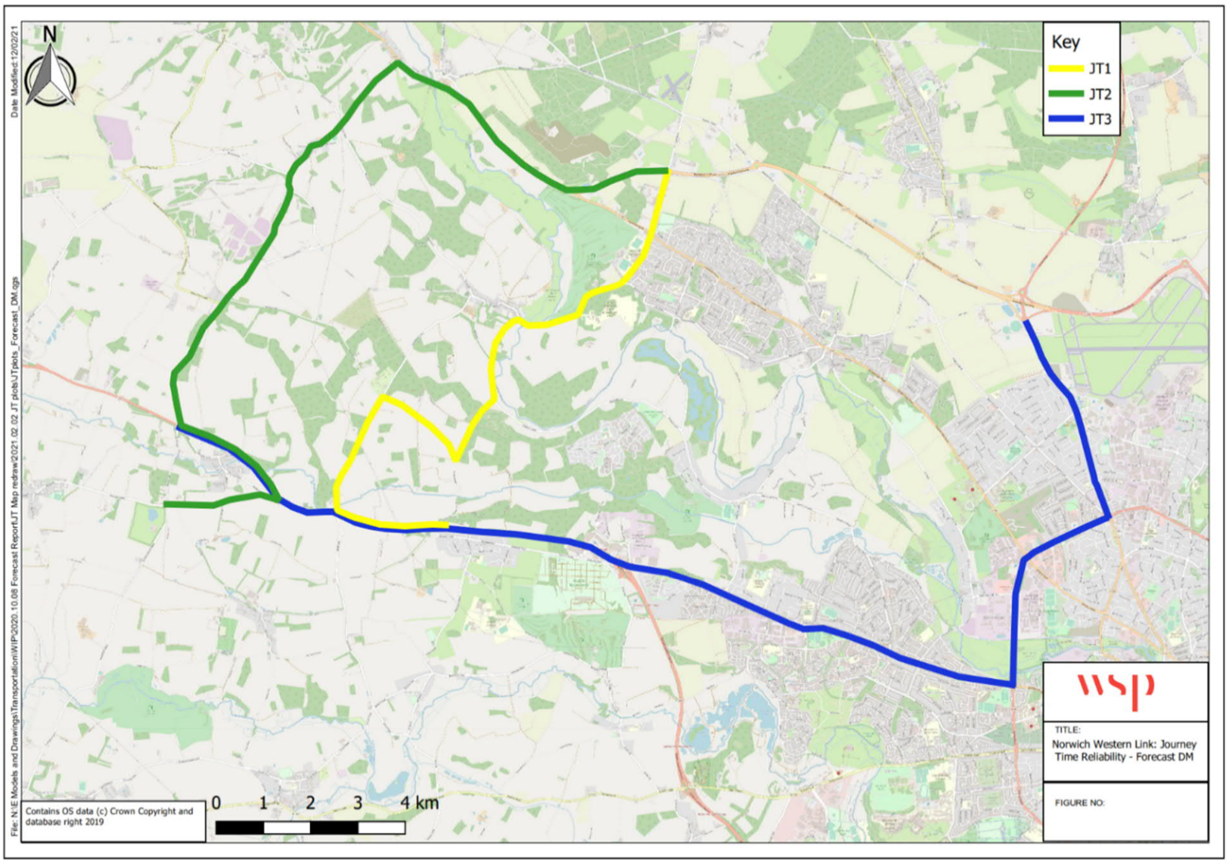


Figure 9-14: Journey Time Reliability, Do Minimum north-south routes 2025

Table 9-7: Journey times within NWQ for north-south routes 2025

Name	Distance (m)	AM peak (s)	PM peak (s)	Off-peak (s)	Variation between AM peak and Off-peak (s)	Variation between PM peak and Off-peak (s)
JT1: Northbound	10,594	978	971	914	+64	+57
JT1: Southbound	10.594	927	1,022	857	+70	+165
JT2: Northbound	13,562	854	857	850	+4	+7
JT2: Southbound	13,751	850	849	843	+7	+6
JT3: Eastbound	18,089	1,675	1,545	1,218	+457	+327
JT3: Westbound	17,365	1,595	1,463	1,239	+356	+224

9.6.8. The introduction of the A47 North Tuddenham to Easton scheme results in the distance of the JT1 route being increased by almost 4km, and the JT2 route being increased by 2km. The variation between 2019 and 2025 figures has therefore not been shown.

9.6.9. It is notable, however, that even with the A47 scheme improving journey times, the variation between peak and off peak travel is still significant, particularly for the JT3 route ending at the key employment areas of Norwich Airport and Imperial Park.

9.6.10. Forecast journey times have also been extracted from the 2040 model. The results are shown in Table 9-8. As the route length is unchanged from the 2025 forecast, the variation between 2025 and 2040 data is also shown.

Table 9-8: Journey times within NWQ for north-south routes 2040

Name	Distance (m)	AM peak (s)	PM peak (s)	Off-peak (s)	Variation between AM peak and Off-peak (s)	Variation between PM peak and Off-peak (s)	Variation between 2025 and 2040 (AM)	Variation between 2025 and 2040 (PM)
JT1: Northbound	10,594	1,112	1,116	914	+198	+202	+134	+145
JT1: Southbound	10,529	1,002	1,053	857	+145	+196	+75	+31
JT2: Northbound	13,562	1,069	1,032	850	+219	+182	+215	+175
JT2: Southbound	13,751	940	921	843	+97	+78	+90	+72
JT3: Eastbound	18,089	1,932	1,779	1,218	+714	+561	+257	+234
JT3: Westbound	17,365	1,750	1,654	1,239	+511	+415	+155	+191

9.6.11. Without the NWL scheme, those routes already expected to suffer from journey time delays in 2025 will worsen. Congestion is expected to spread to rural roads, with most routes now showing a variation of over a minute when compared to off-peak levels.

DO SOMETHING VERSUS DO MINIMUM JOURNEY TIME

9.6.12. A comparison of the journey times has been undertaken for those routes shown in Figure 9-14 which use existing routes compared to the journey times for JT1, JT2 and JT3 using the Norwich Western Link as shown in Figure 9-15

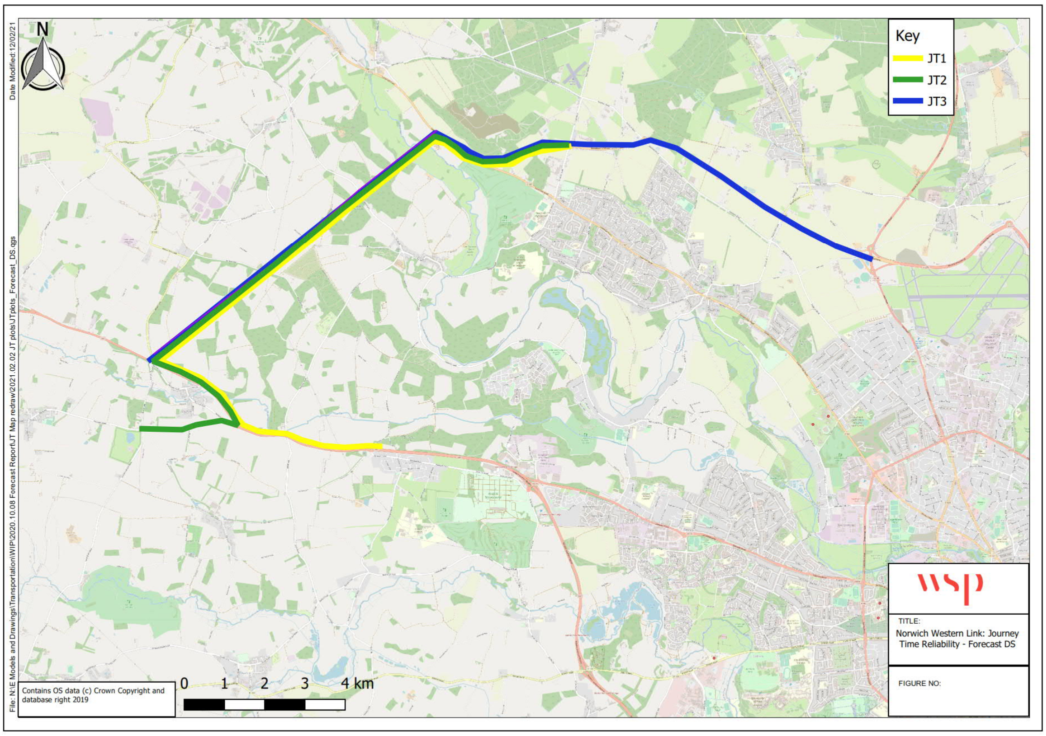


Figure 9-15: Journey Time Reliability, Do Minimum north-south routes 2025

9.6.13. Table 9-9 shows the modelled journey time improvements for JT1, JT2 and JT3 in the 2025 and 2040 forecast years for the AM peak, Inter peak and PM peak.

Table 9-9: Journey times improvements – DS versus DM (2025 and 2040)

2025 / 2040 Do Minimum i.e. without Norwich Western Link using existing roads							
		2025: AM peak DM	2025: Inter peak DM	2025: PM peak DM	2040: AM peak DM	2040: Inter peak DM	2040: PM peak DM
ID	Name	Modelled (s)	Modelled (s)	Modelled (s)	Modelled (s)	Modelled (s)	Modelled (s)
1	JT1: Northbound	1000	966	1035	1112	972	1116
2	JT1: Southbound	964	1019	1036	1002	1021	1053
3	JT2: Northbound	927	870	926	1069	898	1032
4	JT2: Southbound	902	864	886	940	891	921
5	JT3: Eastbound and Northbound	1752	1450	1597	1932	1525	1779
6	JT3: Southbound and Westbound	1630	1450	1475	1750	1526	1654
2025 / 2040 Do Something i.e. with Norwich Western Link (NWL) but using the NWL							
		2025: AM peak DS	2025: Inter peak DS	2025: PM peak DS	2040: AM peak DS	2040: Inter peak DS	2040: PM peak DS
ID	Name	Modelled (s)	Modelled (s)	Modelled (s)	Modelled (s)	Modelled (s)	Modelled (s)
1	JT1: Northbound	556	542	555	656	546	632
2	JT1: Southbound	514	508	512	523	511	519
3	JT2: Northbound	498	491	499	597	494	574
4	JT2: Southbound	488	484	486	495	486	491
5	JT3: Eastbound and Northbound	512	502	512	622	505	590
6	JT3: Southbound and Westbound	511	504	508	525	509	526
Difference							
		2025: AM peak DS	2025: Inter peak DS	2025: PM peak DS	2040: AM peak DS	2040: Inter peak DS	2040: PM peak DS
ID	Name	Modelled (s)	Modelled (s)	Modelled (s)	Modelled (s)	Modelled (s)	Modelled (s)
1	JT1: Northbound	-444	-424	-480	-456	-426	-484
2	JT1: Southbound	-451	-511	-524	-479	-510	-535
3	JT2: Northbound	-429	-379	-427	-472	-404	-458
4	JT2: Southbound	-414	-380	-400	-445	-405	-430
5	JT3: Eastbound and Northbound	-1241	-948	-1085	-1310	-1019	-1189
6	JT3: Southbound and Westbound	-1119	-946	-967	-1224	-1017	-1129

9.6.14. Table 9-9 shows that there is between a 380 second improvement in journey time for JT2 (southbound) in the 2025 Inter peak time period to a 1,310 second improvement in journey time for JT3 (eastbound and northbound) in the 2040 AM peak time period.

9.7 TRAFFIC FLOWS ON THE NORWICH WESTERN LINK

9.7.1. To demonstrate the distribution of traffic flow with the Norwich Western Link place a Select Link Analysis (SLA) has been undertaken showing the Annual Average Daily Traffic (AADT) flows using the Norwich Western Link.

9.7.2. Figure 9-16 and Figure 9-17 show the SLA on the Norwich Western Link in the northbound and southbound direction in the 2040 forecast year respectively.

9.7.3. Figure 9-18 to Figure 9-23 shows directional peak hour select link analysis for the AM peak, Inter peak and PM peak in the 2040 forecast year.

9.7.4. Traffic on the NWL route in the northbound direction for the AM peak, Inter peak and PM peak has origins from the A47 with a destination mainly to use the A1270 Broadland Northway. The southbound direction shows the opposite in that the origin of traffic using the NWL is mainly from the A1270 Broadland Northway and then uses the NWL to access the A47.

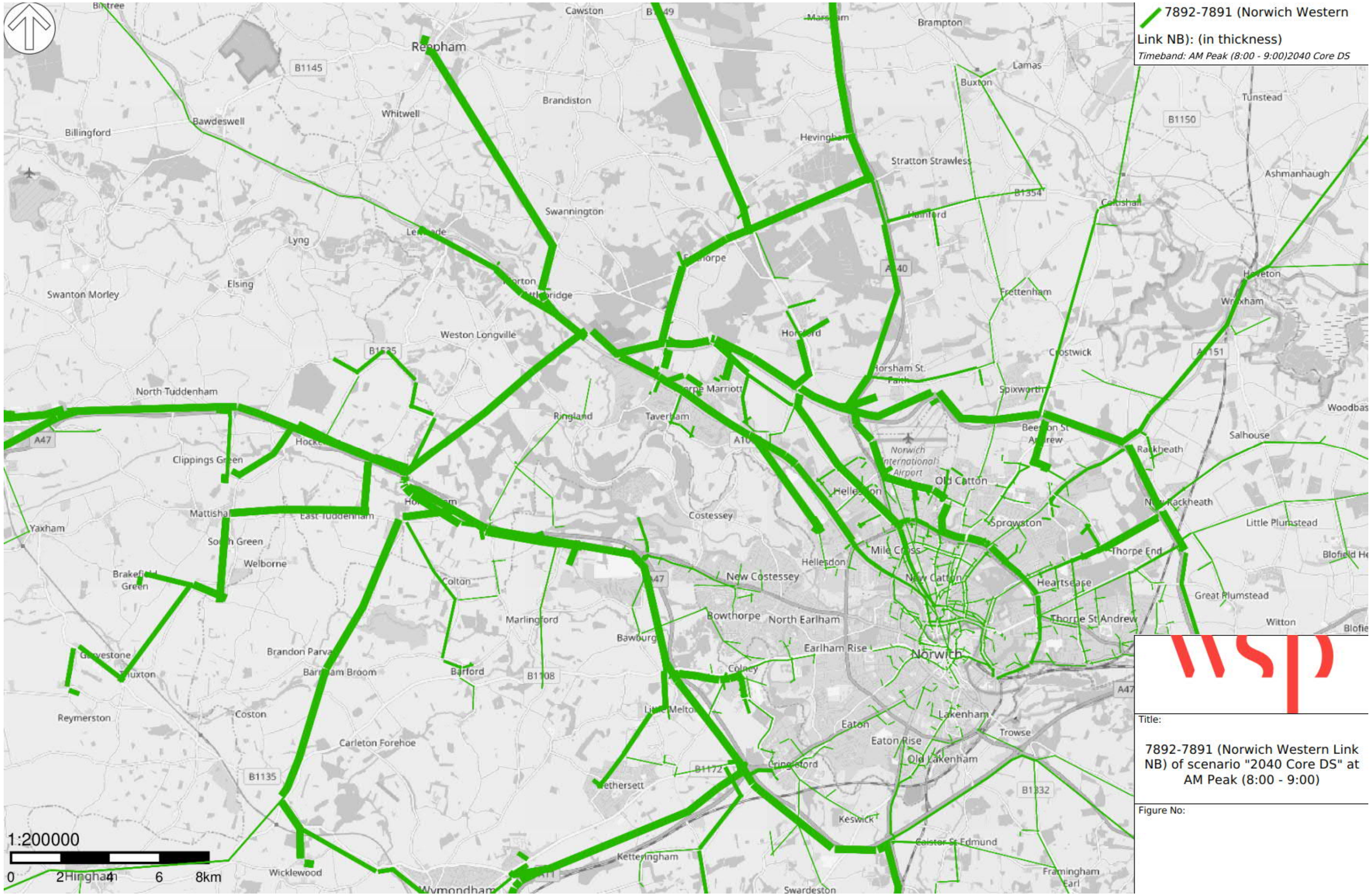


Figure 9-16: Select Link Analysis in the Northound direction – Norwich Western Link 2040 DS

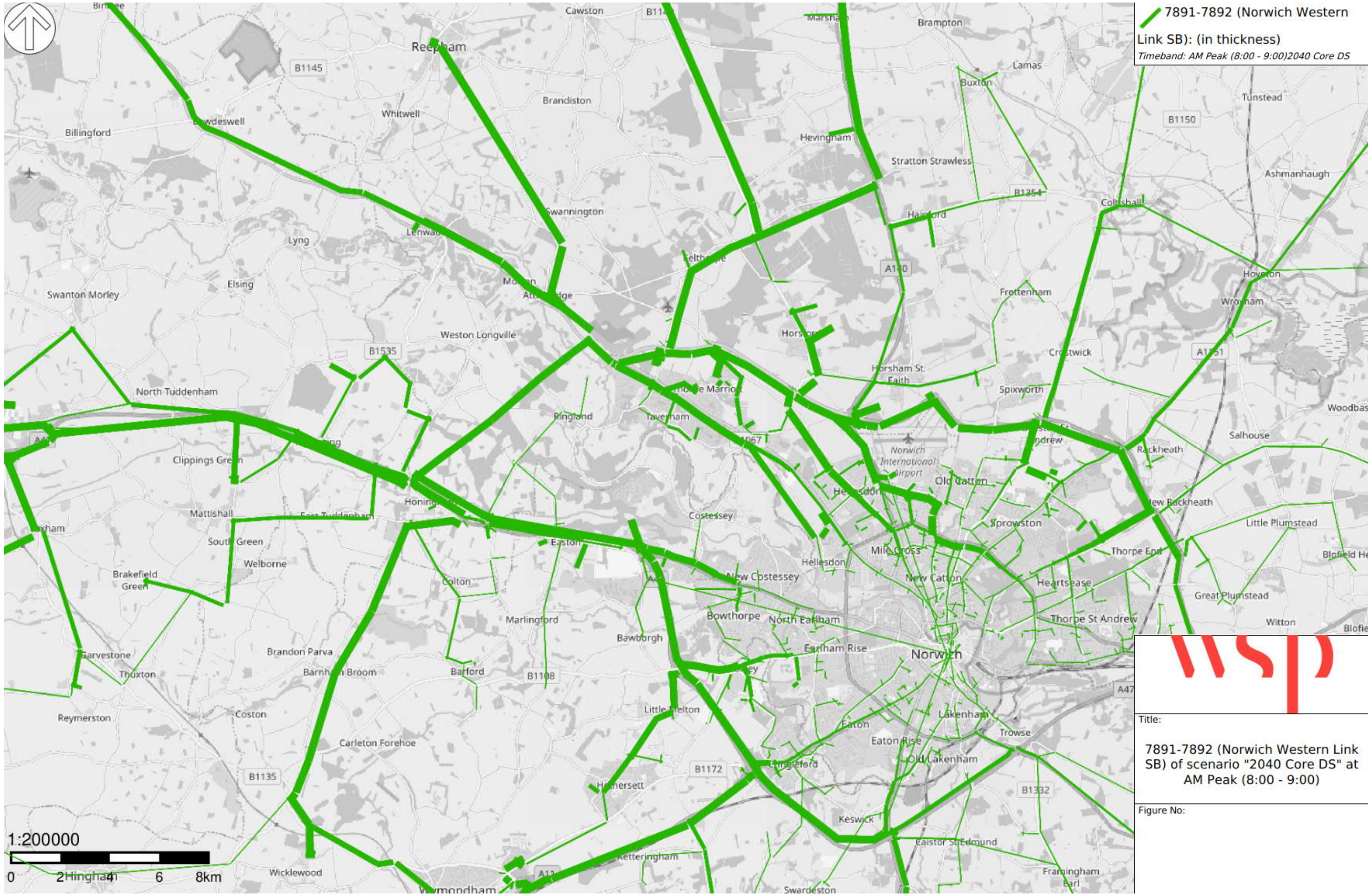


Figure 9-17: Select Link Analysis in the Northound direction – Norwich Western Link 2040 DS

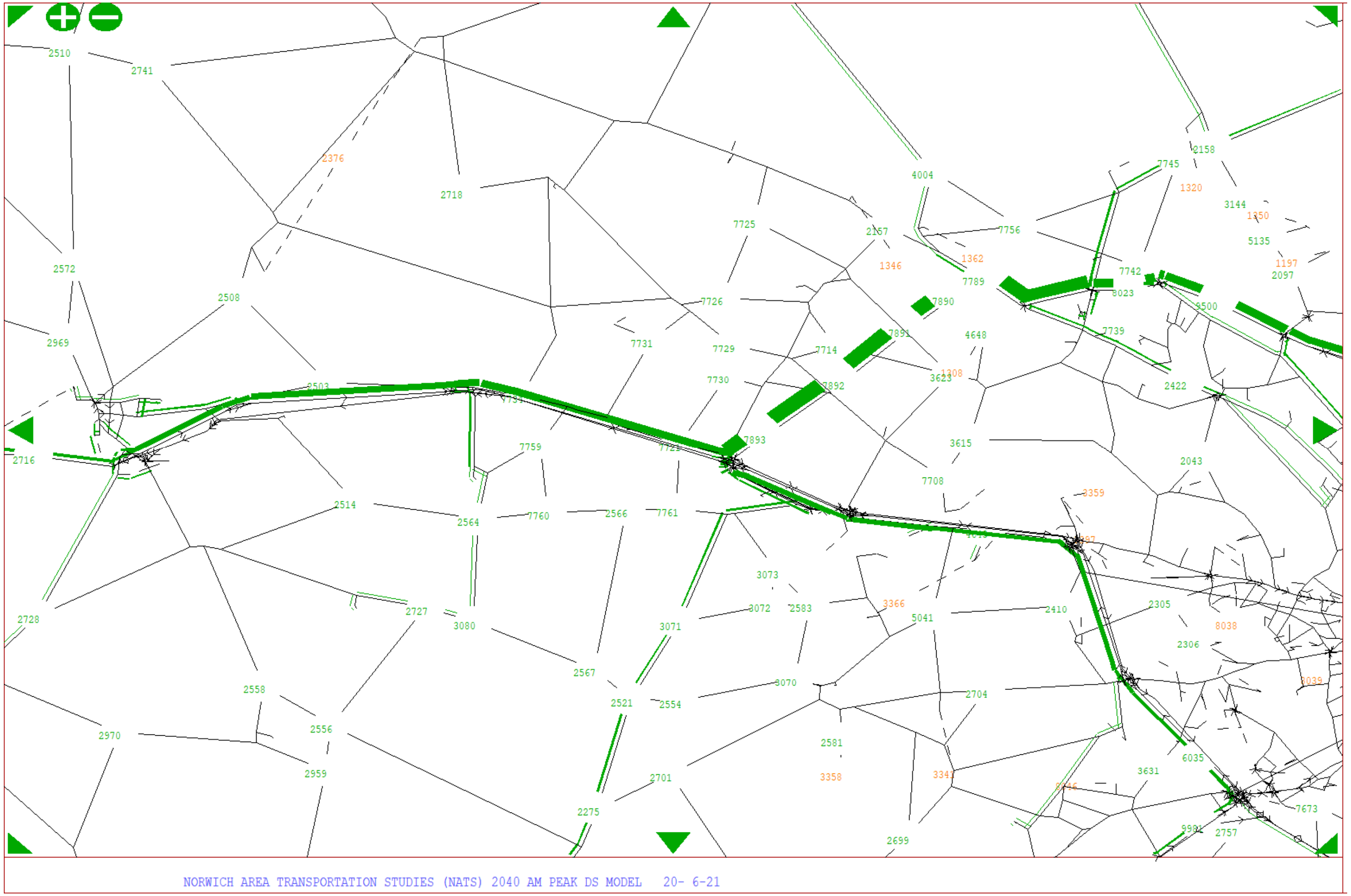


Figure 9-18: AM peak Select Link Analysis in the Northound direction – Norwich Western Link 2040 DS

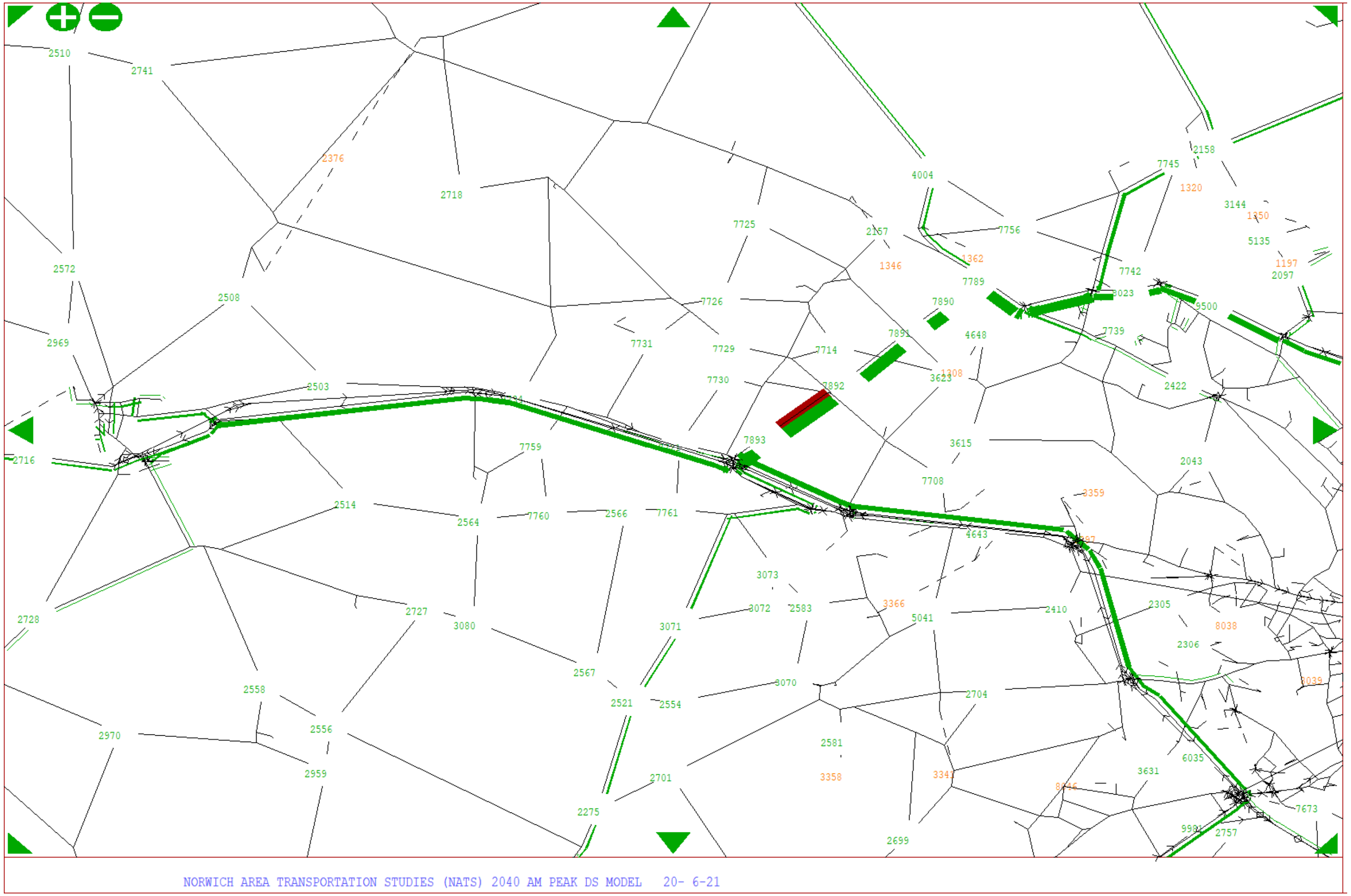


Figure 9-19: AM peak Select Link Analysis in the Northound direction – Norwich Western Link 2040 DS

