COMET 7

FORECASTING REPORT

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BACKGROUND AND MODELLING APPROACH

Hertfordshire County Council (HCC) commissioned WSP to produce 2036 forecast models using their Countywide Model of Transport (COMET), a multi model transport model. Two forecast scenarios have been prepared:

- A National Trip End Model (NTEM) Constrained scenario following Department for Transport (DfT) Transport Analysis Guidance (TAG) for use on Business Cases[1]
- A Local Plan forecast.

The forecasts are derived from transport schemes as well as planning data (employment and dwelling growth) provided to HCC by the Districts in the County in Spring 2022. Both the schemes and planning data have been categorised based on certainty level. In line with DfT TAG guidance, only schemes and developments with a certainty of 'near certain' or 'more than likely' have been included in the NTEM constrained scenario. All schemes and developments, irrespective of certainty are included in the Local Plan scenario. In both scenarios NTEM 7.2 growth has been applied in the areas outside Hertfordshire. In addition to the identified schemes the Local Plan scenario includes an adjustment to highway generalised costs to simulate modal shift.

The forecast year of 2036 is the year that most closely aligns with the end of plan year for the ten districts within Hertfordshire. The NTEM Constrained scenario has been constrained at the county wide level, rather than at a district level, to preserve the distribution of growth across the county.

The Local Plan scenario is the seventh forecast undertaken, the second by WSP, with the other five by the previous consultant, AECOM. This is the second NTEM Constrained Scenario developed at the same time as the Local Plan scenario and will be used as a basis for business case and developer testing.

Key elements of the model, such as Core base year zone structure, remain unchanged in this version compared to previous versions, however some minor improvements have been made to the Base Year model to form a version 7. COMET 7, like COMET 6, expands the number of development zones to allow a larger number of development sites (those with proposals for more than 300 homes or more than 500 jobs to be explicitly modelled).

A summary of the growth assumed in these two scenarios in contained in Table 1-1.

The NTEM constrained scenario includes all developments built from 2014 to 2021, those sites already in the planning system, and an adjustment to NTEM projections to 2036. The Local Plan

[1] The National Trip End Model (NTEM) forecasts the growth in trip origin-destinations (or productions-attractions) up to 2051 for use in transport modelling. The forecasts take into account national projections of: population, employment, housing, car ownership, trip rates. The current version is 7.2. The freely available TEMPro software is required to view the datasets which can be found here: https://data.gov.uk/dataset/11bc7aaf-ddf6-4133-a91d-84e6f20a663e/national-trip-end-model-ntem

scenario includes all developments built from 2014 to 2021, those sites already in the planning system, as well as local plan growth and windfall allowances to 2036.

The NTEM constrained scenario is derived on the basis of constraining to County levels of NTEM growth, see section 4 for a full breakdown on the derivation of the overall numbers. The Local Plan scenario includes negative jobs (those employment sites that have been converted to residential or demolished). In the Local Plan scenario housing and jobs are not constraint to NTEM levels as applied in the NTEM Constrained scenario, which leads to different outturn numbers.

Table 1-1: Growth Assumptions in Hertfordshire (2014 – 2036)

District	2014 Base Year (based on NTEM 7.2 (TEMPro) data)		2014 - 2036 NTEM Constrained Scenario Growth				2014 - 2036 Local Plan Scenario Growth				Difference between NTEM Constrained Scenario and Local Plan Scenario (Local Plan - NTEM)	
	Housing	Jobs	Housing Growth	Jobs Growth	% Housing Growth	% Jobs Growth	Housing Growth	Jobs Growth	% Housing Growth	% Jobs Growth	% Difference in Housing Growth	% Difference in Jobs Growth
Broxbourne	38,746	42,425	8,034	9,257	21%	22%	9,169	7,865	24%	19%	14%	-15%
Dacorum	61,986	71,625	11,089	4,581	18%	6%	21,531	13,315	35%	19%	94%	191%
East Hertfordshire	58,886	63,318	16,612	5,009	28%	8%	21,046	3,007	36%	5%	27%	-40%
Hertsmere	41,223	50,065	6,100	3,139	15%	6%	14,832	4,752	36%	9%	143%	51%
North Hertfordshire	55,087	57,011	10,993	2,305	20%	4%	16,826	3,480	31%	6%	53%	51%
St Albans	58,035	67,183	6,543	7,255	11%	11%	14,536	12,129	25%	18%	122%	67%
Stevenage	35,803	48,912	7,074	6,586	20%	13%	13,017	4,493	36%	9%	84%	-32%
Three Rivers	36,225	38,145	4,507	3,737	12%	10%	11,714	5,541	32%	15%	160%	48%
Watford	38,119	57,601	7,630	11,680	20%	20%	14,732	3,735	39%	6%	93%	-68%
Welwyn Hatfield	45,115	73,999	10,118	3,792	22%	5%	16,688	5,950	37%	8%	65%	57%
HERTFORDSHIRE	**469,224**	**570,284**	**88,700**	**57,339**	**19%**	**10%**	**154,091**	**64,268**	**33%**	**11%**	**74%**	**12%**

HIGHWAY NETWORK RESULTS

The forecast results show significant congestion on key urban and inter-urban roads in 2036. Highway trips originating in Hertfordshire are shown to increase by approximately 15% and 22% between 2014 and 2036 in the NTEM Constrained in the AM and PM peaks respectively. For the Local Plan scenario, the growth is significantly higher at 20% and 26% for these peak periods. This increase is accompanied by a rise in travel distance of between 24% and 39% (depending on the scenario and time period, with the longest distances travelled in the IP period), and an increase in travel time of between 40% to 52%, depending on the scenario and time period, although highest in the Local Plan scenario, especially the Interpeak. The relatively sharp rise in travel time compared to travel distance is indicative of increasing congestion and corroborates the maximum fall in average network speed of approximately 12-13% in the AM and PM peaks of the Local Plan scenario.

Vehicle Flows and Congestion

There are notable impacts on flow levels on strategic routes:

- The key north south strategic roads, the A41, M1, A1(M), and A10 all see large increases in flow, albeit the A41 and A10 sees less of an increase than the M1 and A1(M).
- The A414 broadly operates within capacity but that the area around Colney Heath and London Colney is under particular stress (volume over capacity).
- A significant flow increase is observed on the A405 between Watford and the A414, and also sections of A1 and M1 in Watford and Hertsmere.
- The M25 experiences significant flow increases, particularly in the section between Junction 24-25 south of Cheshunt, with resultant impact on capacity.
- In the AM, the increases on the A10 are particularly prominent from the M25 to Puckeridge, where the A10 connects with the A120. In the PM, the northbound increase is less significant beyond Ware.
- The eastern part of the A120 shows increased traffic flows in each direction from Stansted Airport / M11 interchange towards Essex in the AM and PM Peak. The western section of the A120 in Bishop's Stortford is observed to have increases in each direction although at a lower level.

The following key roads on the Hertfordshire road network show evidence of congestion (V/C over 80%) in the 2036 Local Plan scenario:

- Sections of M25 between Junction 17-20 and between Junction 22-26 shows high V/Cs especially in the PM Peak, and Junctions 18, 21, 23 and 27 are forecast with V/C over 100% also in the PM peak This highlights the important role of the M25 in East-West movements across the area.
- High V/C are shown along the length of the M1 and A1(M) through Hertfordshire to varying extents, with stress being particularly noticeable in the AM and PM peaks.
- The A414 around Hertford and between the A1(M) and Colney Heath Longabout junction shows high V/Cs throughout the day.
- Low V/C is predicted for the A120 however the eastern part of the Bishops Stortford ring road operates near capacity, due to the delays on the link towards Essex.
- Sections of A41 and its connecting roads near Watford are forecast at over-capacity with V/C between 90% - 110%.

Inter-Urban Highway Journey Times

Increased vehicle flow and congestion in the forecast year leads to a rise in the average journey time between urban areas of Hertfordshire.

Table 1-2 and Table 1-3 present the percentage increase in journey times between key towns in the AM Peak for the NTEM Constrained scenario and Local Plan scenario from 2014 to 2036. The levels of change shown are similar to the previous Local Plan 6 model run. There are some particularly large increases in the PM peak, with full details presented in Section 6.2. Colour grading helps to highlight those journeys with particularly large changes.

These percentages have been derived by considering the average journey time between a key zone in each town, generally representing a town centre. As these are average times some journeys will see smaller increases compared to the Base Year whilst some routes will see larger increases.

As would be expected, the Local Plan scenario generally shows larges increase in inter urban journey times than the NTEM constrained scenario due to the greater levels of growth. It is clear that in both scenarios the southern part of the county (e.g., Watford, Cheshunt, St Albans, Hemel Hempstead and Rickmansworth) tends to see greater increases in journey times due to increased congestion.

The journey time increases in Table 1-2 and Table 1-3 only highlights the cells where the increases are worth noting, with increases of over 30% shown in brown, between 20-30% in pink, between 10-20% in yellow and any values less than 10% increase have not been highlighted.

Table 1-2: Journey Time Comparisons between NTEM Constrained Scenario and Base Year in AM Peak (minutes (%)

	Bishops Stortford	Borehamwood	Cheshunt	Hemel Hempstead	Hertford	Hitchin	Rickmansworth	St Albans	Stevenage	Watford	Welwyn Garden City
Bishops Stortford	-	9 (20%)	-1 (-4%)	9 (14%)	-1 (-3%)	6 (12%)	11 (18%)	5 (8%)	0 (1%)	13 (19%)	2 (5%)
Borehamwood	6 (13%)	-	8 (36%)	7 (25%)	4 (16%)	9 (27%)	7 (24%)	3 (15%)	7 (23%)	5 (20%)	3 (16%)
Cheshunt	2 (4%)	10 (43%)	-	13 (36%)	3 (15%)	8 (17%)	13 (38%)	10 (33%)	6 (18%)	15 (38%)	9 (29%)
Hemel Hempstead	6 (8%)	6 (20%)	12 (31%)	-	7 (16%)	3 (9%)	9 (37%)	4 (18%)	7 (14%)	7 (26%)	5 (14%)
Hertford	-1 (-4%)	2 (8%)	-1 (-3%)	10 (26%)	-	6 (17%)	9 (23%)	5 (17%)	2 (7%)	9 (20%)	3 (18%)
Hitchin	3 (7%)	4 (11%)	3 (6%)	4 (10%)	4 (11%)	-	7 (16%)	3 (8%)	2 (17%)	5 (12%)	5 (20%)
Rickmansworth	6 (9%)	4 (13%)	12 (33%)	9 (34%)	9 (21%)	6 (14%)	-	8 (27%)	13 (30%)	6 (36%)	10 (27%)
St Albans	3 (5%)	2 (8%)	8 (27%)	3 (15%)	4 (14%)	4 (12%)	8 (29%)	-	6 (19%)	7 (23%)	4 (17%)
Stevenage	0 (0%)	0 (1%)	-1 (-3%)	5 (11%)	2 (7%)	3 (19%)	7 (15%)	2 (7%)	-	7 (13%)	2 (10%)
Watford	5 (9%)	3 (14%)	11 (35%)	6 (28%)	8 (20%)	3 (8%)	6 (32%)	4 (19%)	12 (30%)	-	9 (27%)
Welwyn Garden City	1 (3%)	1 (3%)	6 (20%)	6 (20%)	4 (21%)	5 (25%)	8 (22%)	3 (12%)	4 (24%)	7 (19%)	-

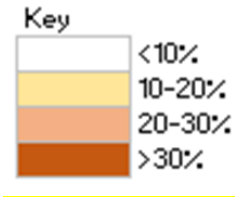


Table 1-3: Journey Time Comparisons between LP and Base Year in AM Peak (minutes (%)

	Bishops Stortford	Borehamwood	Cheshunt	Hemel Hempstead	Hertford	Hitchin	Rickmansworth	St Albans	Stevenage	Watford	Welwyn Garden City
Bishops Stortford	-	11 (23%)	-1 (-3%)	15 (22%)	-1 (-2%)	7 (14%)	12 (19%)	7 (12%)	1 (2%)	13 (19%)	3 (7%)
Borehamwood	9 (18%)	-	11 (51%)	12 (41%)	8 (30%)	7 (21%)	9 (35%)	5 (22%)	8 (29%)	8 (32%)	8 (38%)
Cheshunt	4 (11%)	17 (74%)	-	23 (62%)	6 (27%)	9 (18%)	21 (59%)	17 (56%)	9 (24%)	22 (59%)	12 (37%)
Hemel Hempstead	9 (13%)	9 (28%)	16 (40%)	-	10 (24%)	4 (12%)	9 (36%)	6 (28%)	9 (18%)	10 (33%)	9 (25%)
Hertford	-1 (-4%)	4 (14%)	-1 (-3%)	15 (42%)	-	4 (12%)	12 (29%)	7 (23%)	2 (7%)	10 (24%)	4 (21%)
Hitchin	9 (18%)	4 (11%)	3 (7%)	9 (26%)	5 (15%)	-	10 (23%)	5 (14%)	5 (37%)	9 (20%)	6 (22%)
Rickmansworth	6 (9%)	4 (11%)	13 (37%)	7 (27%)	12 (29%)	6 (14%)	-	7 (27%)	12 (28%)	7 (44%)	12 (33%)
St Albans	4 (8%)	2 (10%)	11 (36%)	7 (32%)	6 (19%)	4 (13%)	10 (36%)	-	6 (17%)	9 (28%)	6 (27%)
Stevenage	1 (3%)	1 (2%)	-1 (-1%)	10 (21%)	2 (10%)	1 (8%)	8 (17%)	3 (9%)	-	7 (13%)	4 (17%)
Watford	6 (9%)	4 (17%)	13 (41%)	8 (38%)	11 (30%)	3 (7%)	5 (28%)	5 (21%)	12 (29%)	-	11 (36%)
Welwyn Garden City	2 (5%)	3 (14%)	7 (24%)	10 (33%)	4 (22%)	0 (1%)	11 (31%)	4 (19%)	2 (14%)	10 (25%)	-

Key

<10%

10-20%

20-30%

>30%

PUBLIC TRANSPORT NETWORK RESULTS

Forecast results indicate that the rail network in Hertfordshire will experience an increase in passenger boardings between 85% and 176% across the AM, IP and PM peaks between 2014 and 2036.

Bus travel is likely to grow at a lower rate (between 61% - 75%) over the same period.

Underground in Hertfordshire is predicted an increase between 35% and 58% over the period also.

Passenger distance travelled increases for both bus and rail, however rail more so as rail becomes a more attractive option. Bus distances are predicted to increase between 18% and 23% over the forecast period, whilst rail distances are predicted to increase by 50% to 71% over the period.

1 INTRODUCTION

1.1 BACKGROUND

1.1.1. WSP has been appointed by Hertfordshire County Council (HCC) to undertake the latest annual forecast model run using the Countywide Model of Transport (COMET) modelling suite. The COMET model provides a base in which current and future transport patterns and demand can be assessed across Hertfordshire.

1.1.2. The COMET model is a multi-modal model comprised of two key components:

- SATURN-based Highways Assignment Model (HAM)
- Emme-based Public Transport (PT) model linked with a Variable Demand Model (VDM)

1.1.3. The current version of COMET is version 7, and incorporates improvements made by WSP since April 2021. This forecast set will also be the 7th iteration (Run 7) of the Local Plan testing undertaken.

Key changes in COMET 7:

- Undertook node delay review – significant delay changes in the Local Plan Run 6 and base year model were investigated to identify any coding errors and underlying reasons for the increase of the delay. The base year and forecast networks were revised where necessary. These network changes were also included in the COMET7 forecast model development.
- In additional to the above network changes, light touch review was also carried out to incorporate a number of base year network changes, such as inclusion of missing alternative link, which were identified from the previous base year network update task
- Inclusion of latest highway scheme assumptions
- Updated economic and generalised cost parameters across the suite based on the information published in the DfT TAG Databook v1.17 November 2021
- Planning data (housing and jobs) updated to the latest data agreed with districts and provide by HCC in April 2022

1.2 PURPOSE OF DOCUMENT

1.2.1. WSP has undertaken model analysis for the AM, Inter Peak (IP) and PM (see section 2.3 for more info on time periods), of the transportation impacts of delivering additional infrastructure, housing and employment proposals in accordance with the data provided by HCC. The COMET model has been used to assess these transport policies and strategies across the highway and public transport network.

1.2.2. HCC provided a detailed list of infrastructure schemes and planning data (housing and employment sites) for each COMET zone.

1.2.3. This report outlines the assumptions that feed into the 2036 forecast scenarios which include the committed and non-committed developments. These scenarios include:

- 2036 National Trip End Model (NTEM) constrained scenario
- 2036 Local Plan (LP)

1.2.4. The NTEM constrained scenario is a TAG Compliant 'Core' growth scenario contains committed infrastructure schemes and planning data in accordance with the Department for Transport (DfT) TAG Uncertainty levels 1 ('near certain') and 2 ('more than likely'), as defined in TAG Unit M4 Table 4.2,

and detailed further in section 4.3 of this report. As such this provides a basis for scheme business case development and testing of the impacts of individual developments on the network.

1.2.5. The Local Plan scenario includes the proposed transport schemes that includes all the growth from the NTEM Constrained scenario with additional infrastructure schemes and planning data relating to district local plans and in accordance with the DfT TAG Uncertainty levels 3 ('reasonably foreseeable') and 4 ('hypothetical').

1.2.6. The Base Year zoning system is the same as version 6, however, additional forecast development zones (detailed in Section 4.4) have been introduced in COMET 7. Figure 1-1 shows the zoning system in the COMET model.

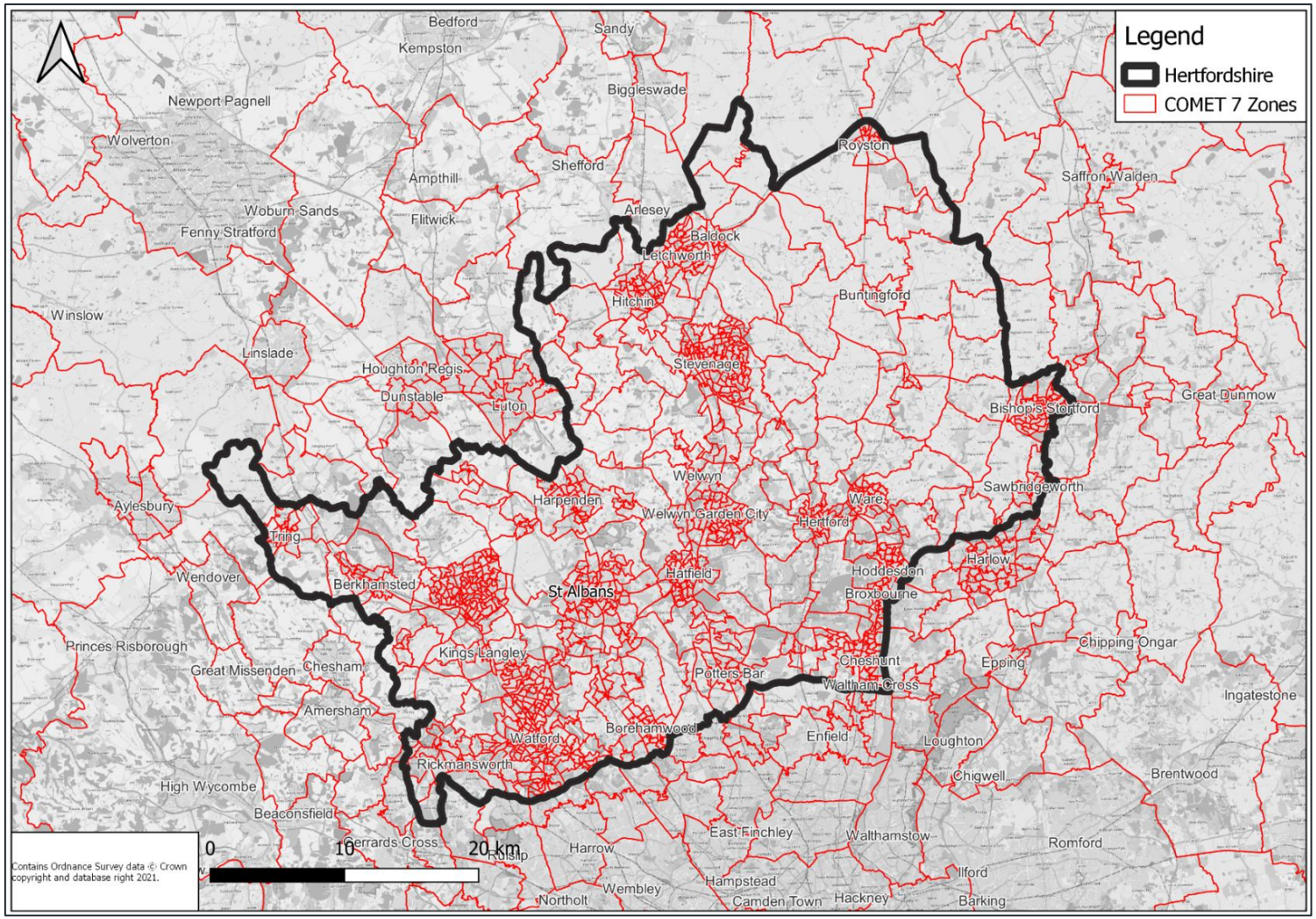


Figure 1-1: Zoning System in COMET Model

1.3 CAVEATS

1.3.1. Although both these forecasts have been modelled for the same year as the previous NTEM and Local Plan 6 models, caution should be exercised when comparing the results between these forecasts and previous forecasts.

1.3.2. The planning data and transport schemes assumptions are different between Local Plan 7 and Local Plan 6 so localised comparisons are not directly possible.

1.3.3. Analysis focuses on results from the AM and PM; however, results have been produced for the Inter peak. These results are available on request. More details on time periods can be found in Section 2.3.

1.3.4. The analysis focusses on the Local Plan scenario results, although again for the NTEM constrained scenario all results have been extracted, and a summary of key impacts have been provided for the NTEM constrained scenario.

1.3.5. Full details of the model development history can be found in Table 1-1.

Table 1-1: COMET MODEL LOG

	Local Model Development and Validation Report	Summary of COMET Base Year Version	Relevant Forecast Scenarios
COMET V1	May 2016 (v1)	Initial version of COMET	Hertfordshire COMET: Local Plan Forecasting Report: June 2016
COMET V2	November 2016 (V2)	Version of COMET based on v1 enhanced in the Watford area: -Refinements to the highway matrix build process -New intra-urban highway screenlines/cordons -Additional highway data collection -Enhancement of network detail in the town -New bus passenger cordon around Watford -Additional bus passenger data collection	Hertfordshire COMET: Local Plan Do Minimum Forecasting Report: January 2017 Local Plan Do Something Scenario – developed in early 2017. Outputs resented to HCC in February 2017, however, no forecasting report was produced.
COMET V3	No LMVR produced	Version of COMET based on v2 enhanced in St Albans district: New intra-urban highway screenlines/cordons Additional highway data collection Enhancement of highway network	St Albans Local Plan Do Minimum scenario. Outputs presented to HCC in June 2017, however, no forecasting report was produced.

	Local Model Development and Validation Report	Summary of COMET Base Year Version	Relevant Forecast Scenarios
		detail in the town, including coding of speeds on urban links in St Albans and Harpenden. New bus passenger cordon around St Albans Additional bus passenger data collection in St Albans and Harpenden	
COMET V4	No LMVR produced	As above for Local Plan v3. Uses the same Base Year version as Local Plan 3 from v2 enhanced in St Albans district.	Local Plan v3 2031 scenario. Outputs and report provided to HCC June 2018. Local Plan v4 2036 scenario. Outputs and report provided to HCC June 2019.
COMET V5	LMVR Produced	Fundamentally different to LP3 and LP4. The Base Year transport network was updated, and re-zoning was introduced for the areas within Hertfordshire and selected neighbouring areas to provide greater detail. All schemes were coded anew.	Local Plan V5 2036 scenario. Outputs and report provided to HCC May 2020
COMET V6	Addendum prepared for the LMVR for COMET V5	Similar to LP5, but the Base year was reviewed and network coding was improved and model performance was improved in some areas.	NTEM constraint scenario built instead of Reference Case in LP5. Transport schemes and planning data updated as provided by HCC in Autumn 2020. NTEM 7.2 levels of growth applied to all zones outside Hertfordshire. Outputs and report provided to HCC August 2021
COMET V7	Addendum prepared for the LMVR for COMET V6	Similar to LP6, but minor network updates	Similar to LP6 but updated planning data and transport schemes to that provided by HCC in Spring 2022. Current

	Local Model Development and Validation Report	Summary of COMET Base Year Version	Relevant Forecast Scenarios
			Forecast documented in this report – referred to as Local Plan v7 with 2036 forecast year.

1.4 REPORT STRUCTURE

1.4.1. This report is structured as follows:

- Executive Summary
- Chapter 1: Introduction
- Chapter 2: Forecasting Approach
- Chapter 3: Forecast Network Development
- Chapter 4: Trip Matrix Development
- Chapter 5: Forecast Assignments
- Chapter 6: Forecast Results
- Chapter 7: Summary and Conclusions

2 FORECASTING APPROACH

2.1 FORECAST OBJECTIVES

2.1.1. This chapter will set out the forecasting approach for the highway and public transport and network to understand the cumulative effect of all the NTEM constrained growth and Local Plan growth in Hertfordshire, in their respective scenarios. This report does not draw any conclusions for any specific individual development or scheme regarding its effect on the local or wider transport network.

2.1.2. This forecast takes into consideration the changes between 2014 and 2036 including increases in population, number of jobs and dwellings, rising cost of travel, and proposed transport infrastructure schemes. However, there is currently no allowance for factors that may fundamentally alter the nature of travel within Hertfordshire. These factors may include new technologies such as autonomous vehicles or COVID-19 pandemic which has caused a significant shift in recent travel patterns.

2.2 MODEL YEARS

2.2.1. The forecast year has been defined by HCC as 2036. Both scenarios use the same forecast year. No other forecasts with alternative model years have been created. 2036 has been chosen to align to the Local Plan years of most districts in Hertfordshire, and where a district's Local Plan is later than 2036 only housing and jobs up to 2036 have been included.

2.3 MODEL TIME PERIODS

2.3.1. As outlined in the LMVR, the time periods for the highway model are:

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

2.3.2. As outlined in the LMVR, the time periods of the public transport model are:

- An average AM period hour (7:00am to 10:00am)
- An average Inter-peak hour (10:00am to 4:00pm)
- An average PM period hour (4:00pm to 7:00pm)

2.3.3. Although the Variable Demand Model covers periods spanning a full day, the assignment to the supply models has been undertaken in smaller but consistent time periods. The time periods are consistent with a three-hour time period in the Demand Model translated into a peak hour in the Highway assignment model and an average peak period in the Public Transport assignment model. As such, the analysis presented in this report reflects these time periods.

2.4 TREATMENT OF VARIABLE DEMAND

2.4.1. COMET includes a variable demand model, which has been used in the preparation of forecast scenarios. The variable demand model is designed to estimate the effect of changes in transport infrastructure and travel cost upon patterns of demand. This considers changes in overall travel movements and is separate to modelling the way in which travellers respond to changes by choosing different routes. The latter is forecast by the highway and public transport assignment models. Further details of the treatment of variable demand can be found in Chapter 4.

2.5 MODEL STRUCTURE

2.5.1. COMET is a multi-modal model with a Highway Assignment Model developed in SATURN, a Public Transport Model in Emme and Variable Demand Model in Emme. The structure of the forecasting process, including the interaction between the demand models and assignment models is shown in Figure 2-1.