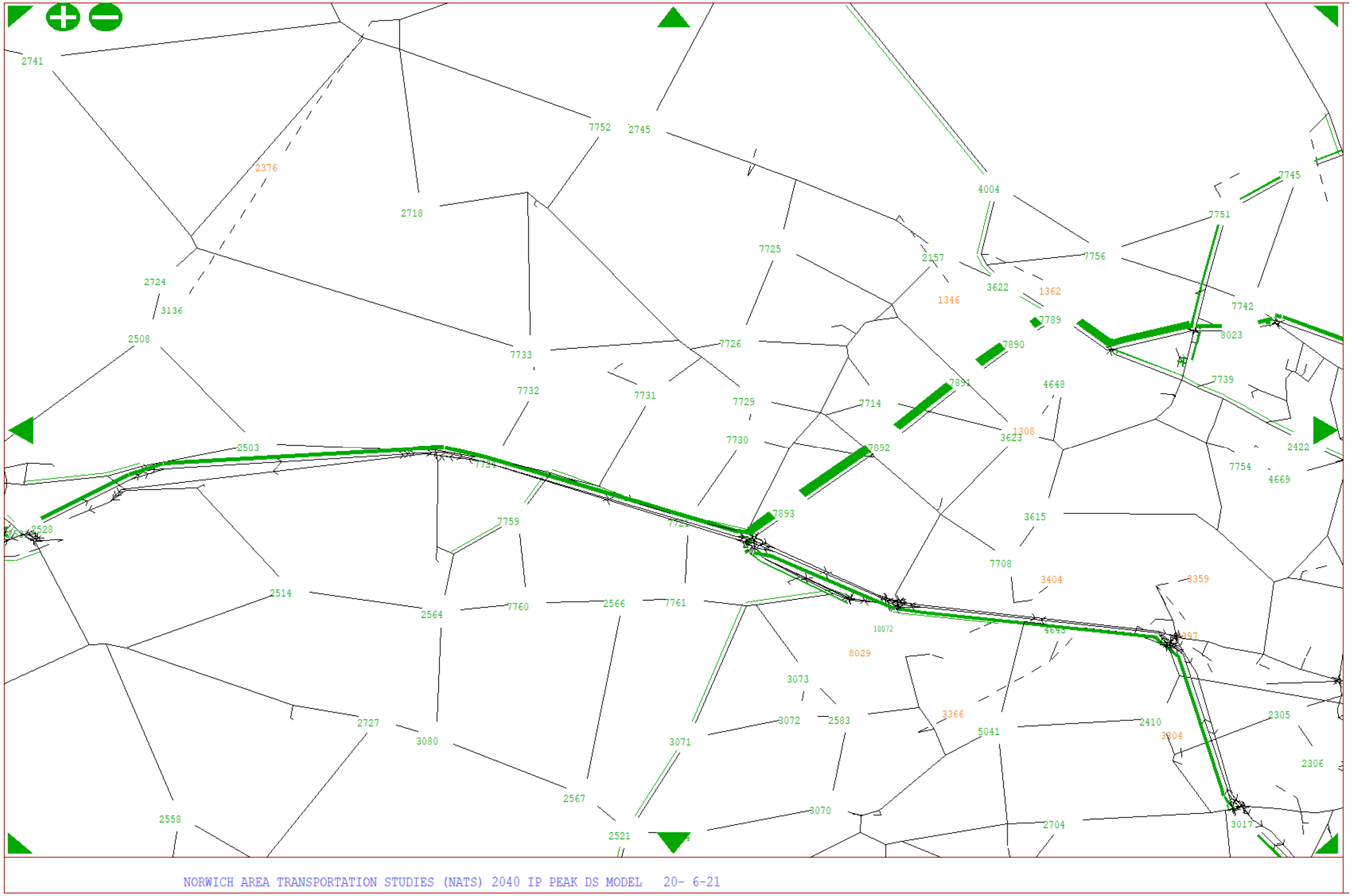


Figure 9-20: Inter peak Select Link Analysis in the Northound direction – Norwich Western Link 2040 DS

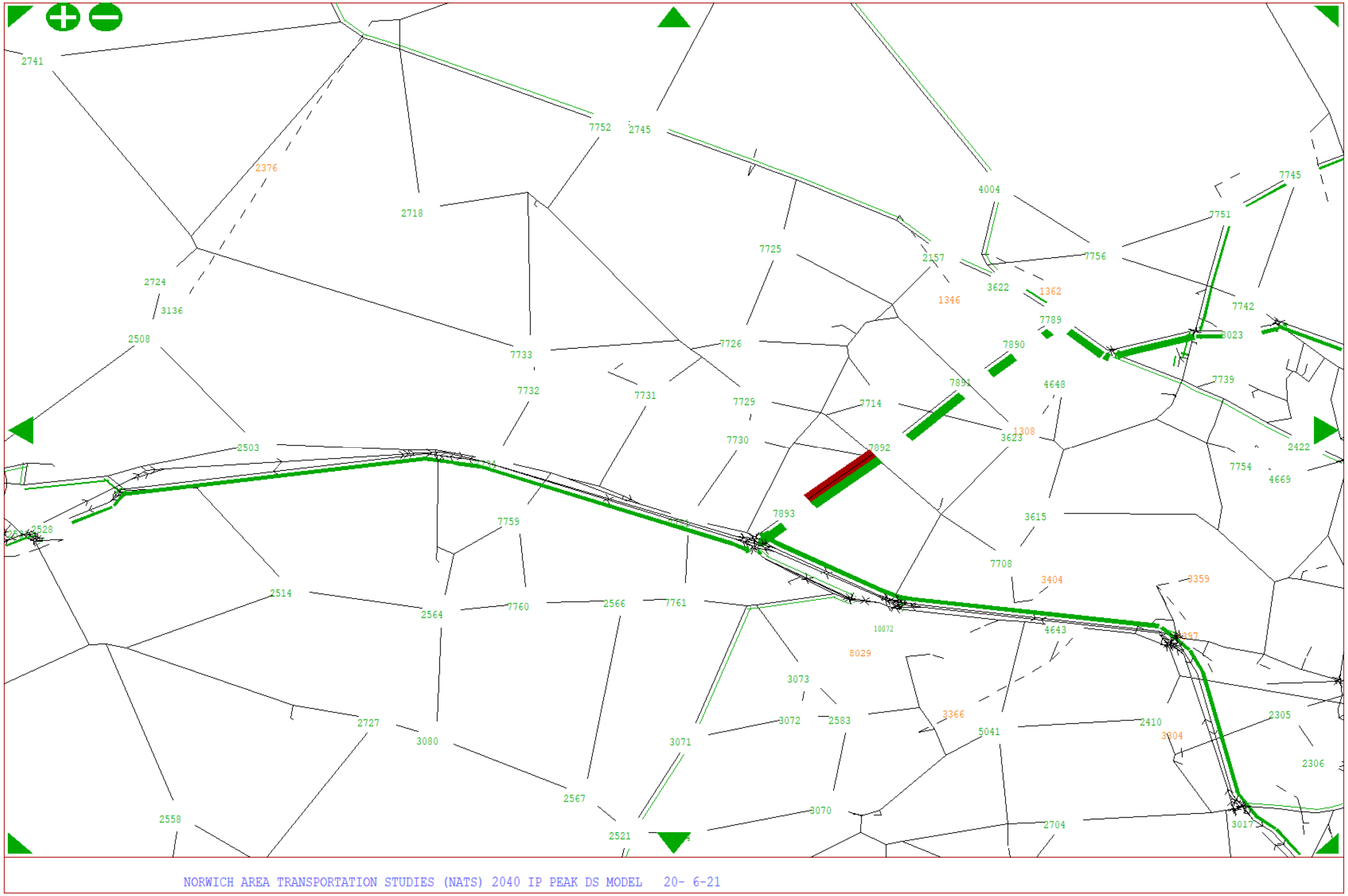


Figure 9-21: Inter peak Select Link Analysis in the Northound direction – Norwich Western Link 2040 DS

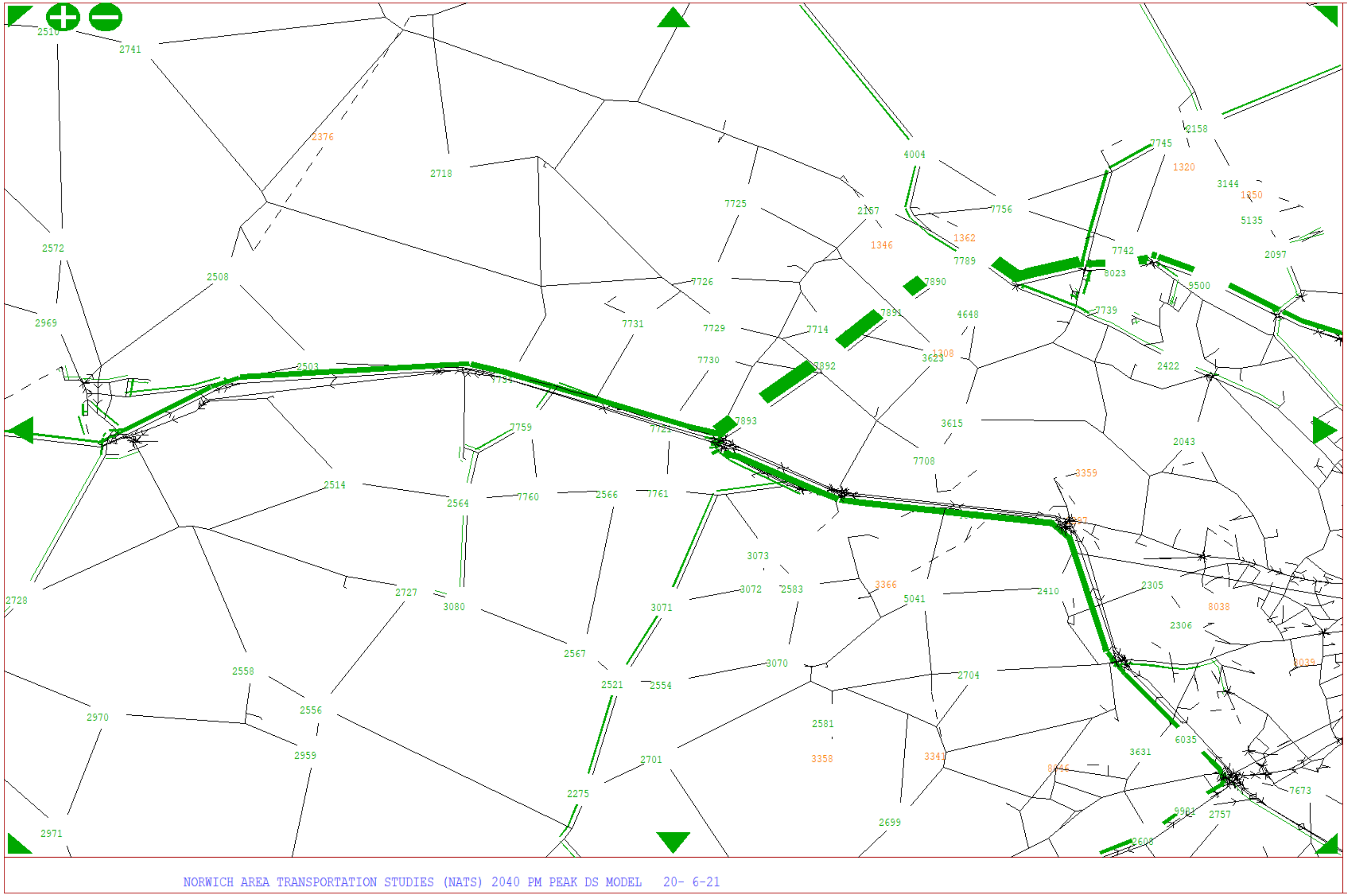


Figure 9-22: PM peak Select Link Analysis in the Northound direction – Norwich Western Link 2040 DS

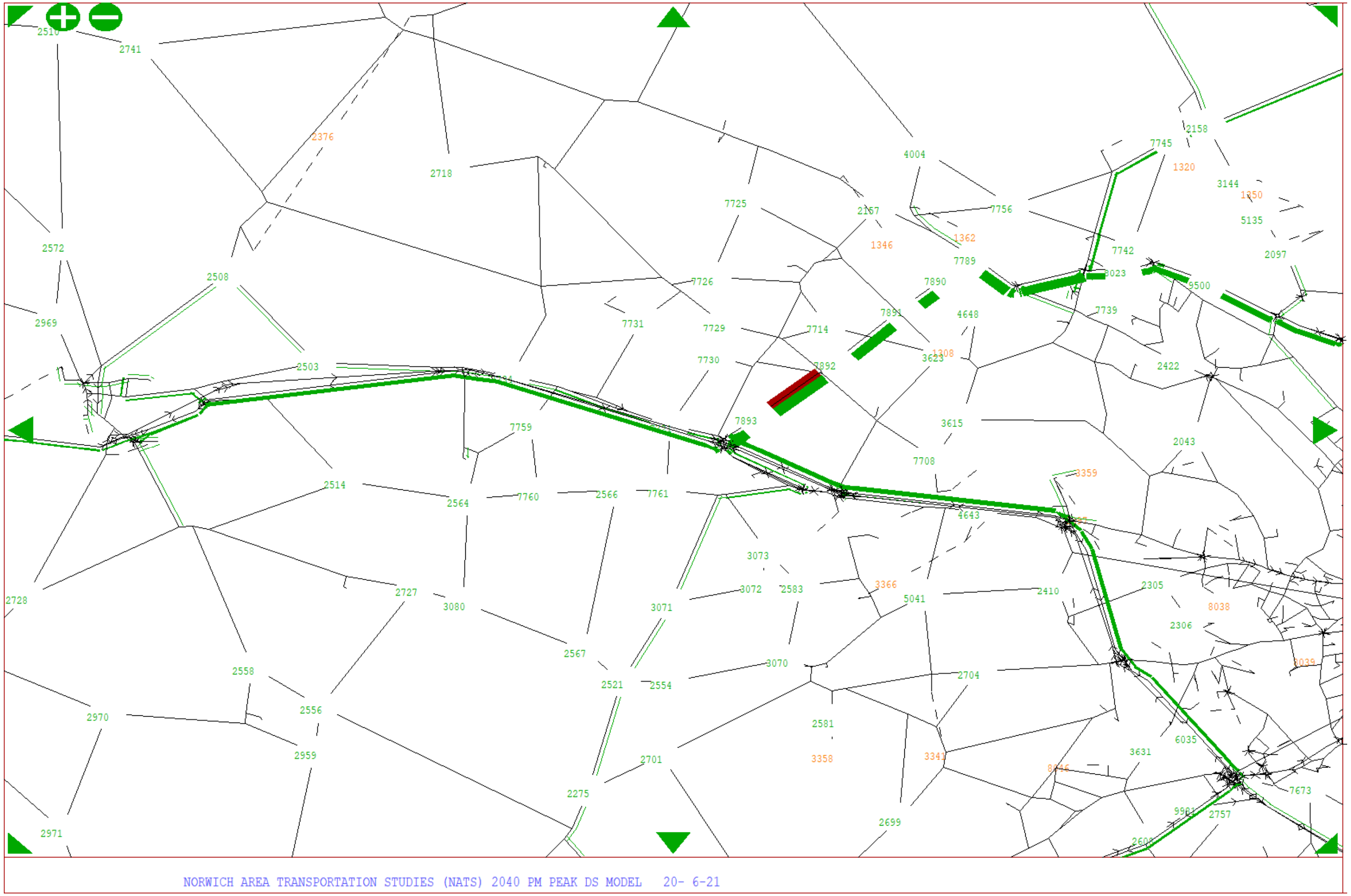


Figure 9-23: PM peak Select Link Analysis in the Northound direction – Norwich Western Link 2040 DS

9.8 JUNCTION DELAYS AND LINK SPEEDS

9.8.1. To check if the model has very low link speeds or high junction delays, the following criteria has been used:

- Link speed under 15 kph
- Junction delays greater than 60 seconds.

9.8.2. The Core Growth forecast year models (2025 and 2040) have been interrogated and there are no link speeds under 15kph in the Do Minimum i.e. without the Norwich Western Link or the Do Something (DS) i.e. with the Norwich Western Link.

9.8.3. There are junction delays greater than 60 seconds in the DM Core Growth scenario on e.g. Marl Hill approach to the A1067 Fakenham Road in the 2040 AM peak (143 seconds) and in the 2040 PM peak (113 seconds). This is one of the routes between the A47 and the 1067 Fakenham Road that is relieved by the introduction of the Norwich Western Link.

9.9 VOLUME OVER CAPACITY

9.9.1. This section provides description of links where the forecast flows are above capacity i.e. Volume over Capacity greater than 85%. Figure 9-18 and Figure 9-19 shows the links that have a VoC greater than 85% on routes between the A47 and the A1067 Fakenham which will be relieved by the introduction of the Norwich Western Link in the 2040 AM peak and PM peak respectively.

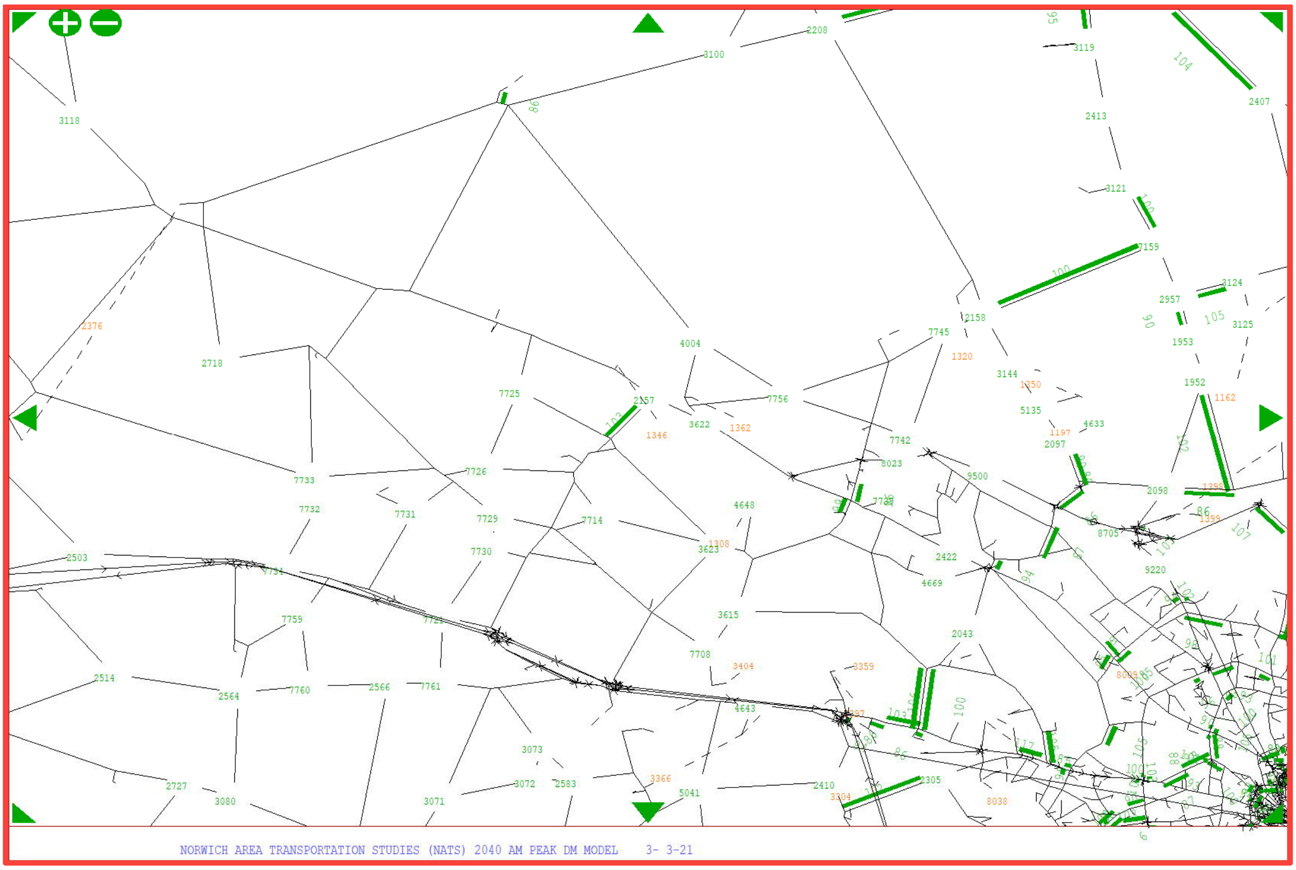


Figure 9-24: VoC greater than 85% - 2040 AM peak

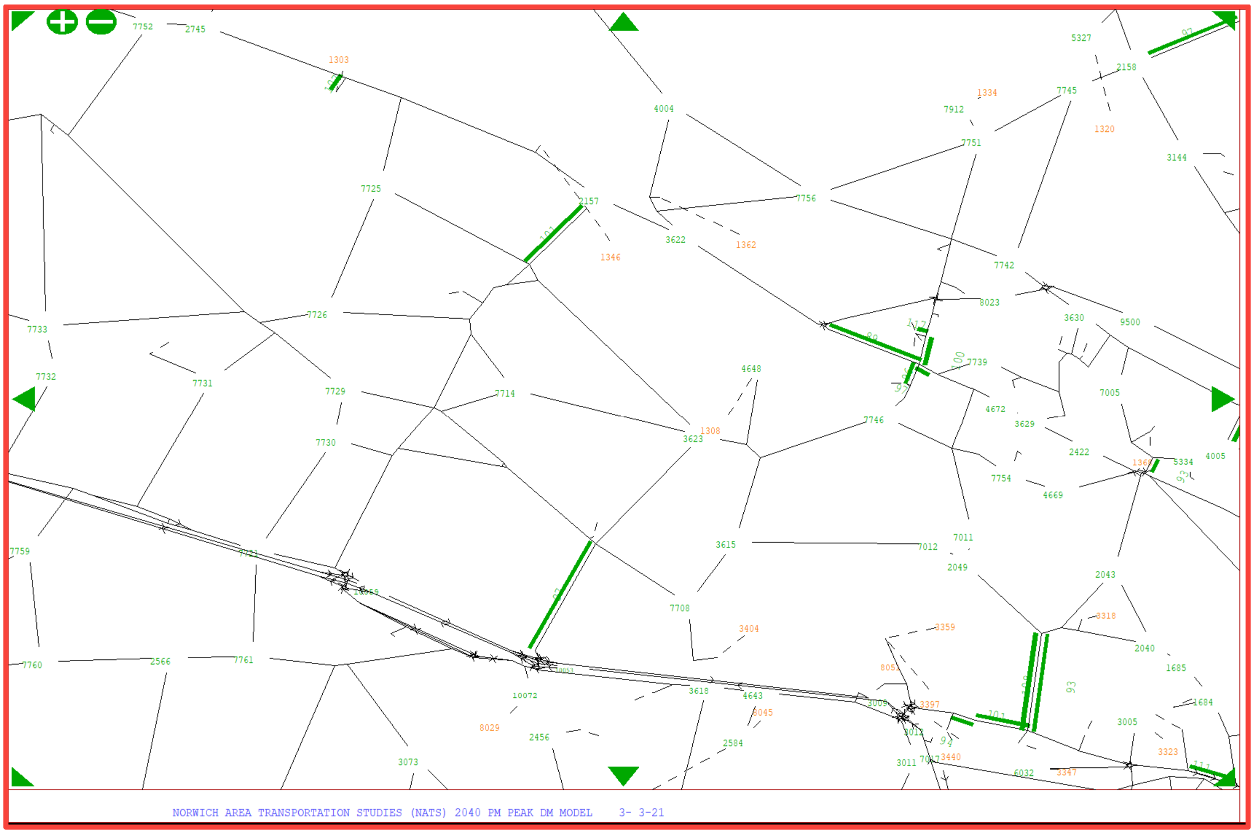


Figure 9-25: VoC greater than 85% - 2040 PM peak

9.10 PUBLIC TRANSPORT

9.10.1. There is a minor impact on the public transport demand matrix totals between the fixed demand totals as shown in Table 7-1 to Table 7-3.

9.10.2. Table 9-10 to Table 9-12 show the change in the public transport demand matrix totals between the fixed demand matrix totals and the VDM DM and VDM DS matrix totals for the AM peak, Inter peak and PM peak respectively

Table 9-10: AM Peak Core Scenario Public Transport Matrix Totals

User Class / Trip Purpose	Vehicle Class	2025			2040		
		Fixed Demand	VDM DM	VDM DS	Fixed Demand	VDM DM	VDM DS
Commute	PT	2,580	2,707	2,703	2,574	2,735	2,698
Work	PT	635	731	734	650	741	748
Other	PT	4,632	4,354	4,454	4,791	4,407	4,543
All		7,846	7,791	7,891	8,015	7,884	7,988

Table 9-11: Inter Peak Core Scenario Public Transport Matrix Totals

User Class / Trip Purpose	Vehicle Class	2025			2040		
		Fixed Demand	VDM DM	VDM DS	Fixed Demand	VDM DM	VDM DS
Commute	PT	601	613	617	593	605	612
Work	PT	387	434	438	398	434	450
Other	PT	5,354	5,044	5,225	5,625	5,099	5,465
All		6,342	6,091	6,281	6,617	6,138	6,527

Table 9-12: PM Peak Core Scenario Public Transport Matrix Totals

User Class / Trip Purpose	Vehicle Class	2025			2040		
		Fixed Demand	VDM DM	VDM DS	Fixed Demand	VDM DM	VDM DS
Commute	PT	2,691	2,772	2,778	2,669	2,779	2,753
Work	PT	667	713	712	681	726	730
Other	PT	3,574	4,754	4,885	3,736	4,942	5,143
All		6,932	8,239	8,376	7,086	8,447	8,626

10

FORECASTING ASSIGNMENT - LOW GROWTH

PUBLIC

10 FORECASTING ASSIGNMENT - LOW GROWTH

10.1 INTRODUCTION

10.1.1. This chapter looks at the network statistics, assignment and converge of the Low Growth forecast scenarios, with and without the NWL scheme, in the 2025 Opening Year and the 2040 Design Year.

10.1.2. These impacts are considered in terms of actual flow changes and differences in delay. Flow difference plots have been produced to demonstrate the volume of vehicle comparisons between the 2019 base year, 2025 Opening Year and 2040 Design Year and any re-routing that occurs as a result of the implementation of the proposed infrastructure.

10.2 ASSIGNMENT CONVERGENCE

10.2.1. Table 10-1 shows the convergence of the Low Growth assignments. These results confirm the assignments which have been taken forward to the economic appraisal have met the TAG convergence criteria for highway assignment models (TAG Unit 3.1, Table 4). They have shown that all assignments in both scenarios have conformed to the criteria set out by TAG.

Table 10-1: Convergence statistics for Low Growth forecast assignments (DM and DS)

Year	Scenario	Time Period	Relative Gap (%)	Final Four Iterations > 98%* - flow change (P)<1%			
				Final Iteration	N-1	N-2	N-3
Base		AM	0.006	99.4	99.1	99.4	99.3
		IP	0	99.2	99.5	99	99.5
		PM	0.005	99.7	99.3	99.1	99.4
2025 DM	Low	AM	0.004	99.4	99.3	99.2	99.1
		IP	0.001	99.3	99.2	99.1	99.0
		PM	0.002	99.2	99.3	99.2	98.9
2040 DM	Low	AM	0.0051	99.3	99.2	99.1	99.3
		IP	0.0013	99.3	99.5	99.6	99.6
		PM	0.0026	99.4	99.0	99.1	98.7
2025 DS	Low	AM	0.004	99.4	99.4	99.2	99.3
		IP	0.0008	99.1	99.0	99.0	99.1
		PM	0.0017	99.3	99.2	99.2	99.2
2040 DS	Low	AM	0.0041	99.1	99.0	98.5	99.0
		IP	0.0016	99.4	99.0	99.4	99.1
		PM	0.0019	99.2	99.7	99.3	98.6

10.3 NETWORK STATISTICS

10.3.1. Network statistics for each of the Low Growth forecast models are presented within this section. The results presented include the total number of kilometres travelled and the total number of vehicle hours travelled.

10.3.2. Table 10-2 presents the network statistics (simulation area) for the 2025 Low Growth DM scenario compared with the 2025 Low Growth DS scenario. The comparison shows that implementation of the NWL scheme reduces transient queueing, total travel time and total travel distance in the AM peak, Inter peak and PM peak. The average speed in the AM peak, Inter peak and PM peak marginally increases with the inclusion of the proposed NWL transport scheme.

Table 10-2: 2025 Network Statistics, Low Growth

Statistic	Unit	DM			DS		
		AM Peak	Inter Peak	PM Peak	AM Peak	Inter Peak	PM Peak
Transient Queues	PCU / Hrs	3,520	2,109	3,334	3,450	2,066	3,268
Over-Capacity Queues	PCU / Hrs	253	54	249	227	71	282
Link Cruise Time	PCU / Hrs	15,802	11,237	25,558	15,582	11,056	15285
Total Travel Time	PCU / Hrs	19,575	13,400	19,142	19,259	13,193	18,835
Total Travel Distance	PCU / KMs	962,525	707,590	954,039	955,832	697,344	943,027
Average Speed	kph	49.17	52.80	49.84	49.63	52.86	50.07

10.3.3. Table 10-3 presents the network statistics (simulation area) for the 2040 Low Growth DM scenario compared with the 2040 Low Growth DS scenario. The comparison shows that implementation of the NWL scheme reduces transient queueing, total travel time and total travel distance in the AM peak, Inter peak and PM. The average speed in the AM peak marginally increases with the inclusion of the proposed NWL transport scheme.

Table 10-3: 2040 Network Statistics, Low Growth

Statistic	Unit	DM			DS		
		AM Peak	Inter Peak	PM Peak	AM Peak	Inter Peak	PM Peak
Transient Queues	PCU / Hrs	4,075	2,439	3,892	4,070	2,383	3,951
Over-Capacity Queues	PCU / Hrs	589	65	440	611	76	530
Link Cruise Time	PCU / Hrs	18,003	13,061	17,570	17,558	12,526	17,123
Total Travel Time	PCU / Hrs	22,667	15,565	21,902	22,240	14,985	21,604
Total Travel Distance	PCU / KMs	1,081,379	827,377	1,065,102	1,063,760	793,633	1,044,852
Average Speed	kph	47.71	53.16	48.63	47.83	52.96	48.36

10.4 LOW GROWTH ASSESSMENT RESULTS

Do Minimum scenario versus Base Year model

10.4.1. Appendix E contains flow difference and delay difference plots for the AM peak, Inter peak and PM peak respectively for the 2025 Low Growth DM scenario versus the 2019 Base Year model to demonstrate the impact of the committed developments and background growth. Traffic flows and delays generally increase in all three time periods and it must be remembered that the Highways England A47 North Tuddenham to Easton scheme has been included within the Do Minimum scenario. The impact of this, in all three peak hours, can be seen along the A47 in the North Tuddenam to Honingham section where the transport model shows reductions along the old A47 route with traffic switching to the new dual carriageway scheme.

10.4.2. Figure 10-1 to Figure 10-6 present flow difference and delay difference plots for the AM peak, Inter peak and PM peak respectively for the 2040 Low Growth DM scenario versus the 2019 Base year model to demonstrate the impact of committed developments and background growth up to the 2040 Design Year.

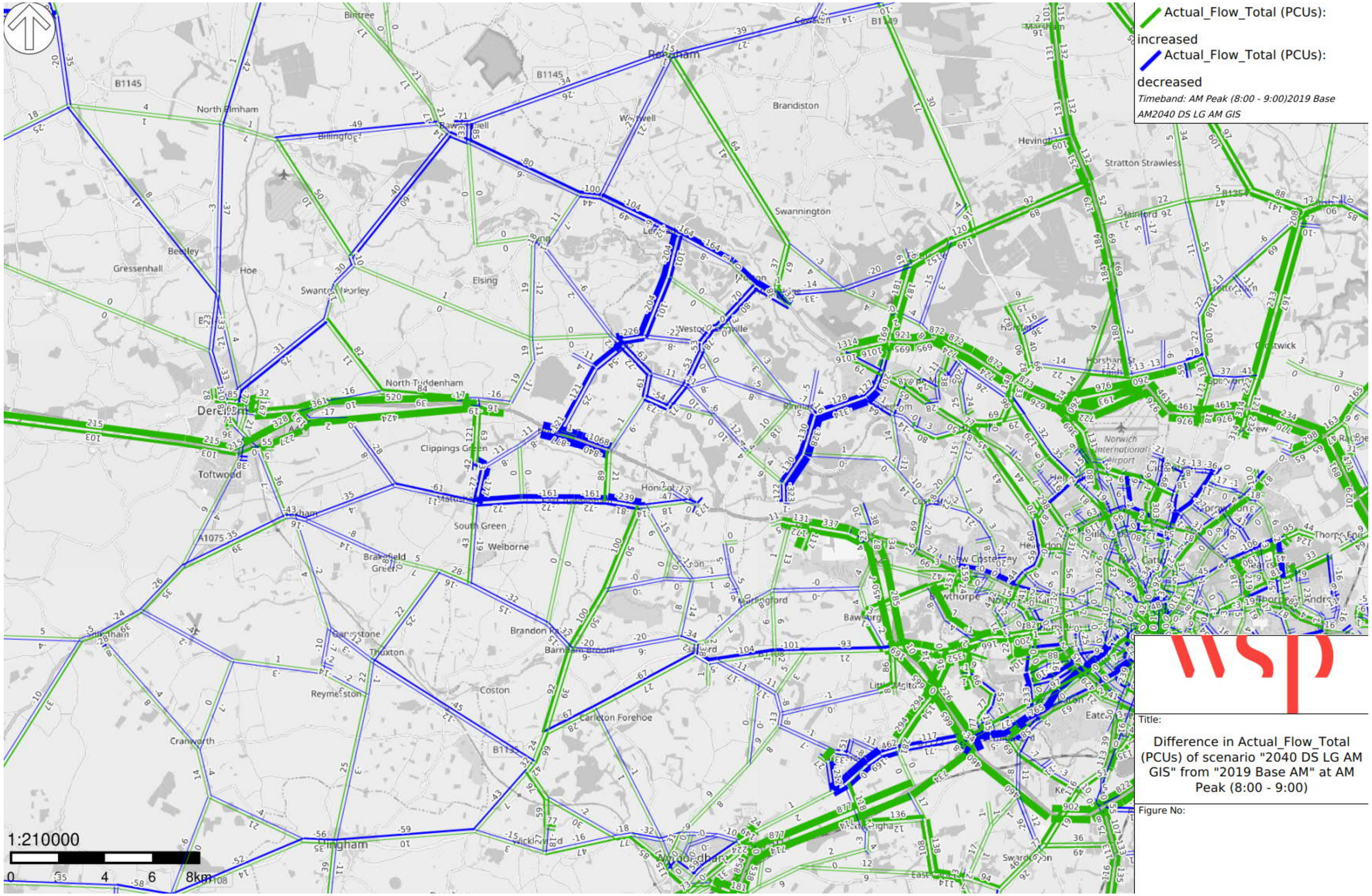


Figure 10-1: 2040 Low Growth scenario versus 2019 Base Year model, Actual Flow Difference, in pcu's - AM peak

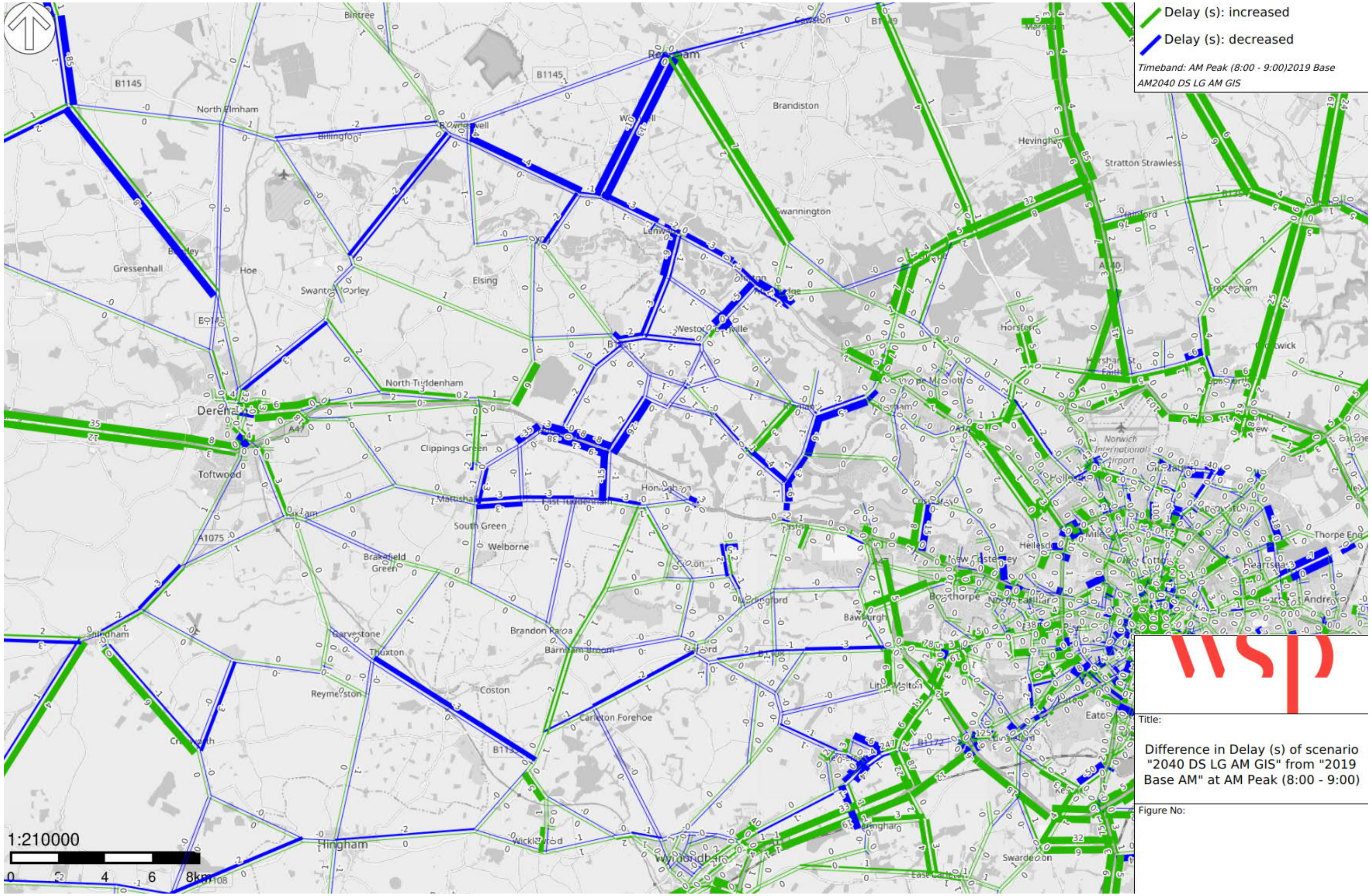


Figure 10-2: 2040 Low Growth scenario versus 2019 Base Year model, Delay Difference, in secs - AM peak

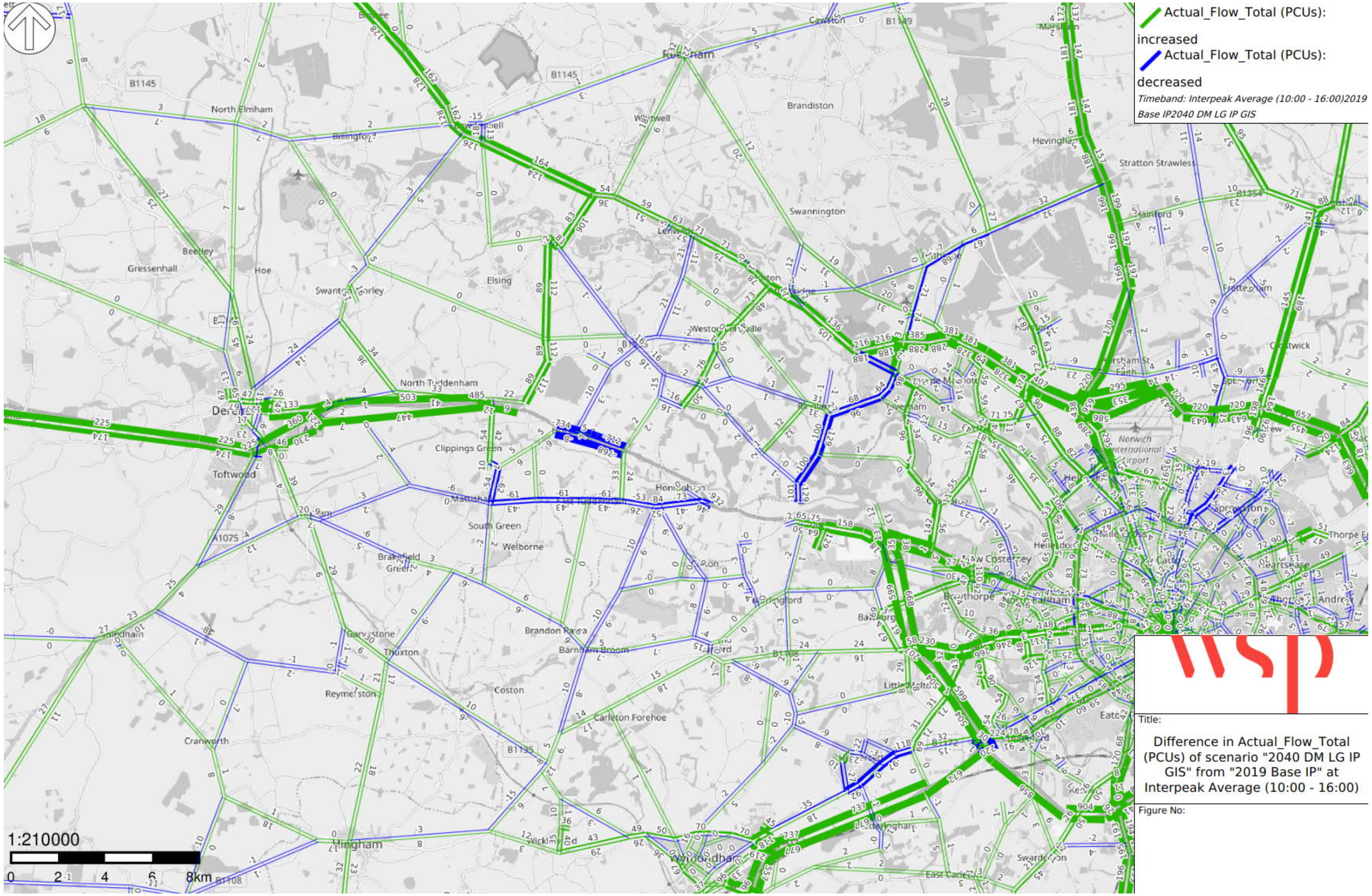


Figure 10-3: 2040 Low Growth scenario versus 2019 Base Year model, Actual Flow Difference, in pcu's – Inter peak

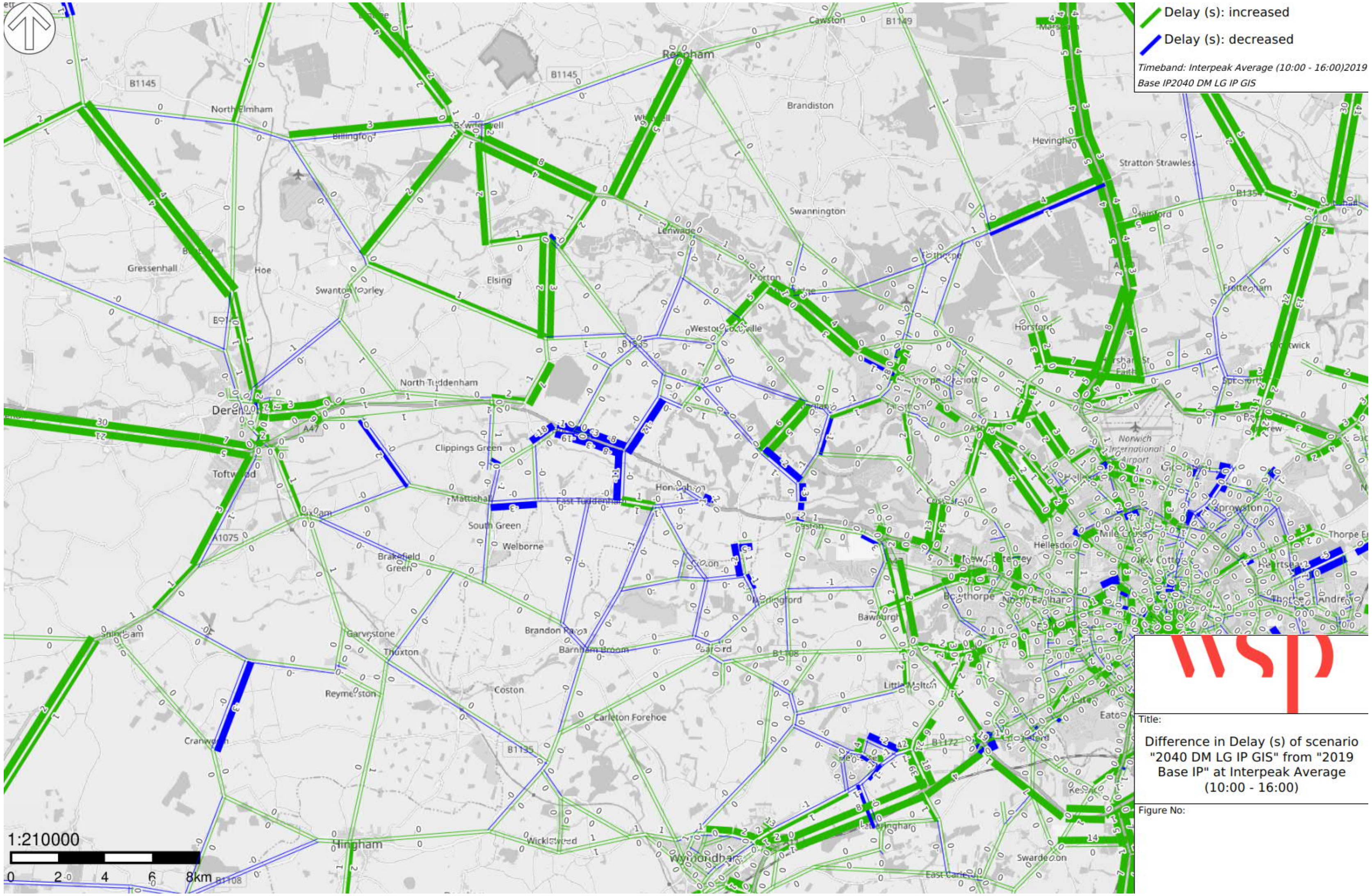


Figure 10-4: 2040 Low Growth scenario versus 2019 Base Year model, Delay Flow Difference, in secs - Inter peak

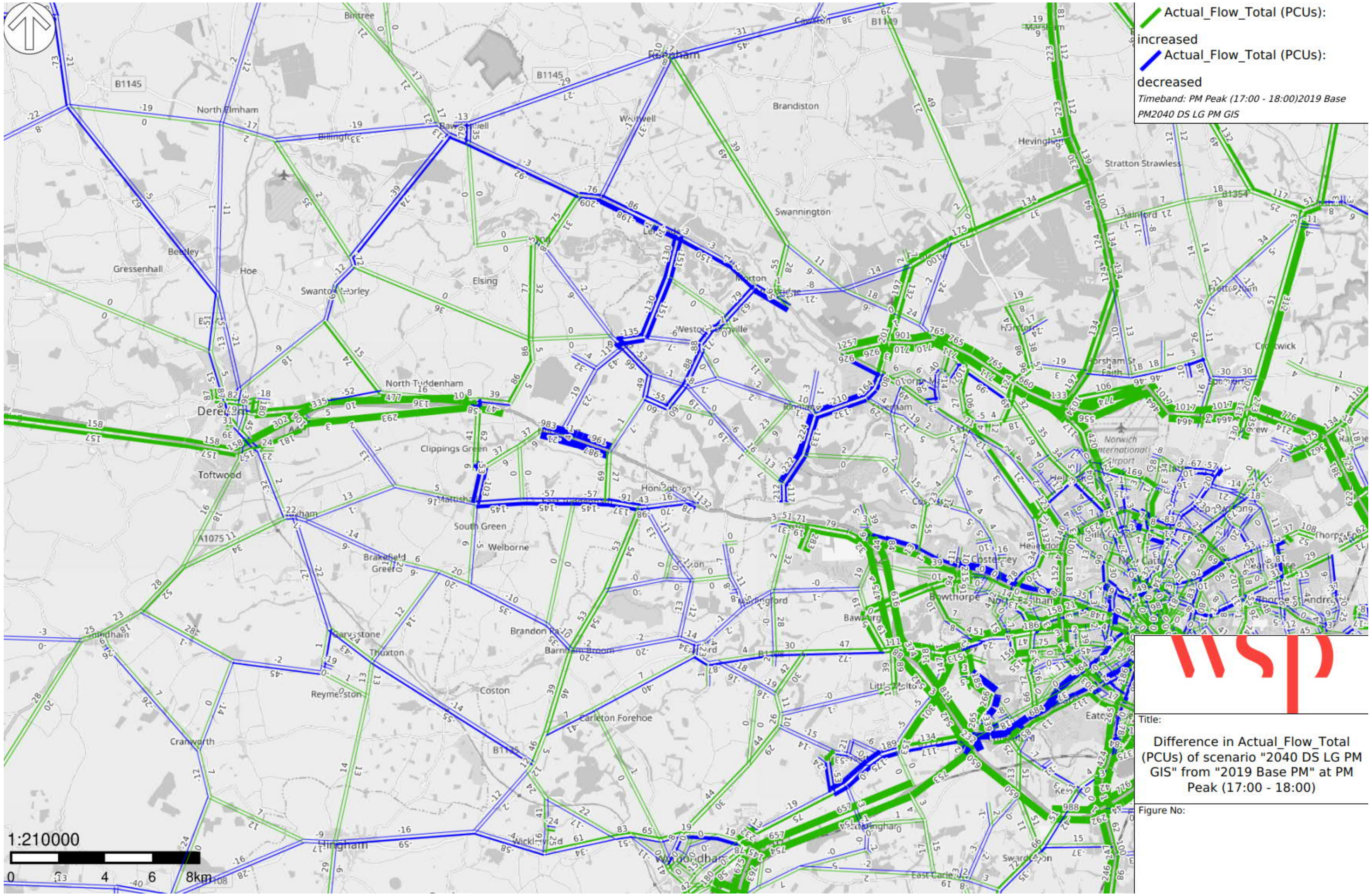


Figure 10-5: 2040 Low Growth scenario versus 2019 Base Year model, Actual Flow Difference, in pcu's - PM peak