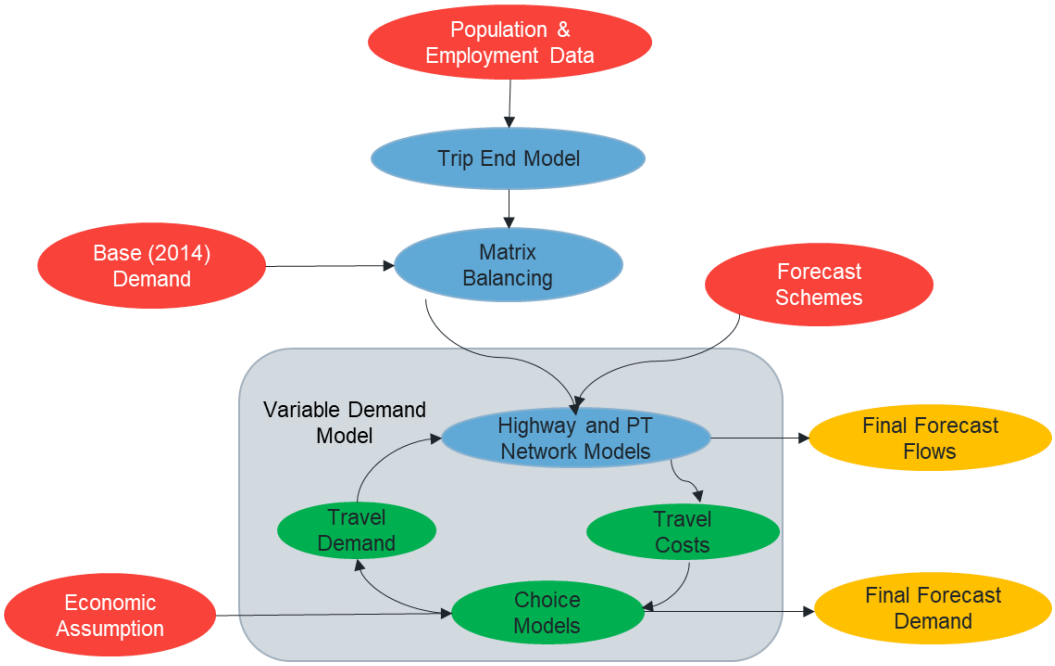


Figure 2-1: Model Structure

3 FORECAST NETWORK DEVELOPMENT

3.1 INTRODUCTION

3.1.1. This chapter will set out the highway and public transport schemes included in the COMET model as part of the NTEM and LP scenarios.

3.1.2. HCC provided WSP with the details of proposed infrastructure schemes - including those already in programmed works as well as more hypothetical schemes identified in strategies such as the Growth and Transport Plans and district Local Plan Infrastructure Delivery Plans. The Local Plan scenario included all schemes regardless of their certainty and a total of 339 schemes were modelled. The schemes are a mixture of highway and public transport schemes.

3.1.3. Some schemes (e.g., cycle schemes, travel planning measures, changes to parking standards) could not be directly modelled and therefore an additional modal shift was simulated in those towns where a concentration of such measures is planned - i.e. the Sustainable Travel Towns (Stevenage, Letchworth and Royston), Watford (where a sustainable transport strategy has been developed) and in the towns along the proposed HERT route (where there will be a focus on connecting walking and cycling schemes) in the Local Plan scenario to capture their effects.

3.1.4. The infrastructure schemes are incorporated into the forecast scenario based on their certainty levels. The NTEM constrained scenario consists of schemes that are categorised as “near certain” and “more than likely” whilst the Local Plan scenario also consists of schemes that are categorised as “reasonably foreseeable” and “hypothetical” as shown in Table 3-1.

3.1.5. Any scheme that features in the NTEM constrained scenario also features in the Local Plan scenario.

Table 3-1: TAG M4 Table A2 Classification of Future Inputs

Probability of the Input	Status	Core Scenario Assumption	NTEM Constrained Scenario	Local Plan scenario
Near certain: **The outcome will happen or there is a high probability this 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 is implemented. Development conditional upon the transport strategy/scheme proceeding. Or, a 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 from 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. Or, a policy aspiration.	These should be excluded from the core scenario but may form part of the alternative scenarios.	✗	✓

3.2 HIGHWAY NETWORK

3.2.1. HCC provided a detailed list of highway schemes that were reviewed and modelled in the COMET model as part of the 2036 NTEM and LP scenarios. The proposed transport schemes were agreed with districts in Spring 2022 and align with the Infrastructure Delivery Plans and Transport Strategies at that time.

3.2.2. The bulk of the schemes were modelled previously in Local Plan Run 6 and where HCC made WSP aware of a change the coding was updated to reflect the updated scheme details. For others sense checking was undertaken to ensure the coding present at a given location matched as far as possible with the latest information provided and light touch checking of the coding was undertaken. New highway schemes were modelled using drawings and maps provided by HCC from the developers to inform the schemes details. Where sufficient detail was not provided by the scheme maps/drawings or other information WSP assumed the coding based on the information available.

3.2.3. As discussed in Chapter 1, the model coding was also reviewed with checks being undertaken where excessive delay was modelled in both base year and forecast models. Issues including incorrect junction configuration or allocation of lane marking or incorrect saturation flow were revised accordingly. In particular, the review also discovered network coding errors at key motorway junctions which included A1(M)(J7, J8, J9), A41/A414 Two Water Road junction, M25 J21a EB/WB and M25 J23 NB.

FORECAST HIGHWAY SCHEMES

3.2.4. The key highway network schemes included in the forecasts are summarised in in Table 3-2. A full scheme list can be found in Appendix A and identifies which scheme was included in the NTEM model and LP model. It is worth reiterating that the LP model will consist of all the NTEM schemes. This list also identifies a handful of schemes included that are outside of Hertfordshire, such as in Essex and Cambridgeshire that have also been modelled, and are detailed in Appendix A.

Table 3-2: Key Modelled Highway Network Schemes in Hertfordshire

District	Description	No of Schemes in NTEM Constrained Scenario	No of Additional Schemes in the Local Plan Scenario
Broxbourne	Includes junction improvements proposed under the A10 MRN schemes and at M25 junction 25 and other measures identified in the Broxbourne Transport Strategy and South East Growth and Transport Plan and Northern Gateway Access Package	8	21
Dacorum	Includes measures identified in the emerging Tring, Berkhamsted and Hemel Hempstead transport strategies including lane relocation for buses on A414Breakspear Way through Hemel and reconfiguration of the A414 / Green Lanes junction.	13	36
East Hertfordshire	includes measures identified in East Herts Local Plan IDP and the East Growth and Transport Plan	20	21
Hertsmere	Includes M25 smart motorway as implemented since 2014, M25 Junction 23 enhancement and measures identified in the South Central Growth and Transport Plan	8	17
North Hertfordshire	Includes A1m Junction 10 Improvement, a mode shift allowance for sustainable travel town measures in Letchworth and Royston and measures identified in the North Central Growth and Transport Plan	6	40
St Albans	Includes mitigation measures for Radlett Rail freight at M25 Junction 21a and Junction 22 to improve junction capacity, signalisation & optimisation of key junctions and speed reduction in town centres and other measures identified in the South Central Growth and Transport Plan	10	27
Stevenage	Includes measures identified in the Stevenage Mobility Strategy and North Central Growth and Transport Plan	10	7
Three Rivers	Includes signalisation and capacity improvements	0	3
Watford	Includes measures identified in the local plan Infrastructure Delivery Plan, speed reduction and bus priority scheme in town centre	5	11
Welwyn Hatfield	Includes measures identified in the South Central Growth and Transport Plan	8	26
Other	Includes M1 Junction 10 improvement, A1M Junction 6-8 widening, sustainable transport corridor schemes in Harlow, Pye Corner bypass and the A14 Cambridge Huntingdon Bypass scheme as well as capacity improvements	15	27

3.2.5. A large number of the schemes are optimisation of existing signal junctions. Following an initial set of assignments signals with significant levels of delay forecast were optimised.

3.2.6. Alongside specifically identified signal schemes listed, other signal junctions where forecast delay was deemed unrealistic were also optimised. Checks of unrealistic delay levels were also conducted at connector locations and where appropriate saturation flows adjusted to provide additional capacity. This was often the consequence of network simplification in the base model (i.e., where multiple roads have been modelled as a single link in the model). These changes have been separated out on specific $INCLUDE files and highlight locations in the network which may warrant a scheme being developed, even if not currently identified.

3.3 PUBLIC TRANSPORT NETWORK

3.3.1. The public transport network was modelled using drawings and maps provided by HCC to inform the schemes details. Coding assumptions from the previous model version were reviewed and updated where necessary.

FORECAST PUBLIC TRANSPORT SCHEMES

3.3.2. The modelled public transport schemes included in the forecast scenarios are shown in Appendix A which identifies which scheme was included in the NTEM and LP scenarios. It is worth reiterating that the LP model will consist of all the NTEM schemes.

3.3.3. Given bus routes operate on a commercial basis, it is acknowledged that the ability to predict changes in the bus network over a 10-20-year period is very limited. Accordingly, the model assumes no changes from the model Base Year other than the schemes identified in Appendix A.

3.3.4. Table 3-3 presents a summary of the public transport schemes modelled in Hertfordshire. It should be noted that given the geographic nature of some of the schemes they may cross multiple districts, although will only be counted in one district in the table. It should be noted that COMET run 7 does not include the proposed HERT mass rapid transit system key details such as the route, mode and frequency are still under review.

Table 3-3: Summary of Public Transport Schemes in Hertfordshire

District	Description	No of Schemes in NTEM Constrained Scenario	No of Additional Schemes in the Local Plan Scenario
Broxbourne	New Bus Services, New Station at Park Plaza and Turnford. Broxbourne to Liverpool Street frequency improvements.	7	1
Dacorum	New Bus and coach services	9	0
East Herts	Rail and bus service improvements	8	0
Hertfordshire/Cross-District	Thameslink frequency improvement and bus service frequency improvement	4	3
Hertsmere	Bus Service Improvements	4	0
Non Hertfordshire	Gilston Area bus network improvements, Cambridge-Oxford Rail Link Removal	5	0

District	Description	No of Schemes in NTEM Constrained Scenario	No of Additional Schemes in the Local Plan Scenario
North Herts	Bus Network Improvements	8	0
St Albans	Abbey Line frequency and bus service frequency improvements	4	0
Stevenage	Bus Network improvements, Hertford Road bus gate measures	1	2
Watford	Bus Priority Measures	3	0

3.4 ROAD TRAFFIC FORECASTS 2018

3.4.1. Road Traffic Forecasts 2018 (RTF 2018) present the latest forecast for traffic demand, congestion and emissions in England and Wales up to 2050. These are produced using the Department for Transport's National Transport Model. Data from the Road Traffic Forecasts is used in COMET to forecast LGV (Light Goods Vehicle) growth, HGV (Heavy Goods Vehicle) growth and buffer speed changes.

3.4.2. In Local Plan 6 and 5, RTF2018 had been used to generate time period specific buffer speeds. These have been used in the NTEM and Local Plan model scenarios and values adopted remains unchanged from the previous Local Plan version which is based on the following key drivers of road traffic, including:

- Population growth;
- Trip rates;
- GDP & Income;
- Costs of driving;
- Young people's driving patterns and licence holding;
- Demand for goods: freight; and
- Technology.

3.5 MODAL SHIFT

3.5.1. Some schemes proposed cannot be directly modelled so the Local Plan scenario includes the simulation of modal shift (from highway to other modes) in selected areas to represent district's proposals to encourage sustainable travel and the impact of emerging Growth and Transport Plan sustainable measures, such as cycle lanes and travel planning / behavioural measures. The areas where this modal shift has been simulated are shown in Figure 3-1. A 5% mode shift was applied in towns (eg those along potential route of the HERT system) to simulate the impact of additional cycling, walking and bus infrastructure. A 10% mode shift was applied in the 3 towns currently in the Sustainable Travel Town programme to simulate the impact of more intense behaviour change, travel planning and other initiatives. Finally, a 15% mode shift was applied in Watford to simulate the implementation of the sustainable transport strategy measures.

3.5.2. The modal shift in the forecast scenario is achieved by applying a factor (in COMET's Variable Demand Model) to the cost of highway trips originating in the selected zones. HCC expressed a desire to achieve a 5% to 15% modal shift target across a particular area, and WSP converted this into COMET zones to apply the factor to through the use of Emme's zone grouping function. Although the resultant models do not meet the desired value for all zones with the achieved reduction in car trips generally being lower (generally in the region of 3-7% depending on the exact location, with higher percentage shifts observed in those areas where 10-15% was applied) compared to a scenario without the shift applied, it demonstrates that by raising the cost of undertaking journeys by car trips will be carried out by alternative means (i.e. public transport or sustainable travel) or suppressed.

3.5.3. The approach undertaken for the modal shift remains the same as the previous Local Plan version where the modelled modal shift is not a result of COMET's Variable Demand Model representing behavioural change; rather, it is the result of a parameter adjustment that is currently not based on any specific interventions to the transport network. As such, it is not the recommended approach to modelling modal shift in a multi modal model, as there is no infrastructure coded to underpin such a behaviour change. Once more specific scheme assumptions regarding the proposed sustainable travel initiatives are known, these should be coded into COMET as other forecast schemes already are, such that in future runs this mechanism can be removed.

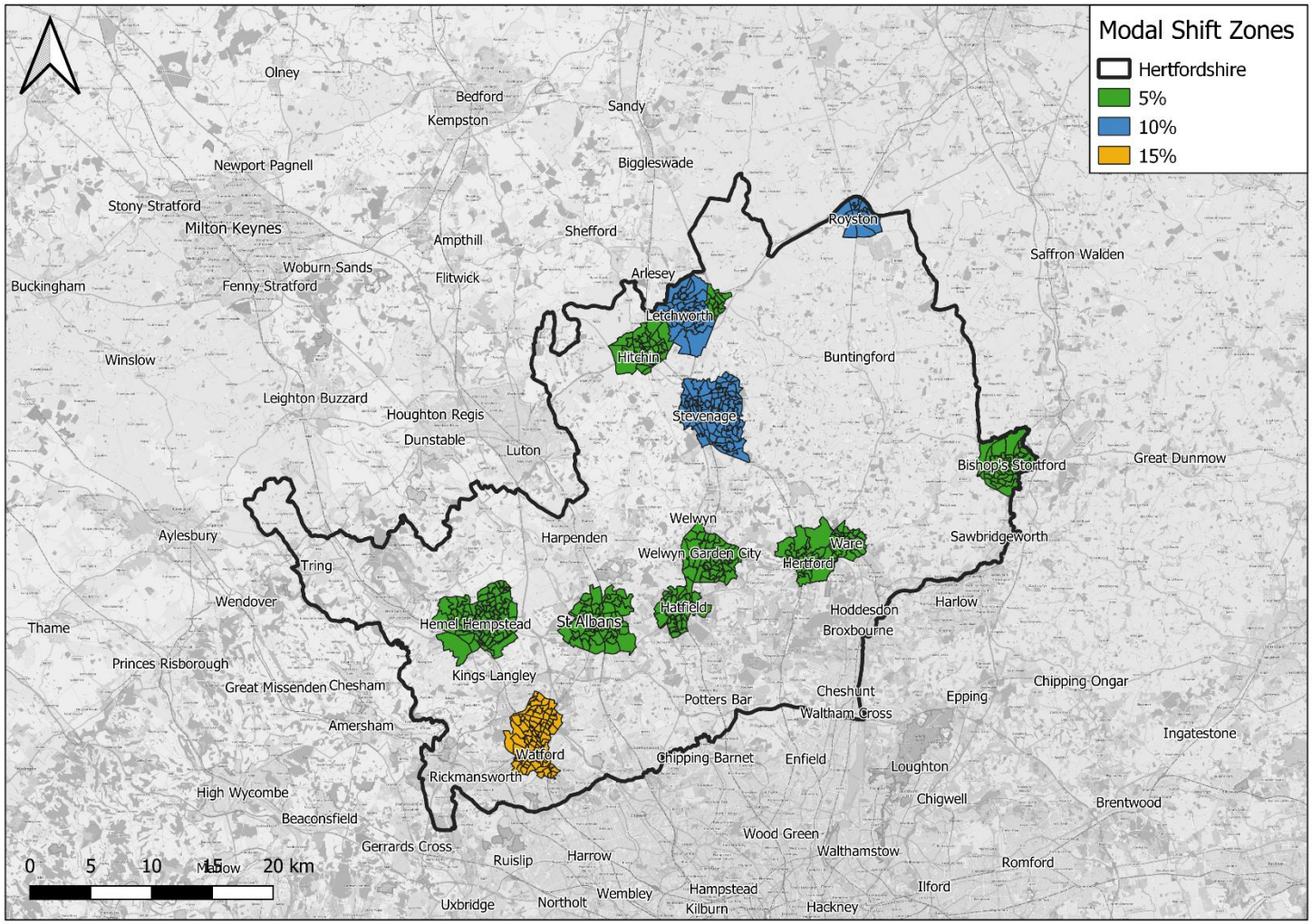


Figure 3-1: Modal Shift Zones - Local Plan Scenario only

4 TRIP MATRIX DEVELOPMENT

4.1 OVERVIEW

4.1.1. The forecast trip matrix is an estimation of future trips in the COMET model based on available planning data and growth assumptions for the rest of Great Britain (NTEM v7.2).

4.1.2. The COMET Trip End model is used to forecast future trip ends, i.e., total productions and attractions for each model zone. These trip ends are used to build a reference matrix for the forecast year (2036). The reference matrix is then adjusted based on the forecast Highway and Public Transport assignments through the VDM, which further adjusts demand to take into account the changes in transport infrastructure, travel times and costs. The resulting matrices constitute the forecast trip matrices.

4.2 COMET TRIP END MODEL

4.2.1. A Trip End model has been built specifically for COMET as part of the COMET Base Year (2014) development. The COMET Trip End model is based on DfT's CTripEnd software package. The software creates trip end estimates based on NTEM planning data (v7.2) combined with a number of metrics based on population, car ownership and employment. It consists of a database of population/employment data and an executable file that runs a series of processes to create final trip end estimates for the desired model year, broken down by mode, time of day and demand segment. The exact version of themodel used in Local Plan Run 5 was unavailable for use by WSP, so WSP have prepared their own version which is Local Plan Run 6. This section sets out the process and assumptions undertaken.

COMET TRIP END MODEL SETUP

4.2.2. The CTripEnd database defaults to MSOA level zoning in England and Wales and Intermediate zones in Scotland. The following tables require updating for each COMET model zone:

- DefZone
- IXIPop (population)
- IXICarOwn (Car ownership)
- IXIe (households and employment)
- IXIk (employment density and types)

4.2.3. In the base year scenario, for the study area, 2011 census population at output area level has been used to split MSOA to zones for IXIPop and IXICarOwn. 2011 workplace population at output are level has been used to split zones for IXIe and IXIk. Outside of this study area, model zones either match MSOA or are aggregations of MSOA – for these external areas, there is no splitting factors required, rather the MSOA outputs from CTripEnd are aggregated up to model zone.

4.2.4. CTripEnd requires an area type to be defined for each zone – these are a list of National Travel Survey land use types and are important in determining trip rates in that zone. CTripEnd's default MSOA level zone system allows each zone to have its own land use area type. These are adhered to as closely as possible, but for external areas, they are classed as urban (NTS area type 4 or 5) for small zones which predominantly consist of urban areas, and rural (NTS area type 8) for large external areas not materially related to the Study Area (such as the North West or North East).

4.2.5. For IXIPop, 2014 Mid-Year Population estimates were used to uplift all population categories from 2011 to 2014[2]. Households (within table IXIe) and car ownership were also updated using the same growth estimates. TEMPro growth in commute and business trips from NTEM 7.2 were used to uplift Jobs in table IXIE.

4.2.6. CTripEnd attempts to balance total trips according to user defined 'balancing areas'. The spatial definition of balancing areas helps to maintain a maximum number of trip ends that can be spread across one area. The CTripEnd database by default contains 46 balancing areas, geographically consistent across Great Britain. As such the default option for these balancing areas is quite geographically broad relative to the size of the study area. More detailed balancing areas have therefore been created in the CTripEnd database to ensure suitable detail in and around the Study Area. The county of Hertfordshire acts as one balancing area, with additional balancing areas in the surrounding counties commensurate to the increasingly disaggregate zone size. For example, Cambridgeshire is split into two balancing areas because the southern zones are smaller than northern zones.

4.2.7. Originally in the replication of the base year, 24 balancing areas were chosen. This was updated as part of the 2036 forecast runs to better manage a realistic spread of trips outside of Hertfordshire. This resulted in a total of 32 balancing areas. Figure 4-2 below illustrates model zones (coloured according to balancing area definition) plotted with Local Authority District.

[2] Mid Year Estimates from Office for National Statistics (ONS) info https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/datasets/populationestimatesforukenglandandwalesscotlandandnorthernireland

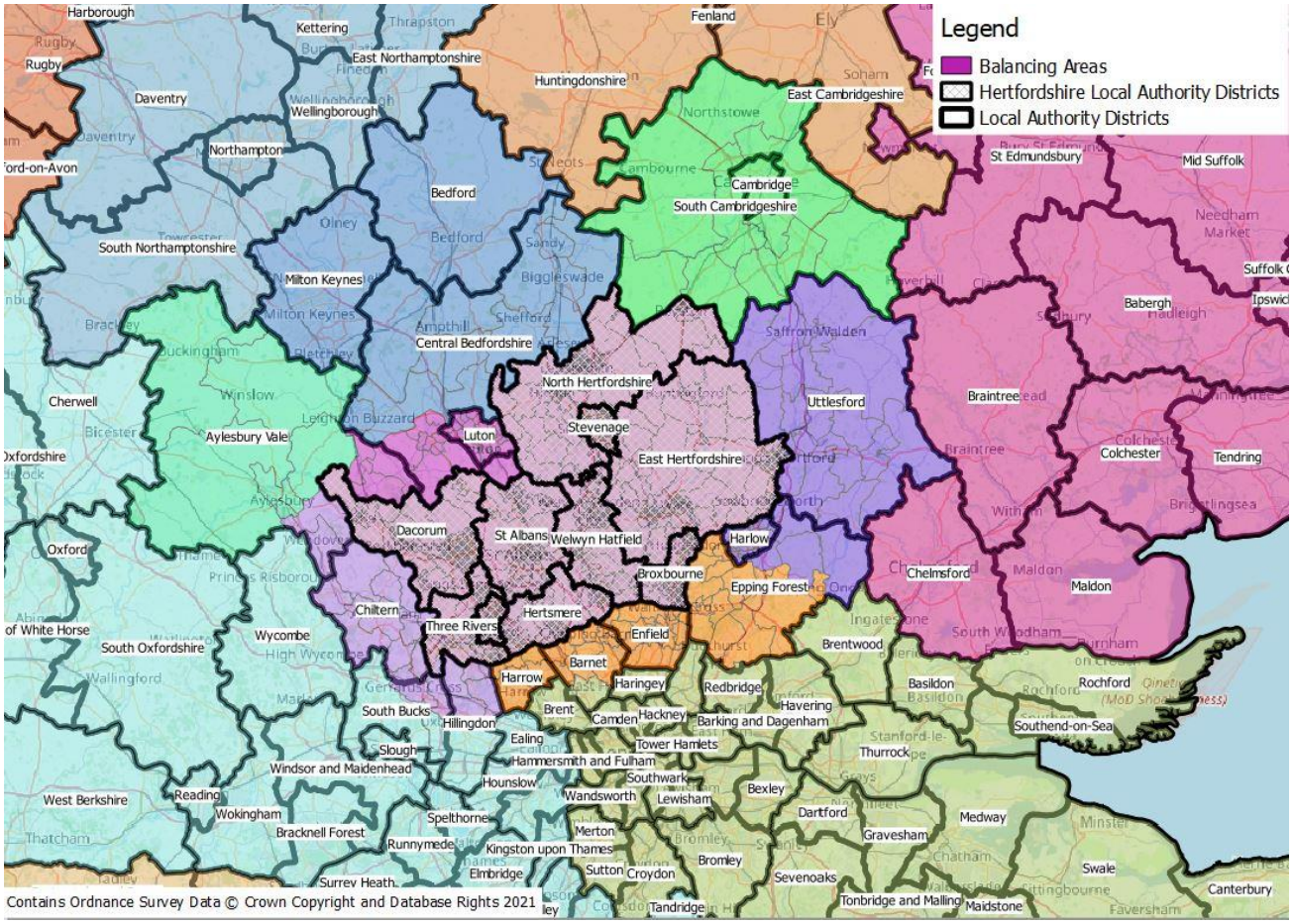


Figure 4-1: Balancing Areas

4.2.8. Table 4-1 to Table 4-4 provide context as to the categories of car ownership, employment, population, and demand segments used within the CTripEnd process.

Table 4-1: NTEM Car Ownership Categories

Category (CTripEnd reference)	Description
HHT1	Adults in 1 adult household with no car
HHT2	Adults in 1 adult household with one or more cars
HHT3	Adults in 2 adult household with no car
HHT4	Adults in 2 adult household with one car
HHT5	Adults in 2 adult household with two or more cars
HHT6	Adults in 3+ adult household with no car
HHT7	Adults in 3+ adult household with one car
HHT8	Adults in 3+ adult household with two or more cars
S1	Children (0-15) in 1 adult household with no car
S2	Children (0-15) in 1 adult household with one or more cars
S3	Children (0-15) in 2 adult household with no car
S4	Children (0-15) in 2 adult household with one car
S5	Children (0-15) in 2 adult household with two or more cars
S6	Children (0-15) in 3+ adult household with no car
S7	Children (0-15) in 3+ adult household with one car
S8	Children (0-15) in 3+ adult household with two or more cars

Table 4-2: NTEM Employment Categories

Category
Primary and Secondary School Employment
High Education employment
Adult Education employment
Hotels, campsites etc
Retail trade
Health / medical employment
Services business & other, equipment rental, repairs)
Industry, construction and transport
Restaurants and bars
Recreation and sport
Agriculture and fishing
Business
Holiday accommodation and 2nd residences

Table 4-3: NTEM Population Categories

Gender	Age
Female	Age 0 to 15
	Age 16 to 29
	Age 30 to 44
	Age 45 to 64
	Age 65 to 74
	Age 75 to 79
	Age 80 to 84
	Age 85 plus
Male	Age 0 to 15
	Age 16 to 29
	Age 30 to 44
	Age 45 to 64
	Age 65 to 74
	Age 75 to 79
	Age 80 to 84
	Age 85 plus

Table 4-4: Demand Segment Categories

Purpose Index (CTripEnd reference)	Description
1	HB Work
2	HB Employers Business
3	HB Education
4	HB Shopping
5	HB Personal Business
6	HB Recreation/Social
7	HB Visiting friends and relatives
8	HB Holiday / Day trip
11	NHB Work
12	NHB Employers Business
13	NHB Education
14	NHB Shopping
15	NHB Personal Business
16	NHB Recreation / Social
18	NHB Holiday / Day Trip

Table 4-5: Mode Definition

Mode	Description	Matrix Mode
1	Walk	Active
2	Cycle	Active
3	Car driver	Highway
4	Car passenger	Highway
5	Bus	PT
6	Rai / Underground	PT

COMET TRIP END MODEL FORECAST UPDATE

4.2.9. Household and Jobs estimates (within table IXIe in the CTripEnd database) for forecast years have been directly inputted as 2014 values plus estimates for each scenario (NTEM constrained or Local Plan) (see section 4.3) for each zone. Population and car ownership (tables IXIPop and IXICarOwn) have been updated to reflect the distribution of households and jobs across zones. Employment density (IXIk) has similarly been updated to reflect the distribution of jobs.

4.2.10. Population and car ownership are scaled up to 2036 using TEMPro planning data (NTEM 7.2) estimates from 2011 to 2036. TEMPro growth is available at 5-year intervals, from 2011 onwards,

hence 2036 is directly measured as growth from 2011 from TEMPro. For external zones in the COMET with no explicit developments, households (along with population and car ownership) are also scaled up from 2011 to 2036 using the same TEMPro growth factors, and jobs are equivalently uplifted using TEMPro planning data growth estimates in jobs.

4.2.11. In the COMET model, large housing and employment sites are modelled in their own development zone, outlined in more detail in Section 4.4 are contained within their own specific model zones. Some of these contain specifically residential or commercial developments, and as such contain only households or jobs. An assumption is adopted in the CTripEnd development that residential areas with only households would contain only productions, and areas with only jobs would contain only attractions. Non-home-based trips however are still permissible between any zone.

4.3 PLANNING DATA

4.3.1. The planning data was provided by the districts via HCC in Spring 2022 and this includes a detailed list of housing and employment growth per COMET zone.

4.3.2. As with the infrastructure schemes, the housing and employment sites are incorporated into the forecast scenario based on their Certainty levels. This includes growth categorised according to TAG definitions as “near certain”, “more than likely”, “reasonably foreseeable”, and “hypothetical”.

4.3.3. The NTEM constrained scenario consists of planning data that are categorised as “near certain” and “more than likely” whilst the Local Plan scenario in addition also consists of planning data that are categorised as “reasonably foreseeable” and “hypothetical” as shown in Table 3-1.

NTEM CONSTRAINED SCENARIO

4.3.4. TAG requires that modelling in business cases for transport schemes applying for national funding is constrained to NTEM. To support forthcoming business case projects this scenario has been developed. The NTEM constrained scenario consists of planned local developments that were provided by HCC as well as an uplift or constraint applied to ensure the overall quantum of development matches that provided by NTEM.

4.3.5. The NTEM constrained scenario is constrained to the County Wide totals of 88,700 households and 57,339 jobs. The constraint has been applied at a county level to preserve, as far as possible, the distribution of new development sites (both housing and employment) across the county. There are some districts where existing planning commitments already exceed the level in NTEM, and the method used reflects this reality.

4.3.6. In the NTEM constrained scenario the impact of negative houses or jobs (i.e., demolitions or conversions from office to residential under Permitted Development Rights) on the forecasted uplift is ignored and only additive development is considered (positive houses and jobs).

HOUSING DATA WITHIN HERTFORDSHIRE

4.3.7. For the NTEM constrained scenario the housing data provided by HCC includes developments built since 2014, and those in the planning system (based on data provided from the HCC Smart planning portal). To derive the overall scenario a constraint or uplift is applied to the planning data (developments built since 2014 and permissions) to reach the NTEM 7.2 projection.

4.3.8. This data from HCC has been filtered to leave just positive housing development, i.e., ignoring negative housing development (demolitions), to inform the allocation of uplift. The positive housing

data provided by HCC is shown in Table 4-6 and is accompanied by a comparison with NTEM v7.2 (central government) housing projections.

4.3.9. The difference between the positive housing figure and the NTEM projection shows a shortfall of 30,821 homes across the county. Watford is the only district where planning data exceeds NTEM projections. The 30,821 homes are applied to the remaining 9 districts based on the proportion of positive houses from the HCC housing data these districts account for. This leads to a set of uplifts which are applied to the HCC planning data to provide the outturn numbers that are modelled. The surplus of homes will be distributed across zones with committed development, this mimics the agglomeration effects of housing and instances where a developer submits an amendment to a planning permission to add more houses than previously allowed.

Table 4-6: Housing Growth Assumptions in Hertfordshire districts (2014-2036)

Districts	District NTEM 7.2 (2014 – 2036)	Planning data (Positive housing) (2014 – 2036)	Difference between NTEM and positive housing	Uplifts to be applied	Outturn numbers
Broxbourne	6,311	5,699	612	2,335	8,034
Dacorum	10,719	7,123	3,596	3,966	11,089
East Hertfordshire	13,856	11,486	2,370	5,126	16,612
Hertsmere	5,489	4,069	1,420	2,031	6,100
North Hertfordshire	17,716	4,439	13,277	6,554	10,993
St Albans	5,075	4,665	410	1,878	6,543
Stevenage	10,675	3,125	7,550	3,950	7,075
Three Rivers	3,617	3,169	448	1,138	4,507
Watford	5,392	7,630	-2,238	0	7,630
Welwyn Hatfield	9,849	6,474	3,375	3,644	10,118
Hertfordshire (Total)	**88,700**	**57,879**	**30,821**	**30,821**	**88,700**

4.3.10. The data is provided spatially by model zone in Figure 4-2. It should be noted that the zone size outside of Hertfordshire increases and as such housing growth shown in these zones is at a much more aggregate basis than zones inside the county boundary.

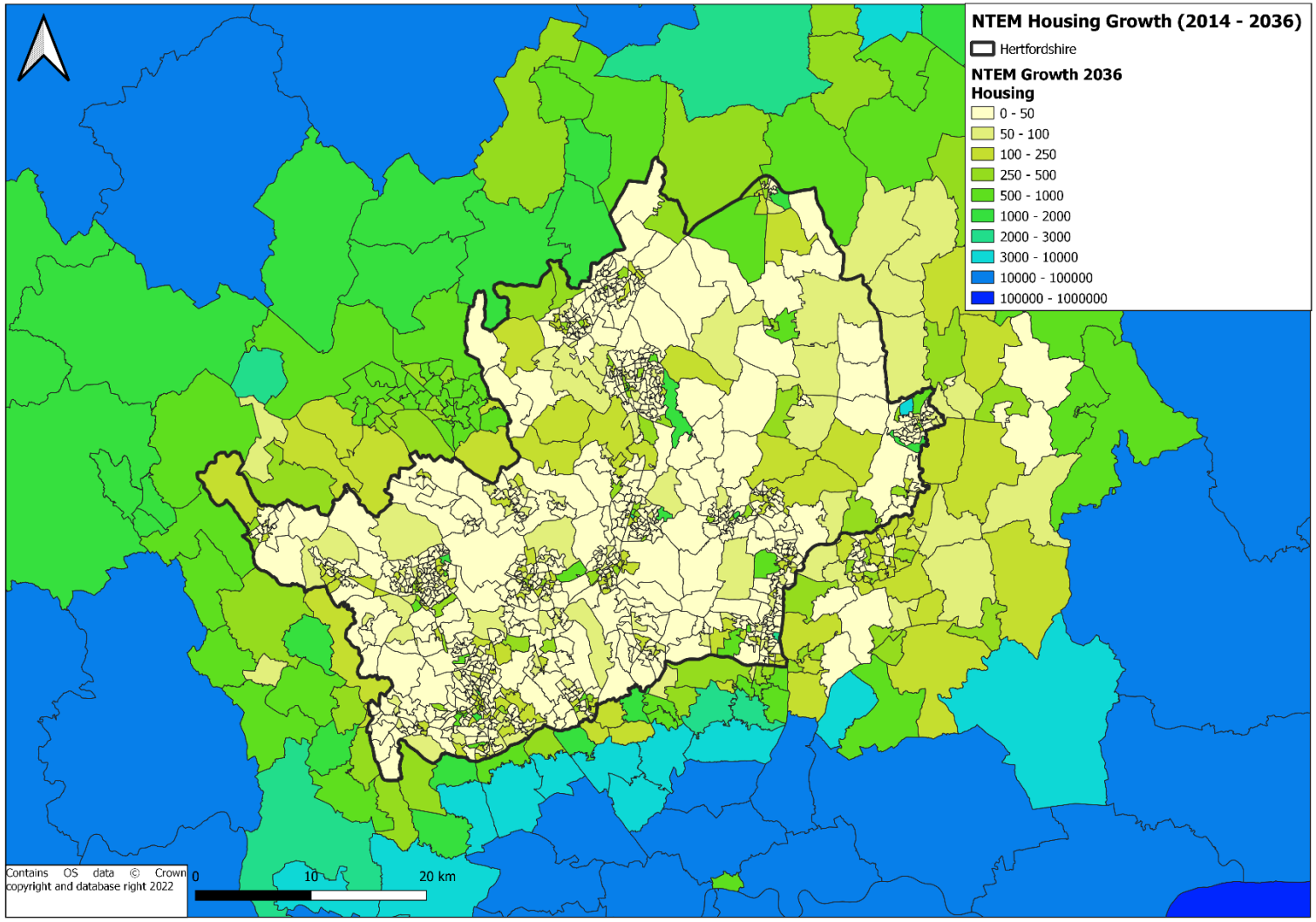


Figure 4-2: Housing Growth between 2014 and 2036 by COMET model zone (NTEM Constrained Scenario)

EMPLOYMENT DATA WITHIN HERTFORDSHIRE

4.3.11. Employment data provided by HCC (i.e., those schemes that are built or are in the planning system) is shown in Table 4-7 and is accompanied by a comparison with NTEM v7.2 projections. The data is shown spatially by model zone in Figure 4-3. Overall, there is assumed to be 57,339 jobs in the NTEM constrained scenario, however 57,517 jobs are accounted for within HCC planning data as positive jobs, i.e., those that are not negative jobs (demolitions or conversions to residential). To keep the modelled job numbers in line with NTEM constraints, jobs have been removed from districts which have positive jobs greater than those predicted by NTEM. Jobs have been removed from these districts in proportion with their NTEM predicted jobs.

Table 4-7: Employment Growth Assumptions in Hertfordshire (2014 – 2036)

Districts	District NTEM 7.2 Jobs (2014 – 2036)	Planning data (Positive jobs) (2014 – 2036)	Difference between NTEM and positive jobs	Changes to be applied	Outturn numbers
Broxbourne	4,186	9,285	-5,099	-29	9,257
Dacorum	6,994	4,581	2,412	0	4,581
East Hertfordshire	6,257	5,009	1,248	0	5,009
Hertsmere	4,832	3,139	1,693	0	3,139
North Hertfordshire	6,117	2,305	3,812	0	2,305
St Albans	6,807	7,302	-495	-47	7,255
Stevenage	5,005	6,620	-1,615	-34	6,586
Three Rivers	3,684	3,762	-78	-25	3,737
Watford	6,253	11,723	-5,470	-43	11,680
Welwyn Hatfield	7,204	3,792	3,413	0	3,792
Hertfordshire (Totals)	**57,339**	**57,517**	**-178**	**-178**	**57,339**

4.3.12. A similar method has been used as with housing. The difference between NTEM projection and the planning data is calculated. Broxbourne, St Albans, Stevenage, Three Rivers and Watford all have a planning data total greater than the NTEM projection. But the projections provided by HCC this time are much closer to NTEM as seen in Table 4-7, which shows a total of 178 jobs needed to be removed from the planning data totals to match NTEM projections. The reductions in jobs are distributed proportionally across districts which currently have greater completions and permissions than the NTEM numbers – this will help preserve, as far as possible, the distribution of new jobs across the county. Within these districts the removals will be applied across all zones for the districts where the planning data is higher than NTEM and this will be based on proportions taken from the CTripEnd 2014 baseline. This spreads jobs across the model rather than agglomerating in particular locations and is in line with evidence seen by HCC about job creation in Hertfordshire.

4.3.13. Projected conversions/demolitions which involve the change or loss of a certain land use type have been taken into consideration during the employment data collation process. This reduces the risk of double counting job sites.

4.3.14. The data also includes permissions for conversion of employment space into residential use, the incidence of which is significant in some areas and shows up as an overall loss in job numbers. The figures below help identify there are targeted areas within Hertfordshire where employment is planned.

4.3.15. HCC provides a number of jobs per site derived from the land use classification provided by the planning system / Districts. The conversion process is based on employment densities as defined in the Employment Densities Guide (November 2015 – Homes and Communities Agency). It should be noted that this particular edition has been withdrawn by the HCA but yet to be replaced. The employment densities used to calculate jobs are listed in Table 4-8.

Table 4-8: Employment Densities used for Calculation of jobs (Provided by HCC)

Land Use Class	Area per FTE
A1 (Retail)	18
A2 (Finance & Professional Services)	16
A3 (Restaurants & Cafes)	18
A4 (Drinking Establishments)	46
A5 (Hot Food Takeaways)	59
B1(a) (Offices)	10
B1(b) (Light Industrial)	50
B1(c) (Light Industrial)	47
B1 (average)	35.7
B2 (Industrial & Manufacturing)	36
B8 (Storage & Distribution)	81
C1 (Hotels)	100
C2 (Residential institutions)	100
D1 (Non-residential institutions)	36
D2 (Assembly and leisure)	75
Sui Generis	92

4.3.16. The data is provided spatially by model zone in Figure 4-3.

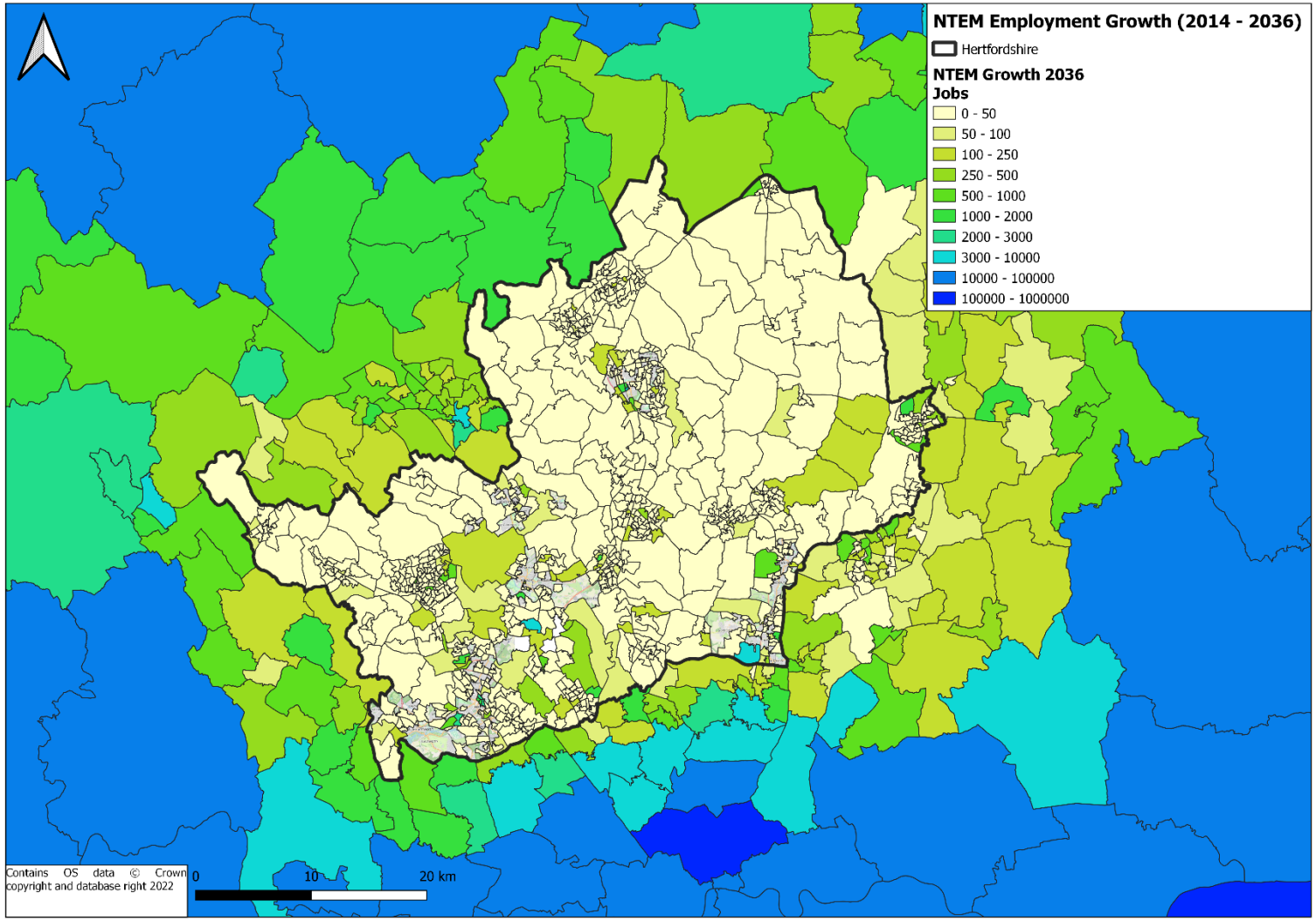


Figure 4-3: Employment Growth between 2014 and 2036 by COMET Model Zone (NTEM Constrained Scenario)

PLANNING DATA OUTSIDE HERTFORDSHIRE

4.3.17. Outside of Hertfordshire NTEM 7.2 levels of growth has been applied across Great Britain in LP7 and LP6, whilst in previous runs specific planning data had been applied to Central Bedfordshire, Luton, Buckinghamshire (all districts), part of Essex (i.e., Epping Forest, Harlow, and Uttlesford), part of Cambridgeshire (i.e., South Cambs and Cambridge) and three boroughs of Outer London (Barnet, Enfield and Hillingdon), with NTEM 7.2 projections for the rest of Great Britain. This approach has been adopted so that areas outside of Hertfordshire are consistent with areas in Hertfordshire for the NTEM constrained scenario and to make it easier to compare the impacts of Hertfordshire's Local Plan Scenario against the NTEM constrained scenario. This also ensured the consistency of the planning data provided, given it was taken at a particular point in time, and ensures compliance with TAG for business cases.

4.3.18. Table 4-9 and Table 4-10 provides the NTEM 7.2 projections against the data used in the LP7 run for housing and employment respectively. The level of growth applied outside Hertfordshire is the same as the NTEM 7.2 projection.

Table 4-9: Housing Growth Assumptions in Selected Neighbouring Districts (2014-2036)

Districts	NTEM 7.2 dwellings (2014 – 2036)	Planning data - dwellings (2014 - 2036)	Difference
Essex (Epping Forest, Harlow, Uttlesford)	19,861	19,861	0
Central Bedfordshire	33,399	33,399	0
Luton	5,828	5,828	0
Buckinghamshire (Aylesbury Vale, Chiltern, Wycombe, South Bucks)	53,071	53,071	0
Outer London (Barnet, Enfield, Hillingdon)	69,863	69,863	0
Cambridgeshire (Cambridge, South Cambridgeshire)	42,272	42,272	0
Totals	**224,294**	**224,294**	**0**

Table 4-10: Employment Growth Assumptions in Selected Neighbouring Districts (2014-2036)

Districts	NTEM 7.2 Jobs (2014 – 2036)	Planning data - obs (2014 – 2036)	Difference
Essex (Epping Forest, Harlow, Uttlesford)	13,873	13,873	0
Central Bedfordshire	11,672	11,672	0
Luton	10,409	10,409	0
Buckinghamshire (Aylesbury Vale, Chiltern, Wycombe, South Bucks)	26,628	26,628	0
Outer London (Barnet, Enfield, Hillingdon)	51,194	51,194	0
Cambridgeshire (Cambridge, South Cambridgeshire)	18,505	18,505	0
Totals	132,280	132,280	**0**

DEVELOPMENT ZONES

4.3.19. In the model there are numerous development zones, explicitly modelled zones for sites of 300 or more houses and 500 or more jobs.

4.3.20. The NTEM uplift applied (for both houses and jobs) that are proportioned to development zones will be donated to the parent zone (the spatial geographic area that the development zone resides). This will preserve the 'purity' of development zones – in future model tests / analysis etc it will be possible to attribute all trips from the development zone with the original development application or site allocation.

LOCAL PLAN SCENARIO

4.3.21. The Local Plan scenario models all development irrespective of certainty level and incorporates 154,091 housing and 64,268 jobs. This includes the housing and employment growth from the NTEM constrained scenario (developments built since 2014 and those in the planning system) as well as local plan allocations and windfall allowances.

4.3.22. The Local Plan scenario has 64,268 jobs, which is approximately 6,929 higher than the NTEM projection. The higher Local Plan employment sites projection is a result of the inclusion of windfall growth in Dacorum. Dacorum is the only district in Hertfordshire with windfall jobs growth, which accounts for 13,700 additional jobs. Windfall growth which is defined as growth not attached to any specific development sites.

4.3.23. In the Local Plan scenario, negative jobs (employment loss due to demolitions or conversions to residential) were taken into consideration as well as positive jobs. This is a key distinction from the consideration of jobs in the NTEM constrained scenario. Checks were undertaken to ensure that the negative jobs (demolitions) did not lead to negative jobs in the outturn numbers when the jobs were removed from the baseline. The windfall growth for jobs was only applied to Dacorum to provide

overall quantum's that are in line with Dacorum's expectations. A new windfall allocation was distributed across the district in the same way as the NTEM uplift was distributed, considering the baseline proportions of jobs rather than job creation zones only. In addition, the windfall growth allocated to a development zone will be donated to the parent zone to preserve the 'purity' of the development zone.

4.3.24. The housing windfall growth was similarly applied but distributed proportionally across all zones and windfall allocated to a development zone was redistributed to its parent zone. Table 4-11 shows the growth assumptions within the Local Plan for the housing and employment growth across each town.

Table 4-11: Housing and Employment growth assumptions in Local Plan Scenario[3] (Built developments, those in the planning system, local plan allocations and windfall allowances)

District	Housing	Jobs
Broxbourne	9,169	7,865
Dacorum	21,531	13,315
East Hertfordshire	21,046	3,007
Hertsmere	14,832	4,752
North Hertfordshire	16,826	3,480
St Albans	14,536	12,129
Stevenage	13,017	4,493
Three Rivers	11,714	5,541
Watford	14,732	3,735
Welwyn Hatfield	16,688	5,950
TOTAL	**154,091**	**64,268**

4.3.25. The data is provided spatially by model zone in Figure 4-4 and Figure 4-5 for housing and employment respectively.

[3] The Local Plan employment assumptions takes into account employment loss due to demolitions or conversions to residential developments.

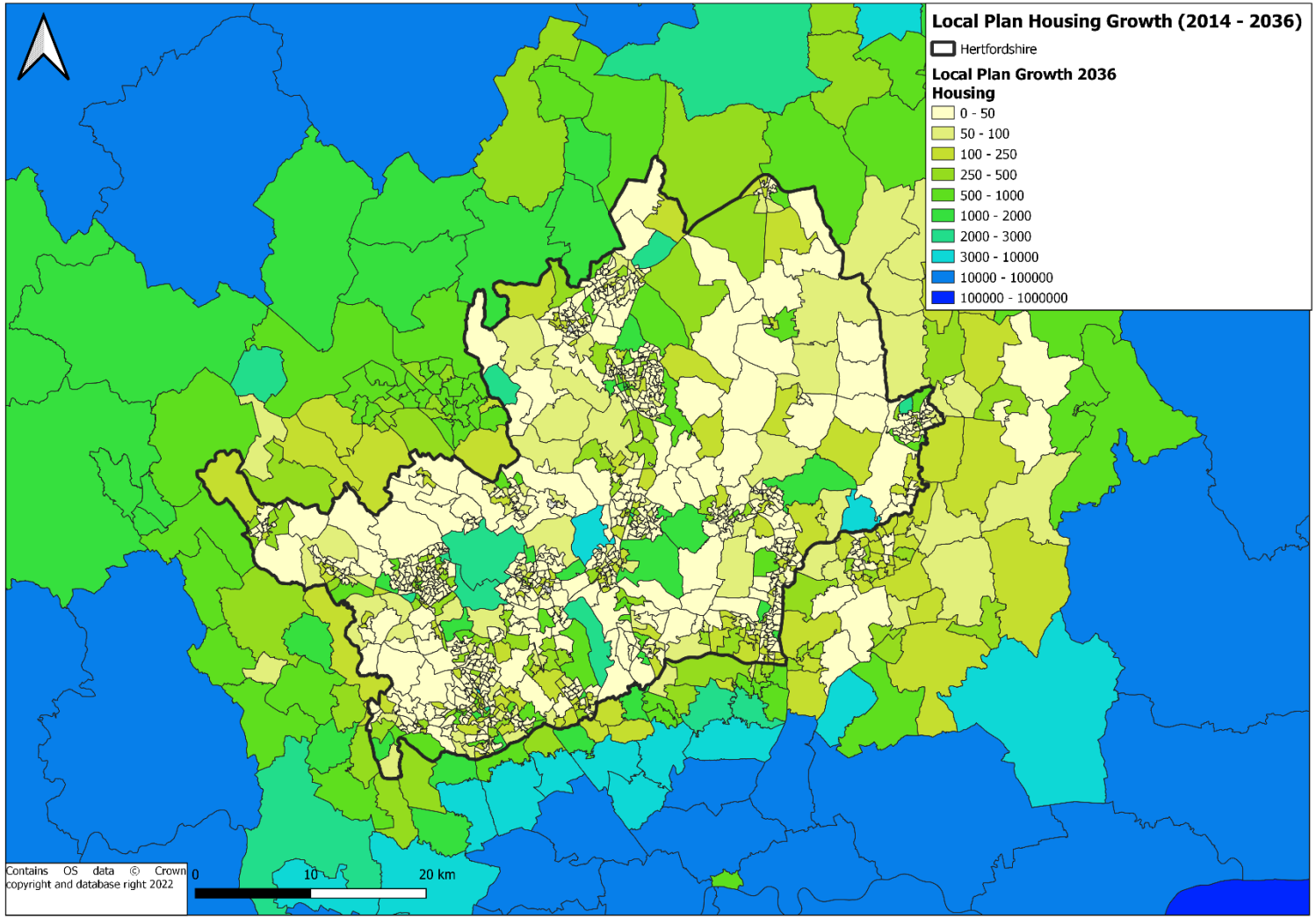


Figure 4-4: Housing Growth between 2014 and 2036 by COMET Model Zone (Local Plan Scenario)

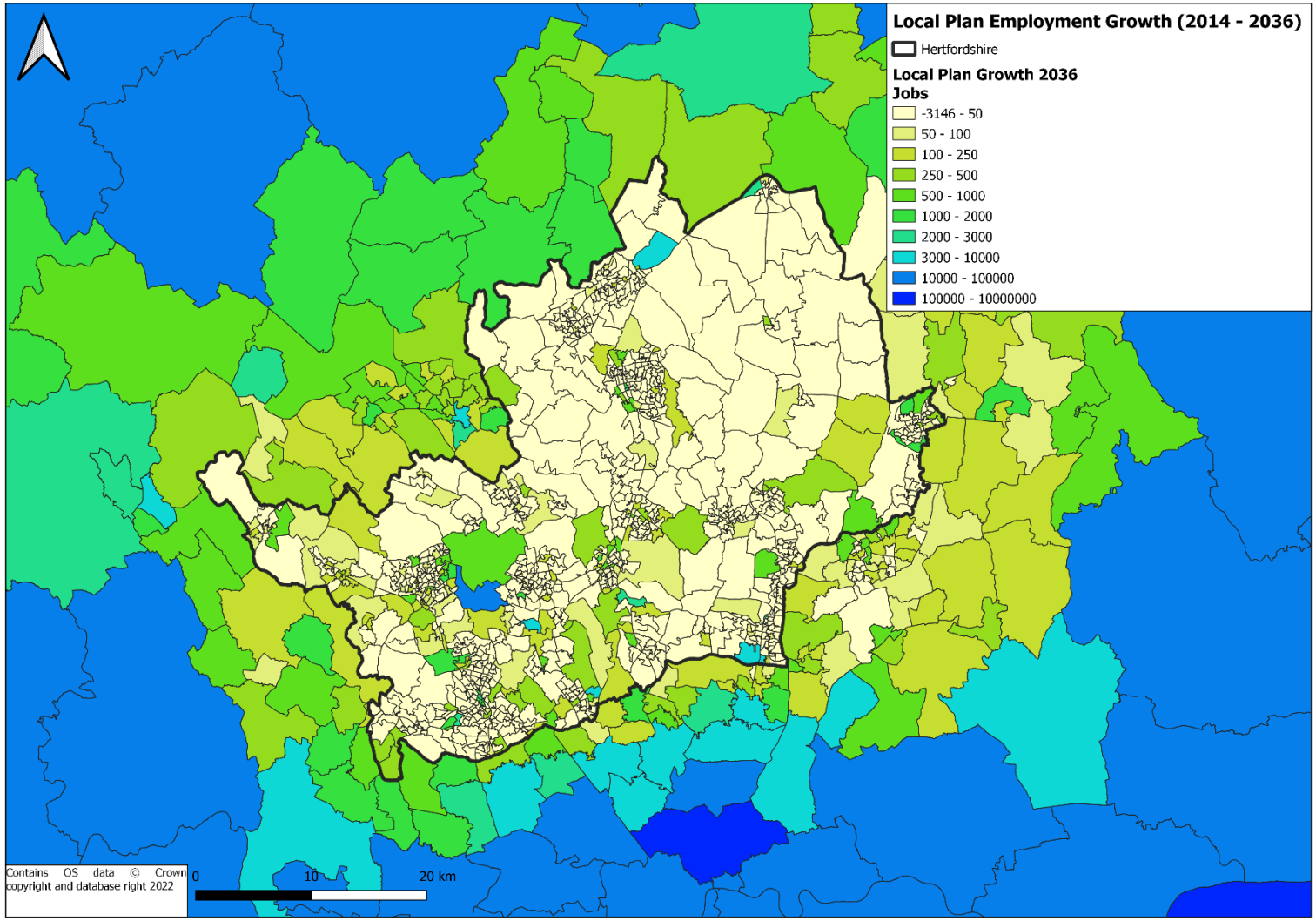


Figure 4-5: Employment Growth between 2014 and 2036 by COMET Model Zone (Local Plan Scenario)

4.4 MODEL DEVELOPMENT ZONES

4.4.1. There are a number of locations within Hertfordshire where significant levels of housing and/or employment growth are anticipated in previously undeveloped areas. The trip patterns of these developments are likely to be different to those of the existing land use, and as such require special consideration in terms of forecast demand estimation and loading points onto the network.