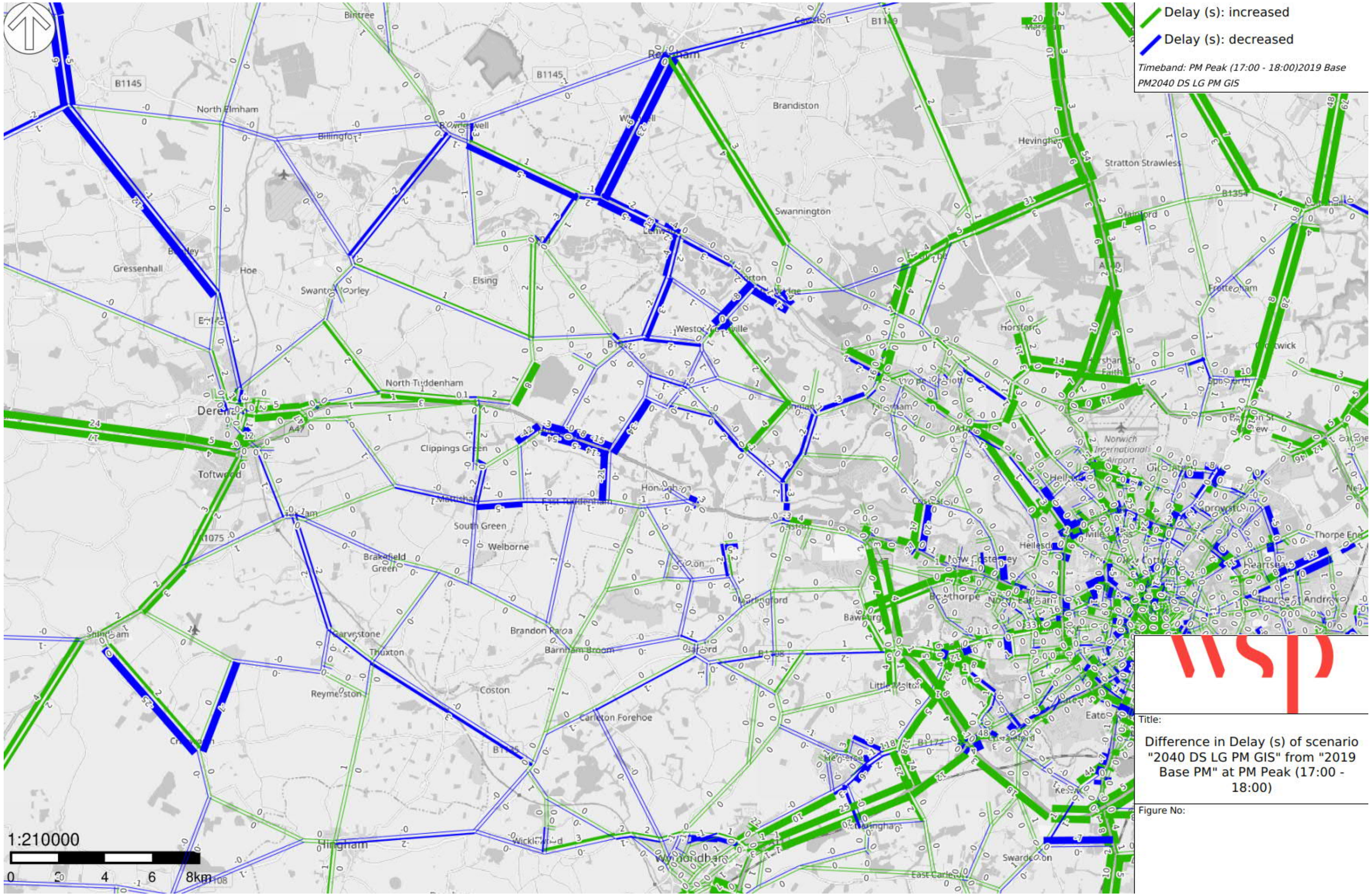


Figure 10-6: 2040 Core Growth scenario versus 2019 Base Year model, Delay Difference, in secs - PM peak

Impact of Norwich Western Link scheme

10.4.3. Appendix F contains flow difference and delay difference plots for the AM peak, Inter peak and PM peak respectively for the 2025 Low Growth DS scenario versus the 2025 Low Growth DM scenario to demonstrate the impact of the Norwich Western Link scheme.

10.4.4. Figure 10-7 to Figure 10-12 present flow difference and delay difference plots for the AM peak, Inter peak and PM peak respectively for the 2040 Low Growth DS scenario versus the 2040 Low Growth DM scenario to demonstrate the impact of the Norwich Western Link scheme up to the 2040 Design Year.

10.4.5. Figure 10-7, Figure 10-9 and Figure 10-11 for the AM peak, Inter peak and PM peak hour time periods respectively all show that north-south routes between the A47 and the A1067 Fakenham Road e.g. B1535 Wood Lane, Heath Road, Church Street (through Weston Longville) and Taverham Road all show reductions in actual flow across all three peak hour time periods

10.4.6. Barnham Broom Road shows an increase in actual flow of 132 pcu's in the AM peak, 76 pcu's in the Inter peak and 101 pcu's in the PM peak.

10.4.7. 10.4.5. Figure 10-7, Figure 10-9 and Figure 10-11 for the AM peak, Inter peak and PM peak hour time periods respectively all show that as a consequence of the introduction of the Norwich Western Link scheme traffic has switched from using the A47 around the south of Norwich to the A1270 Broadland Northway around the north of Norwich.

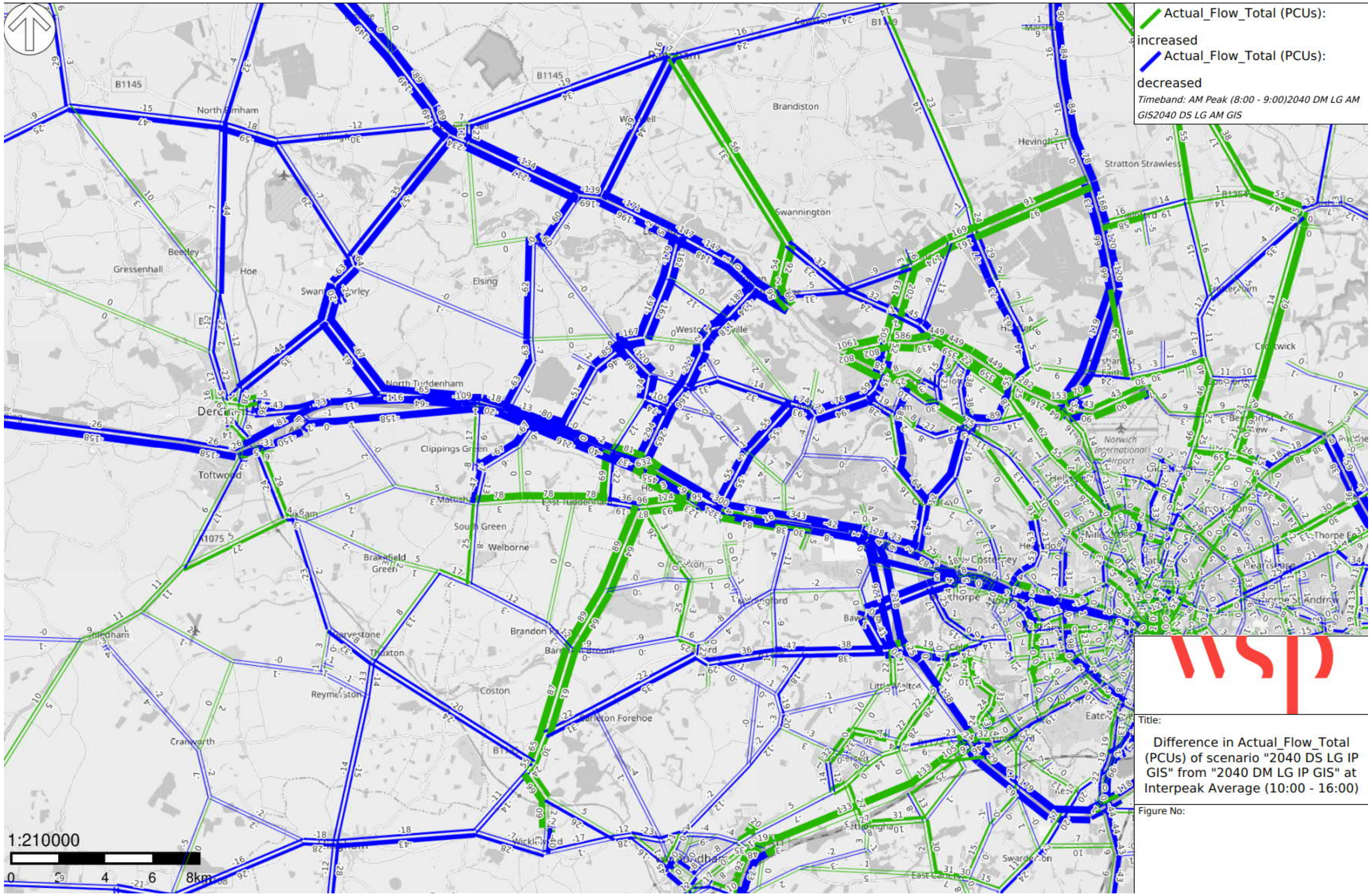


Figure 10-7: 2040 Low Growth DS scenario versus 2040 Low Growth DM scenario, Actual Flow Difference, in pcu's - AM peak

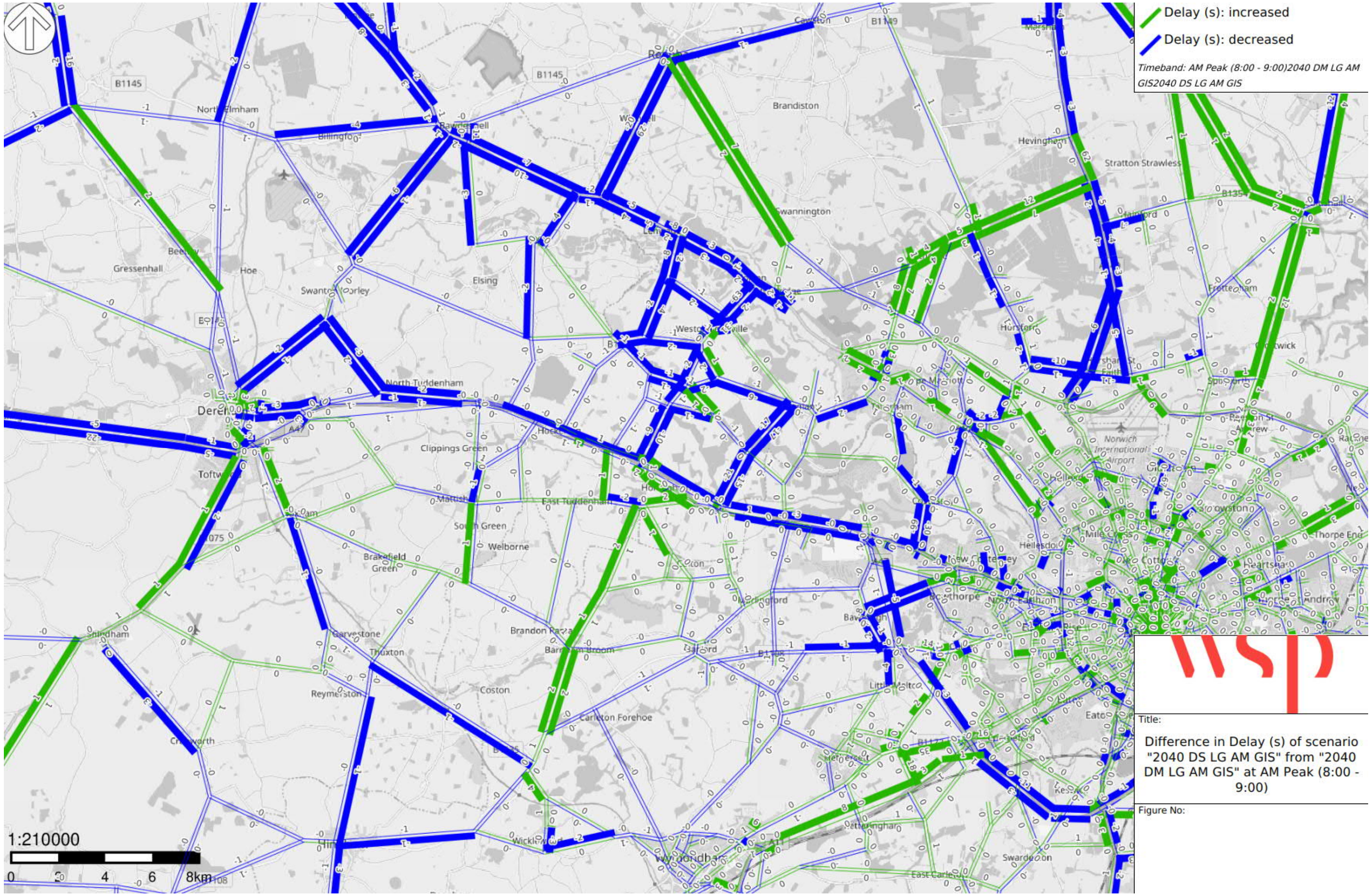


Figure 10-8: 2040 Low Growth DS scenario versus 2040 Low Growth DM scenario, Delay Difference, in secs - AM peak

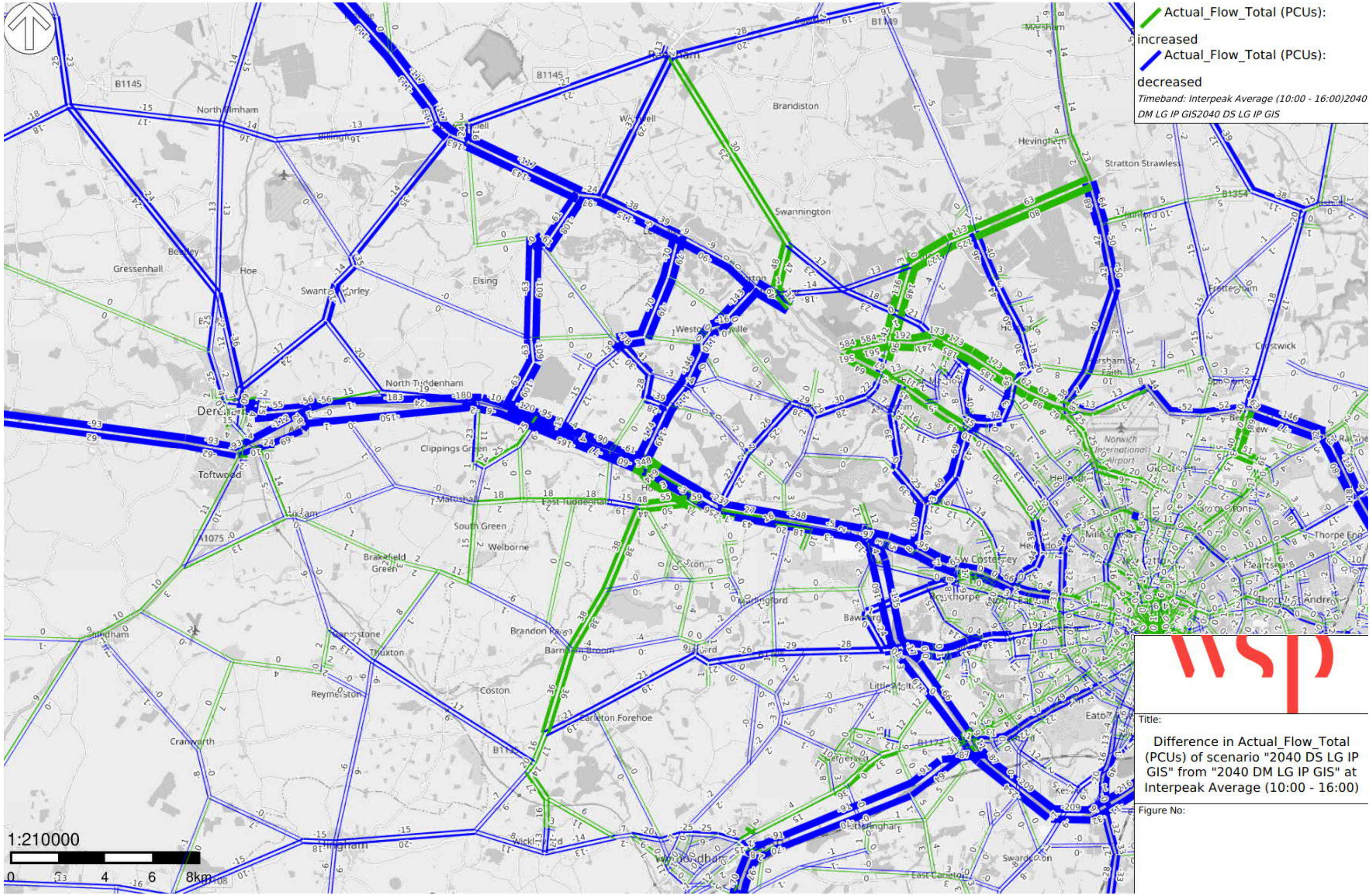


Figure 10-9: 2040 Low Growth DS scenario versus 2040 Low Growth DM scenario, Actual Flow Difference, in pcu's – Inter peak

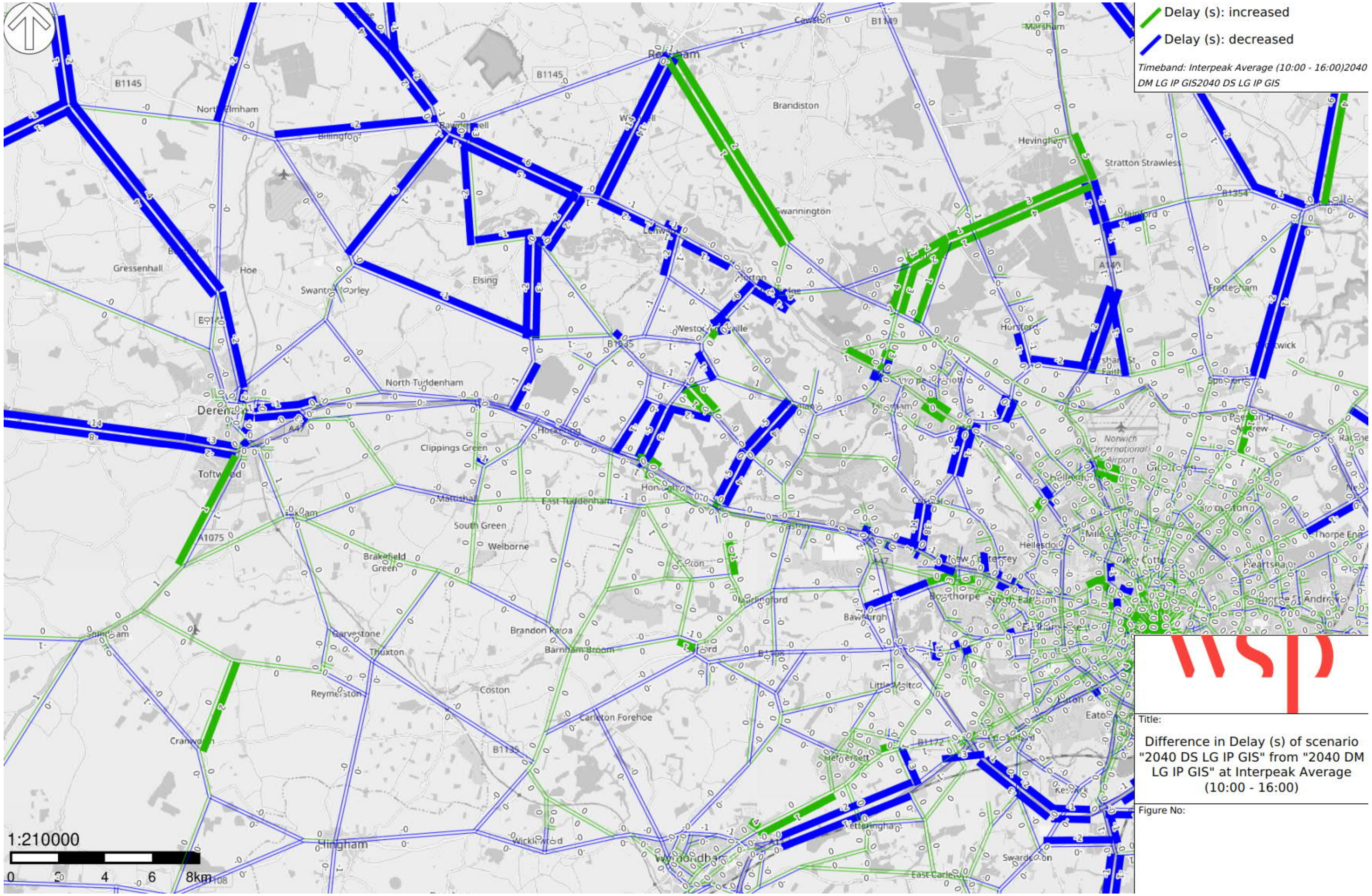


Figure 10-10: 2040 Low Growth DS scenario versus 2040 Low Growth DM scenario, Delay Flow Difference, in secs - Inter peak

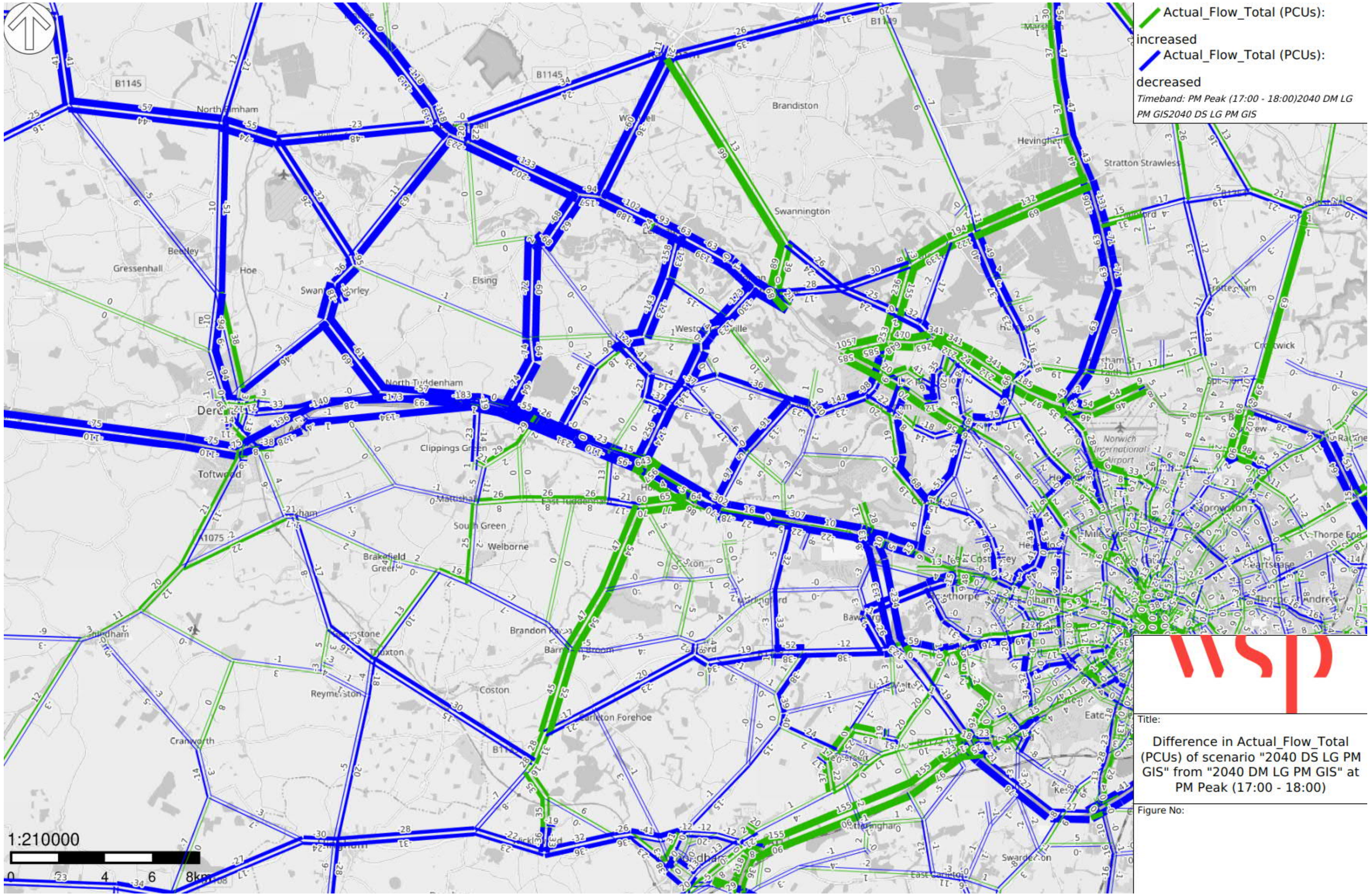


Figure 10-11: 2040 Low Growth DS scenario versus 2040 Low Growth DM scenario, Actual Flow Difference, in pcu's - PM peak

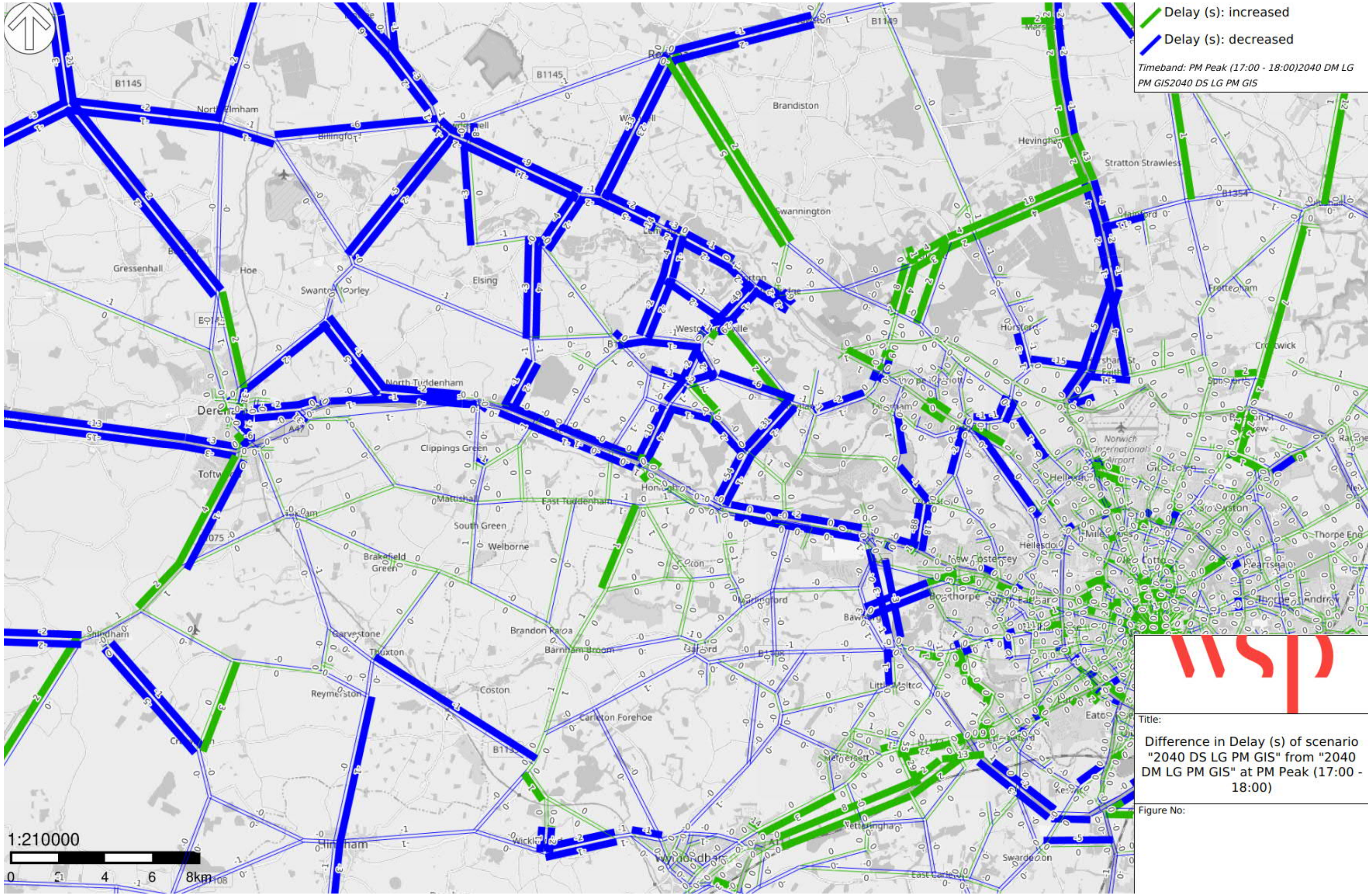


Figure 10-12: 2040 Low Growth DS scenario versus 2040 Low Growth DM scenario, Delay Difference, in seconds - PM peak

10.4.8. Appendix G contains the 2-way Annual Average Daily Traffic (AADT) flows for the 2025 Opening Year and 2040 Design Year. Table 10-4 shows the 2019 Base Year, DM and DS AADT Low Growth flows for the 2025 and 2040 forecast years.

Table 10-4: AADT base year and forecast year flow – Low Growth

Road Name	2019	2025		2040	
	Base	DM	DS	DM	DS
A47 west of Lyng Road	25,400	37,500	34,200	43,800	38,100
The Street (west of Heath Road	1,600	3,400	2,800	4,400	2,500
Heath Road	1,700	1,200	1,100	1,400	1,000
Sandy Lane	100	100	100	100	-
A47 west of A47 / Sandy Lane junction	23,900	37,500	34,200	43,800	38,100
A47 west of A47 / Wood Lane junction	23,900	37,500	34,200	43,800	38,100
B1535 Wood Lane	4,600	5,600	1,300	7,000	1,500
Berry's Lane	1,400	#N/A	#N/A	#N/A	#N/A
A47 / Wood Lane junction: eastbound off-slip	-	1,600	5,700	2,100	7,200
A47 / Wood Lane junction: westbound on-slip	-	1,000	4,400	1,300	5,800
Link between A47 roundabouts at Wood Lane	-	4,200	11,100	5,500	15,600
A47 / Wood Lane junction: eastbound on-slip	-	2,200	5,600	2,800	7,900
A47 / Wood Lane junction: westbound off-slip	-	2,000	5,500	2,700	7,700
A47 east of A47 / Wood Lane junction	24,300	39,100	35,200	45,900	40,700
Norwich Road (east of Mattishall Road)	3,600	1,100	2,500	1,300	3,100
Taverham road	200	1,600	1,000	2,100	1,100
Honingham Lane	500	1,300	700	1,800	800
Blind Lane	200	#N/A	#N/A	#N/A	#N/A
A47 / Taverham Road junction: eastbound off-slip	-	600	800	800	1,200
A47 / Taverham Road junction: westbound on-slip	-	400	700	600	1,300
Link between A47 roundabouts at Taverham Road	-	1,800	1,400	2,500	1,900
A47 / Taverham Road junction: eastbound on-slip	-	600	500	800	600
A47 east of A47 / Taverham Road junction	-	800	600	1,100	800
Church Lane	5,300	#N/A	#N/A	#N/A	#N/A
Weston Road	400	400	500	400	500

Road Name	2019	2025		2040	
	Base	DM	DS	DM	DS
Ringland Road (North of Weston Road)	4,600	400	300	400	300
A47 east of A47 / Church Lane junction	31,900	39,500	34,900	46,300	39,500
Dereham Road (east of A47 / Church Lane roundabout)	3,000	800	1,300	1,300	2,200
Costessey Road (Taverham Bridge)	6,300	7,700	6,900	7,500	6,800
Honingham Road (Weston Longville)	2,600	3,800	700	4,600	700
Ringland (The Street)	800	1,700	800	1,700	800
Norwich Western Link	-	-	23,000	-	31,400

10.4.9. It is predicted that the Norwich Western Link will have an AADT flow of 23,000 vehicles in the Low Growth 2025 Opening Year and an AADT flow of 31,400 vehicles in the Low Growth 2040 Design Year.

10.5 PUBLIC TRANSPORT

10.5.1. There is a minor impact on the public transport demand matrix totals between the fixed demand totals as shown in Table 7-1 to Table 7-3.

10.5.2. Table 10-5 to Table 10-7 show the change in the Low Growth public transport demand matrix totals between the fixed demand matrix totals and the VDM DM and VDM DS matrix totals for the AM peak, Inter peak and PM peak respectively

Table 10-5: AM Peak Low Growth Scenario Public Transport Matrix Totals

User Class / Trip Purpose	Vehicle Class	2025			2040		
		Fixed Demand	VDM DM	VDM DS	Fixed Demand	VDM DM	VDM DS
Commute	PT	2,460	2,597	2,593	2,356	2,530	2,492
Work	PT	599	705	707	591	691	698
Other	PT	4,422	4,156	4,257	4,410	4,038	4,173
All		7,481	7,458	7,558	8,325	7,259	7,363

Table 10-6: Inter Peak Low Growth Scenario Public Transport Matrix Totals

User Class / Trip Purpose	Vehicle Class	2025	2040

		Fixed Demand	VDM DM	VDM DS	Fixed Demand	VDM DM	VDM DS
Commute	PT	571	587	592	542	557	564
Work	PT	364	418	423	362	404	421
Other	PT	5,131	4,821	5,001	5,210	4,681	5,046
All		6,066	5,826	6,016	6,115	5,643	6,031

Table 10-7: PM Peak Low Growth Scenario Public Transport Matrix Totals

User Class / Trip Purpose	Vehicle Class	2025			2040		
		Fixed Demand	VDM DM	VDM DS	Fixed Demand	VDM DM	VDM DS
Commute	PT	2,572	2,657	2,663	2,451	2,564	2,538
Work	PT	634	685	684	623	674	678
Other	PT	3,423	4,604	4,735	3,457	4,662	4,863
All		6,629	7,946	8,083	6,532	7,899	8,078

11

FORECASTING ASSIGNMENT - HIGH GROWTH

PUBLIC

11 FORECASTING ASSIGNMENT - HIGH GROWTH

11.1 INTRODUCTION

11.1.1. This chapter looks at the network statistics, assignment and converge of the High Growth forecast scenarios, with and without the NWL scheme, in the 2025 Opening Year and the 2040 Design Year.

11.1.2. These impacts are considered in terms of actual flow changes and differences in delay. Flow difference plots have been produced to demonstrate the volume of vehicle comparisons between the 2019 base year, 2025 Opening Year and 2040 Design Year and any re-routing that occurs as a result of the implementation of the proposed infrastructure.

11.2 ASSIGNMENT CONVERGENCE

11.2.1. Table 11-1 shows the convergence of the High Growth assignments. These results confirm the assignments which have been taken forward to the economic appraisal have met the TAG convergence criteria for highway assignment models (TAG Unit 3.1, Table 4). They have shown that all assignments in both scenarios have conformed to the criteria set out by TAG.

Table 11-1: Convergence statistics for High Growth forecast assignments (DM and DS)

Year	Scenario	Time Period	Relative Gap (%)	Final Four Iterations > 98%* - flow change (P)<1%			
				Final Iteration	N-1	N-2	N-3
Base		AM	0.006	99.4	99.1	99.4	99.3
		IP	0	99.2	99.5	99	99.5
		PM	0.005	99.7	99.3	99.1	99.4
2025 DM	Core	AM	0.008	99.1	99.3	99.1	98.9
		IP	0.001	99.3	99.3	99.0	99.3
		PM	0.014	99.4	99.5	99.5	99.4
2040 DM	Core	AM	0.0079	99.4	99.3	99.4	98.8
		IP	0.0034	99.5	99.6	98.6	99.5
		PM	0.0280	99.3	99.1	99.1	98.6
2025 DS	Core	AM	0.0064	99.3	99.2	98.9	99.4
		IP	0.0007	99.2	99.4	99.2	99.4
		PM	0.006	99.1	99.0	99.2	99.4
2040 DS	Core	AM	0.014	99.2	99.0	99.2	98.7
		IP	0.0058	99.5	99.0	99.3	97.7
		PM	0.013	99.4	99.3	98.9	98.7

11.3 NETWORK STATISTICS

11.3.1. Network statistics for each of the forecast models are presented within this section. The results presented include the total number of kilometres travelled and the total number of vehicle hours travelled.

11.3.2. Table 11-2 presents the network statistics (simulation area) for the 2025 High Growth DM scenario compared with the 2025 High Growth DS scenario. The comparison shows that implementation of the NWL scheme reduces transient queueing, total travel time and total travel distance in the AM peak, Inter peak and PM. The average speed in the AM peak, Inter peak and PM peak marginally increases with the inclusion of the proposed NWL transport scheme.

Table 11-2: 2025 Network Statistics, High Growth

Statistic	Unit	DM			DS		
		AM Peak	Inter Peak	PM Peak	AM Peak	Inter Peak	PM Peak
Transient Queues	PCU / Hrs	4,354	2,481	4,193	4,274	2,425	4,079
Over-Capacity Queues	PCU / Hrs	791	134	606	683	154	613
Link Cruise Time	PCU / Hrs	17,873	12,629	17,616	17,627	12,402	17,300
Total Travel Time	PCU / Hrs	23,017	15,244	22,415	22,584	14,981	21,992
Total Travel Distance	PCU / KMs	1,066,147	788,839	1,058,991	1,061,491	776,699	1,048,508
Average Speed	kph	46.32	51.75	47.24	47.00	51.85	47.68

11.3.3. Table 11-3 presents the network statistics (simulation area) for the 2040 High Growth DM scenario compared with the 2040 High Growth DS scenario. The comparison shows that implementation of the NWL scheme reduces transient queueing, total travel time and total travel distance in the AM peak, Inter peak and PM. The average speed in the Inter peak and PM peak marginally increases with the inclusion of the proposed NWL transport scheme.

Table 11-3: 2040 Network Statistics, High Growth

Statistic	Unit	DM			DS		
		AM Peak	Inter Peak	PM Peak	AM Peak	Inter Peak	PM Peak
Transient Queues	PCU / Hrs	5,785	3,455	5,676	5,763	3,354	5,698
Over-Capacity Queues	PCU / Hrs	2,604	299	1999	2,745	280	2,068
Link Cruise Time	PCU / Hrs	21,664	16,031	21,320	21,126	15,330	20,816
Total Travel Time	PCU / Hrs	30,053	19,785	28,995	29,635	18,963	28,582
Total Travel Distance	PCU / KMs	1,248,936	987,859	1,238,005	1,231,360	951,431	1,221,058
Average Speed	kph	41.56	49.93	42.70	41.55	50.17	42.72

11.4 HIGH GROWTH ASSESSMENT RESULTS

Do Minimum scenario versus Base Year model

11.4.1. Appendix H contains flow difference and delay difference plots for the AM peak, Inter peak and PM peak respectively for the 2025 High Growth DM scenario versus the 2019 Base Year model to demonstrate the impact of the committed developments and background growth. Traffic flows and delays generally increase in all three time periods and it must be remembered that the Highways England A47 North Tuddenham to Easton scheme has been included within the Do Minimum scenario. The impact of this, in all three peak hours, can be seen along the A47 in the North Tuddenam to Honingham section where the transport model shows reductions along the old A47 route with traffic switching to the new dual carriageway scheme.

11.4.2. Figure 11-1 to Figure 11-6 present flow difference and delay difference plots for the AM peak, Inter peak and PM peak respectively for the 2040 High Growth DM scenario versus the 2019 Base year model to demonstrate the impact of committed developments and background growth up to the 2040 Design Year.

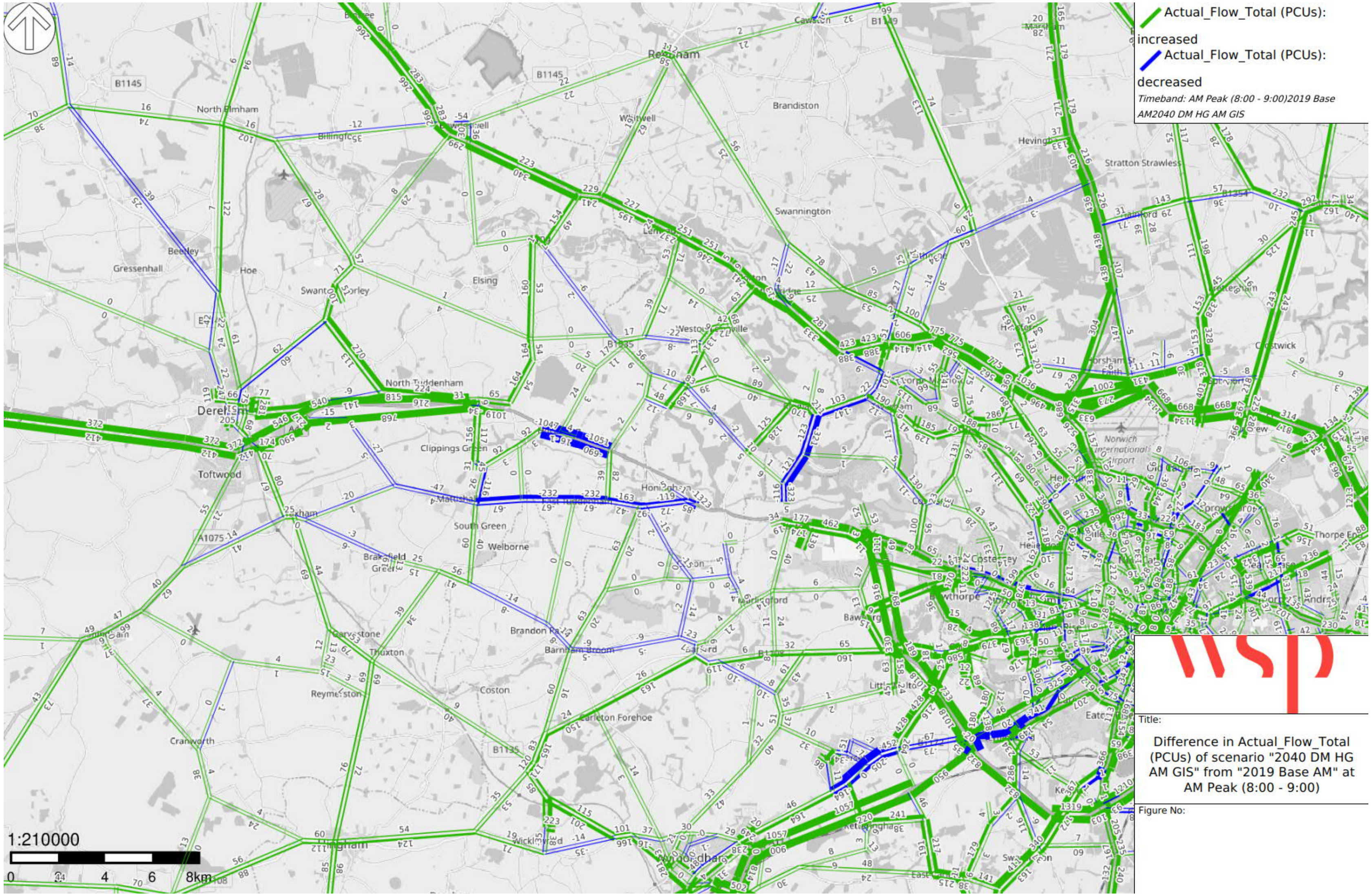


Figure 11-1: 2040 High Growth scenario versus 2019 Base Year model, Actual Flow Difference, in pcu's - AM peak

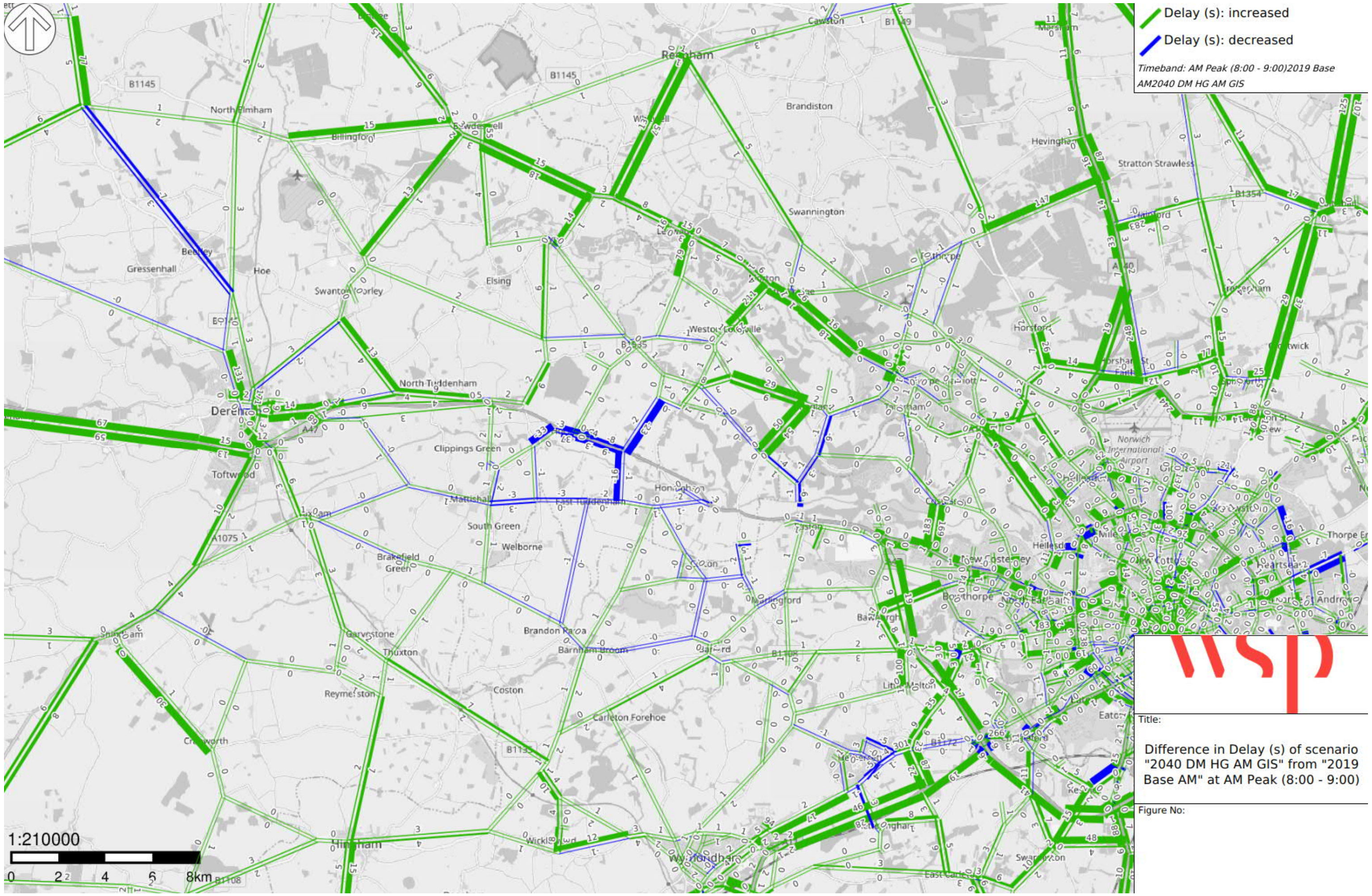


Figure 11-2: 2040 High Growth scenario versus 2019 Base Year model, Delay Difference, in secs - AM peak

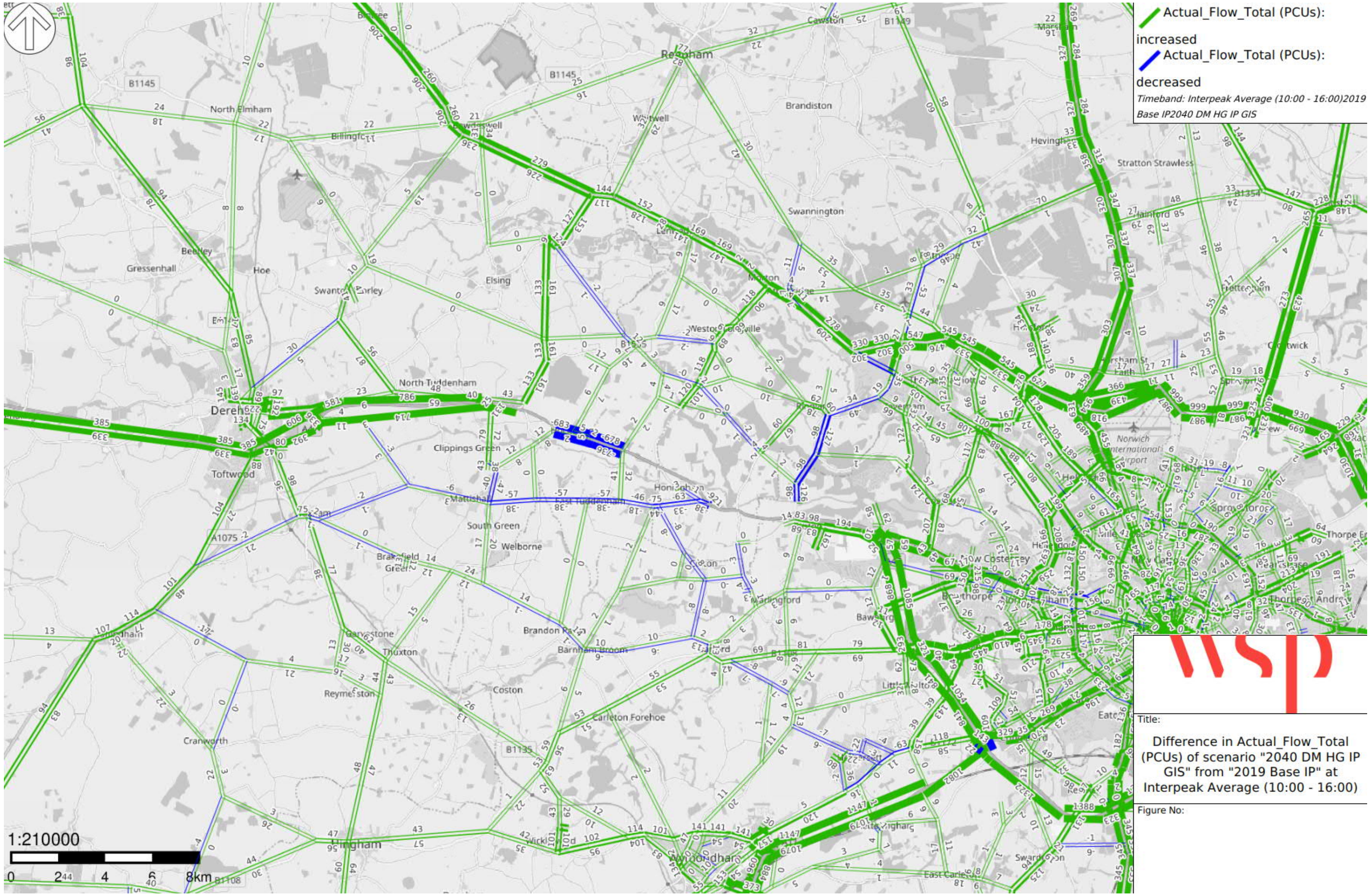


Figure 11-3: 2040 High Growth scenario versus 2019 Base Year model, Actual Flow Difference, in pcu's – Inter peak