4.4.2. Given there are limited number of development zones that can be loaded onto the network, the development zones were selected on a size criterion for both housing and employment areas. The criteria decided upon by HCC was that development sites with over 300 homes or over 500 jobs were allocated a unique development zone number. These thresholds also align with the threshold required by HCC for a developer to undertake testing within the COMET suite and isolating out all these potential sites should make this process easier.

4.4.3. The development zones shown in are split between schemes within the NTEM constrained scenario and schemes solely in the Local Plan scenario. The NTEM consists of a total of 43 zones, that are split between 20 housing development zones and 23 employment zones. The Local Plan consists of an additional 138 zones that are split between 72 additional housing zones and 29 employment zones and 37 empty zones. Overall, the Local Plan model consists of 181 development zones, although 37 remain empty for future use. The development zones within Hertfordshire are shown in Figure 4-6. A full list of development zone sites can be found in Appendix B.

4.4.4. Since all of these zones are empty in the base model, the demand model treats these differently to other zones in the model where it is possible to apply proportional growth. A set of gravity models, calibrated by mode and purpose based on the distribution of base matrices, exist to estimate the distribution of trips to and from development zones.

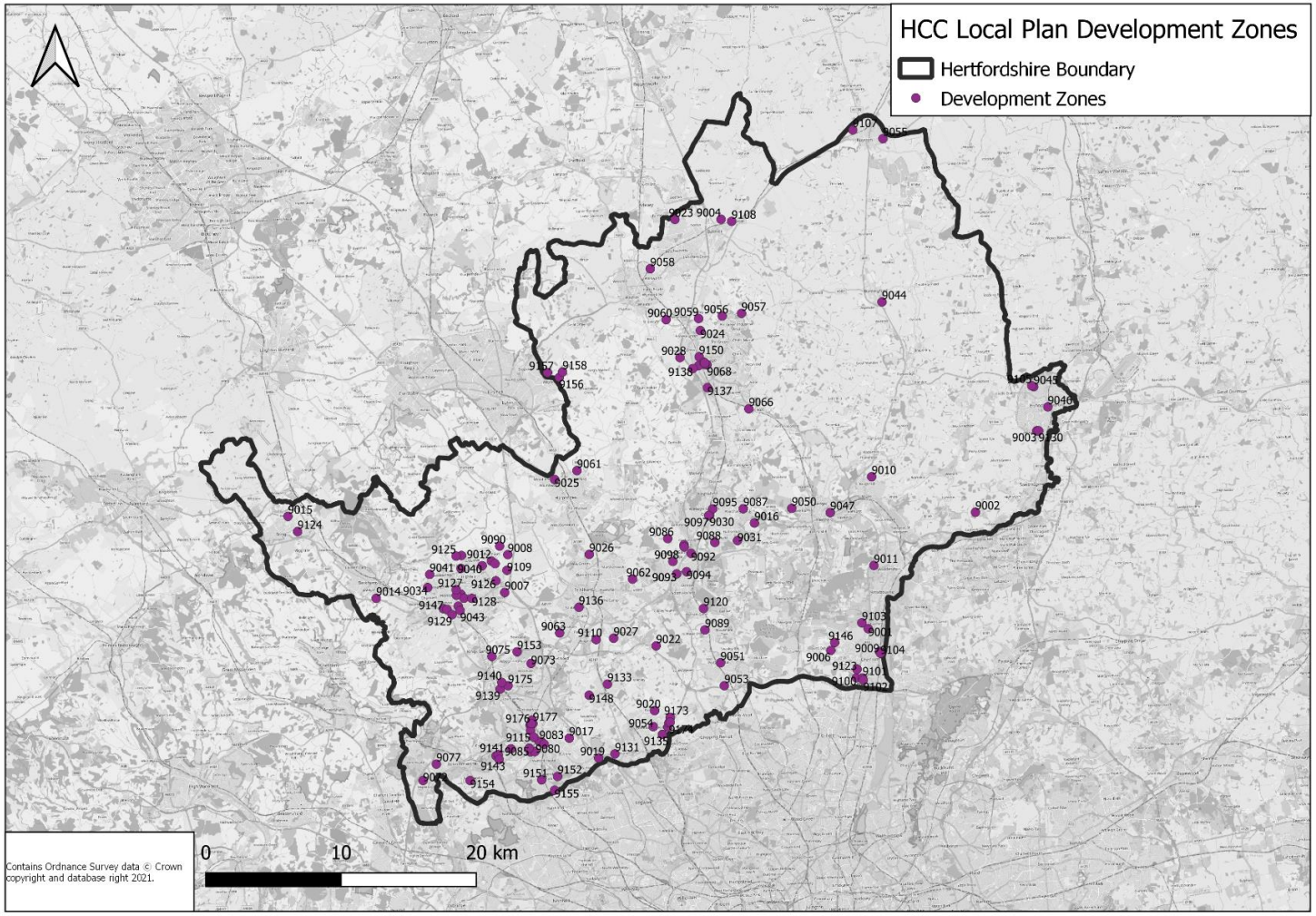


Figure 4-6: Model Development Zones

4.5 VARIABLE DEMAND MODELLING (VDM)

PROCESS

4.5.1. The variable demand process undertaken remains unchanged from version 6 of COMET. That is to say that proportional growth, implied by the trip end model between the 2014 Base Year and 2036 Forecast Year, is applied to the Base Year matrix to create an estimate of forecast demand a 'reference' forecast matrix. A "matrix balancing" approach is used where the reference matrices are controlled to productions and then attractions on an iterative basis until the matrix "balances" for both productions and attractions.

4.5.2. These matrices feed the production of the final forecast matrices by application of the variable demand model to take account of the effect of changes in transport cost over time on traveller behaviour.

4.5.3. The VDM runs iteratively to adjust the forecast matrices taking to account the changes in generalised cost based on the Highway and Public Transport model assignments. Where generalised costs increase (e.g., congestion) arise there will be a reduction in trips, and vice versa. The VDM includes components that adjust mode share based on relative cost changes between modes, adjust time period splits based on relative changes in cost between periods.

4.5.4. As described in section 3.5 the Local Plan scenario also includes an add-on which raises the generalised cost of highway trips to simulate model shift from highway to PT/sustainable modes. This is not used in the NTEM constrained scenario.

CONVERGENCE

4.5.5. Convergence of the VDM is measured that %GAP, the difference between costs along the chosen routes and those along the minimum cost routes, summed across the whole network, and expressed as a percentage of the minimum costs. %GAP provides a measure of the proximity to equilibrium of the assignment. The convergence of the VDM is closely linked to the assignment models. The Public Transport model does not model congestion so there is no convergence to measure. The convergence of the VDM is therefore strongly related to that of the highway assignment model. This will be discussed further in Chapter 5.

4.5.6. %GAP values are presented in Table 4-12:

Table 4-12: VDM Convergence (%GAP)

%GAP	NTEM Constrained Scenario	Local Plan Scenario
Hertfordshire	0.26%	0.16%
Full Model	0.02%	0.02%

4.5.7. TAG M2-1 Section 6.3.8 suggests that "tests indicate that gap values of less than 0.1% can be achieved in many cases, although in more problematic systems this may be nearer to 0.2%." The values presented indicate both scenarios are within guidance, although Hertfordshire specifically, falls just outside the range of guidance in the NTEM constrained scenario. It may be possible to reach guidance values with further work or through increasing the number of iterations, however this could lead increased model run times and it is unlikely the results reported would be materially different.

4.6 ECONOMIC PARAMETERS

4.6.1. The variable demand model uses economic parameters including values of time, fuel prices, etc. to calculate the generalised costs of travel. These vary over time and forecast projections for the majority of these parameters are provided in TAG Nov 2021 v1.17(the latest version available at the time of undertaking the modelling for COMET 7). The forecast values for these parameters are summarised in Table 4-13 alongside the base values and growth factors. Bus and rail fare change assumptions are not provided in TAG but based on recent trends are assumed to grow by 1% per year above inflation.

Table 4-13: Economic Parameter Changes over Time, Fixed 2010 Prices[4]

Values	2014	2036	Change
Value of Time, Commuting (p/min)	17.402	22.423	28.9%
Value of Time, Business (p/min)	25.989	33.488	28.9%
Value of Time, Other (p/min)	7.943	10.234	28.9%
Value of Time, LGV (p/min)	17.139	22.084	28.9%
Value of Time, HGV (p/min)	42.416	54.655	28.9%
Petrol Price – business (p/litre)	99.167	96.469	-2.7%
Diesel Price – business (p/min)	103.520	99.888	-3.5%
Electricity cost	14.465	15.669	8.3%
Petrol Price – Non work (p/litre)	119.000	115.763	-2.7%
Diesel Price – Non work (p/min)	124.224	119.865	-3.5%
Electricity cost	14.465	15.669	8.3%
Petrol Car Efficiency Improvement Factor	1.013	0.693	-31.6%
Diesel Car Efficiency Improvement Factor	1.013	0.743	-26.7%
Electric Car Efficiency Improvement Factor	0.991	0.728	-26.6%
Car Fleet Proportion, Petrol	0.515	0.474	-8.0%
Car Fleet Proportion, Diesel	0.484	0.256	-47.1%
Car Fleet Proportion, Electric	0.001	0.270	32413.4%
Rail Fares	Varied	Varied	27.10%
Bus Fares	Varied	Varied	27.10%
Rail and Bus Fares	Varied	Varied	27.10%
Car Passenger Occupancy	Varied	Varied	None

[4] Source: TAG Databook November 2021 v1.17(except Rail Fares and Bus Fares which both rise at 1% per annum above inflation – in line with previous modelling and government policy for rail, and in line with recent historical trends for bus).

4.7 FORECAST GROWTH RATES

4.7.1. The overall growth in highway and public transport trips from the demand model is summarised in Table 4-14 and Table 4-15 respectively.

Table 4-14: Highway Trip Growth over Time, 24 Hour Person Trips, Hertfordshire Productions only

User Class	2014	2036 NTEM Constrained	2036 Local Plan Scenario	Trip Growth (2014 – 2036 NTEM Constrained)	Trip Growth (2014 – 2036 Local Plan)
Commuting	589,996	610,889	621,640	3.5%	5.4%
HB Business	112,085	114,683	114,009	2.3%	1.7%
HB Other	1,639,276	1,725,960	1,790,250	5.30%	9.2%
NHB Business	61,190	80,522	84,876	31.6%	38.7%
NHB Other	143,879	198,345	209,954	37.9%	45.9%
LGV	251,639	325,014	325,014	29.2%	29.2%
HGV	104,320	104,618	104,618	0.3%	0.3%
All	**2,902,385**	**3,160,031**	**3,250,361**	**8.9%**	**12.0%**

Table 4-15: Public Transport Trip Growth over Time, 24 Hour Person Trips, Hertfordshire Productions only

User Class	2014	2036 NTEM Constrained	2036 Local Plan Scenario	Trip Growth (2014 – 2036 NTEM Constrained)	Trip Growth (2014 – 2036 Local Plan)
Commuting	109,596	123,624	154,015	12.8%	40.5%
HB Business	12,904	14,215	16,150	10.2%	25.15%
HB Other	112,400	136,944	173,622	21.8%	54.47%
NHB Business	4,477	6,033	7,206	34.8%	60.96%
NHB Other	20,237	28,299	35,360	39.8%	74.73%
All	**259,614**	**309,115**	**386,353**	**19.1%**	**48.8%**

4.7.2. Highway commuting trips show an increase of 3.5% between 2014 and 2036 NTEM constrained scenario and a growth of 5.4% between 2014 and 2036 Local Plan scenario.

4.7.3. Non-home-based business and non-home-based other trips present a considerable increase between 32-38% for NTEM, and around 39-46% for Local Plan scenario. The interpeak accounts for the greatest increase in non-home-based trips.

4.7.4. The differences seen in the growth values compared to Local Plan 6 will be, in part, a consequence on the CTripEnd process undertaken.

4.7.5. The high growth in Light Goods Vehicle (LGV) trips relative to Heavy Goods Vehicle (HGV) is consistent with current trends.

4.7.6. Both scenarios show the same level of freight growth as these remain unchanged between the two scenarios and are based on the Local Plan 6 freight growth, albeit with the removal of freight trips from the development zones that were previously defined.

4.7.7. The public transport model shows strong growth across all purposes, although with a different profile of growth compared Local Plan 6, a product of the split across purposes. It should be noted that there is no modelling of crowding within the public transport model, so whilst the highway assignment model experiences increased congestion, and thus increased generalised cost for car travel, this increase is not reflected in public transport, resulting in mode shift.

5 FORECAST ASSIGNMENTS

5.1 HIGHWAY ASSIGNMENT

ASSIGNMENT PARAMETERS

5.1.1. No changes have been made in terms of SATURN assignment options or parameters relative to the base year. For reference, a full list is provided in Appendix D.

5.1.2. It was noted during the running of the model, on the occasion that an error occurred, that NITA is currently set to 30. Atkins advised that this is inefficient and could be lowered to 10, and this would get around the error if it occurred in future. This has not been required to date but is recorded here for reference. They also advised that the version of SATURN 11.4.07H used should be upgraded to the latest version when the opportunity allows given the version currently being used is a few years old and lacking improvements and bug fixes applied in more recent versions. To maintain consistency with previous forecast, COMET 7 model adopts SATURN 11.4.07H.

ASSIGNMENT CONVERGENCE

5.1.3. The convergence of the highway assignment has been measured according to standards set out in Table 5-1 (as stated in TAG M3.1 section 3.3.5). When a model does not achieve convergence criteria, it may produce large variations between iterations, “noise”, leading to unreliable results.

5.1.4. Every effort was made to optimise signals and reduce delays wherever possible, however this had to be considered alongside creating a stable, reliable forecast model scenario which converged in all time periods.

5.1.5. In SATURN terms, “percentage of links with flow change (P) <1%” is referred to as %FLOWS.

Table 5-1: TAG Convergence Criteria (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 0.1% (SUE only)

5.1.6. For reference, the 2014 Base Year highway assignment convergence values, as also outlined in the *LMVR Addendum* prepared, are given in Table 5-2.

Table 5-2: Base Year Convergence Values (Last Six Iterations)

Iteration	Delta	%Flow	%GAP
AM Peak			
22	0.0019	97.5	0.0030
23	0.0015	97.8	0.0030
24	0.0014	98.2	0.0024
25	0.0016	98.5	0.0038
26	0.0014	98.1	0.0025
27	0.0014	98.5	0.0025
Interpeak			
18	0.0008	98.3	0.0022
19	0.0008	97.0	0.0013
20	0.0007	98.2	0.0011
21	0.0007	99.0	0.0012
22	0.0007	98.3	0.0009
23	0.0004	98.9	0.0008
PM Peak			
28	0.0037	98.1	0.0083
29	0.0074	97.3	0.0044
30	0.0040	98.5	0.0046
31	0.0038	98.6	0.0060
32	0.0054	98.3	0.0069
33	0.0054	98.3	0.0073

5.1.7. The 2036 convergence values in terms of %Flows and %GAP are presented in Table 5-3 and show that both indicators meet TAG criteria in all time periods and in both the NTEM constrained scenario and the Local Plan scenario.

Table 5-3: 2036 Convergence Values (Last Six Iterations)

NTEM Constrained Scenario				Local Plan			
Iteration	Delta	%Flow	%GAP	Iteration	Delta	%Flow	%GAP
AM Peak				AM Peak			
33	0.0037	97.4	0.0069	42	0.0022	98.4	0.0065
34	0.0027	97.9	0.0063	43	0.0027	96.9	0.0043
35	0.0024	98.1	0.0069	44	0.0021	98.1	0.0055
36	0.0028	98.2	0.0058	45	0.0027	98.3	0.0046
37	0.0027	98.2	0.0051	46	0.0023	98.0	0.0044
38	0.0024	98.4	0.0075	47	0.0022	98.1	0.0038
Interpeak				Interpeak			
13	0.0018	98.4	0.0055	14	0.0016	98.2	0.0049
14	0.0025	97.3	0.0034	15	0.0016	97.1	0.0021
15	0.0019	98.5	0.0031	16	0.0015	98.6	0.0020
16	0.0017	98.3	0.0040	17	0.0011	98.6	0.0022
17	0.0014	98.1	0.0031	18	0.0014	98.4	0.0016
18	0.0014	99.0	0.0030	19	0.0010	99.1	0.0027
PM Peak				PM Peak			
59	0.0031	98.6	0.0094	46	0.0036	98.5	0.0110
60	0.0034	97.6	0.0057	47	0.0052	97.0	0.0061
61	0.0033	98.4	0.0053	48	0.0026	98.3	0.0064
62	0.0034	98.6	0.0062	49	0.0026	98.3	0.0054
63	0.0030	98.5	0.0071	50	0.0028	98.5	0.0069
64	0.0026	98.3	0.0043	51	0.0026	98.2	0.0079

5.2 PUBLIC TRANSPORT ASSIGNMENT

ASSIGNMENT PARAMETERS

5.2.1. Other than the modelled schemes, the forecast 2036 public transport assignment is identical to the Base Year. A 1% increase per year in public transport fares and an increase in the passenger value of time in line with the demand model has been applied. The increases in fare and values of time above inflation are applied for both bus and rail travel. This approach is consistent with previous model runs and in line with the TAG criteria.

ASSIGNMENT CONVERGENCE

5.2.2. The public transport model does not model congestion (i.e., in vehicle capacity constraints), and as such there is no convergence to measure.

6 FORECAST RESULTS

6.1 INTRODUCTION

6.1.1. This section provides the results from the NTEM constrained scenario and Local Plan scenario concerning the highway and public transport assignments. Most of the focus is on the Local Plan scenario but key statistics are presented for both scenarios and there are some comparisons between the two scenarios.

6.1.2. The summary sections indicate the differences between the NTEM and the LP scenarios.

6.2 HIGHWAY RESULTS

SIMULATION AREA STATISTICS

6.2.1. This section provides a summary of simulation area statistics concerning the highway assignment. For reference, the 2014 Base Year model values are also given. All values only include the travel within the time period simulated, and do not consider extra time and distance in later periods due to vehicles queued at over-capacity junctions.

6.2.2. The Total Trips Loaded show increases of 14%, 19% and 11% in the AM, IP and PM between the 2014 Base and the 2036 NTEM constrained scenario and increases of 15%, 21% and 12% between 2014 and 2036 Local Plan scenario. These numbers are similar to the previous NTEM and Local Plan 6 scenario.

6.2.3. The percentage increase in travel distance is higher than the percentage increase in trips loaded, in all time periods and across both scenarios. This is indicative of trip lengths increase in the forecast relative to the base year. Equally, the increase in travel time at a greater rate than the distance and total trips loaded which is indicative of higher levels of congestion and delay in the forecast.

6.2.4. In both the NTEM constrained scenario and the Local Plan scenario the increase in over capacity queues is most pronounced in the Interpeak (246% and 360% respectively), and considerably higher than equivalent increases in the AM and PM but this is a product of the higher levels of congestion in AM and PM peaks of the Base model relative to the Interpeak.

6.2.5. Table 6-1 show the assignment statistics for all user classes combined for the following metrics:

- Transient Queues (PCU Hrs)
- Over capacity queues (PCU Hrs)
- Link Cruise Time (PCU Hrs)
- Total Travel Time (PCU Hrs)
- Total Travel Distance (PCU kms)
- Average speed (kph)
- Total Trips Loaded (PCUs)

6.2.6. §8.4.1 of the SATURN manual outlines the difference between “transient” or “under capacity” delays and “queuing” or “over capacity” delays. It states that “at traffic signals, the transient delays correspond to the time spent queuing during the red phase by vehicles which then depart during the green phase, whereas the queuing delays only occur for turning movements in excess of capacity where a permanent queue builds up which is unable to clear in a single cycle.”

Table 6-1: Simulation Area Assignment Statistics - All User Classes including Fixed Flows

Unit	AM Peak					Interpeak					PM Peak				
	2014	2036 NTEM	2036 LP	Change NTEM - 2014	Change LP - 2014	2014	2036 NTEM	2036 LP	Change NTEM - 2014	Change LP - 2014	2014	2036 NTEM	2036 LP	Change NTEM - 2014	Change LP - 2014
Transient Queues (PCU - Hrs)	14,922	23,555	25,312	8,633 (58%)	10,389 (70%)	8,315	13,875	15,135	5,560 (67%)	6,819 (82%)	15,742	24,664	26,222	8,923 (57%)	10,481 (67%)
Over-capacity Queues (PCU - Hrs)	6,820	14,093	16,053	7,273 (107%)	9,233 (135%)	726	2,514	3,340	1,788 (246%)	2,614 (360%)	10,201	19,767	21,533	9,566 (94%)	11,332 (111%)
Link Cruise Time (PCU - Hrs)	71,512	92,654	94,868	21,143 (30%)	23,357 (33%)	51,948	71,836	74,161	19,889 (38%)	22,213 (43%)	73,781	94,898	96,581	21,117 (29%)	22,800 (31%)
Total Travel Time (PCU - Hrs)	93,253	130,302	136,232	37,049 (40%)	42,979 (46%)	60,989	88,226	92,635	27,237 (45%)	31,646 (52%)	99,724	139,330	144,337	39,606 (40%)	44,613 (45%)
Total Travel Distance (PCU - kms)	4,704,350	5,940,739	6,049,588	1,236,389 (26%)	1,345,238 (29%)	3,623,858	4,897,297	5,030,512	1,273,439 (35%)	1,406,654 (39%)	4,888,675	6,054,796	6,134,807	1,166,121 (24%)	1,246,132 (25%)
Average Speed (kph)	50.4	45.6	44.4	-5 (-10%)	-6 (-12%)	59.4	55.5	54.3	-4 (-7%)	-5 (-9%)	49.0	43.5	42.5	-6 (-11%)	-7 (-13%)
Total Trips Loaded (PCUs)	778,895	889,306	899,298	110,411 (14%)	120,403 (15%)	559,761	666,572	674,888	106,811 (19%)	115,127 (21%)	723,561	801,878	809,461	78,317 (11%)	85,900 (12%)

TRAFFIC FLOWS

6.2.7. The flow difference plots presented in Figure 6-1 to Figure 6-3 demonstrate the change (in Passenger Car Units (PCUs[5]), between the 2014 Base Year and 2036 Local Plan forecast year in Hertfordshire for key links, those defined as a Base Year flow of 700 or more. An equivalent set of plots for all links in Hertfordshire, as well as for all links in the NTEM constrained scenario can be found in Appendix D.

6.2.8. The orange, yellow and red bands indicate the flow increase in the forecast, whilst green and blue indicates flow decrease. As expected, the greatest increases in absolute terms in vehicle flow occur on the strategic road network, however, most of the minor links also experience traffic growth.

[5] Passenger Car Unit (PCU): A common unit to represent general traffic and assigns a conversion factor that that equivalent PCU values can be generated from classified vehicle data. In COMET Cars and LGVs have a PCU factor of 1 whilst HGVs have a PCU factor of 2.2, as outlined in the LMVR)

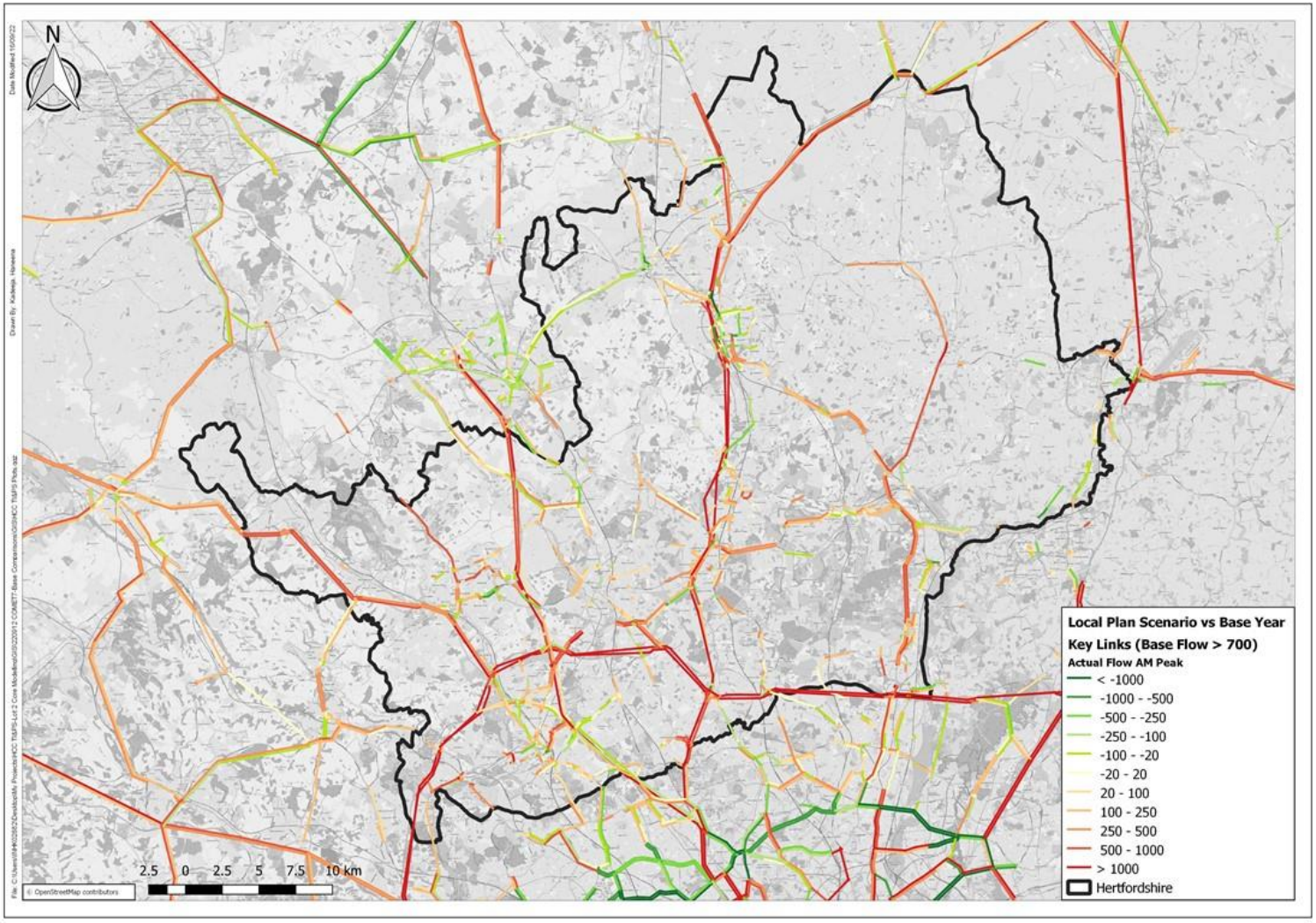


Figure 6-1: 2036 Local Plan Scenario vs 2014 AM Peak Flow (links with a base flow greater than 700)