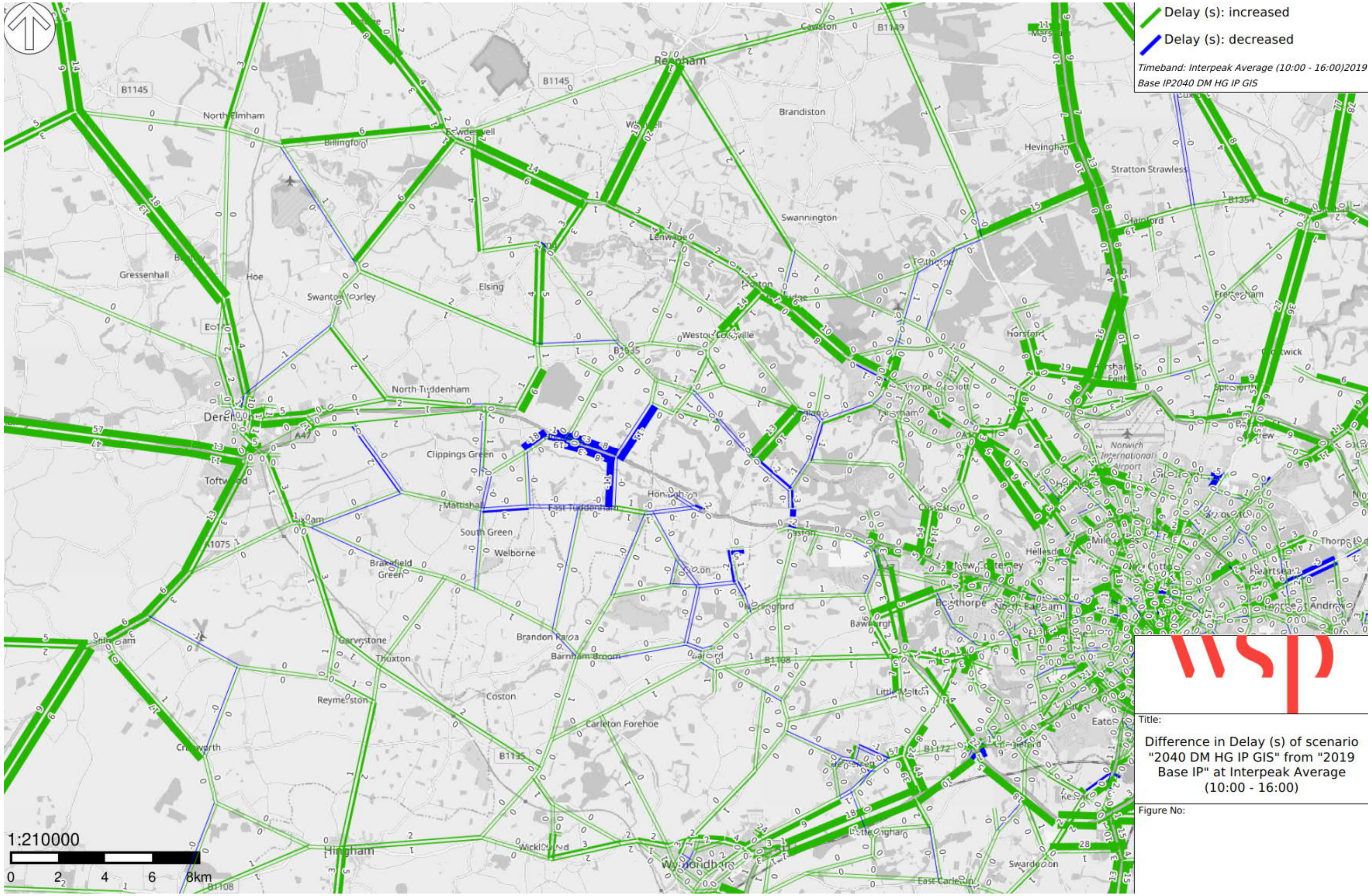


Figure 11-4: 2040 Low Growth scenario versus 2019 Base Year model, Delay Flow Difference, in secs - Inter peak

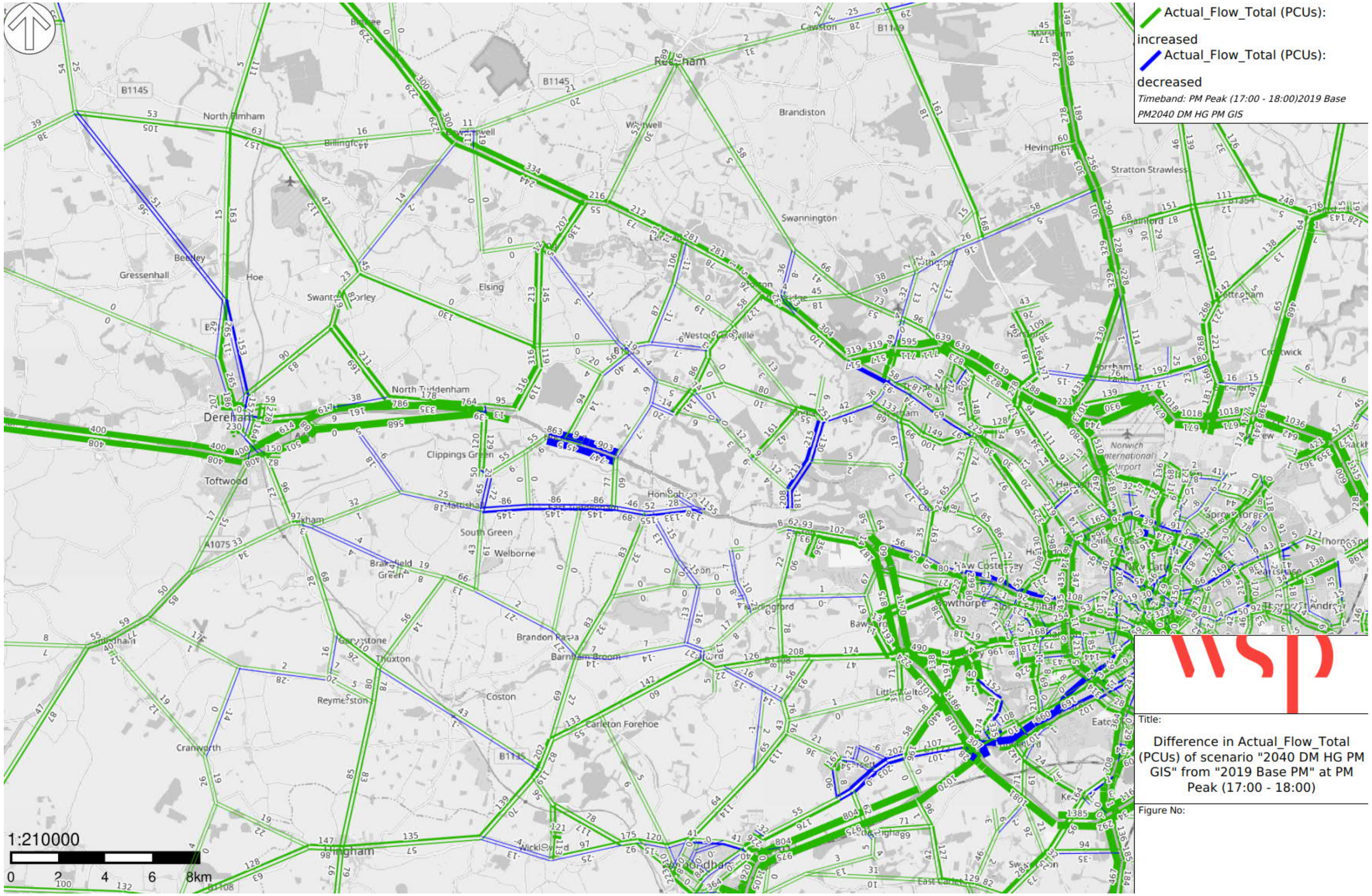


Figure 11-5: 2040 High Growth scenario versus 2019 Base Year model, Actual Flow Difference, in pcu's - PM peak

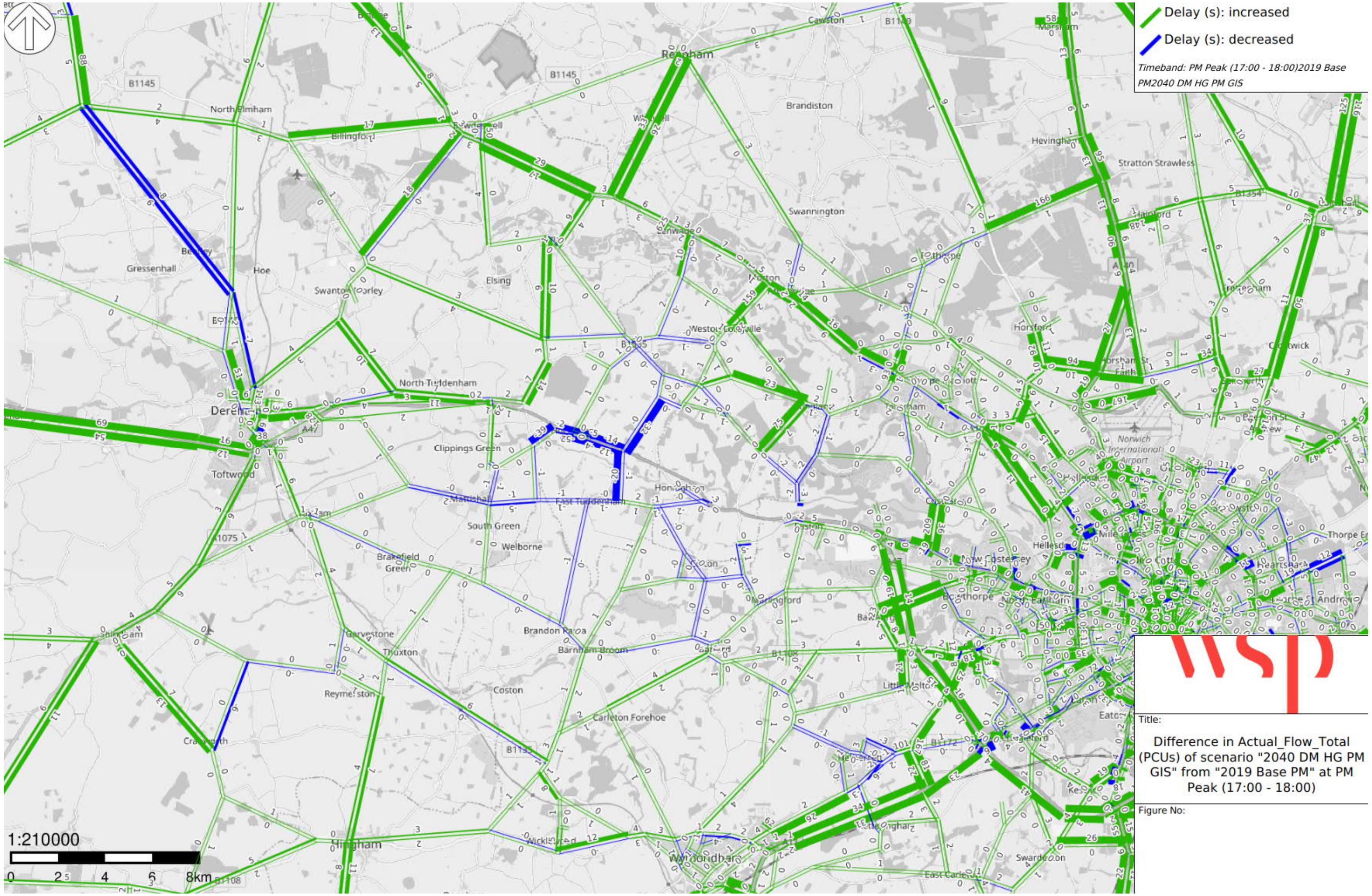


Figure 11-6: 2040 High Growth scenario versus 2019 Base Year model, Delay Difference, in secs - PM peak

Impact of Norwich Western Link scheme

11.4.3. Appendix I contains flow difference and delay difference plots for the AM peak, Inter peak and PM peak respectively for the 2025 High Growth DS scenario versus the 2025 High Growth DM scenario to demonstrate the impact of the Norwich Western Link scheme.

11.4.4. Figure 11-7 to Figure 11-12 present flow difference and delay difference plots for the AM peak, Inter peak and PM peak respectively for the 2040 High Growth DS scenario versus the 2040 High Growth DM scenario to demonstrate the impact of the Norwich Western Link scheme up to the 2040 Design Year.

11.4.5. Figure 11-7, Figure 11-9 and Figure 11-11 for the AM peak, Inter peak and PM peak hour time periods respectively all show that north-south routes between the A47 and the A1067 Fakenham Road e.g. B1535 Wood Lane, Heath Road, Church Street (through Weston Longville) and Taverham Road all show reductions in actual flow across all three peak hour time periods

11.4.6. Barnham Broom Road shows an increase in actual flow of 186 pcu's in the AM peak, 93 pcu's in the Inter peak and 154 pcu's in the PM peak.

11.4.7. Figure 11-7, Figure 11-9 and Figure 11-11 for the AM peak, Inter peak and PM peak hour time periods respectively all show that as a consequence of the introduction of the Norwich Western Link scheme traffic has switched from using the A47 around the south of Norwich to the A1270 Broadland Northway around the north of Norwich.

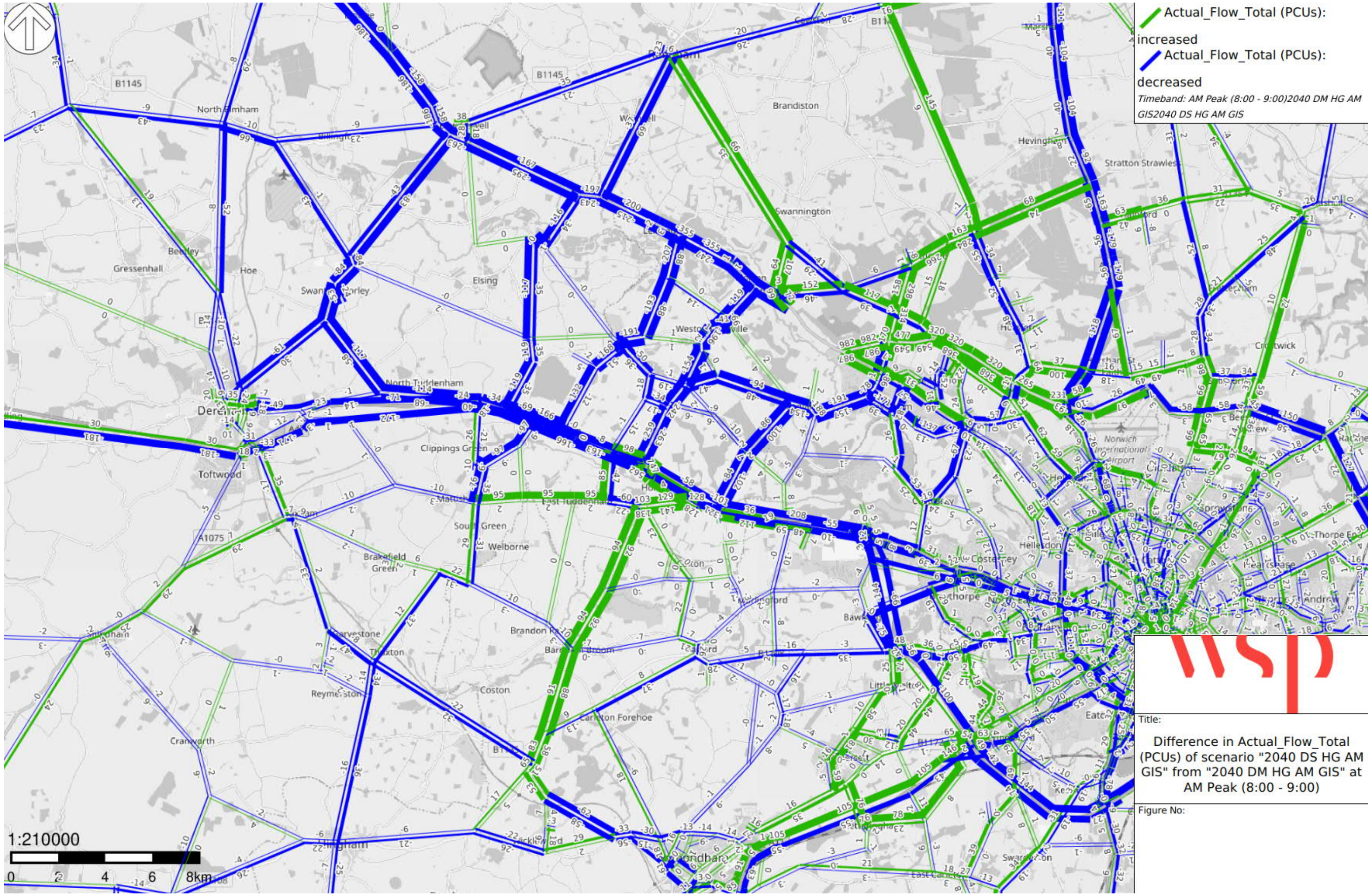


Figure 11-7: 2040 High Growth DS scenario versus 2040 High Growth DM scenario, Actual Flow Difference, in pcu's - AM peak

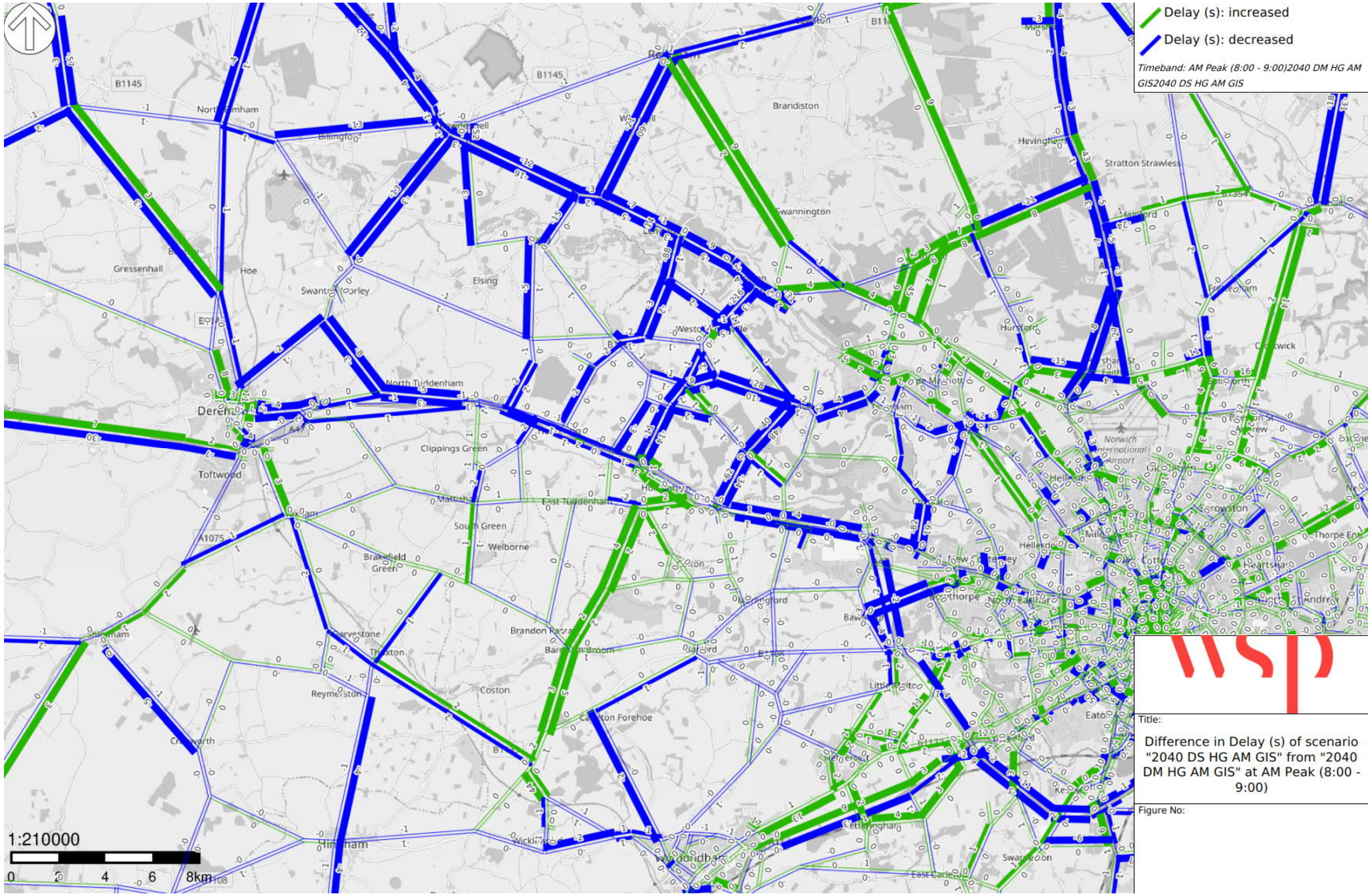


Figure 11-8: 2040 High Growth DS scenario versus 2040 High Growth DM scenario, Delay Difference, in secs - AM peak

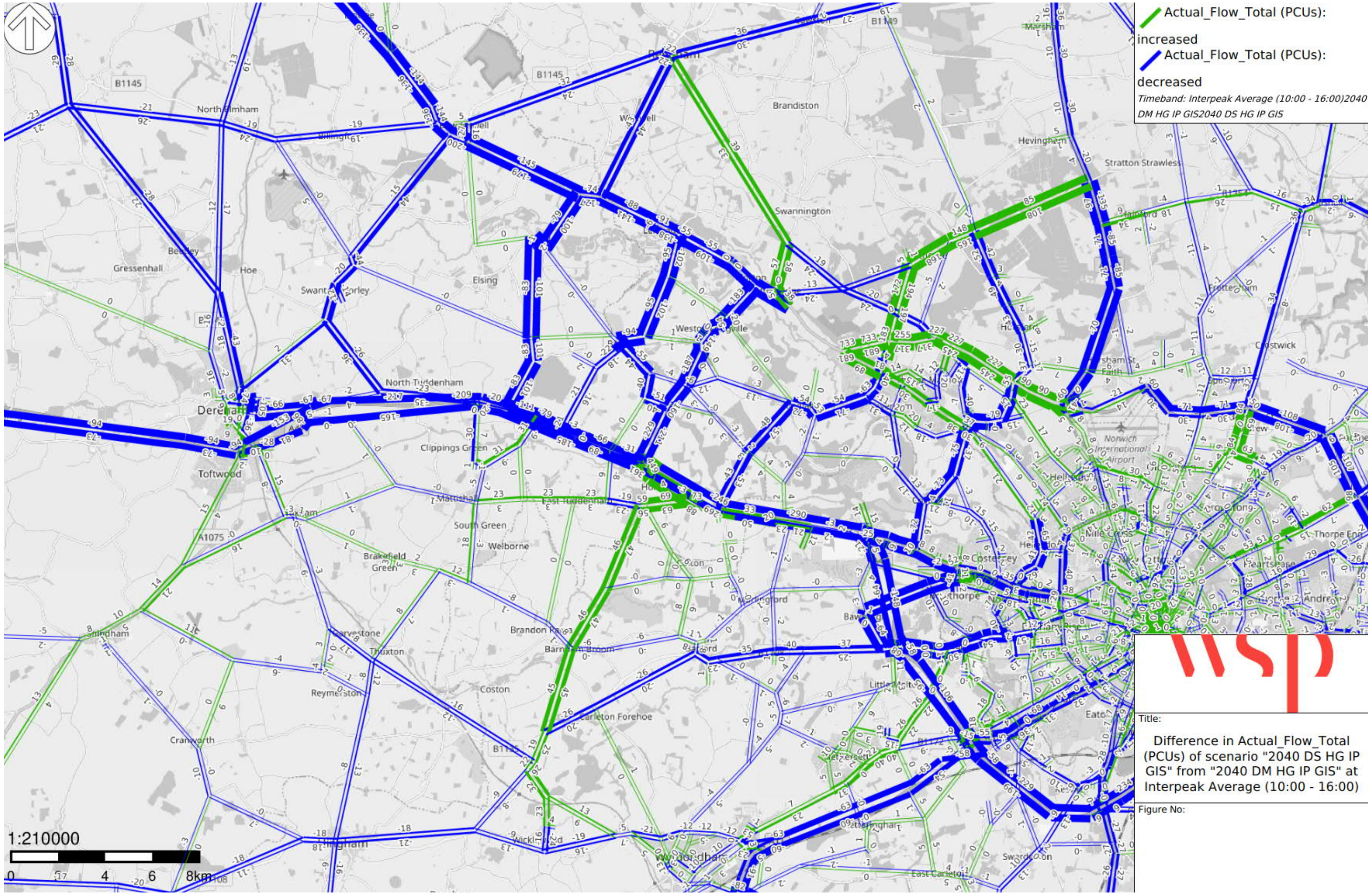


Figure 11-9: 2040 High Growth DS scenario versus 2040 High Growth DM scenario, Actual Flow Difference, in pcu's – Inter peak

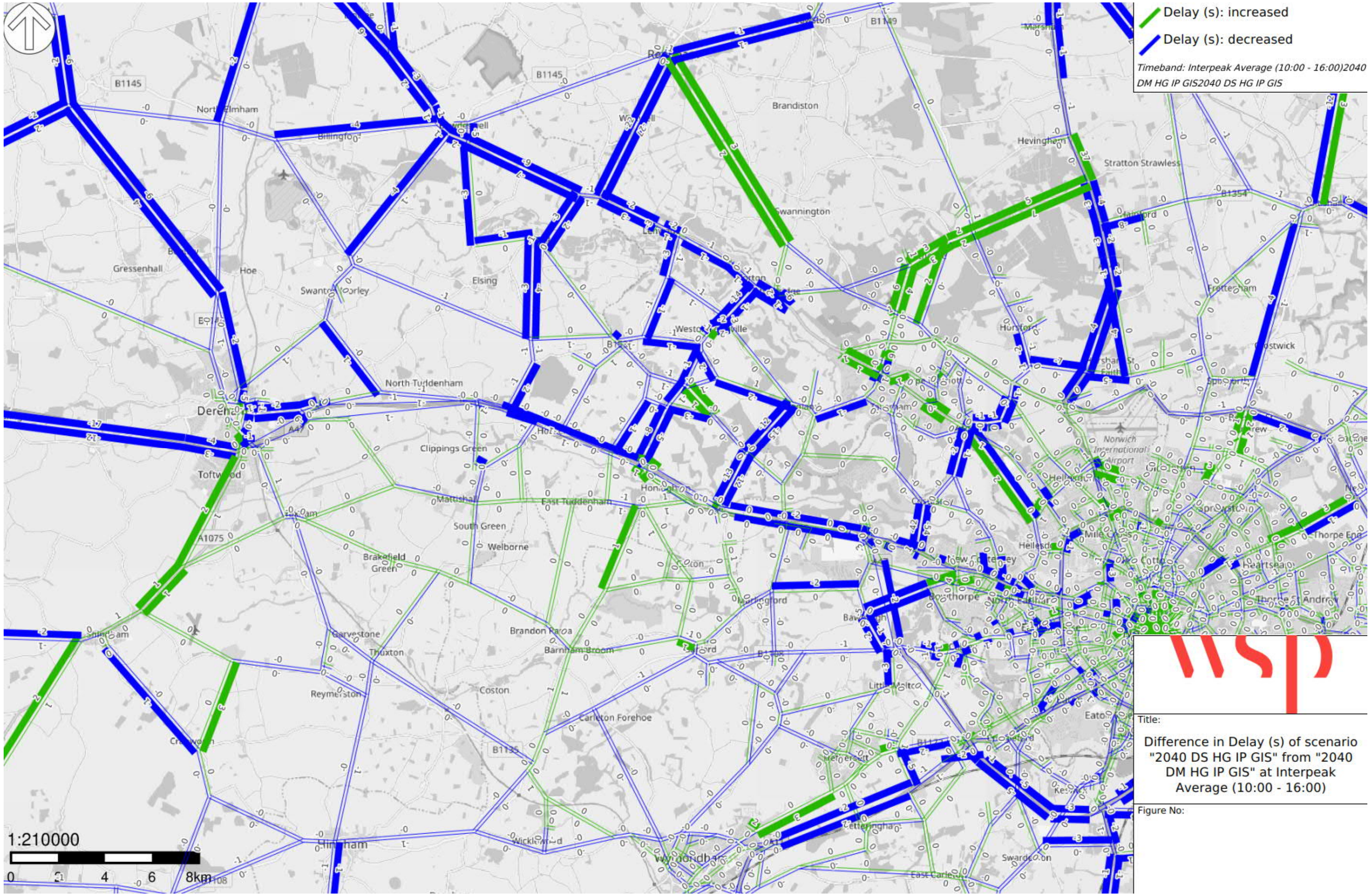


Figure 11-10: 2040 High Growth DS scenario versus 2040 High Growth DM scenario, Delay Flow Difference, in secs - Inter peak