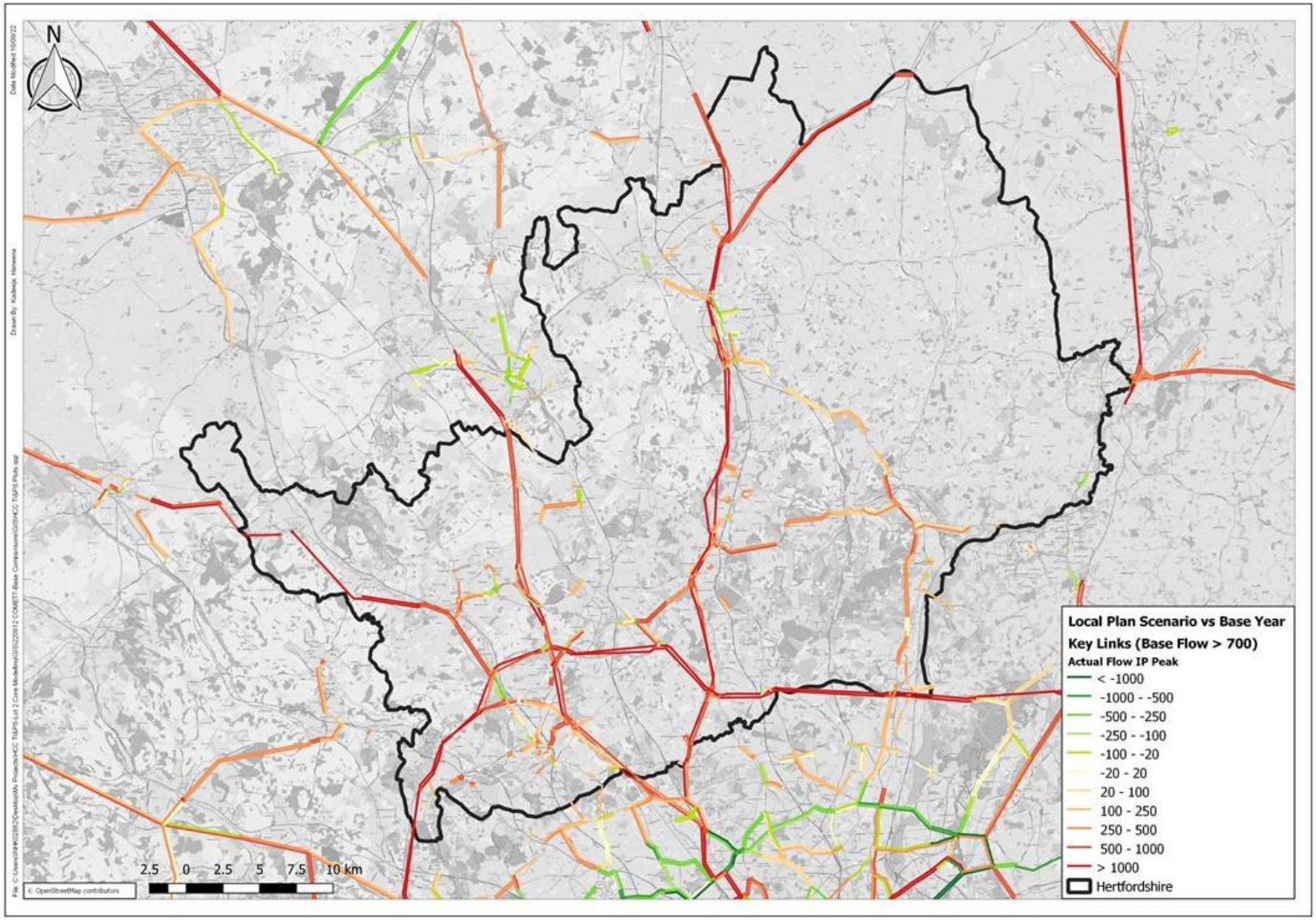


Figure 6-2: 2036 Local Plan Scenario vs 2014 Inter-Peak Flow (links with a base flow greater than 700)

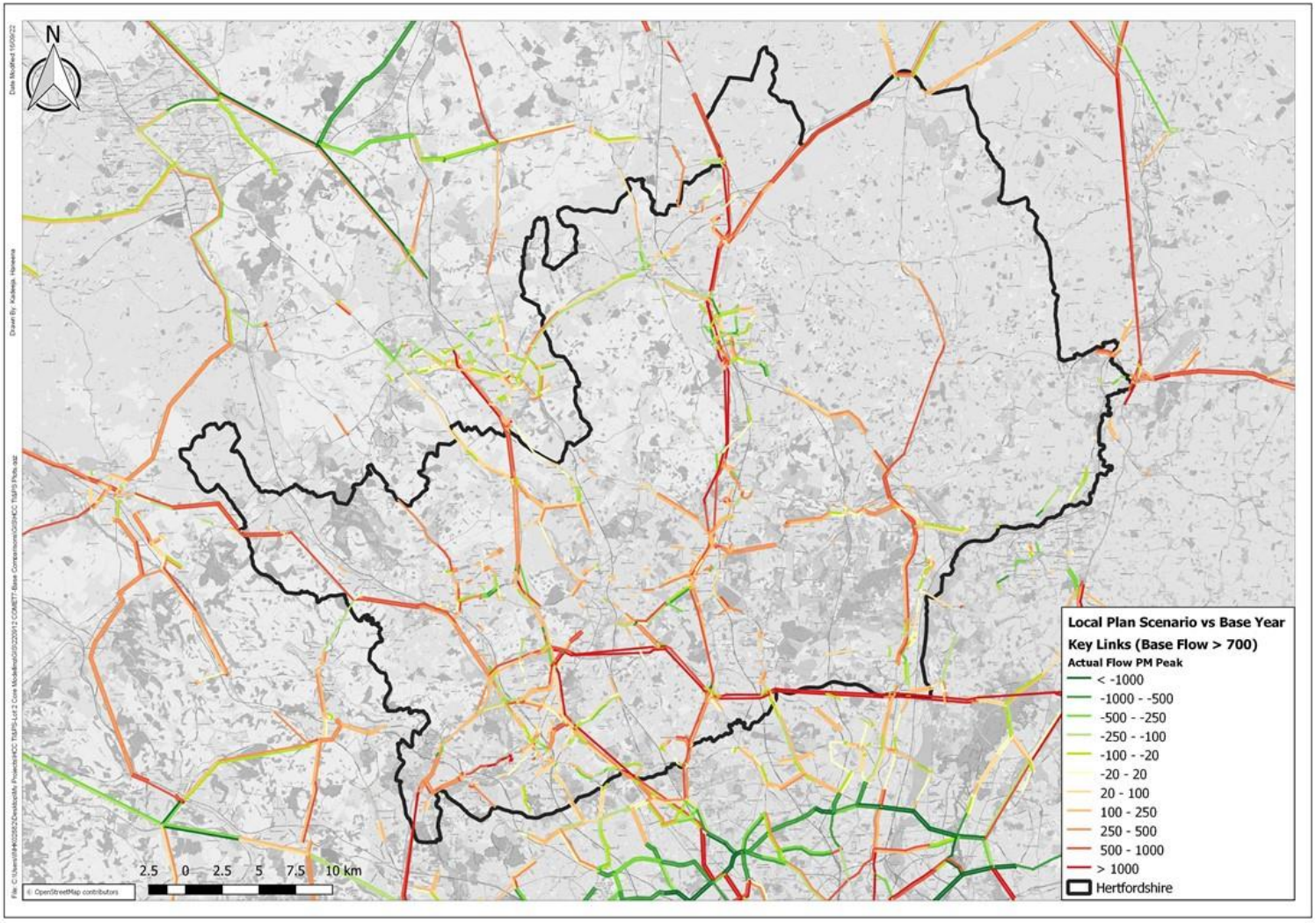


Figure 6-3: 2036 Local Plan Scenario vs 2014 PM Peak Flow (links with a base flow greater than 700)

6.2.9. The impact of schemes leads to local re-routeing in town centres, sometimes with flow reductions observed.

6.2.10. There are a number of notable impacts on strategic routes:

- Within Hertfordshire, the key north south strategic roads, the A41, M1, A1(M), and M25 all see large increases in flow, albeit the A41 and A10 sees less of an increase than the M1 and A1(M). The increase of traffic flows along A1(M) is the result of the proposed widening scheme (3 lanes in each direction) between Junction 6 and Junction 8, which causes significant impacts to the connecting strategic road network.
- For the east west traffic routes, the M25 experiences significant flow increases, particularly at section between Junction 24-25 south of Cheshunt, with peak hour flow increases by 3,300 and 2,600 PCU/hour on the westbound direction in AM and PM respectively.
- Significant increase of traffic is forecast on the A414, but it broadly operates within capacity but that the area around Colney Heath and London Colney is under particular stress with V/C over 100% in both AM and PM peaks.
- A significant flow increase is observed on the A405 between Watford and the A414 (near How Wood, and also sections of A1 in Hertsmere south of the M25 and M1 in Hertsmere and Watford.
- In the AM the traffic increases on the A10 are forecast from the M25 to Puckeridge, where the A10 connects with the A120. In the PM the traffic increase is similar to AM forecast, with significant growth of traffic is forecast.
- Due to the completion of Little Hadham Bypass, the section of the old A120 through Little Hadham village (Hadham Road) shows reduced traffic flows over 400 PCUs in each direction in the AM and PM Peak, and traffic is forecast to divert to the new bypass in the Local Plan scenario. For the remaining section of A120, significant increase of traffic is forecast in Bishop's Stortford, and the western section of the A120 in Puckeridge with around 300-400 PCUs increases in each direction.

NETWORK STRESS AND DELAYS

6.2.11. Delays modelled in the highway assignment model are presented in the following sections in terms of link stress (volume over capacity – V/C) and junction (node) delay in minutes. Link stress or V/C represents the level of congestions along a link (road). Where the V/C is below 80%, roads are expected to be relatively free flowing with minimal delays. For V/Cs between 80% and 90% roads will begin to show signs of congestion, speeds will lower, and delays will occur at junctions. When V/Cs are over 90% the road will be very congested with lower average speeds and longer delays expected at junctions. At links where over 100% V/C is forecast, significant queue and delay is expected as the links is forecast to be over-capacity.

6.2.12. The commentary provided in this section are not intended as a comprehensive review of how the network is performing. Instead, it highlights some of the main areas of congestion and delays within a particular town or along a particular corridor, given the assumptions inherent in the Local Plan forecast.

Link Stress

6.2.13. Figure 6-4 to Figure 6-6 show the 2036 modelled link stress in terms of volume over capacity (V/C) for the three modelled time periods for the Local Plan scenario for key links, those links with a Base Year flow of 700. An equivalent set of plots for all links in the Local Plan scenario and the NTEM constrained scenario can be found in Appendix D. It should be noted that the extent shown by the colour is the length of the link in the model, and not the length of any queue that might be on that link.

This appears to give prominence to those longer rural links which would likely have less queuing than the shorter urban links.

6.2.14. The modelling shows the highest level of congestion can be observed in the western half of Hertfordshire (west of the A1(M)). Particularly in the urban areas of Watford, St Albans, Hemel Hempstead. The urban areas of Hertford, Welwyn Garden City, Hatfield, Hitchin, Bishop's Stortford also have links with V/Cs above 90%, although not to the same extent as some of these southwestern settlements, and are primarily limited to key routes into these towns.

6.2.15. The following key roads on the Hertfordshire road network show evidence of congestion (V/C over 80%) in the 2036 Local Plan scenario:

- Near or over-capacity links are forecast at junctions on M25 mainline within Hertfordshire. Overall the PM model shows higher congestion than AM, and Junction 18, 21, 23 and 27 are forecast with V/C over 100% in the PM model. This highlights the important role of the M25 in East-West movements across the area.
- High V/Cs are shown along the length of the M1 and A1(M) through Hertfordshire to varying extents, with stress being particularly noticeable in the AM and PM peaks. In particular, A1(M) south of Hatfield is under some stress, some sections in Hatfield and Potters Bar are forecast with V/C approaching or over 100%.
- It should be noted the PM model forecast very high V/C of over 100% at M11 junction 8A, which may significantly impact the performance of this junction to access Bishop's Stortford.
- The A414 west of Hatfield between the A1(M) Junction 2 and Colney Heath roundabout junction shows high V/Cs of over 100% in both AM and PM. The Hertford town centre section of A414 near, Gascoyne Way, Cross Lane and Campfield Road roundabouts also forecast with V/C over 100% in both peaks.
- Low V/C is predicted for the A120 however the eastern part of the Bishops Stortford ring road operates near capacity, due to the delays on the link towards Essex.
- Sections of A41 near Watford shows very high V/C between 90-110%, similarly high level of V/C are also observed on the connecting roads in the area.

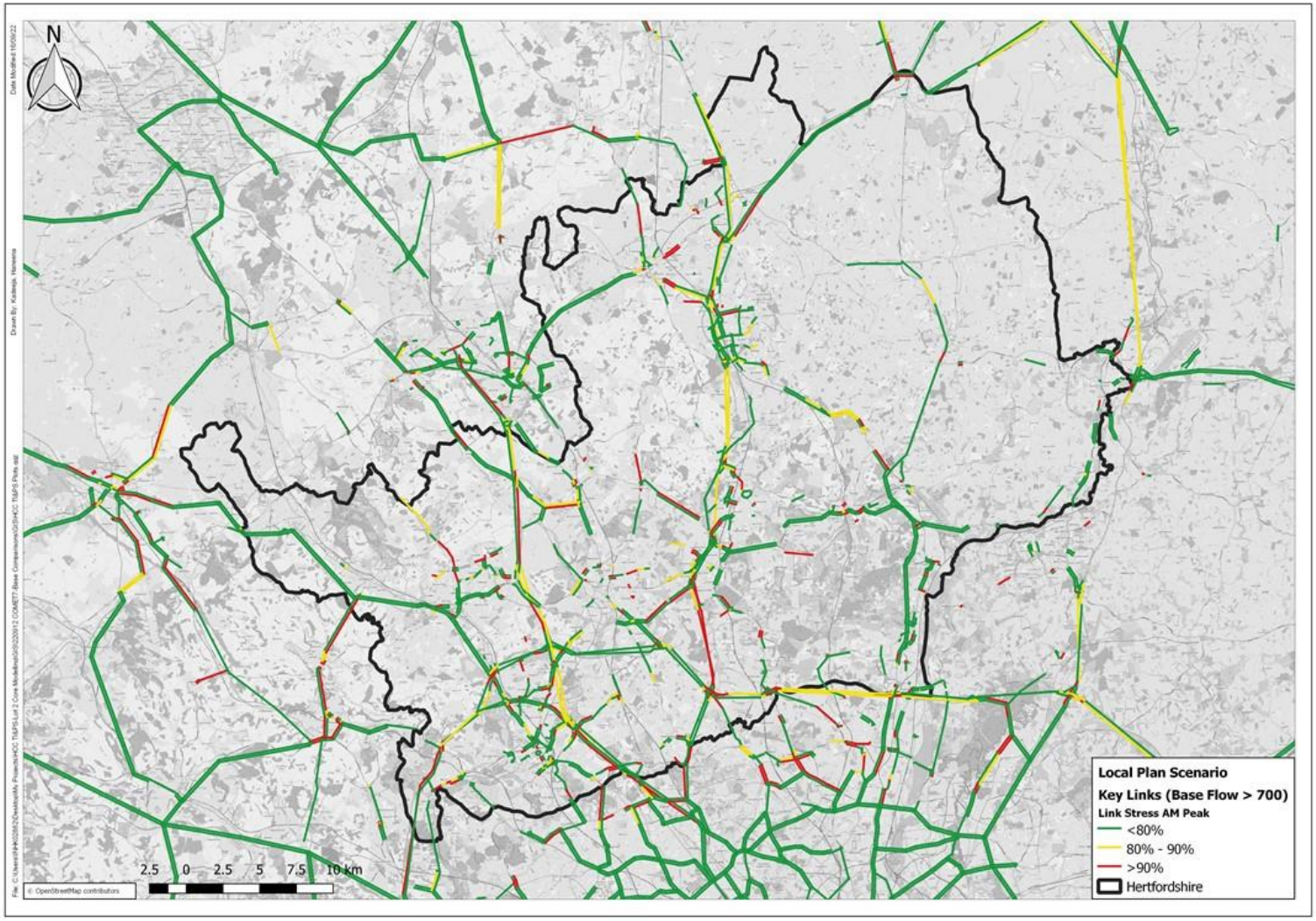


Figure 6-4: 2036 Local Plan Scenario AM Peak Link V/C (links with a base flow greater than 700)

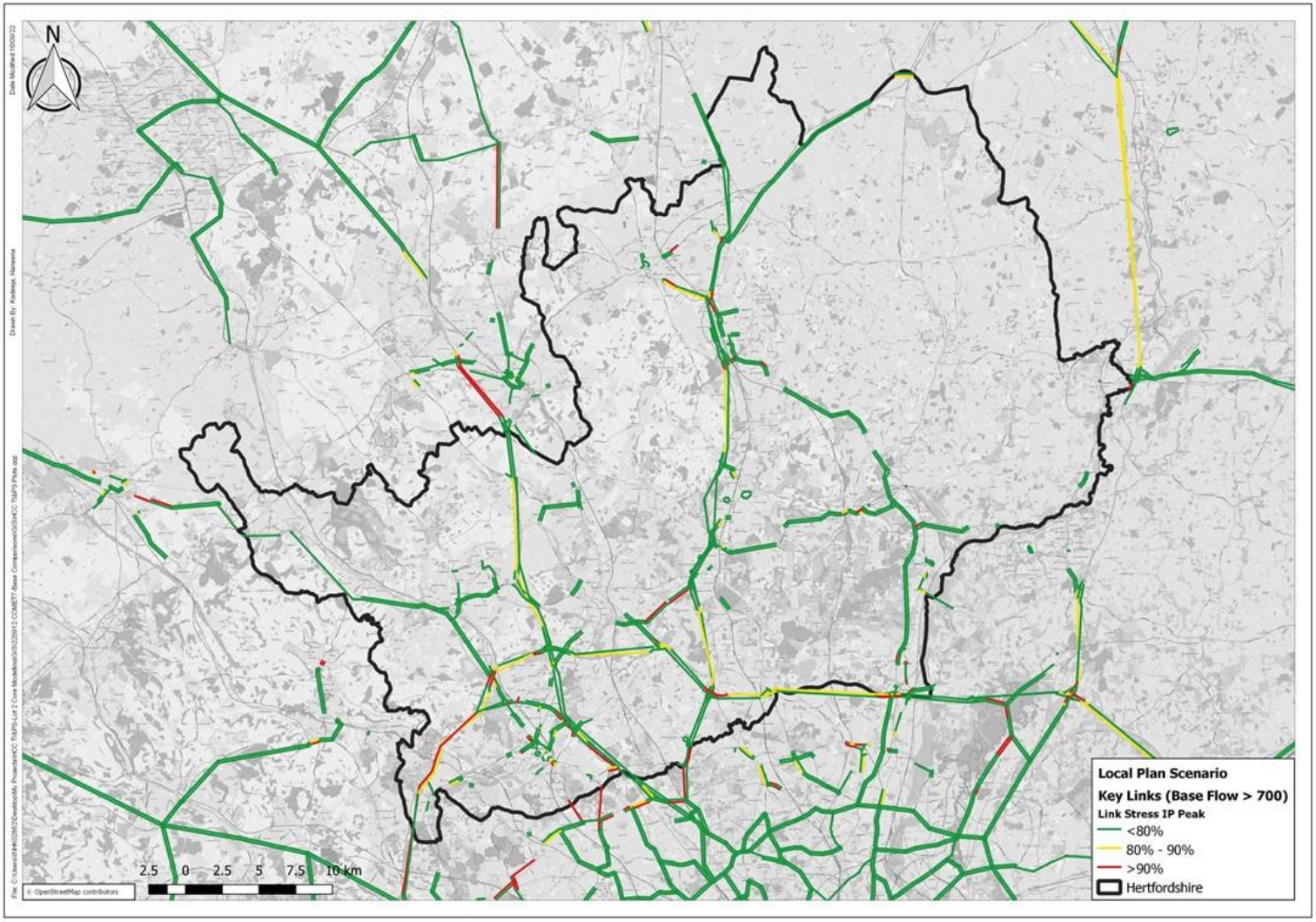


Figure 6-5: 2036 Local Plan Scenario Inter-Peak Link V/C (links with a base flow greater than 700)

Figure 6-6: 2036 Local Plan Scenario PM Peak Link V/C (links with a base flow greater than 700)

6.2.16. Overall, western Hertfordshire experiences more congestion than eastern Hertfordshire, which is consistent with the results derived from the previous Local Plan versions of the forecast model, this is also not unexpected given the higher density of populations in the western side of Hertfordshire and higher levels of growth for this part of the county.

Junction Delay

6.2.17. The average junction delay per vehicle for the Local Plan scenario is shown in Figure 6-7 to Figure 6-9. The delay shown for each junction is an average of the delays for each possible arm that junction. Whilst this will give an indication of some problems it will mask junctions where one arm has acute delay levels whilst other arms do not experience delay. An equivalent set of plots for the NTEM constrained scenario can be found in Appendix D.

6.2.18. Significant junction delays are recognised within the town of Watford and particularly West of the town centre along the A411 in the AM and PM peak with some long delays. The most significant delays are observed in PM peak with over 5 minutes delay.

6.2.19. Heavy delays are observed along the A1(M) junctions such as the A1(M) southbound (merged with SB slip road at A1(M) Junction 3) experiences nearly 5 minutes delay in the PM peak. There are also long delays observed at the Colney Heath Longabout on A414 where delays of over 3 minutes are observed in the PM peak.

6.2.20. There are a number of significant node delays also observed in Hemel Hempstead, St Albans and Hatfield in the AM and PM peak, where the forecast delay at these nodes can be over 5 minutes.

6.2.21. Along the strategic network, there are a number of junction delays along the M25 which are shown to have issues on one or more approaches, such as Junction 17/18, Junction 20 (A41), Junction 21 (M1), Junction 21a (A405), Junction 23 (A1) with up to 5 mins delay in the AM and PM peak. Among these junctions, the model also forecasts significant delay of more than 5 minutes at Junction 18 and Junction 20.

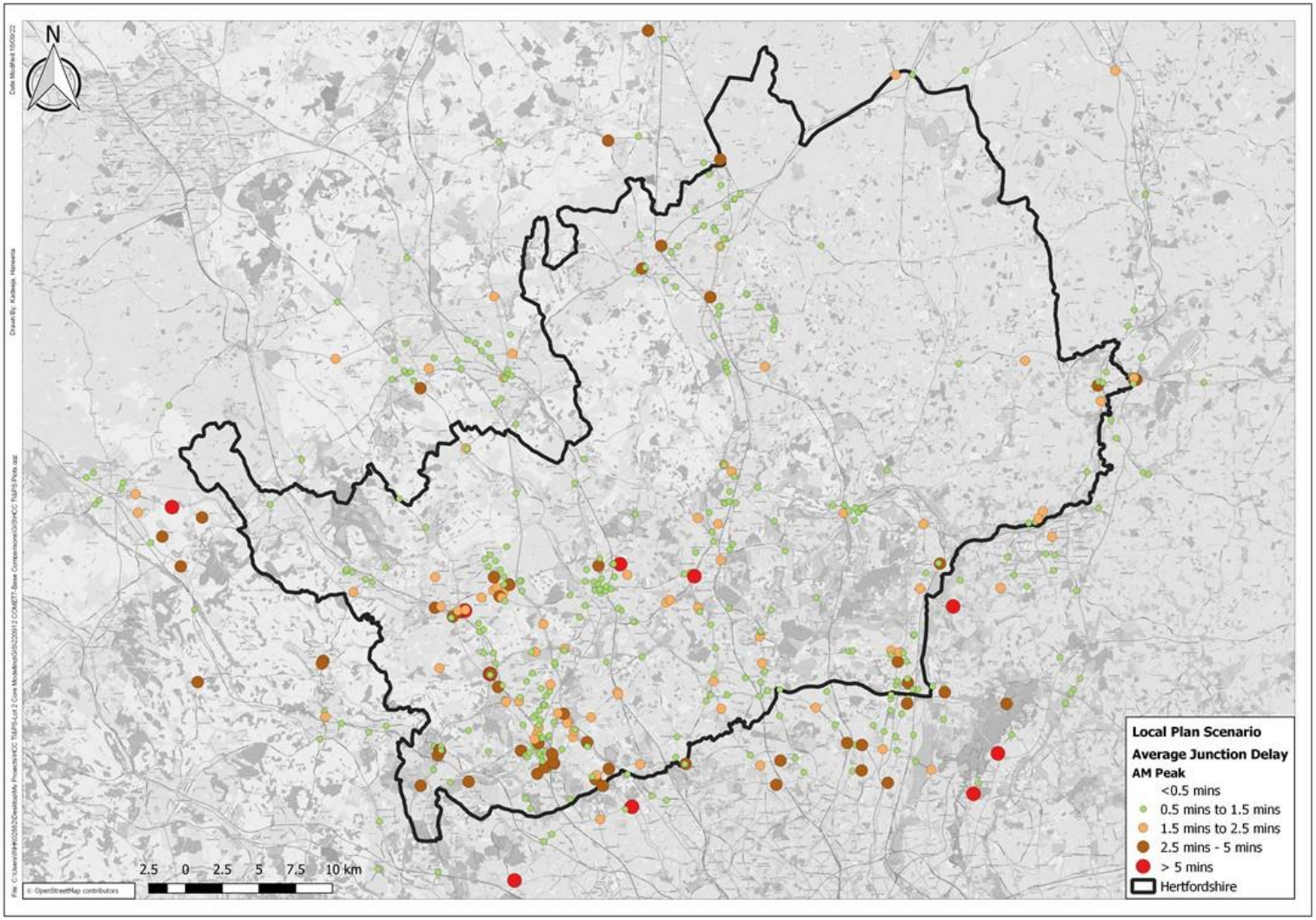


Figure 6-7: 2036 Local Plan Scenario AM Peak Delay

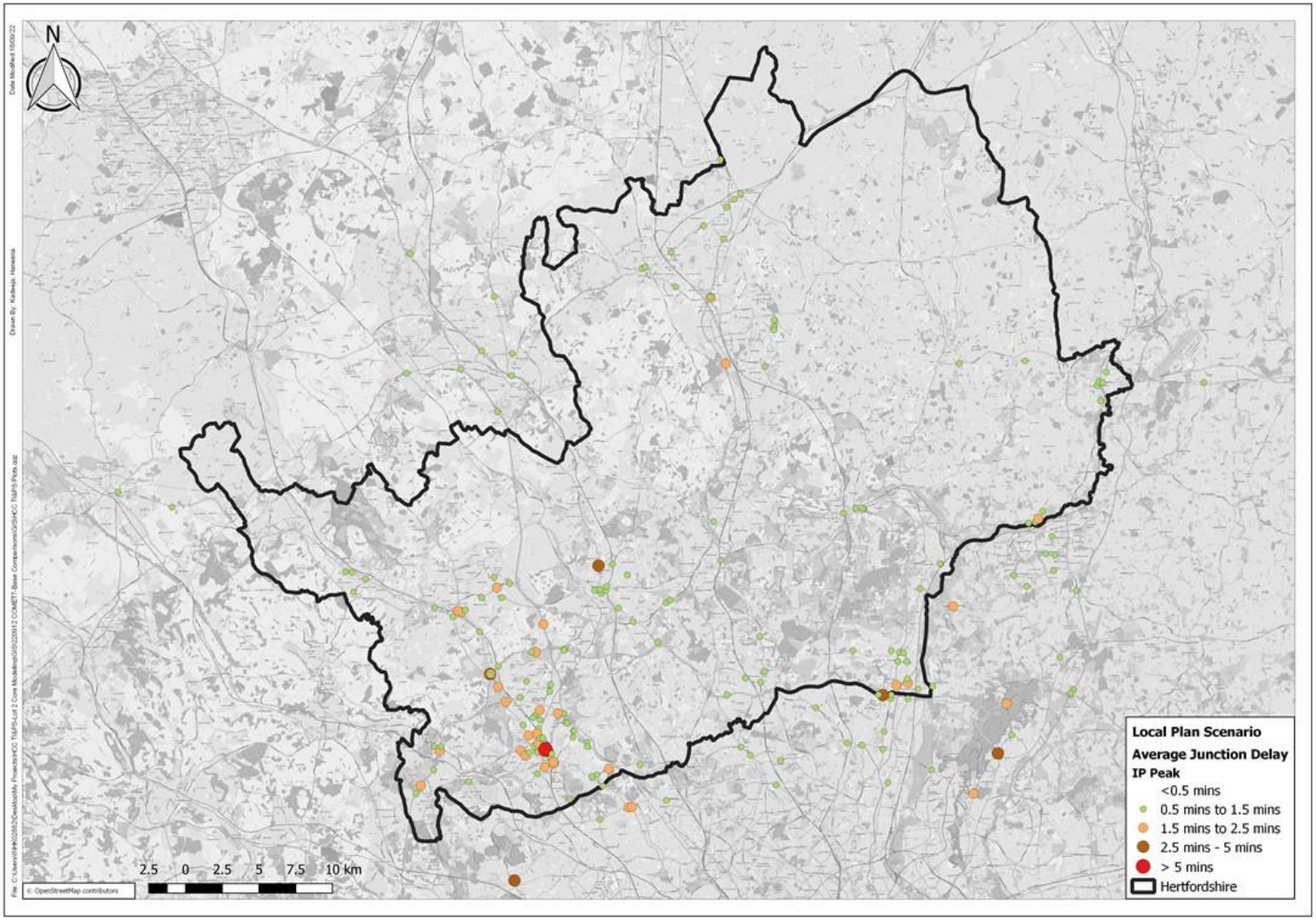


Figure 6-8: 2036 Local Plan Scenario Inter-Peak Delay

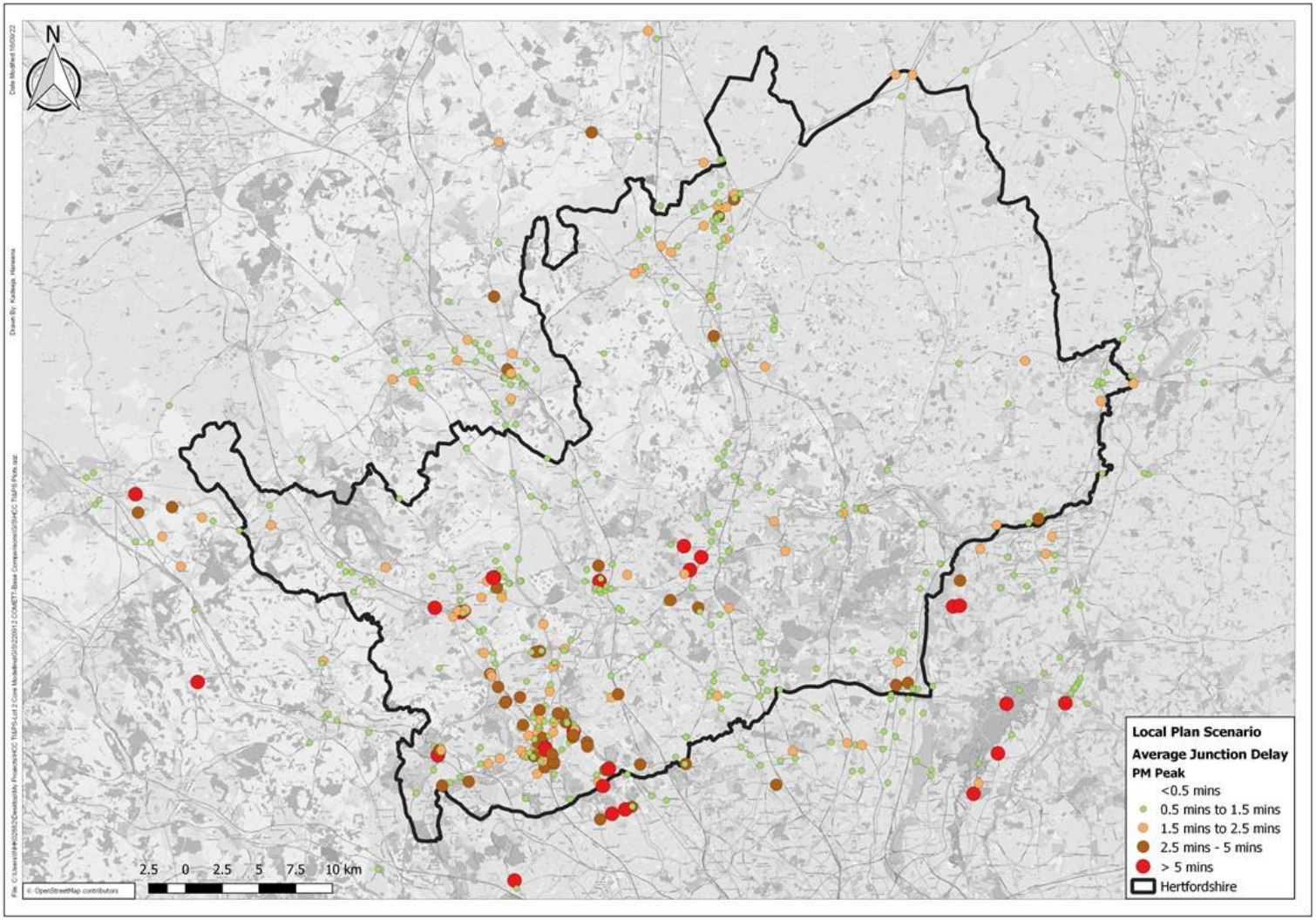


Figure 6-9: 2036 Local Plan Scenario PM Peak Delay

6.2.22. Figure 6-10 to Figure 6-12 show the junction delay differences between the 2014 Base Year and 2036 Local Plan scenario. Some reductions are noted in key areas where signal optimisation or other infrastructure scheme has been implemented.

6.2.23. There are a significant number of junctions with increased delays of over 3 minutes observed in Watford, Hemel Hempstead, Stevenage and Hatfield in the AM and PM peak.

6.2.24. There are a number of reduced junction delays of up to 4 minutes in the AM and over 3 minutes in the PM observed along the A1(M) between Welwyn Garden City and Stevenage, in part contributed to by the increase in lanes brought about by the proposed A1(M) improvement scheme between Junction 6 and Junction 8.

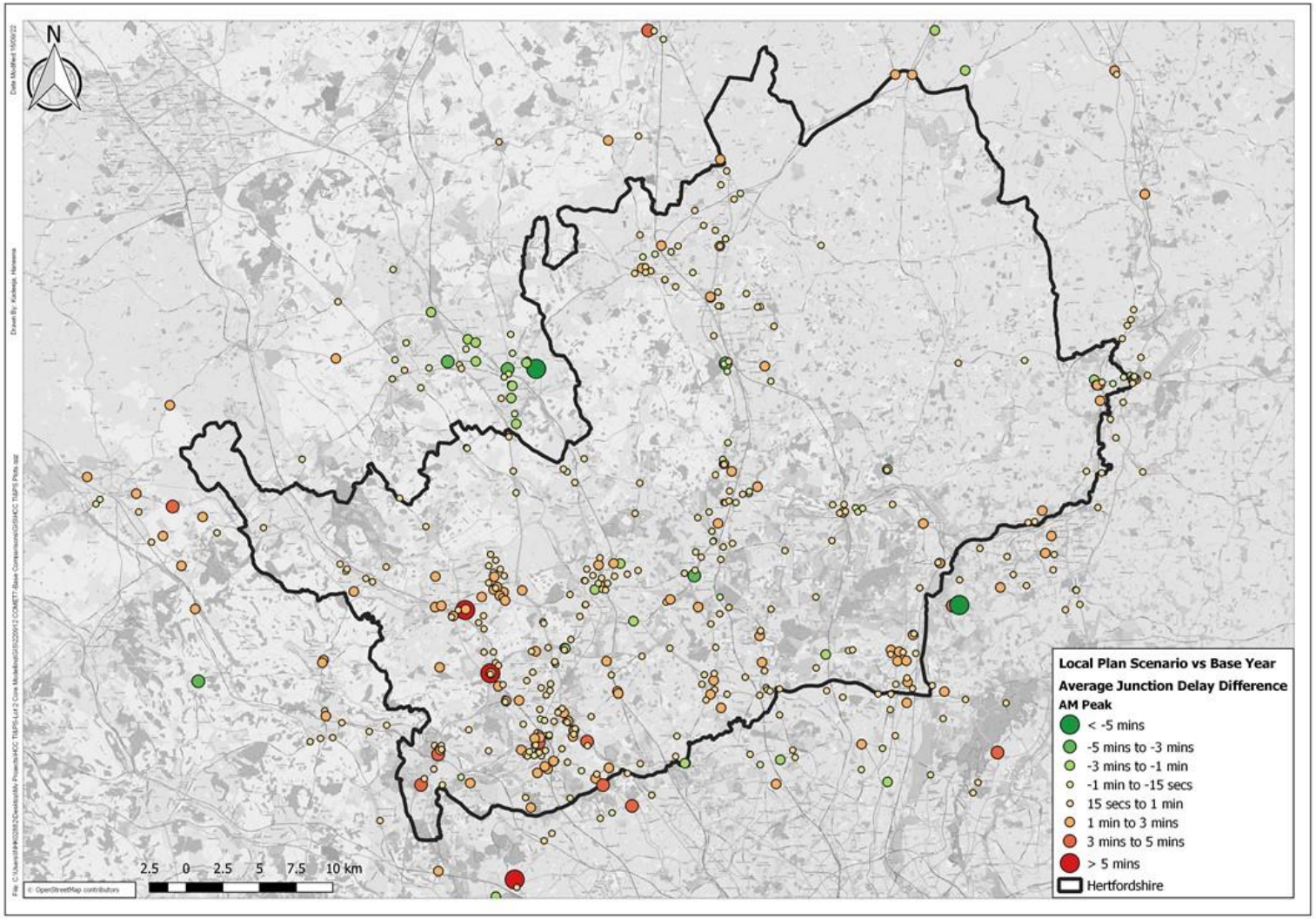


Figure 6-10: 2036 Local Plan Scenario vs 2014 AM Peak Delay

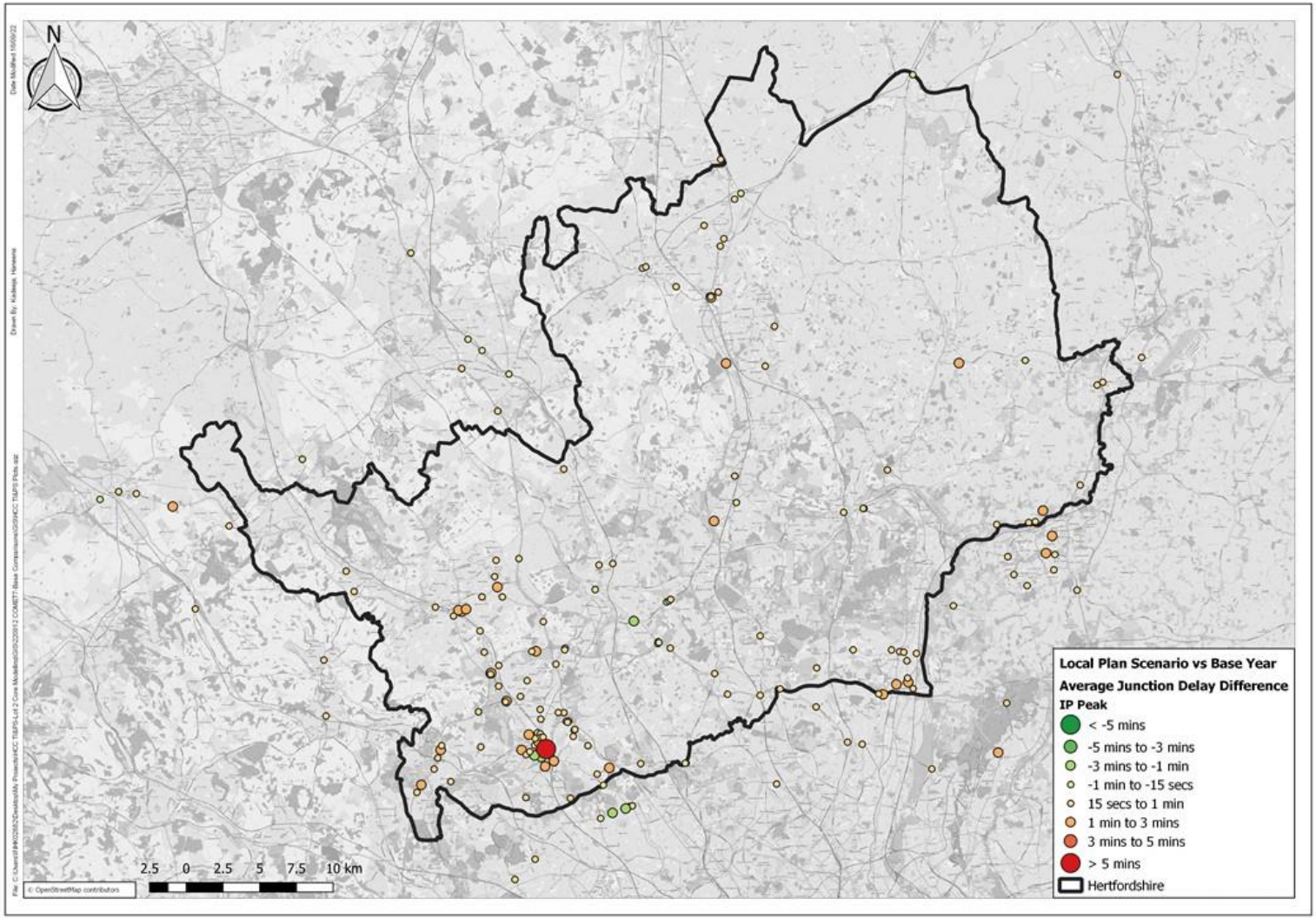


Figure 6-11: 2036 Local Plan Scenario vs 2014 Inter-Peak Delay

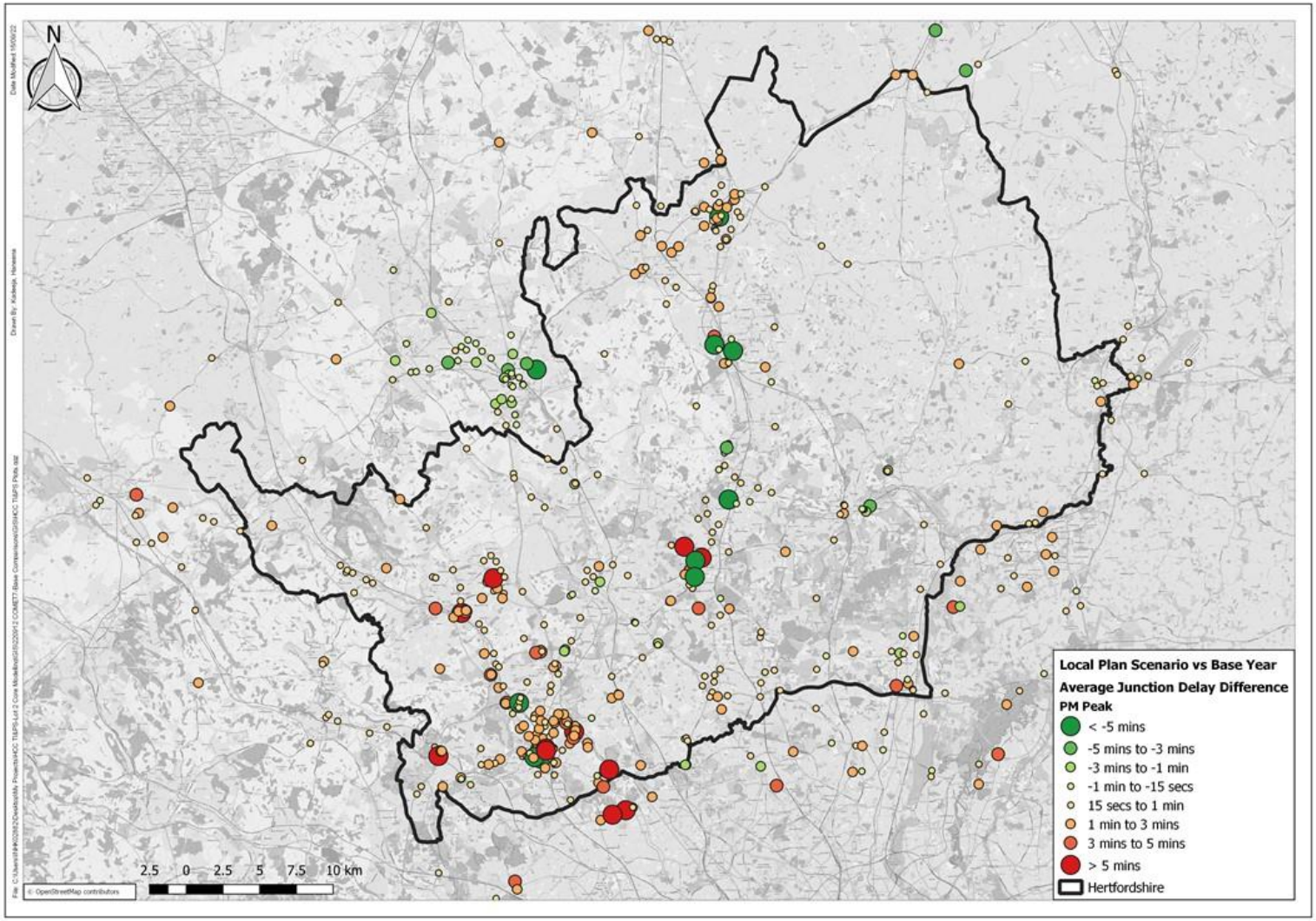


Figure 6-12: 2036 Local Plan Scenario vs 2014 PM Peak Delay

TRAFFIC IMPACTS IN KEY HERTFORDSHIRE TOWNS

6.2.25. Table 6-2 below summarises the key highway flows, link stress and delay impacts noted from the Local Plan scenario in the urban areas of Hertfordshire.

Table 6-2: Traffic Impacts in Key Hertfordshire Towns

Urban Area	Strategic Impacts
Hemel Hempstead / Tring / Berkhamsted	• Minimal impact on junction delays in Tring, although some increases on A4251 High Street / A416 Kingshill Way in Berkhamsted. • Increased flows around Maylands area in Hemel are linked to proposed developments. • Increased flows along the A41 during the AM and PM peak periods are observed. Heavy delays are observed at the A41/Two Waters Road and nearby London Road junctions. • Flow reduction on Lawn Lane at the Plough roundabout, Hemel and associated increase of junction delay on London Road. This is caused by various bus lane interventions affecting this area. Traffic increase on A414 Two Water Roads is therefore forecast. • Due to the introduction of bus corridor infrastructure improvement scheme on A414, flow reduction is forecast on A414 in Hemel Hempstead between St Albans Road / Leverstock Green Way roundabout and St Albans Road / White Hart Road roundabout. Traffic is forecast to divert to other East-West links in the area.
Watford	• There are moderate increases in traffic flows in the centre of Watford (A412, A4178, A4008) which suggests some localised rerouting occurring. Delay is forecast in both AM and PM models for traffic on the accesses to the Watford town centre ring road as a result of the growth in traffic and proposed changes to the highway infrastructure. • Increased delays at junctions on M25- J18, J20 influences the re-routeing on rural linkage roads. • Increased mainline traffic flows along the M1 are observed particularly near Junction 5, which shows some increased delays at this junction. • Many junctions in this district (N. Watford in PM) are shown to be experiencing moderate increases in delay, exacerbating some already acute delay levels
Elstree/Borehamwood	• Only moderate increases in flows around the town centre of Borehamwood, larger increase of flow at A1/Rowley Ln junction and A1 mainline. No significant

Urban Area	Strategic Impacts
	delay is forecast in the Borehamwood area in both AM and PM • The Elstree Road / Heathbourne Road junction is forecast with significant delay in PM, which indicates the proposed intervention need further review
St Albans/Harpenden	• East-west cross-country routes between St Albans and Hatfield show minor increase in flows • Increased flows along the A414, between the A1(M), Park Street Roundabout and London Colney Roundabout, although localised reduction on the Westbound direction near Colney Heath in the AM and PM peaks is forecasted. This is the result of increased Eastbound traffic and causing longer delay from other directions on the Longabout. The westbound traffic is forecast to divert to alternative routes to avoid the problem junction. • Moderate increases in flow on most roads within St Albans although some localised reductions and rerouting observed. Increases delay within St Albans is therefore estimated. • Moderate increase in flows are observed travelling north and south between Harpenden / Redbourn and St Albans along the A5183 / A1081 in both peak periods. Some minor increases of East-West flows are also observed on Redbourn Bypass / B487 near Redbourn. B487 is forecast to be approach capacity with V/C >90%
Hatfield/Welwyn Garden City	• Increased flows around the town centres particularly along the strategic roads in the periphery and some localised re-routeing is observed in the town centre through increased traffic flows on minor roads. • Significant junction delays are observed only along the A1(M) at the Hatfield Avenue / Comet Way junction and Hatfield Avenue / Coopers Green Lane junctions during the PM peak. • Increased flows along the A414 corridor between Hatfield and St Alban, Hatfield and Hertford
Stevenage/Hitchin/Baldock	• There is increased traffic along the A1(M) / A505 and their connecting corridors through the towns. There is generally a reduction in traffic flows in each of the town centres as a result of the mode shift away from cars applied to replicate the impact of sustainable travel initiatives.

Urban Area	Strategic Impacts
	• There is moderate to significant increase in delays at the A1/Letchworth Gate junction and A1/A602 junction travelling to/from Letchworth and Hitchin town centres respectively towards Stevenage. • Moderate junction delays are also forecast on the A505 between Baldock, Letchworth and Hitchin • Changes to Lytton Way in Stevenage increase traffic pressure on alternative routes, such as St George's Way
Broxbourne	• Increase traffic flow is observed on A10 and its connecting highway from Broxbourne. Sections of A10 between Church Lane and College Road junctions in Cheshunt is over-capacity with V/C >100% in AM peak. Increase delay and traffic rerouting is forecast at this section • The M25 south of Broxbourne shows significant increase in traffic flows, which is operating almost at capacity through this area. (Between 90% -100%) • Increased flows on east-west rural routes to/from Broxbourne.
Hertford/Ware	• Moderate increases in flows along the link roads between Hertford and Welwyn Garden City, including A414, A602 and B1001 travelling south towards Ware. • There is a general reduction of traffic flows on minor roads observed in Ware town centre whereas Hertford shows moderate increase in traffic flows on localised routes. • Moderate delay increases are shown along the A414 west of Hertford in PM and no significant increase in junction delays are observed in Ware. • Increased flows are forecast along the A10 and the results show increased traffic coming off the A10 via B1001 into Ware town centre.
East Herts	• Increased flows on the A120, reduction of traffic through Little Hadham with traffic using Little Hadham Bypass in LP. • High level of delay at A120/M11 junction is forecast at several junction nodes, may cause by increase traffic accessing M11. • Moderate increase in flows around some parts of the outer link roads at Bishops Stortford particularly on the A1184 St James Way and Bishop's Park Way north of

Urban Area	Strategic Impacts
	Bishops Stortford through the B1383 Stansted Road junction. • There is a moderate increase in flows observed along Stansted Road / Hallingbury Road through Bishops Stortford. • Modest increase in delay are observed in Bishops Stortford town centre (South Street), which could be the results of new developments in the area.

INTER-URBAN JOURNEY TIMES

6.2.26. The inter-urban journey times have been assessed by skimming the time matrices in SATURN. This time matrix represents the required travel time between town centres via the quickest route derived by the model. For each town a central zone has been used as a proxy for the town in the analysis. This zone has been chosen based on the point a Google Maps search defaults to when the town is searched for. The towns and zones chosen are presented in Table 6-3.

Table 6-3: Zones chosen for Inter Urban Journey Time analysis

Town	Zone
Bishops Stortford	2003
Borehamwood	2544
Cheshunt	1014
Hemel Hempstead	1583
Hertford	2104
Hitchin	3060
Rickmansworth	4582
St Albans	3564
Stevenage	4024
Watford	5026
Welwyn Garden City	5535

6.2.27. Journey times are compared to the 2014 Base Year on a proportional basis and these results are presented in Table 6-4 to Table 6-6, with a colour grading to help highlight those movements where the journey times have increased the most.

6.2.28. Increased vehicle flow and congestion in the Forecast Year cause a rise in the average journey time between urban areas in Hertfordshire. The tables below present the journey times between key towns in Hertfordshire.

6.2.29. Appendix E provides further tables presenting the absolute increase in the Local Plan scenario, the change from the Base to the NTEM constrained scenario on a proportional and absolute basis.

6.2.30. The following key points are observed in the journey time analysis:

- The changes seen are comparable to previous COMET 6 forecast results.
- There are some particularly large changes in journey time experienced in the PM, and particularly for towns in the south west part of the county such as Cheshunt, Watford and Rickmansworth, consistent with the flow and delay analysis.
- The average increase is 23% (7 minutes) and 27% (9 minutes) in the AM and PM peaks respectively across the town pairs analysed.

Table 6-4: Journey Time Comparisons between LP and Base Year in AM Peak (%)

	Bishops Stortford	Borehamwood	Cheshunt	Hemel Hempstead	Hertford	Hitchin	Rickmansworth	St Albans	Stevenage	Watford	Welwyn Garden City
Bishops Stortford	-	11 (23%)	-1 (-3%)	15 (22%)	-1 (-2%)	7 (14%)	12 (19%)	7 (12%)	1 (2%)	13 (19%)	3 (7%)
Borehamwood	9 (18%)	-	11 (51%)	12 (41%)	8 (30%)	7 (21%)	9 (35%)	5 (22%)	8 (29%)	8 (32%)	8 (38%)
Cheshunt	4 (11%)	17 (74%)	-	23 (62%)	6 (27%)	9 (18%)	21 (59%)	17 (56%)	9 (24%)	22 (59%)	12 (37%)
Hemel Hempstead	9 (13%)	9 (28%)	16 (40%)	-	10 (24%)	4 (12%)	9 (36%)	6 (28%)	9 (18%)	10 (33%)	9 (25%)
Hertford	-1 (-4%)	4 (14%)	-1 (-3%)	15 (42%)	-	4 (12%)	12 (29%)	7 (23%)	2 (7%)	10 (24%)	4 (21%)
Hitchin	9 (18%)	4 (11%)	3 (7%)	9 (26%)	5 (15%)	-	10 (23%)	5 (14%)	5 (37%)	9 (20%)	6 (22%)
Rickmansworth	6 (9%)	4 (11%)	13 (37%)	7 (27%)	12 (29%)	6 (14%)	-	7 (27%)	12 (28%)	7 (44%)	12 (33%)
St Albans	4 (8%)	2 (10%)	11 (36%)	7 (32%)	6 (19%)	4 (13%)	10 (36%)	-	6 (17%)	9 (28%)	6 (27%)
Stevenage	1 (3%)	1 (2%)	-1 (-1%)	10 (21%)	2 (10%)	1 (8%)	8 (17%)	3 (9%)	-	7 (13%)	4 (17%)
Watford	6 (9%)	4 (17%)	13 (41%)	8 (38%)	11 (30%)	3 (7%)	5 (28%)	5 (21%)	12 (29%)	-	11 (36%)
Welwyn Garden City	2 (5%)	3 (14%)	7 (24%)	10 (33%)	4 (22%)	0 (1%)	11 (31%)	4 (19%)	2 (14%)	10 (25%)	-

Key
<10%
10-20%
20-30%
>30%

Table 6-5: Journey Time Comparisons between LP and Base Year in Inter-Peak (%)

	Bishops Stortford	Borehamwood	Cheshunt	Hemel Hempstead	Hertford	Hitchin	Rickmansworth	St Albans	Stevenage	Watford	Welwyn Garden City
Bishops Stortford	-	7 (14%)	0 (1%)	8 (13%)	2 (6%)	6 (13%)	7 (12%)	4 (8%)	2 (6%)	5 (9%)	2 (6%)
Borehamwood	4 (10%)	-	8 (40%)	5 (19%)	2 (7%)	2 (6%)	3 (11%)	1 (4%)	2 (7%)	2 (8%)	2 (8%)
Cheshunt	1 (4%)	9 (41%)	-	13 (38%)	3 (14%)	5 (13%)	13 (37%)	9 (31%)	3 (8%)	11 (33%)	3 (9%)
Hemel Hempstead	7 (12%)	5 (20%)	13 (35%)	-	6 (18%)	4 (12%)	6 (23%)	2 (11%)	7 (17%)	5 (23%)	4 (14%)
Hertford	1 (3%)	1 (2%)	1 (7%)	6 (18%)	-	1 (5%)	8 (22%)	3 (9%)	0 (2%)	4 (10%)	1 (3%)
Hitchin	4 (10%)	2 (5%)	4 (10%)	4 (12%)	2 (6%)	-	4 (10%)	1 (4%)	4 (29%)	2 (4%)	2 (12%)
Rickmansworth	3 (5%)	2 (8%)	11 (33%)	4 (17%)	6 (15%)	4 (9%)	-	5 (19%)	6 (15%)	4 (27%)	6 (17%)
St Albans	3 (6%)	1 (7%)	10 (36%)	1 (5%)	2 (7%)	1 (2%)	9 (34%)	-	3 (8%)	4 (19%)	2 (9%)
Stevenage	1 (1%)	1 (3%)	1 (4%)	7 (17%)	1 (7%)	2 (16%)	9 (21%)	2 (8%)	-	4 (10%)	2 (9%)
Watford	5 (8%)	2 (12%)	11 (35%)	6 (29%)	5 (14%)	3 (9%)	2 (13%)	3 (12%)	5 (14%)	-	5 (16%)
Welwyn Garden City	0 (0%)	1 (4%)	2 (8%)	4 (14%)	0 (3%)	0 (0%)	9 (26%)	2 (9%)	1 (6%)	4 (13%)	-

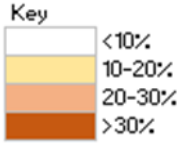
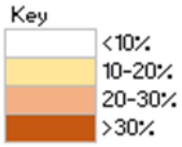


Table 6-6: Journey Time Comparisons between LP and Base Year in PM Peak (%)

	Bishops Stortford	Borehamwood	Cheshunt	Hemel Hempstead	Hertford	Hitchin	Rickmansworth	St Albans	Stevenage	Watford	Welwyn Garden City
Bishops Stortford	-	10 (20%)	-1 (-2%)	8 (12%)	0 (1%)	7 (15%)	14 (21%)	5 (9%)	1 (2%)	11 (17%)	2 (4%)
Borehamwood	9 (18%)	-	11 (45%)	5 (16%)	7 (25%)	5 (12%)	13 (44%)	3 (13%)	4 (10%)	8 (32%)	6 (27%)
Cheshunt	4 (11%)	15 (62%)	-	16 (41%)	4 (20%)	8 (16%)	23 (61%)	13 (41%)	5 (11%)	20 (61%)	6 (17%)
Hemel Hempstead	13 (19%)	11 (36%)	18 (44%)	-	13 (31%)	6 (15%)	11 (40%)	8 (34%)	8 (15%)	10 (43%)	8 (24%)
Hertford	2 (7%)	7 (23%)	0 (0%)	11 (28%)	-	4 (13%)	19 (45%)	5 (17%)	1 (6%)	12 (34%)	2 (15%)
Hitchin	9 (20%)	10 (28%)	5 (10%)	6 (18%)	5 (18%)	-	11 (24%)	3 (10%)	5 (33%)	6 (16%)	3 (13%)
Rickmansworth	11 (16%)	9 (27%)	17 (44%)	8 (29%)	13 (30%)	7 (13%)	-	12 (43%)	10 (18%)	7 (46%)	12 (31%)
St Albans	6 (9%)	3 (11%)	10 (28%)	2 (10%)	5 (17%)	2 (7%)	15 (56%)	-	3 (8%)	9 (42%)	3 (14%)
Stevenage	3 (8%)	7 (24%)	2 (6%)	11 (29%)	3 (11%)	4 (28%)	19 (45%)	6 (20%)	-	13 (35%)	0 (2%)
Watford	23 (34%)	18 (72%)	26 (69%)	21 (86%)	21 (49%)	18 (40%)	12 (60%)	17 (57%)	18 (33%)	-	20 (53%)
Welwyn Garden City	4 (9%)	8 (35%)	7 (20%)	11 (34%)	4 (26%)	1 (6%)	20 (56%)	4 (19%)	1 (4%)	14 (46%)	-



6.2.31. Table 6-7 to Table 6-9 present the change in journey time between the NTEM constrained scenario and Local Plan scenario and show that generally the Local Plan has longer journey times.