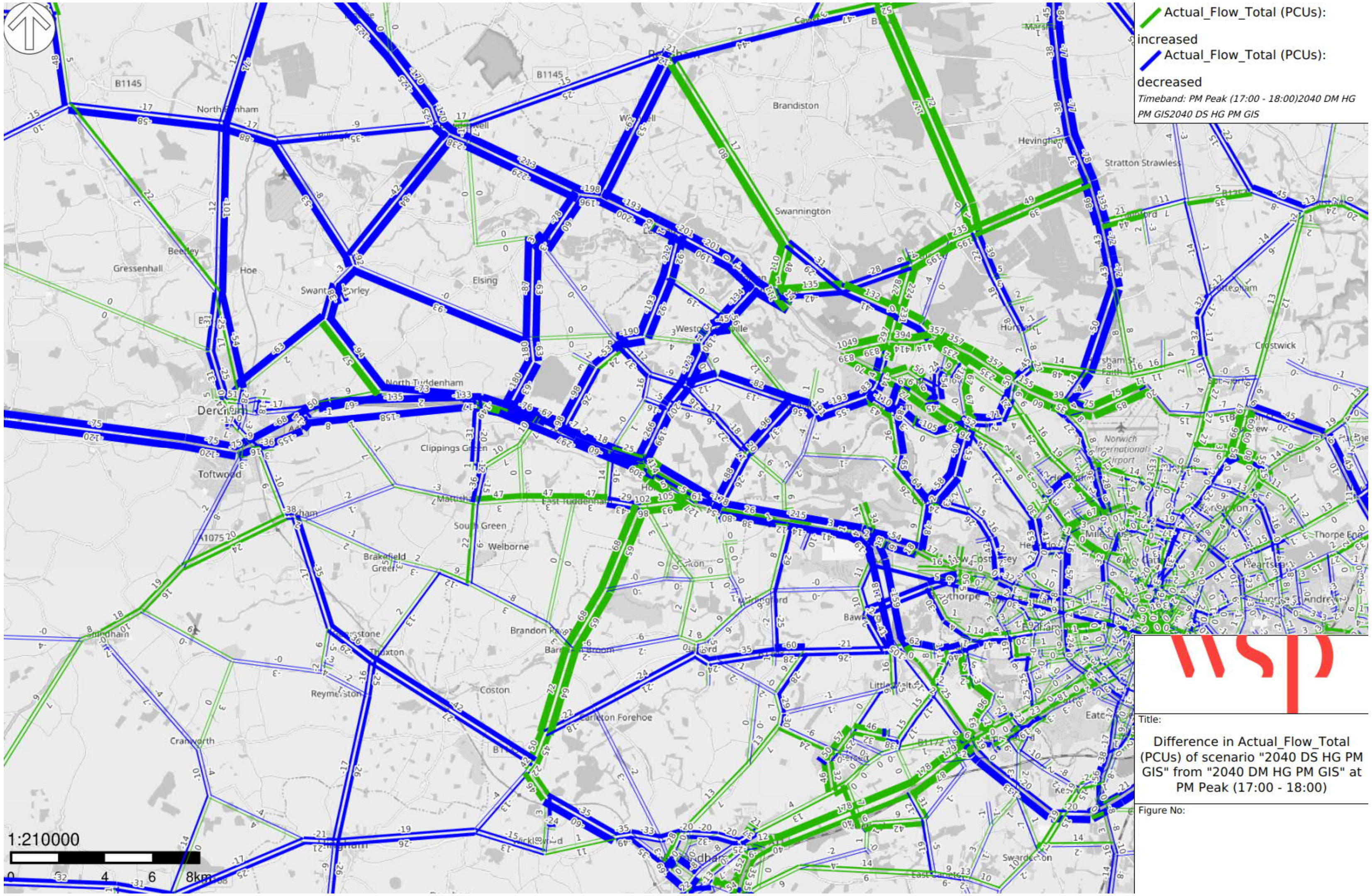


Figure 11-11: 2040 High Growth DS scenario versus 2040 High Growth DM scenario, Actual Flow Difference, in pcu's - PM peak

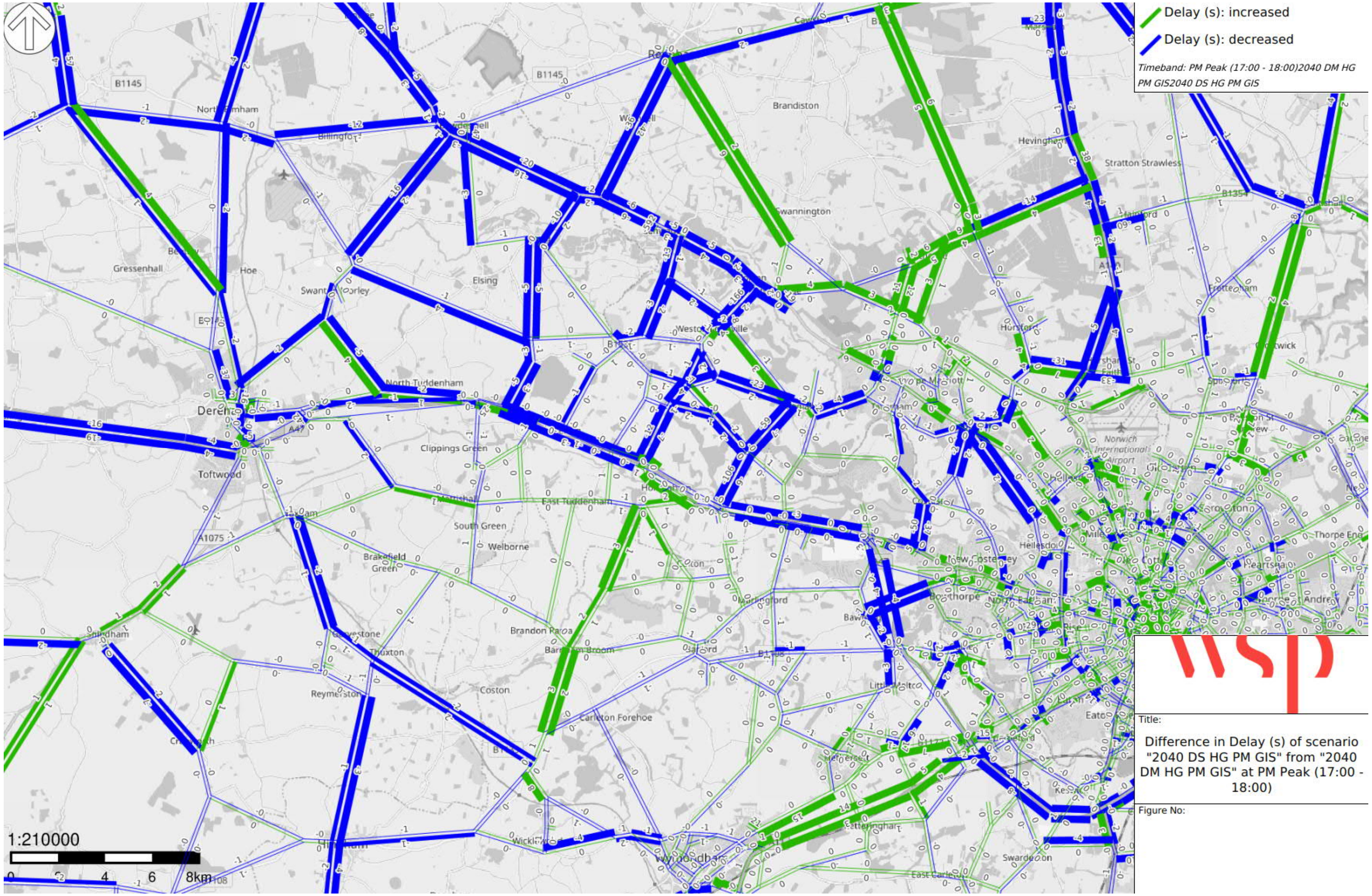


Figure 11-12: 2040 High Growth DS scenario versus 2040 High Growth DM scenario, Delay Difference, in seconds - PM peak

11.5 HIGH GROWTH ASSESSMENT RESULTS

11.5.1. Appendix J contains the 2-way Annual Average Daily Traffic (AADT) flows for the 2025 Opening Year and 2040 Design Year. Table 11-4 shows the 2019 Base Year, DM and DS AADT flows for the 2025 and 2040 forecast years.

Table 11-4: AADT base year and forecast year flow – High Growth

Road Name	2019	2025		2040	
	Base	DM	DS	DM	DS
A47 west of Lyng Road	25,400	41,300	37,700	50,300	44,400
The Street (west of Heath Road	1,600	3,900	3,500	6,500	3,900
Heath Road	1,700	1,500	1,200	2,100	1,300
Sandy Lane	100	100	100	100	100
A47 west of A47 / Sandy Lane junction	23,900	41,300	37,700	50,300	44,400
A47 west of A47 / Wood Lane junction	23,900	41,300	37,700	50,300	44,400
B1535 Wood Lane	4,600	6,600	1,600	8,500	2,200
Berry's Lane	1,400	#N/A	#N/A	#N/A	#N/A
A47 / Wood Lane junction: eastbound off-slip	-	1,900	6,600	2,300	8,300
A47 / Wood Lane junction: westbound on-slip	-	1,200	4,900	1,700	6,700
Link between A47 roundabouts at Wood Lane	-	4,800	13,100	6,900	20,000
A47 / Wood Lane junction: eastbound on-slip	-	2,500	6,700	3,300	10,400
A47 / Wood Lane junction: westbound off-slip	-	2,300	6,500	3,600	9,600
A47 east of A47 / Wood Lane junction	24,300	43,000	39,300	53,200	49,400
Norwich Road (east of Mattishall Road)	3,600	1,300	2,900	1,800	4,100
Taverham road	200	2,100	1,100	3,100	1,400
Honingham Lane	500	1,800	800	2,900	1,100
Blind Lane	200	#N/A	#N/A	#N/A	#N/A
A47 / Taverham Road junction: eastbound off-slip	-	700	900	1,000	1,500
A47 / Taverham Road junction: westbound on-slip	-	400	800	700	1,700
Link between A47 roundabouts at Taverham Road	-	2,200	1,600	3,300	2,500
A47 / Taverham Road junction: eastbound on-slip	-	800	600	1,400	600
A47 east of A47 / Taverham Road junction	-	900	700	1,500	1,000

Road Name	2019	2025		2040	
	Base	DM	DS	DM	DS
Church Lane	5,300	#N/A	#N/A	#N/A	#N/A
Weston Road	400	400	600	500	600
Ringland Road (North of Weston Road)	4,600	400	400	500	400
A47 east of A47 / Church Lane junction	31,900	43,700	38,800	54,400	47,900
Dereham Road (east of A47 / Church Lane roundabout)	3,000	900	1,500	1,600	2,900
Costessey Road (Taverham Bridge)	6,300	8,300	7,500	8,300	7,800
Honingham Road (Weston Longville)	2,600	4,500	800	5,400	900
Ringland (The Street)	800	2,300	900	2,300	900
Norwich Western Link	-	-	26,700	#REF!	38,200

11.5.2. It is predicted that the Norwich Western Link will have an AADT flow of 26,700 vehicles in the High Growth 2025 Opening Year and an AADT flow of 38,200 vehicles in the High Growth 2040 Design Year.

11.6 PUBLIC TRANSPORT

11.6.1. There is a minor impact on the public transport demand matrix totals between the fixed demand totals as shown in Table 7-1 to Table 7-3.

11.6.2. Table 11-5 to Table 11-7 show the change in the High Growth public transport demand matrix totals between the fixed demand matrix totals and the VDM DM and VDM DS matrix totals for the AM peak, Inter peak and PM peak respectively

Table 11-5: AM Peak High Growth Scenario Public Transport Matrix Totals

User Class / Trip Purpose	Vehicle Class	2025			2040		
		Fixed Demand	VDM DM	VDM DS	Fixed Demand	VDM DM	VDM DS
Commute	PT	2,681	2,816	2,813	2,770	2,941	2,903
Work	PT	653	758	761	692	791	797
Other	PT	4,819	4,551	4,652	5,152	4,777	4,912
All		8,153	8,125	8,225	8,613	8,508	8,613

Table 11-6: Inter Peak High Growth Scenario Public Transport Matrix Totals

User Class / Trip Purpose	Vehicle Class	2025			2040		
		Fixed Demand	VDM DM	VDM DS	Fixed Demand	VDM DM	VDM DS
Commute	PT	610	638	643	622	653	659
Work	PT	388	450	454	412	464	480
Other	PT	5,559	5,268	5,449	6,024	5,518	5,883
All		6,557	6,356	6,546	7,058	6,634	7,022

Table 11-7: PM Peak High Growth Scenario Public Transport Matrix Totals

User Class / Trip Purpose	Vehicle Class	2025			2040		
		Fixed Demand	VDM DM	VDM DS	Fixed Demand	VDM DM	VDM DS
Commute	PT	2,791	2,887	2,893	2,869	2,994	2,968
Work	PT	682	741	740	718	778	782
Other	PT	3,706	4,904	5,035	3,997	5,223	5,424
All		7,179	8,532	8,669	7,584	8,995	9,174

12

FORECASTING ASSIGNMENT: SENSITIVITY

12 FORECASTING ASSIGNMENT: SENSITIVITY

12.1 ECONOMIC UNCERTAINTY - SENSITIVITY TEST

12.1.1. The Transport Appraisal and Strategic Modelling (TASM) division within the Department for Transport (DfT) produces guidance on:

- project modelling and appraisal
- value for money assessments
- analytical assurance.

12.1.2. It is also responsible for providing evidence on trends in, and drivers of, strategic transport outcomes, including multi-modal forecasting and simulation of policy impacts. With that in mind on the 24 July 2020 the TASM division issued an email setting out a number of significant changes to the Transport Analysis Guidance (TAG). This is related to several unexpected events which includes COVID019, revised fiscal and economic outlook, the Green Book review with its focus on levelling-up and the government's commitment to net zero and the transport decarbonisation plan.

12.1.3. All of these could have the potential to have significant impacts on scheme appraisals which we will need to take account of in the evidence base. Revised economic and population projections were issued by the Office for Budget Responsibility (OBR) in March 2020 along with updated medium-term economic projections published in July 2020 which reflects the OBR assessment of the impact of COVID-19 on economic growth. These impacts require sensitivity testing to be undertaken to account for the impact of these revisions as well as for updated fleet assumptions.

12.1.4. DfT guidance is that until these updates are definitive, scheme promoters should undertake a sensitivity test using the new projections unless it is immaterial or disproportionate to do so.

12.1.5. One of the main adjustments was to Gross Domestic Product (GDP) which results in GDP per capita being 23% lower than previously forecast by 2069. There was also an amendment to population growth. It should be noted that the revised forecast do not take any account of the effects of Covid-19 so are potentially optimistic. The OBR forecasts are used within all of the Benefit to Cost Ratio (BCR), and these downward revisions in forecast GDP and population growth may have a negative impact on scheme BCR.

12.1.6. A further model scenario has been created that reflects the economic uncertainty. This is prescribed within the TAG Databook 2020 update. There are updated OBR projections and revised fleet assumptions in modelling and appraisal, and these have been applied to the values of time and the vehicle operating costs. The impact of these changes on the values of time and vehicle operating have been summarised in Appendix K.

12.1.7. The sensitivity test has been applied to the Core Growth scenario including undertaking a VDM assessment using DIADEM.

12.1.8. Figure 12-1 to Figure 12-3 present flow difference plots for the AM peak, Inter peak and PM peak respectively for the 2025 Core Growth DS scenario versus the 2025 Core Growth Sensitivity DS scenario to demonstrate the difference in the impact on the local road network in the Opening Year.

12.1.9. Figure 12-4 to Figure 12-6 present flow difference plots for the AM peak, Inter peak and PM peak respectively for the 2040 Core Growth DS scenario versus the 2040 Core Growth Sensitivity DS scenario to demonstrate the difference in the impact on the local road network in the Design Year.

12.1.10. The information shown in Figure 12-1 to Figure 12-6 show that the Core Growth Sensitivity assessment has a minimal impact on the flows in the 2025 and 2040 forecast years. The impact is greater in the 2025 Opening Year with actual flows, in pcu's, reducing on the Norwich Western Link scheme by 68 pcu in the AM peak, 30 pcu in the Inter peak and 47 pcu in the PM peak.

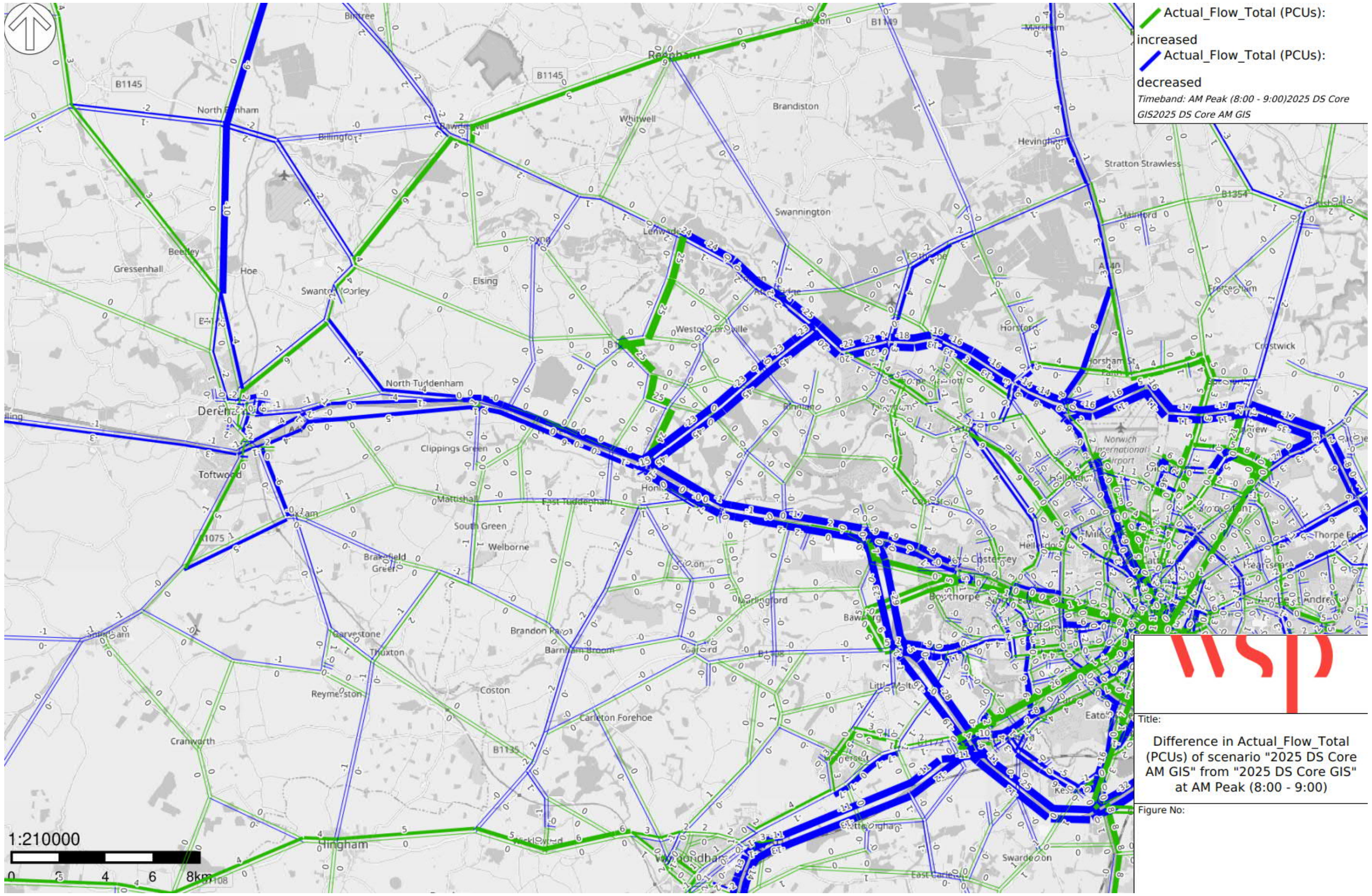


Figure 12-1: 2025 Core Growth DS scenario versus 2025 Core Growth Sensitivity DS scenario, Actual Flow Difference, in pcu's - AM peak

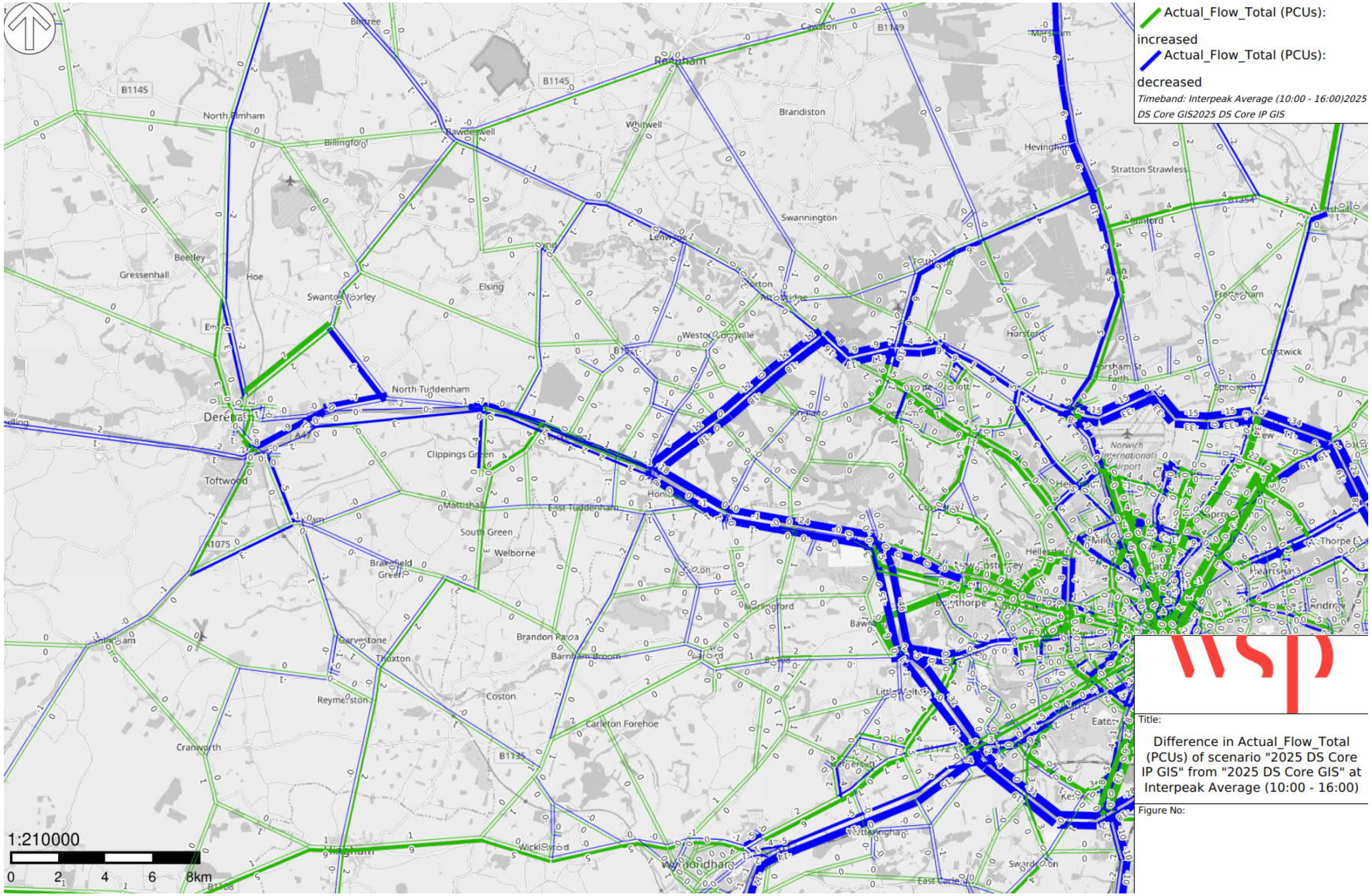


Figure 12-2: 2025 Core Growth DS scenario versus 2025 Core Growth Sensitivity DS scenario, Actual Flow Difference, in pcu's – Inter peak