Table 6-7: Journey Time Comparisons between Local Plan Scenario and NTEM Constrained Scenario in AM Peak (%)

	Bishops Stortford	Borehamwood	Cheshunt	Hemel Hempstead	Hertford	Hitchin	Rickmansworth	St Albans	Stevenage	Watford	Welwyn Garden City
Bishops Stortford	-	2 (3%)	0 (1%)	5 (7%)	0 (1%)	1 (2%)	1 (1%)	2 (3%)	0 (1%)	0 (0%)	1 (1%)
Borehamwood	3 (5%)	-	3 (11%)	5 (13%)	4 (12%)	-2 (-5%)	3 (8%)	2 (7%)	2 (4%)	3 (10%)	4 (18%)
Cheshunt	3 (7%)	7 (22%)	-	9 (19%)	2 (10%)	1 (1%)	7 (15%)	7 (17%)	2 (5%)	8 (15%)	3 (7%)
Hemel Hempstead	3 (4%)	3 (7%)	3 (7%)	-	3 (6%)	1 (2%)	0 (-1%)	2 (8%)	2 (4%)	2 (6%)	4 (9%)
Hertford	0 (1%)	2 (5%)	0 (0%)	6 (12%)	-	-2 (-5%)	2 (4%)	1 (4%)	0 (0%)	2 (3%)	0 (2%)
Hitchin	5 (11%)	0 (0%)	0 (1%)	6 (14%)	1 (3%)	-	3 (6%)	2 (5%)	3 (17%)	4 (8%)	0 (1%)
Rickmansworth	0 (0%)	-1 (-2%)	1 (3%)	-2 (-5%)	3 (6%)	0 (-1%)	-	0 (0%)	-1 (-1%)	1 (5%)	2 (5%)
St Albans	2 (3%)	1 (2%)	3 (7%)	4 (14%)	2 (4%)	0 (1%)	2 (5%)	-	-1 (-2%)	2 (4%)	2 (8%)
Stevenage	1 (3%)	0 (0%)	0 (1%)	5 (9%)	1 (3%)	-2 (-9%)	1 (1%)	1 (2%)	-	0 (0%)	2 (7%)
Watford	0 (1%)	1 (3%)	2 (5%)	2 (8%)	4 (8%)	0 (-1%)	-1 (-3%)	0 (2%)	0 (-1%)	-	3 (7%)
Welwyn Garden City	1 (2%)	2 (10%)	1 (4%)	4 (11%)	0 (1%)	-5 (-19%)	3 (7%)	1 (6%)	-2 (-8%)	2 (5%)	-

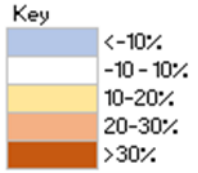


Table 6-8: Journey Time Comparisons between Local Plan Scenario and NTEM Constrained Scenario in Inter Peak (%)

	Bishops Stortford	Borehamwood	Cheshunt	Hemel Hempstead	Hertford	Hitchin	Rickmansworth	St Albans	Stevenage	Watford	Welwyn Garden City
Bishops Stortford	-	1 (1%)	1 (3%)	4 (7%)	1 (3%)	4 (8%)	1 (2%)	2 (4%)	1 (2%)	2 (3%)	1 (4%)
Borehamwood	0 (0%)	-	4 (18%)	3 (11%)	1 (5%)	-1 (-3%)	1 (3%)	0 (2%)	-1 (-2%)	1 (3%)	1 (5%)
Cheshunt	-1 (-2%)	4 (15%)	-	7 (16%)	-1 (-4%)	0 (0%)	5 (11%)	4 (11%)	-1 (-3%)	5 (12%)	0 (0%)
Hemel Hempstead	4 (6%)	3 (10%)	7 (17%)	-	4 (11%)	1 (3%)	2 (6%)	1 (4%)	2 (6%)	2 (8%)	2 (6%)
Hertford	0 (1%)	0 (1%)	0 (0%)	3 (9%)	-	0 (1%)	2 (4%)	1 (4%)	0 (0%)	1 (3%)	0 (1%)
Hitchin	3 (8%)	0 (1%)	2 (6%)	2 (7%)	0 (0%)	-	1 (3%)	1 (2%)	3 (21%)	1 (3%)	1 (4%)
Rickmansworth	-1 (-2%)	0 (0%)	5 (12%)	1 (4%)	2 (4%)	0 (1%)	-	1 (2%)	0 (0%)	1 (4%)	1 (4%)
St Albans	1 (1%)	0 (2%)	4 (12%)	0 (-1%)	1 (3%)	-1 (-2%)	2 (7%)	-	-1 (-3%)	2 (9%)	1 (3%)
Stevenage	0 (1%)	1 (2%)	1 (3%)	4 (9%)	1 (4%)	1 (5%)	2 (4%)	1 (3%)	-	1 (4%)	0 (2%)
Watford	0 (1%)	0 (1%)	5 (12%)	2 (8%)	3 (8%)	0 (0%)	0 (0%)	1 (4%)	1 (3%)	-	3 (8%)
Welwyn Garden City	0 (1%)	1 (3%)	1 (4%)	2 (5%)	0 (2%)	-2 (-8%)	2 (5%)	1 (4%)	-1 (-8%)	1 (5%)	-

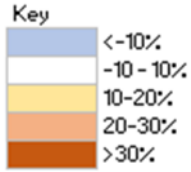
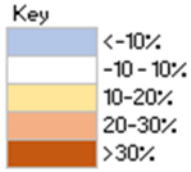


Table 6-9: Journey Time Comparisons between Local Plan Scenario and NTEM Constrained Scenario in PM Peak (%)

	Bishops Stortford	Borehamwood	Cheshunt	Hemel Hempstead	Hertford	Hitchin	Rickmansworth	St Albans	Stevenage	Watford	Welwyn Garden City
Bishops Stortford	-	3 (5%)	-1 (-2%)	3 (4%)	1 (2%)	2 (3%)	1 (1%)	1 (1%)	0 (1%)	3 (4%)	2 (4%)
Borehamwood	2 (3%)	-	7 (26%)	3 (10%)	3 (10%)	-2 (-5%)	2 (5%)	2 (8%)	1 (3%)	4 (14%)	4 (17%)
Cheshunt	-1 (-2%)	8 (25%)	-	9 (19%)	-1 (-4%)	-4 (-7%)	7 (14%)	7 (18%)	-1 (-2%)	8 (19%)	1 (3%)
Hemel Hempstead	6 (8%)	4 (11%)	10 (20%)	-	6 (12%)	1 (2%)	0 (1%)	5 (20%)	4 (8%)	3 (11%)	5 (12%)
Hertford	1 (2%)	1 (3%)	-1 (-4%)	3 (7%)	-	-2 (-6%)	1 (1%)	0 (1%)	1 (3%)	2 (5%)	2 (9%)
Hitchin	6 (12%)	3 (6%)	1 (2%)	3 (8%)	2 (5%)	-	1 (2%)	0 (1%)	3 (22%)	2 (5%)	1 (4%)
Rickmansworth	-1 (-1%)	-1 (-1%)	5 (10%)	-2 (-4%)	2 (3%)	-3 (-5%)	-	0 (0%)	-1 (-2%)	1 (3%)	1 (3%)
St Albans	1 (1%)	0 (-2%)	6 (14%)	0 (0%)	1 (2%)	-3 (-8%)	2 (5%)	-	0 (0%)	3 (12%)	1 (3%)
Stevenage	1 (3%)	0 (1%)	0 (-1%)	3 (6%)	1 (5%)	-1 (-3%)	1 (1%)	-1 (-2%)	-	2 (5%)	-2 (-8%)
Watford	0 (0%)	0 (1%)	6 (10%)	2 (4%)	2 (3%)	-1 (-2%)	1 (2%)	1 (3%)	0 (0%)	-	3 (5%)
Welwyn Garden City	1 (2%)	2 (7%)	2 (5%)	3 (8%)	1 (6%)	-4 (-14%)	3 (5%)	1 (3%)	-1 (-4%)	4 (10%)	-



6.3 PUBLIC TRANSPORT RESULTS

6.3.1. The Public Transport results presented in this section are the results from the Local Plan scenario.

SIMULATION AREA STATISTICS

6.3.2. The forecast change in public transport usage in Hertfordshire is summarised in Table 6-10 to Table 6-13. It should be noted that the COMET rail model does not consider capacity or passenger crowding and is therefore unconstrained by congestion. In summary, the growth in the public transport trips is down to several factors including the change in planning assumptions, key service frequency improvements and shift from highway demand where the generalised cost for public transport trips is less. The network improvements and the changes in service frequencies that have contributed to the growth in public transport trips have been provided in Table 6-14.

6.3.3. Rail and Bus mode was considered in LP to account for the interchange on trips requiring more than one mode to be completed. While the model forecast is not considered implausibly high as a central assumption, it might require capacity improvements on the rail network.

6.3.4. As shown in Table 6-10, in the Local Plan scenario rail travel distance increases by 50 - 71% of the volumes seen in the Base scenario. While bus travel distance also increases, this is at a lower rate of 18-23%. Considering trips using both bus and rail, travel distance increases the most by 125 - 223%. Travel distance growth is generally larger in the inter-peak, which is due to the higher growth in the "Non-Home Based Other" trips compared to "Home-Based Business" and Commuting trips.

Table 6-10: Public Transport Passenger Distance (passenger kms), Hertfordshire Only

Period	Mode	2014 Base Year	2036 NTEM Constrained Scenario	2036 Local Plan Scenario	NTEM - Base	Local Plan - Base
AM	Bus	69,554	66,525	85,864	-4%	23%
IP	Bus	61,095	61,889	74,893	1%	23%
PM	Bus	67,957	60,101	80,491	-12%	18%
AM	Rail	1,037,630	1,634,737	1,690,665	58%	63%
IP	Rail	400,856	655,697	685,296	64%	71%
PM	Rail	1,013,787	1,464,405	1,520,997	44%	50%
AM	Bus and Rail	81,786	103,099	183,823	26%	125%
IP	Bus and Rail	28,383	46,376	91,684	63%	223%
PM	Bus and Rail	71,939	101,656	183,437	41%	155%

6.3.5. Table 6-11 shows the forecast results in terms of passenger boardings in Hertfordshire. It should be noted that whilst bus travel accounts for approximately 45% of total passenger transport boardings, it only represents a small minority (~5%) of total passenger distance. This is because rail trips are substantially longer.

6.3.6. The number of rail boardings in the AM Peak (11,305 in the BY, about 14,300 in the NTEM constrained scenario, and around 20,900 in the Local Plan scenario) is much larger than in other periods, as much of the demand is heading out of Hertfordshire as commuting trips. This is also shown by the passenger boardings on the London Underground mode, where the AM peak boardings are approximately triple the boardings in the IP.

6.3.7. While the model forecast for rail growth is fairly high relative to other modes, it is plausible that these will be realised, particularly if the current impacts of the COVID pandemic are only temporary. UK rail growth in the past two decades has been close to 4% per year, which it continued, would imply nearly 90% growth from 2014 to 2036. In the AM the model projections are more conservative but there are higher levels predicted in the IP and PM.

Table 6-11: Public Transport Passenger Boardings, Hertfordshire Only

Period	Mode	2014 Base Year	2036 NTEM Constrained Scenario	2036 Local Plan Scenario	NTEM - Base	Local Plan - Base
AM	Bus	8,939	10,467	14,432	17%	61%
IP	Bus	7,093	8,560	11,488	21%	62%
PM	Bus	7,756	10,526	13,594	36%	75%
AM	Coach	9	5	6	-44%	-38%
IP	Coach	4	1	1	-77%	-84%
PM	Coach	3	5	2	74%	-17%
AM	Rail	11,305	14,353	20,892	27%	85%
IP	Rail	2,918	4,997	7,750	71%	166%
PM	Rail	4,480	11,959	12,350	167%	176%
AM	Underground	2,954	3,556	3,982	20%	35%
IP	Underground	847	1,235	1,335	46%	58%
PM	Underground	1,285	2,715	2,037	111%	58%

6.3.8. Table 6-12 shows the average public transport fare per journey. The fare values are the actual average fare paid by an average passenger, i.e. (Sum of demand x Cost)/Sum of Demand.

6.3.9. The average fare for rail trips increases by 9-12% in NTEM constrained scenario and 11-18% in the Local Plan scenario compared to the base model suggesting some lengthening of the average trip. An average fare decreased of 1% is shown for the PM Peak of the Local Plan scenario for trips using Bus and Rail, and the same is shown in the AM peak of NTEM constrained scenario, showing that as more people choose rail and bus for long distances, the cost of such trips reduces. The overall average public transport fare increase is much larger, at over 16% in the NTEM constrained scenario and over 21% in the Local Plan scenario. This is because demand has shifted from bus travel to rail, for which journeys have higher fares on average.

Table 6-12: Average Public Transport Fare (£) per Journey, Hertfordshire Only, 2010 prices

Period	Mode	2014 Base Year	2036 NTEM Constrained Scenario	2036 Local Plan Scenario	NTEM - Base	Local Plan - Base
AM	Rail	£7.79	£8.73	£9.20	12%	18%
IP	Rail	£7.61	£8.31	£8.47	9%	11%
PM	Rail	£7.87	£8.67	£9.18	10%	17%
AM	Bus	£0.99	£0.99	£1.05	0%	6%
IP	Bus	£0.92	£0.93	£0.96	1%	4%
PM	Bus	£0.97	£0.95	£1.04	-2%	7%
AM	Rail and Bus	£6.67	£6.58	£6.64	-1%	0%
IP	Rail and Bus	£6.81	£7.11	£7.41	4%	9%
PM	Rail and Bus	£6.68	£6.72	£6.62	1%	-1%
AM	All	£5.78	£6.80	£7.11	18%	23%
IP	All	£4.06	£5.07	£5.43	25%	34%
PM	All	£5.93	£6.85	£7.18	16%	21%

6.3.10. Table 6-13 below shows the average public transport journey distance per journey. All modes apart from bus in NTEM constrained scenario are predicted an increase in average journey distance when compared to the Base Year scenario, however the largest increase in average distance is seen on the rail and bus mode, especially in the Inter Peak (106%) for Local Plan scenario. As a result, the overall public transport average journey distance is notably highest (between 36 - 46km) for the Local Plan scenario. This is because rail demand growth is predicted to be higher than bus growth, and rail trips are significantly longer in the first place.

Table 6-13: Average Public Transport Journey Distance (km), Hertfordshire Only

Period	Mode	2014 Base Year	2036 NTEM Constrained Scenario	2036 Local Plan Scenario	NTEM - Base	Local Plan - Base
AM	Rail	35.5	40.7	43.3	15%	22%
IP	Rail	34.3	37.2	38.3	8%	12%
PM	Rail	35.8	40.0	42.9	12%	20%
AM	Bus	7.7	7.3	8.3	-5%	8%
IP	Bus	6.9	6.7	7.3	-3%	6%
PM	Bus	7.9	7.2	8.7	-9%	10%
AM	Rail and Bus	64.7	81.7	120.6	26%	86%
IP	Rail and Bus	68.9	94.6	141.6	37%	106%
PM	Rail and Bus	62.9	85.6	123.0	36%	96%
AM	All	29.8	36.7	44.7	23%	50%
IP	All	21.7	28.0	36.8	29%	70%
PM	All	30.3	37.1	45.6	22%	50%

6.3.11. Table 6-14 details the Bus and Rail network schemes that are either improvements or new schemes added into the 2036 Local Plan 7 network. The network updates are then compared in terms of peak period service frequency against the Base year across each district. These network improvements have impacted the transit volumes in 2036 along with other changes made to the planning assumptions and highway network.

Table 6-14 - Bus and Rail network improvements from Base 2014 to 2036and Peak Period service frequency comparison

Mode	District	Description	Service Code	Service Description	Frequency		Freq Difference
					Base	LP7	
Bus	Broxbourne	New bus service to and from High Leigh development and Broxbourne station	991_1	High Leigh - Broxbourne Station	-	12	12
			991_2	High Leigh - Broxbourne Station	-	12	12
		New bus service Park Plaza North to Waltham Cross bus station	993_1	Park Plaza North - Waltham Cross Bus Station	-	6	6
			993_2	Park Plaza North - Waltham Cross Bus Station	-	6	6
		New bus service Waltham Cross station to Hertford Regional College	992_1	Waltham Cross Station - Hertford Regional College	-	9	9
			992_2	Waltham Cross Station - Hertford Regional College	-	9	9
		Zero emissions bus route between Enfield Town and Hoddesdon via the A10 - New bus service, Hoddesdon to Enfield via Cheshunt (2 buses per hour)	X666_1	Enfield - Hoddesdon	-	6	6
			X666_2	Hoddesdon - Enfield	-	6	6
	Dacorum	Hemel Hempstead-GreenLane Bus with 10min hdw	HHGL1	Hemel Hempstead-Green Lane	-	18	18
			GLHH1	Green Lane-Hemel Hempstead	-	18	18
		New Local bus link to Berkhamsted South development site 20 min frequency	BKH_CL	Berkhamsted Circular Loop 1	-	9	9
			BKH_CL	Berkhamsted Circular Loop 2	-	9	9
			HHWF_1	Hemel Hempstead Station – Woodhall Farm	-	9	9

Mode	District	Description	Service Code	Service Description	Frequency		Freq Difference
					Base	LP7	
		New 20 min bus service travelling into town centre via Leighton Buzzard Road and into East Hemel development via new Spine Road	WFHH_1	Woodhall Farm-Hemel Hempstead Station	-	9	9
	East Herts	Doubling Frequency on Villiers-Sur-Marne avenue	512_1	Bishops Stortford - Thorley Park	3	6	3
			512_2	Bishops Stortford - Thorley Park	1	2	1
			512_3	Bishops Stortford - Thorley Park	1	2	1
			308_3	Bishops Park - Stansted Airport	5	10	5
			308_4	Bishops Park - Stansted Airport	4	7	3
			302_1	Saffron Walden - Bishops Stortford	1	2	1
	Hertfordshire/ Cross District	Hatfield-Luton Bus Services - No. 610 bus; Increasing 30 frequencies for each direction	610_1	Enfield - Hatfield	1	6	5
			610_3	Enfield - Hatfield	2	2	0
	Non-Hertfordshire	Gilston Village new bus route Schemes	GIPN_1	Gilston-Pinnacles	-	6	6
			PNGI_1	Pinnacles-Gilston	-	6	6
			HTGI_1	Harlow-Gilston(via templefields)	-	6	6
			Harlow	Harlow TC-Gilston CW	-	9	9
	North Herts	Hitchin - Luton bus frequency increase with priority and enhancement of 100/101 service Increase frequency of 100/ 101 service to 4 per hour (Hitchin- Luton)	100_1	Luton - Stevenage	2	12	10
			100_2	Luton - Stevenage	3	12	9
			101_1	Luton - Stevenage	2	12	10
			101_2	Luton - Stevenage	2	12	10
		Bus access to Baldock North Development, increased frequency Bus service 98 to divert into Baldock North development via new spine road. Increased	98_1	Baldock - Hitchin	5	9	4
			98_2	Baldock - Hitchin	4	9	5

Mode	District	Description	Service Code	Service Description	Frequency		Freq Difference
					Base	LP7	
		frequency to 20 mins per hour and add stops serving development					
Rail	Broxbourne	Crossrail 2 - 10 tph from Broxbourne to Liverpool Street	BXLS1	BROXBOURNE_LONDON LIVERPOOL STREET	4	30	26
			LSBX1	LONDON LIVERPOOL STREET_BROXBOURNE	-	30	30
		New Station at Park Plaza	CHLS1	CHESHUNT_LONDON LIVERPOOL STREET	4	4	0
			CHLS2	CHESHUNT_LONDON LIVERPOOL STREET	1	1	0
			CHLS3	CHESHUNT_LONDON LIVERPOOL STREET	1	1	0
			LSCH1	LONDON LIVERPOOL STREET_CHESHUNT	1	1	0
			LSCH2	LONDON LIVERPOOL STREET_CHESHUNT	5	5	0
			LSCH3	LONDON LIVERPOOL STREET_CHESHUNT	1	1	0
		New station at Turnford	BISR2	BISHOPS STORTFORD_STRATFORD (LONDON)	1	1	0
			CBLS2	CAMBRIDGE_LONDON LIVERPOOL STREET	2	2	0
			HFLS1	HERTFORD EAST_LONDON LIVERPOOL STREET	2	2	0

Mode	District	Description	Service Code	Service Description	Frequency		Freq Difference
					Base	LP7	
			HFLS2	HERTFORD EAST_LONDON LIVERPOOL STREET	3	3	0
			HFSR1	HERTFORD EAST_STRATFORD (LONDON)	2	2	0
			LSCB2	LONDON LIVERPOOL STREET_CAMBRIDGE	1	1	0
			LSHF1	LONDON LIVERPOOL STREET_HERTFORD EAST	6	6	0
			SRBI2	STRATFORD (LONDON)_BISHOPS STORTFORD	2	2	0
	Hertfordshire/ Cross District	Post HS2 timetable changes on WCML Additional one hour per service for each direction- From Euston to MK	MKEU5	MILTON KEYNES CENTRAL_LONDON EUSTON	-	3	3
			EUMK5	LONDON EUSTON_MILTON KEYNES CENTRAL	-	3	3
	St Albans	Abbey Line frequency improvements: headway > 20mins	WFSA1	WATFORD JUNCTION_ST ALBANS ABBEY	4	9	5
			SAWF1	ST ALBANS ABBEY_WATFORD JUNCTION	4	9	5
	Stevenage	Stevenage to Hertford Thameslink timetable change to 30min headway improvement Increased capacity of station with 5th platform and associated timetable changes	MOSV1	MOORGATE_STEVENAGE	2	6	4
			MOSV2	MOORGATE_STEVENAGE	1	6	5
			SVMO1	STEVENAGE_MOORGATE	2	6	4
			SVMO2	STEVENAGE_MOORGATE	2	6	4

BUS PASSENGER FLOW

6.3.12. Frequency change and Flow difference plots for bus demand are presented below in Figure 6-13 to Figure 6-18.

6.3.13. The bus frequency change plots depict the changes in the transit service frequencies between 2036 Local Plan and 2014 Base year for bus mode. It is to be noted that the headways in the model have been coded as per peak period (i.e. 3hrs), hence, the service frequency changes are the ones as per the peak period. The green bars indicate a decrease in flow, while the red bars indicate an increase. The greater the thickness of the line, the greater the change in service frequency. The bus improvements made from 2014 Base Year to 2036 Local Plan as per Table 6-14 are depicted in the bus frequency change plots.

6.3.14. The flow difference plots show the differences between 2036 Local Plan and 2014 Base Year bus passenger flow. The green bars indicate a decrease in flow, while the red bars indicate an increase. The greater the thickness of the line, the greater the flow difference. An equivalent set of plots for the NTEM constrained scenario is presented in Appendix F.

6.3.15. The changes in the service frequency plots are seen to be consistent in terms of the changes in the flow difference plots in each peak, as seen in particular for A41 and M1 corridor and in Stevenage and A505 corridor. However, the generalised cost changes due to the network improvements have also caused additional network effects across the study area.