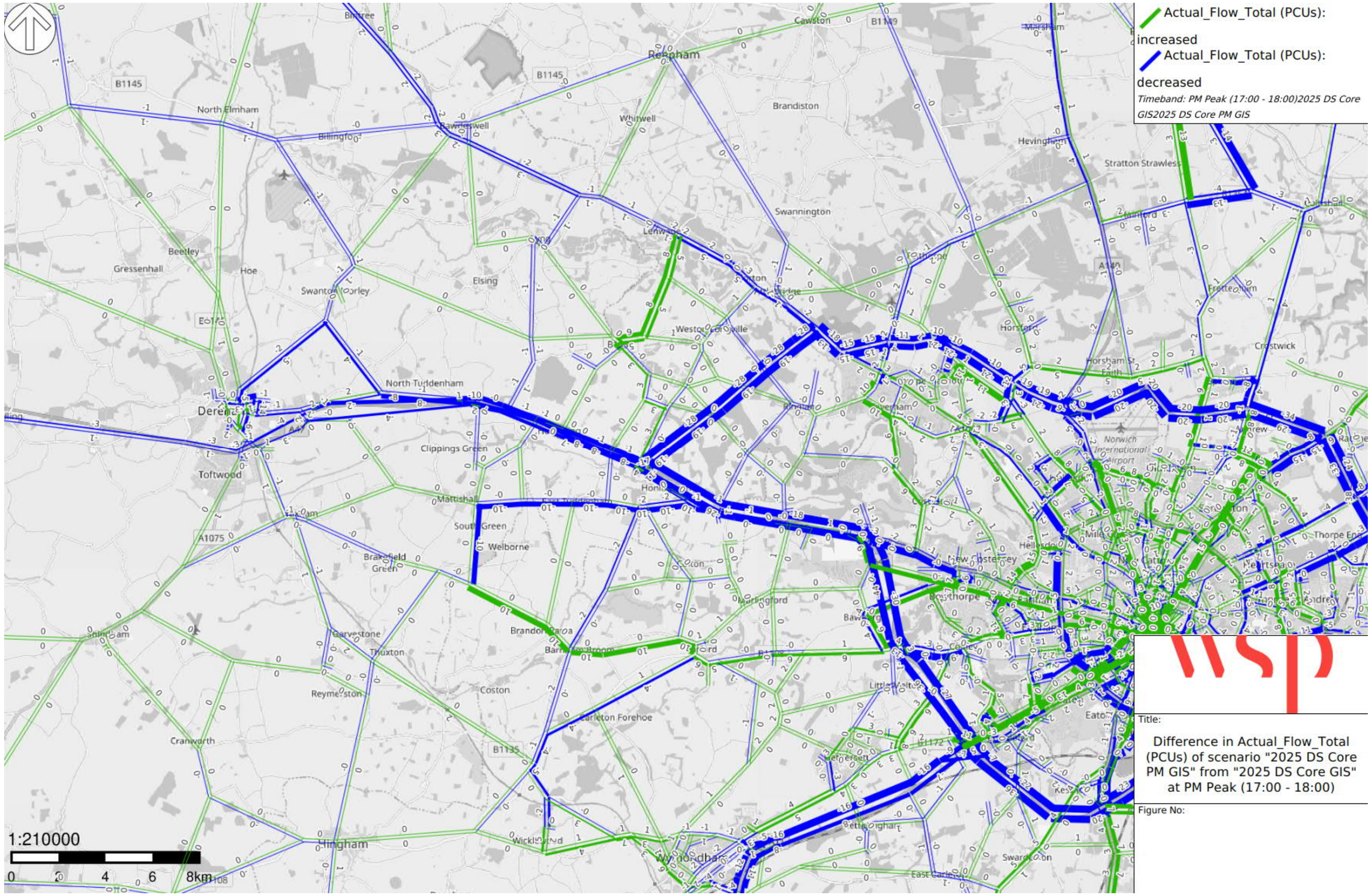


Figure 12-3: 2025 Core Growth DS scenario versus 2025 Core Growth Sensitivity DS scenario, Actual Flow Difference, in pcu's - PM peak

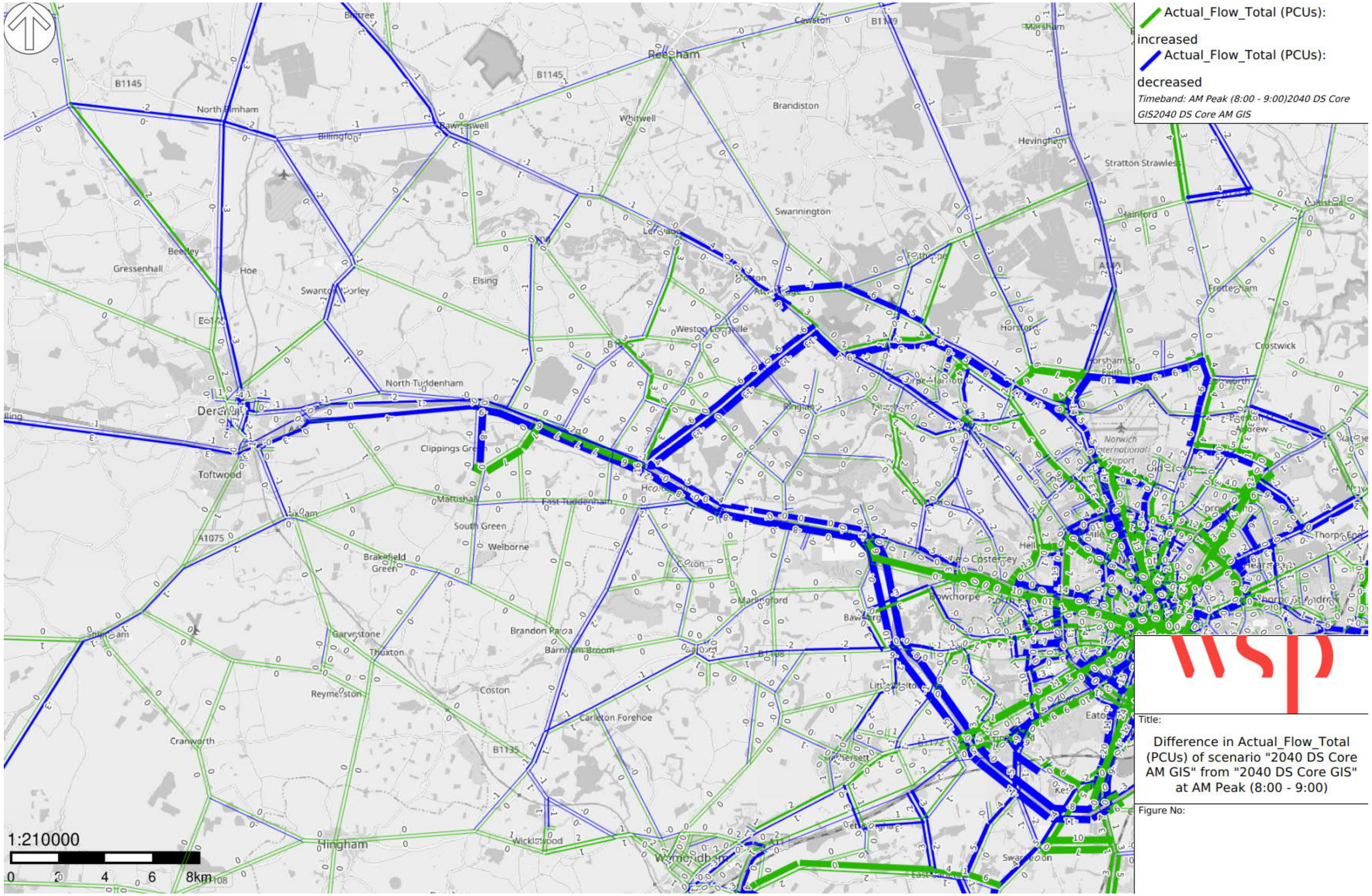


Figure 12-4: 2040 Core Growth DS scenario versus 2040 Core Growth Sensitivity DS scenario, Actual Flow Difference, in pcu's - AM peak

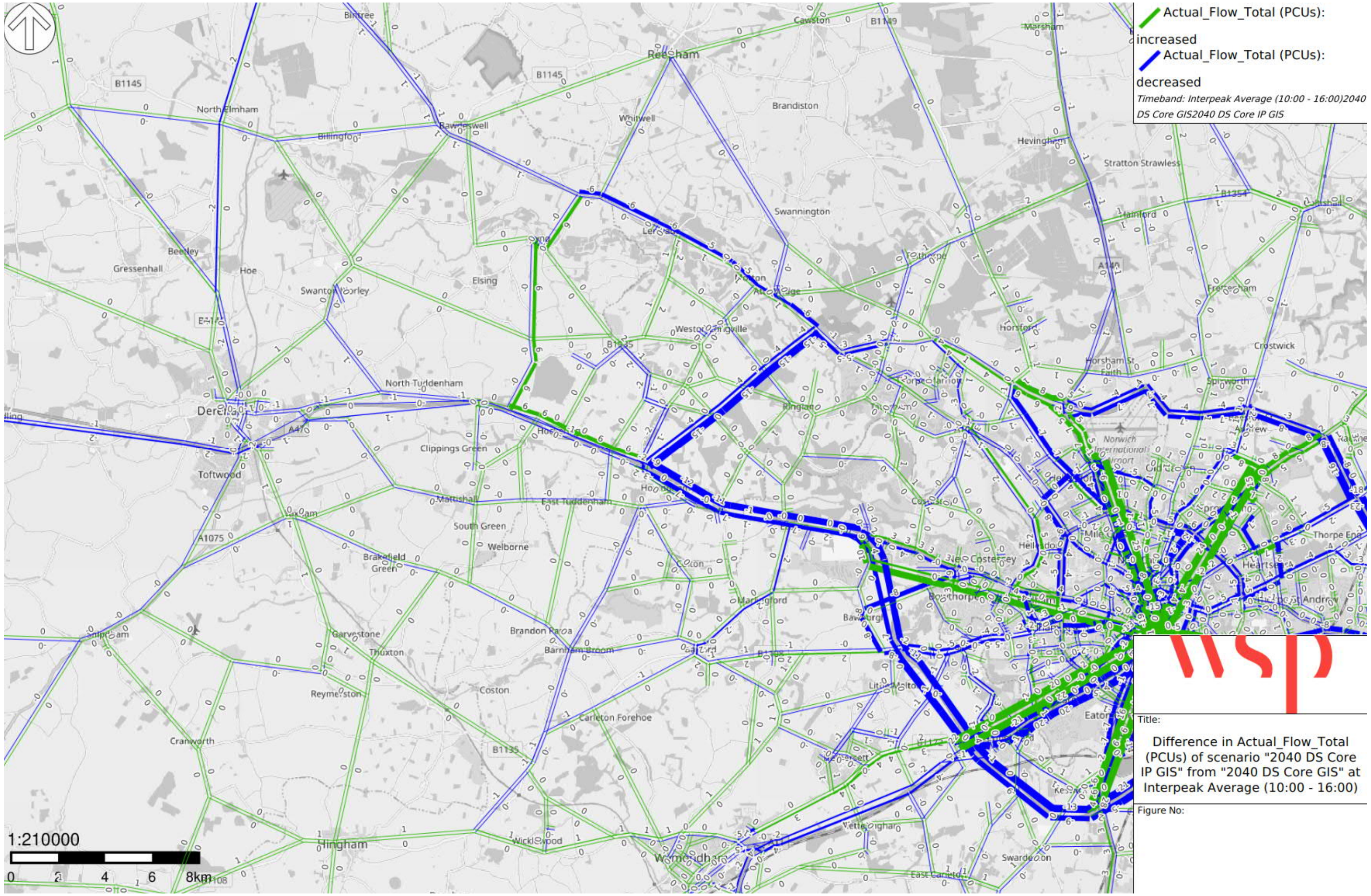


Figure 12-5: 2040 Core Growth DS scenario versus 2040 Core Growth Sensitivity DS scenario, Actual Flow Difference, in pcu's – Inter peak

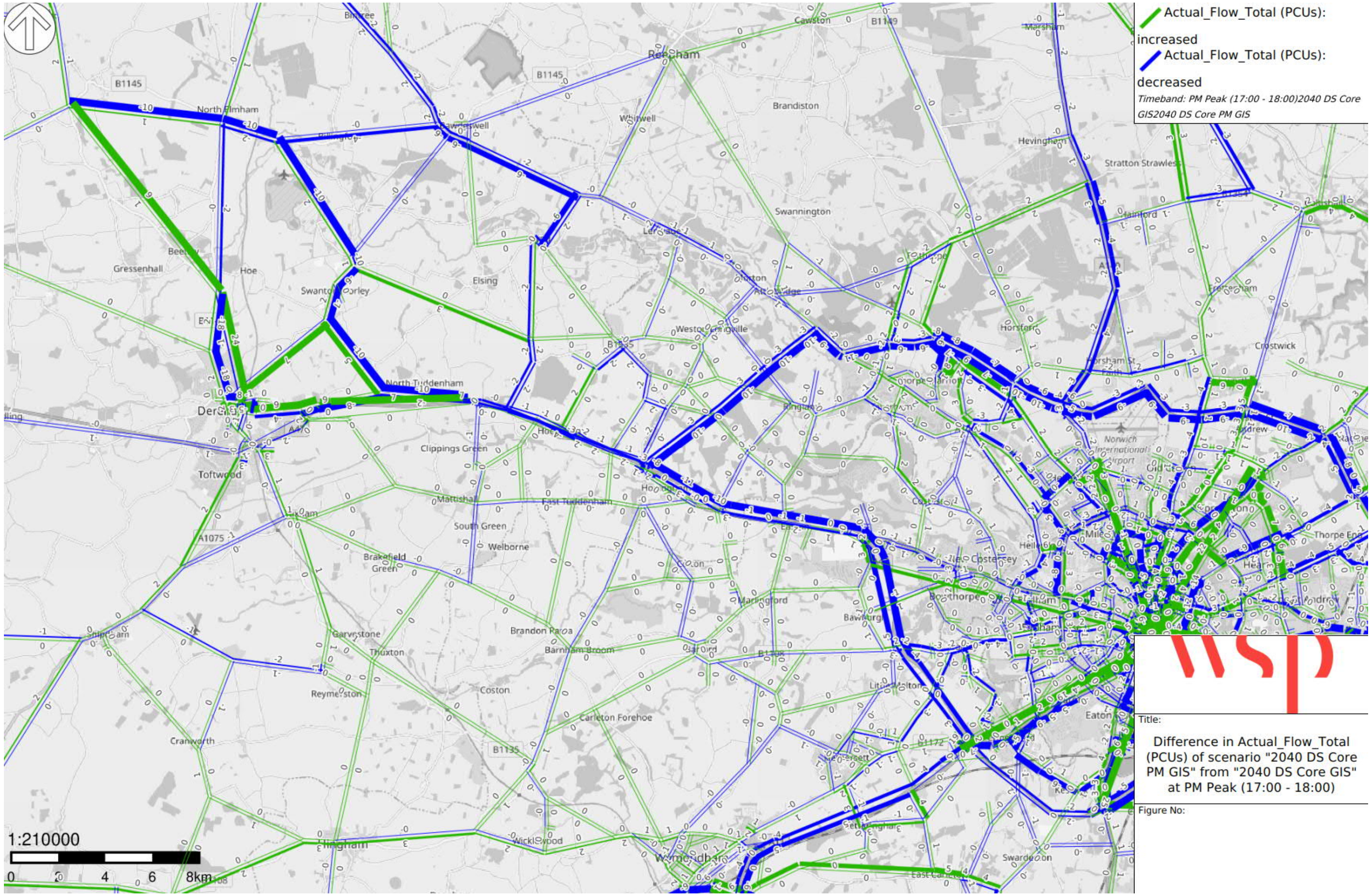


Figure 12-6: 2040 Core Growth DS scenario versus 2040 Core Growth Sensitivity DS scenario, Actual Flow Difference, in pcu's - PM peak

12.1.11. Table 12-1 shows the difference between the Core Growth scenario and the Core Growth (Sensitivity Assessment) for the DM and DS 2025 forecast year.

Table 12-1: AADT - Core Growth scenario and Core Growth (Sensitivity Assessment) DS minus DM for the 2025 forecast year

Road Name	2025 Core Growth		2025 Core Growth (Sensitivity Assessment		Diff (DM)	Diff (DS)
	DM	DS	DM	DS		
A47 west of Lyng Road	39,400	36,000	38,300	35,800	-1,100	-200
The Street (west of Heath Road	3,600	3,200	3,500	3,200	-100	-
Heath Road	1,400	1,100	1,400	1,100	-	-
Sandy Lane	100	100	100	100	-	-
A47 west of A47 / Sandy Lane junction	39,400	36,000	38,300	35,800	-1,100	-200
A47 west of A47 / Wood Lane junction	39,400	36,000	38,300	35,800	-1,100	-200
B1535 Wood Lane	6,000	1,400	5,800	1,500	-200	100
Berry's Lane	-	-	-	-	-	-
A47 / Wood Lane junction: eastbound off-slip	1,700	6,100	1,700	6,100	-	-
A47 / Wood Lane junction: westbound on-slip	1,100	4,600	1,000	4,600	-100	-
Link between A47 roundabouts at Wood Lane	4,500	12,100	4,200	11,700	-300	-400
A47 / Wood Lane junction: eastbound on-slip	2,300	6,100	2,200	5,900	-100	-200
A47 / Wood Lane junction: westbound off-slip	2,200	5,900	2,000	5,800	-200	-100
A47 east of A47 / Wood Lane junction	41,100	37,300	39,800	36,800	-1,300	-500
Norwich Road (east of Mattishall Road)	1,200	2,700	1,100	2,600	-100	-100
Taverham road	1,800	1,100	1,800	1,100	-	-
Honingham Lane	1,500	800	1,500	800	-	-
Blind Lane	-	-	-	-	-	-
A47 / Taverham Road junction: eastbound off-slip	600	800	600	800	-	-
A47 / Taverham Road junction: westbound on-slip	400	800	400	800	-	-
Link between A47 roundabouts at Taverham Road	2,000	1,500	2,000	1,500	-	-
A47 / Taverham Road junction: eastbound on-slip	700	500	700	500	-	-
A47 east of A47 / Taverham Road junction	800	700	800	600	-	-100

Road Name	2025 Core Growth		2025 Core Growth (Sensitivity Assessment		Diff (DM)	Diff (DS)
	DM	DS	DM	DS		
Church Lane	-	-	-	-	-	-
Weston Road	400	500	400	500	-	-
Ringland Road (North of Weston Road)	400	300	400	300	-	-
A47 east of A47 / Church Lane junction	41,600	36,900	40,200	36,300	-1,400	-600
Dereham Road (east of A47 / Church Lane roundabout)	900	1,400	900	1,400	-	-
Costessey Road (Taverham Bridge)	8,000	7,200	8,100	7,300	100	100
Honingham Road (Weston Longville)	4,100	700	4,000	700	-100	-
Ringland (The Street)	2,000	900	1,900	900	-100	-
Norwich Western Link	-	24,700	-	24,100	-	-600

12.1.12. It is predicted that the Norwich Western Link will have an AADT flow of 24,100 vehicles in the Core Growth (Sensitivity Assessment) 2025 Opening Year i.e. a reduction of 600 vehicles on the Core Growth scenario.

12.1.13. Table 12-2 shows the difference between the Core Growth scenario and the Core Growth (Sensitivity Assessment) for the DM and DS 2040 forecast years.

Table 12-2: AADT - Core Growth scenario and Core Growth (Sensitivity Assessment) DS minus DM for the 2040 forecast year

Road Name	2040 Core Growth		2040 Core Growth (Sensitivity Assessment		Diff (DM)	Diff (DS)
	DM	DS	DM	DS		
A47 west of Lyng Road	47,200	41,200	46,800	41,100	-400	-100
The Street (west of Heath Road	5,200	3,100	5,100	3,200	-100	100
Heath Road	1,700	1,100	1,700	1,100	-	-
Sandy Lane	100	100	100	100	-	-
A47 west of A47 / Sandy Lane junction	47,200	41,200	46,800	41,100	-400	-100
A47 west of A47 / Wood Lane junction	47,200	41,200	46,800	41,100	-400	-100
B1535 Wood Lane	7,800	2,100	7,800	2,000	-	-100
Berry's Lane	-	-	-	-	-	-

Road Name	2040 Core Growth		2040 Core Growth (Sensitivity Assessment		Diff (DM)	Diff (DS)
	DM	DS	DM	DS		
A47 / Wood Lane junction: eastbound off-slip	2,200	7,800	2,200	7,800	-	-
A47 / Wood Lane junction: westbound on-slip	1,500	6,300	1,500	6,200	-	-100
Link between A47 roundabouts at Wood Lane	6,200	17,700	6,100	17,500	-100	-200
A47 / Wood Lane junction: eastbound on-slip	3,000	9,000	3,000	8,900	-	-100
A47 / Wood Lane junction: westbound off-slip	3,100	8,700	3,100	8,600	-	-100
A47 east of A47 / Wood Lane junction	49,600	44,800	49,100	44,600	-500	-200
Norwich Road (east of Mattishall Road)	1,500	3,600	1,500	3,600	-	-
Taverham road	2,600	1,200	2,600	1,200	-	-
Honingham Lane	2,400	900	2,400	900	-	-
Blind Lane	-	-	-	-	-	-
A47 / Taverham Road junction: eastbound off-slip	900	1,300	900	1,300	-	-
A47 / Taverham Road junction: westbound on-slip	600	1,500	600	1,500	-	-
Link between A47 roundabouts at Taverham Road	2,900	2,100	2,900	2,100	-	-
A47 / Taverham Road junction: eastbound on-slip	1,100	600	1,100	600	-	-
A47 east of A47 / Taverham Road junction	1,300	800	1,300	800	-	-
Church Lane	-	-	-	-	-	-
Weston Road	500	600	500	600	-	-
Ringland Road (North of Weston Road)	400	400	400	400	-	-
A47 east of A47 / Church Lane junction	50,400	43,500	49,900	43,200	-500	-300
Dereham Road (east of A47 / Church Lane roundabout)	1,400	2,500	1,400	2,500	-	-
Costessey Road (Taverham Bridge)	8,000	7,300	8,100	7,300	100	-
Honingham Road (Weston Longville)	5,000	800	5,000	800	-	-
Ringland (The Street)	3,200	1,000	3,200	1,000	-	-
Norwich Western Link	-	34,600	-	34,400	-	-200

12.1.14. It is predicted that the Norwich Western Link will have an AADT flow of 34,400 vehicles in the Core Growth (Sensitivity Assessment) 2040 Design Year i.e. a reduction of 200 vehicles on the Core Growth scenario.

13

SUMMARY AND CONCLUSIONS

13 SUMMARY AND CONCLUSIONS

13.1 INTRODUCTION

13.1.1. WSP were commissioned by NCC to undertake transport modelling to support the business case and planning application for the proposed Norwich Western Link scheme.

13.1.2. This Traffic Forecasting Report (TFR) has provided a summary of the development of the forecast year travel demand scenarios that assess the impact of the Norwich Western Link scheme on the local highway network. This report has demonstrated that the scenarios have been developed in accordance with TAG guidance using up to date, future land use development information. The forecast year assignments have been undertaken using DIADEM Variable Demand Modelling.

13.2 FORECASTING

13.2.1. A Core Scenario has been developed to provide the best basis for decision making and has been produced in accordance with DfT TAG. Growth is constrained to NTEM V7.2 with schemes and proposed developments represented which have been identified as More Than Likely or Near Certain within the Uncertainty Log.

13.2.2. However, further growth scenarios have been developed:

- High Growth scenario should consist of forecasts that are based on a **proportion of base year demand** added to the demand from the **Core Growth scenario**
- High Growth scenario should consist of forecasts that are based on a **proportion of base year demand** below to the demand from the **Core Growth scenario**.
- **Sensitivity Assessment:** Updated OBR projections and revised fleet assumptions in modelling and appraisal.

13.3 FORECAST SUPPLY

13.3.1. Infrastructure information in uncertainty logs, provided to WSP by NCC were used to inform the forecast networks. Specific network information was also incorporated into the coding for residential or commercial developments.

13.4 FORECAST DEMAND

13.4.1. Uncertainty also informed the 'Near Certain' and 'More than Likely' housing and employment developments that were specifically modelled. Development trip rates were obtained using the NTEM 7.2 dataset and calculated at a district level. The total trip generation for each of the developments was distributed into user classes using the base year matrix total proportions for each user class and time period respectively.

13.4.2. Background growth factors, extracted from TEMPro, were applied to each of the zones across each of the study areas. Specifically, modelled housing and job totals were removed from the planning data within the alternative assumptions tool in TEMPro to ensure that double counting didn't occur.

13.4.3. Traffic growth for LGV and HGV were calculated based on the latest 2018 National Road Traffic Forecasts data; factors are available by region and East of England factors were applied across the zoning system.

13.4.4. Final forecast matrices were constrained to TEMPro by capping the unconstrained matrix OD values where they exceed those of the TEMPro constrain matrix.

13.4.5. Highway networks were updated to reflect committed infrastructure schemes with specific network and access arrangement detail was included to reflect explicitly modelled developments.

13.5 FORECAST ASSIGNMENTS

13.5.1. Model results demonstrated that all forecast model scenarios converge to TAG and flow and link delay change plots have been presented showing the impact of the proposed Norwich Western Link scheme. The impact of the Norwich Western Link has been summarised by identifying the trips using the new link and the benefit to the other parts of the highway network the scheme brings. The scheme has been shown to improve journey times and to reduce the overall amount of delay within the model network

13.6 SUITABILITY FOR APPRAISAL

13.6.1. The forecast modelling has been undertaken in line with TAG guidance and has yielded a set of traffic forecasts which appear to be sensible and meet expectations about transport conditions in the future years. It is therefore considered that these forecasts provide a suitable basis for the economic and environmental appraisals of the Norwich Western Link scheme.

Appendix A

UNCERTAINTY LOG

Appendix B

CORE GROWTH: 2025 DM VERSUS 2019 BASE YEAR (AM PEAK, INTER PEAK AND PM PEAK)

Appendix C

CORE GROWTH: 2025 DS VERSUS 2025 DM (AM PEAK, INTER PEAK AND PM PEAK)

Appendix D

CORE GROWTH – 2025 AND 2040
AADT FLOW PLOTS

Appendix E

LOW GROWTH: 2025 DS VERSUS 2019 BASE YEAR (AM PEAK, INTER PEAK AND PM PEAK)

Appendix F

LOW GROWTH: 2025 DS VERSUS 2025 DM (AM PEAK, INTER PEAK AND PM PEAK)

Appendix G

LOW GROWTH: 2025 AND 2040 AADT FLOW PLOTS

Appendix H

HIGH GROWTH: 2025 DS VERSUS 2019 BASE YEAR (AM PEAK, INTER PEAK AND PM PEAK)

Appendix I

HIGH GROWTH: 2025 DS VERSUS 2025 DM (AM PEAK, INTER PEAK AND PM PEAK)

Appendix J

HIGH GROWTH: 2025 AND 2040 AADT FLOW PLOTS

Appendix K

TAG SENSITIVITY ASSESSMENT - GENERALISED COST

Mountbatten House
Basing View
Basingstoke, Hampshire
RG21 4HJ

wsp.com

PUBLIC