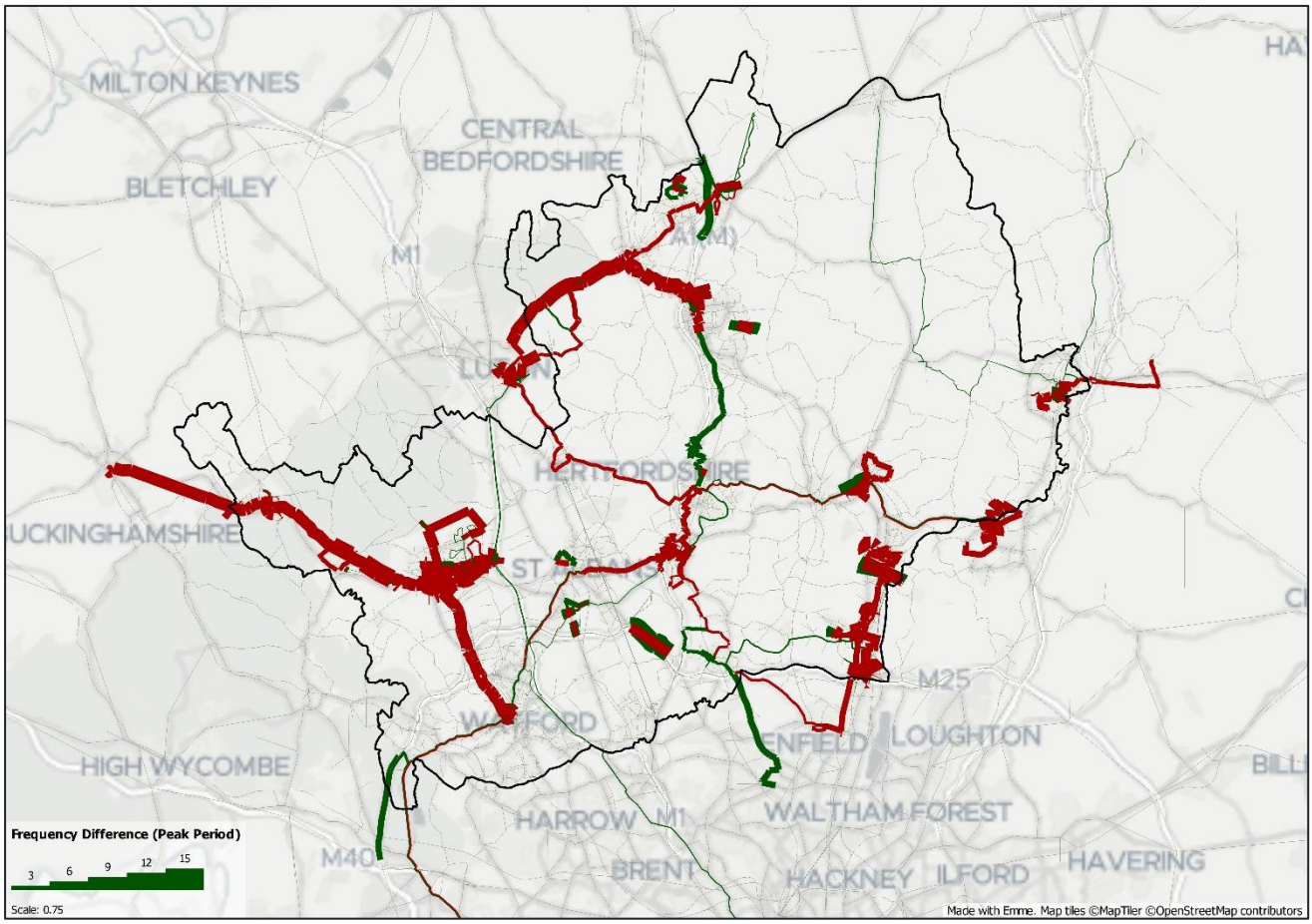


Figure 6-13 - Bus Frequency Change 2014 vs 2036 Local Plan AM Peak Period

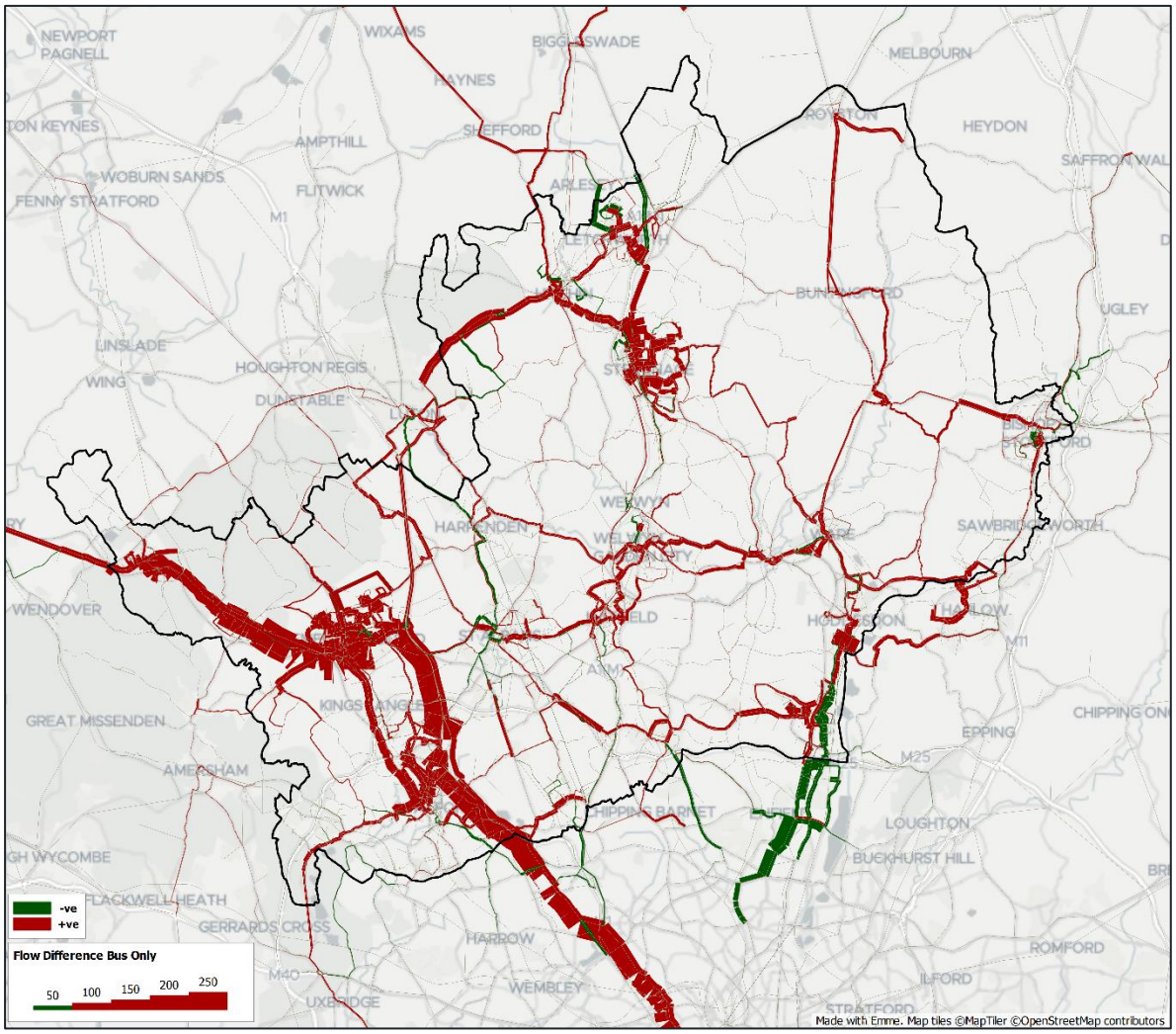


Figure 6-14: Bus Passenger Flow Change 2014 vs 2036 Local Plan AM Peak Hourly Flow

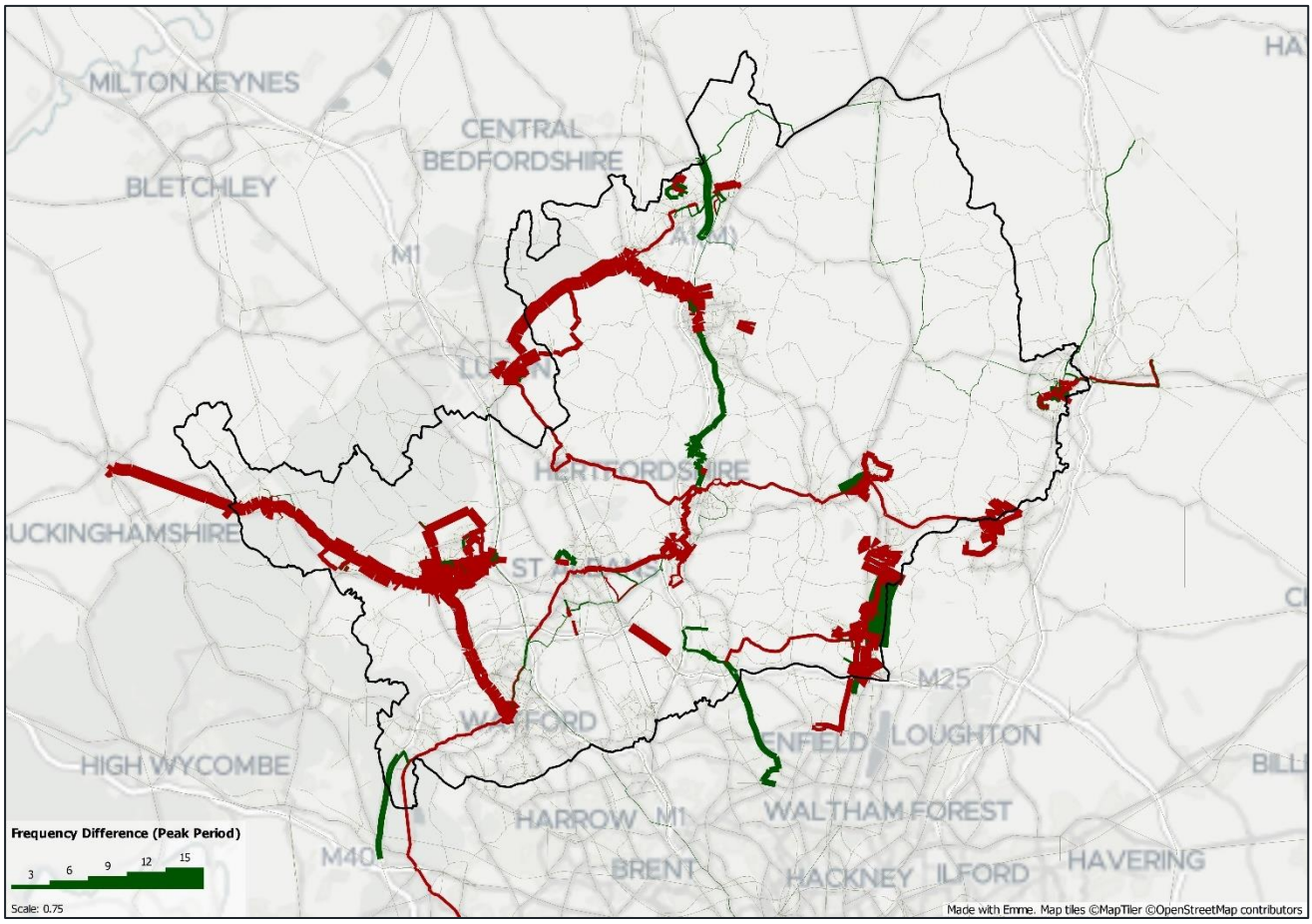


Figure 6-15 - Bus Frequency Change 2014 vs 2036 Local Plan Inter-Peak Period

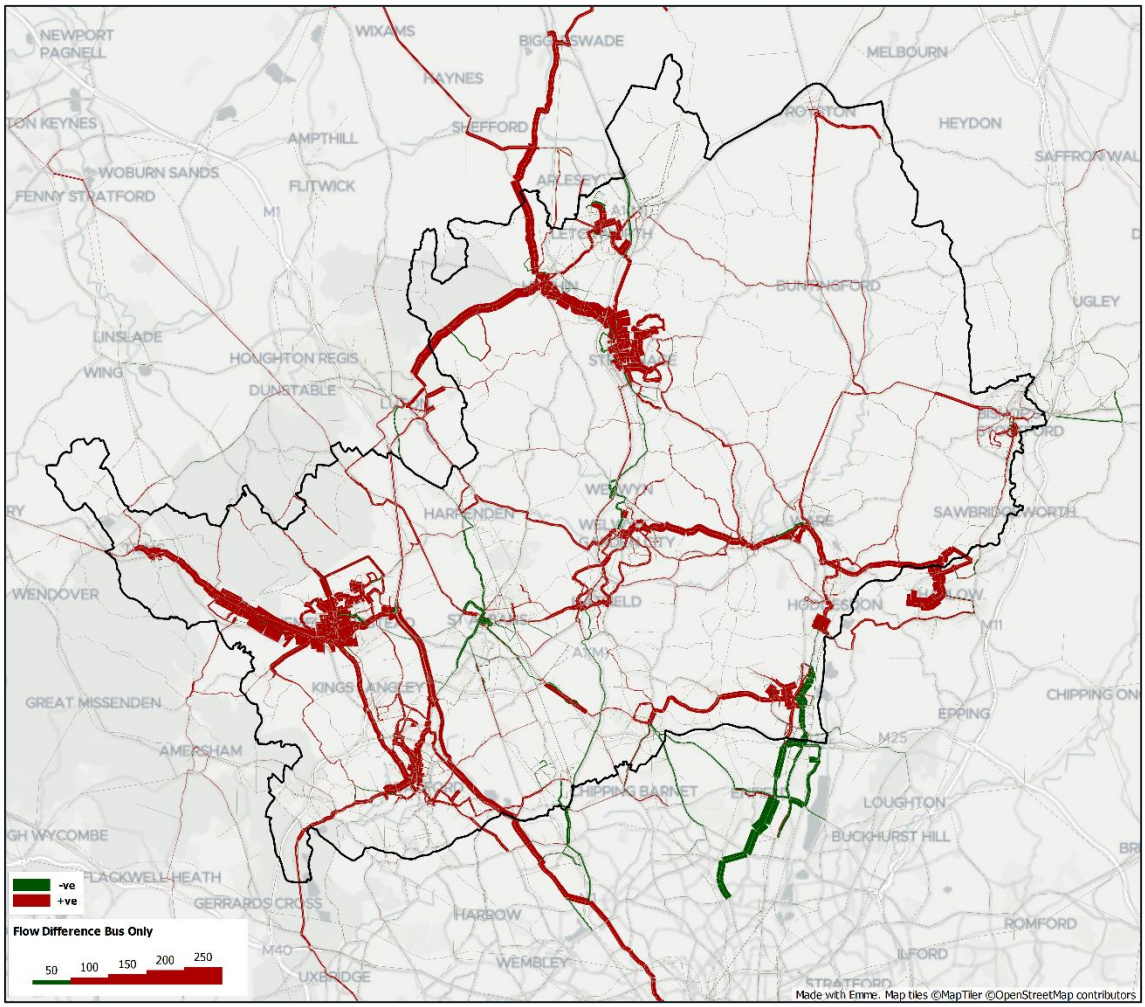


Figure 6-16: Bus Passenger Flow Change 2014 vs 2036 Local Plan Inter-Peak Hourly Flow

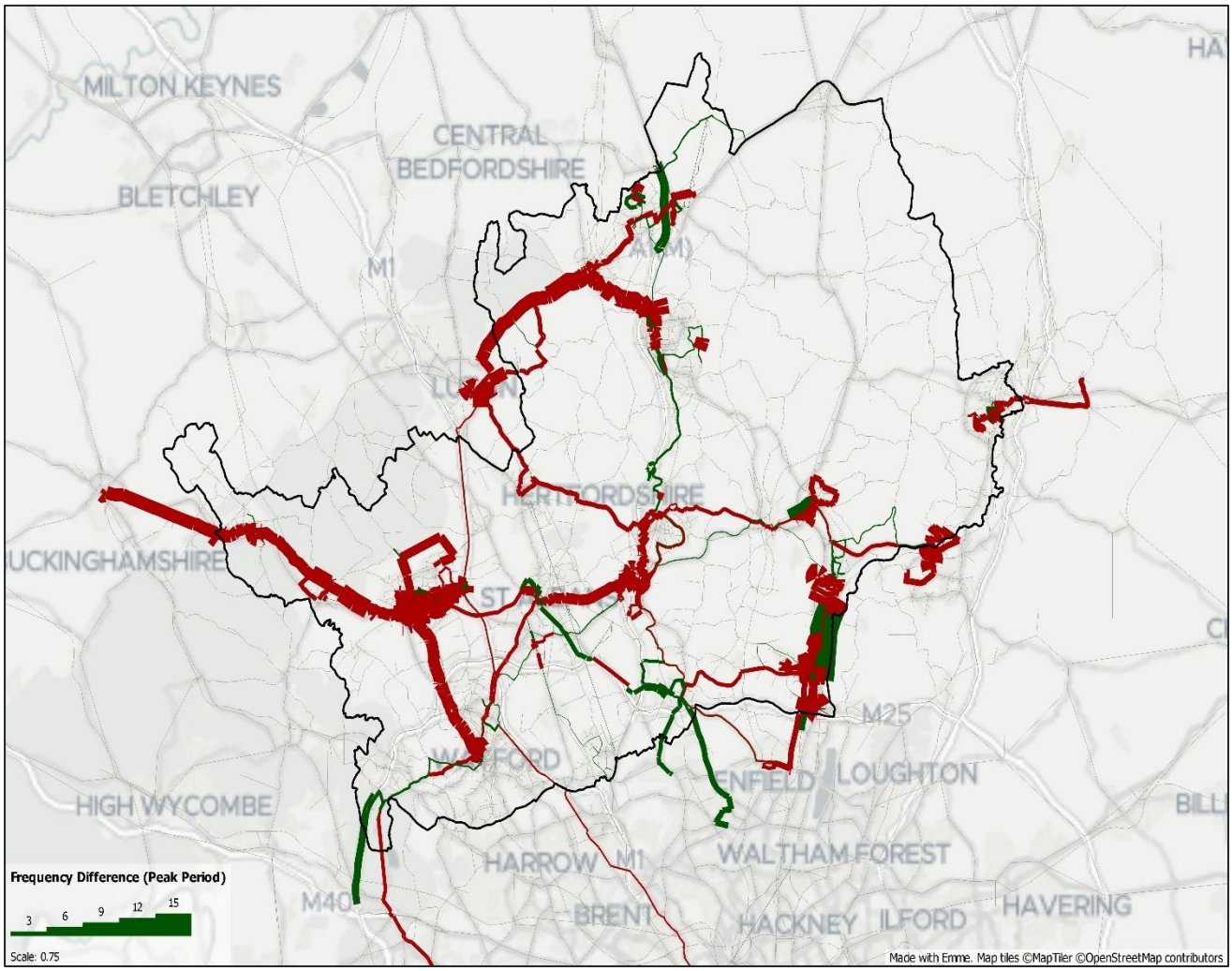


Figure 6-17 - Bus Frequency Change 2014 vs 2036 Local Plan PM Peak Period

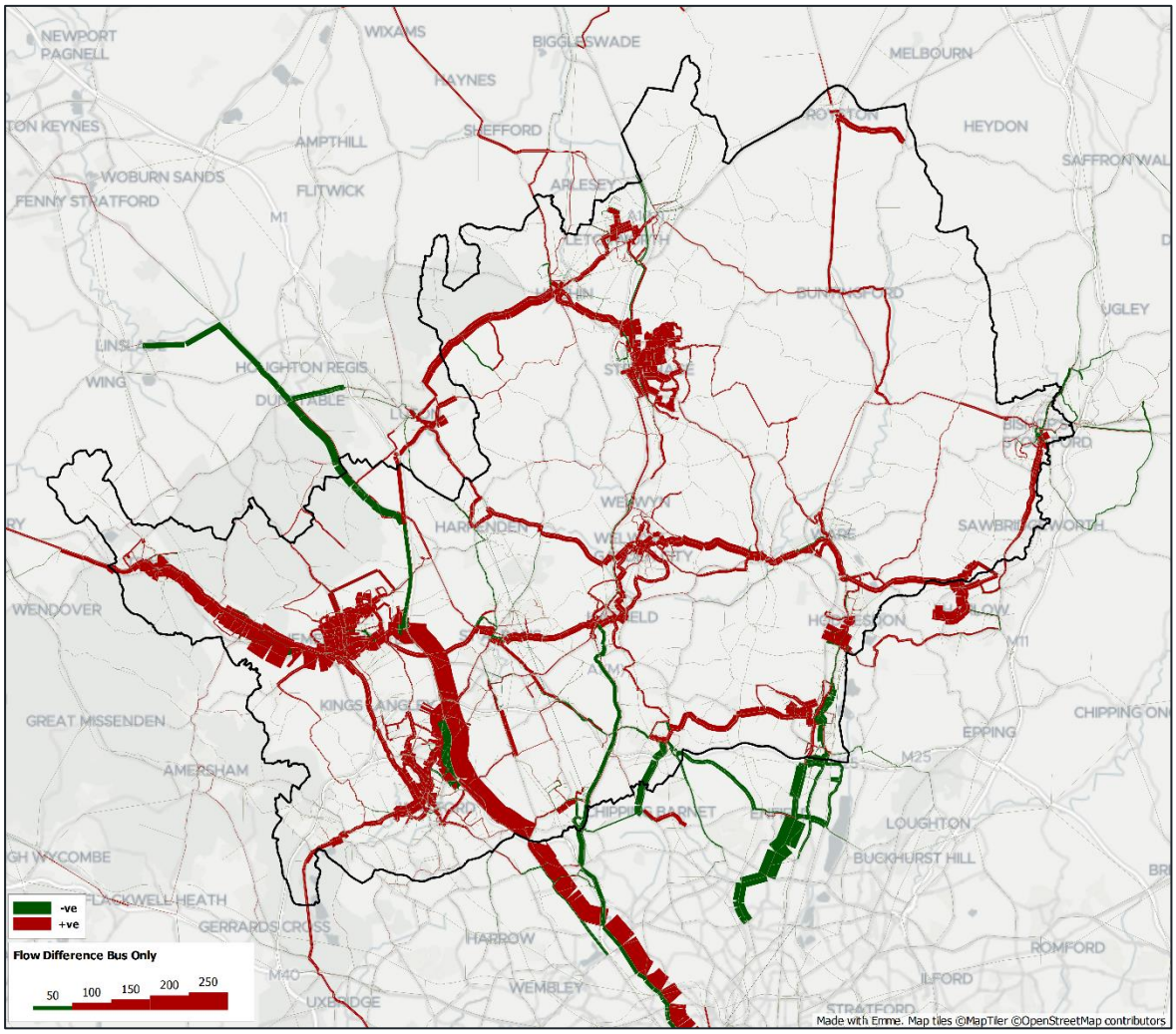


Figure 6-18: Bus Passenger Flow Change 2014 vs 2036 Local Plan PM Peak Hourly Flow

RAIL PASSENGER FLOW

6.3.16. The rail frequency change and passenger flow difference plots between 2036 Local Plan and 2014 Base Year are shown below in Figure 6-19 to Figure 6-24. The green bars indicate a decrease in flow, while the red bars indicate an increase. The greater the thickness of the line, the greater the flow difference.

6.3.17. The rail frequency change plots depict the changes in the transit service frequencies between 2036 Local Plan and 2014 Base year for bus mode. It is to be noted that the headways in the model have been coded as per peak period (i.e. 3hrs), hence, the service frequency changes are the ones as per the peak period. The green bars indicate a decrease in flow, while the red bars indicate an increase. The greater the thickness of the line, the greater the change in service frequency. The rail improvements made from 2014 Base Year to 2036 Local Plan as per Table 6-14 are also depicted in the rail frequency change plots.

6.3.18. Some of the main increases in passenger flows due to the increased frequency can be seen on the Thameslink service from Stevenage to Hertford, West Anglia line through the Cross Rail route and

the West Coast mainline from Euston to Milton Keynes, and Oxford to Cambridge rail link via London.

6.3.19. The changes in the service frequency plots are seen to be consistent in terms of the changes in the flow difference plots in each peak. However, the generalised cost changes due to the network improvements have also caused additional network effects across the study area.

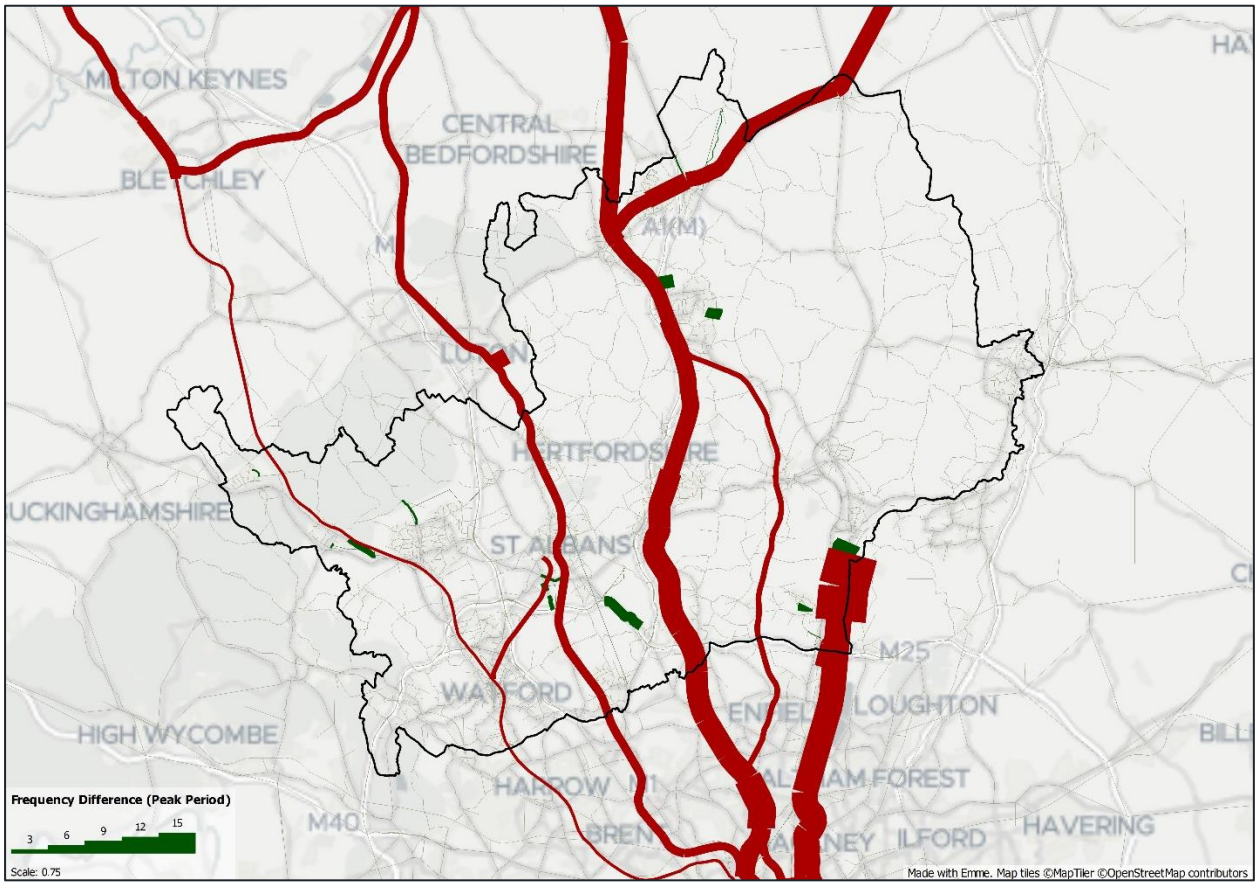


Figure 6-19 - Rail Frequency Change 2036 Local Plan vs 2014 AM Peak Period

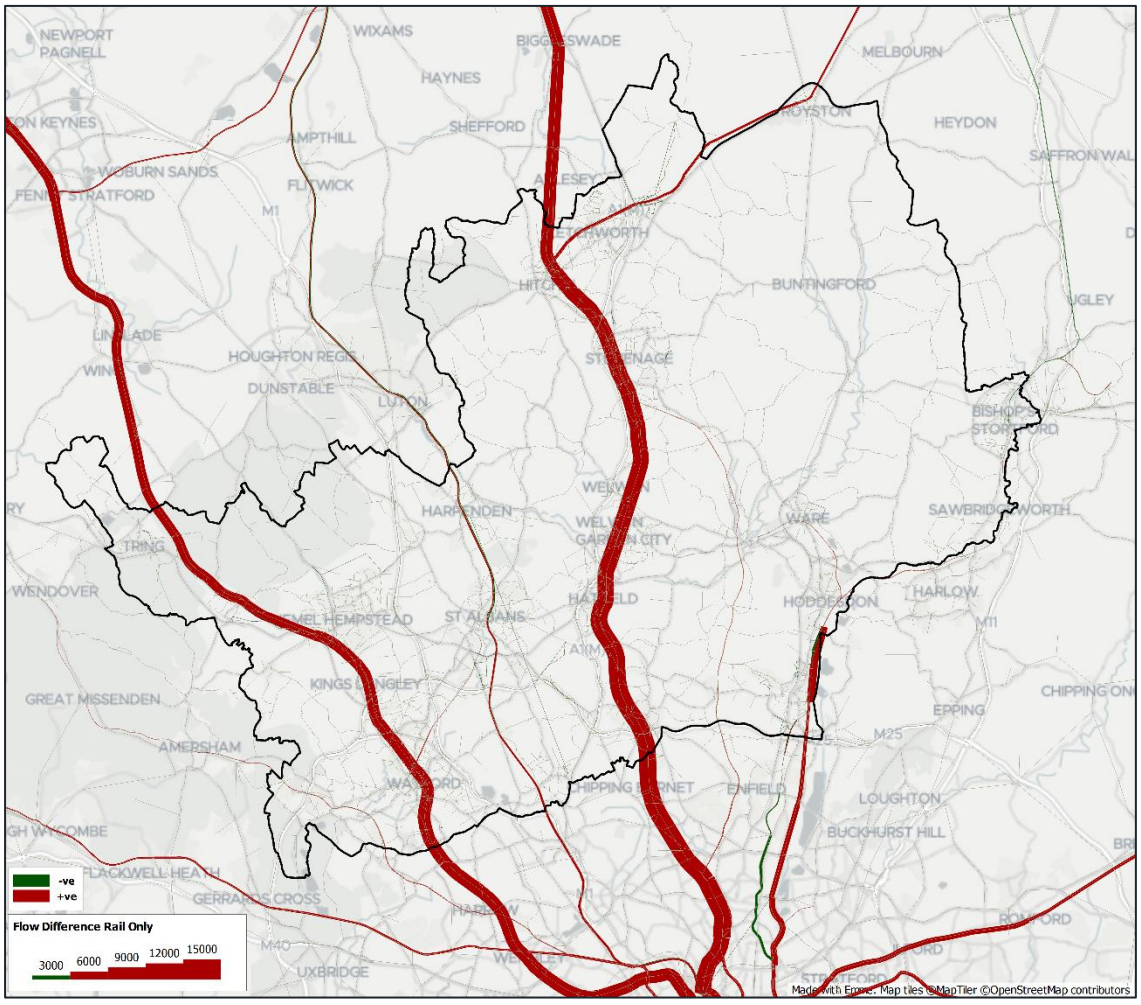


Figure 6-20: Rail Passenger Flow Change 2036 Local Plan vs 2014 AM Peak Hourly Flow

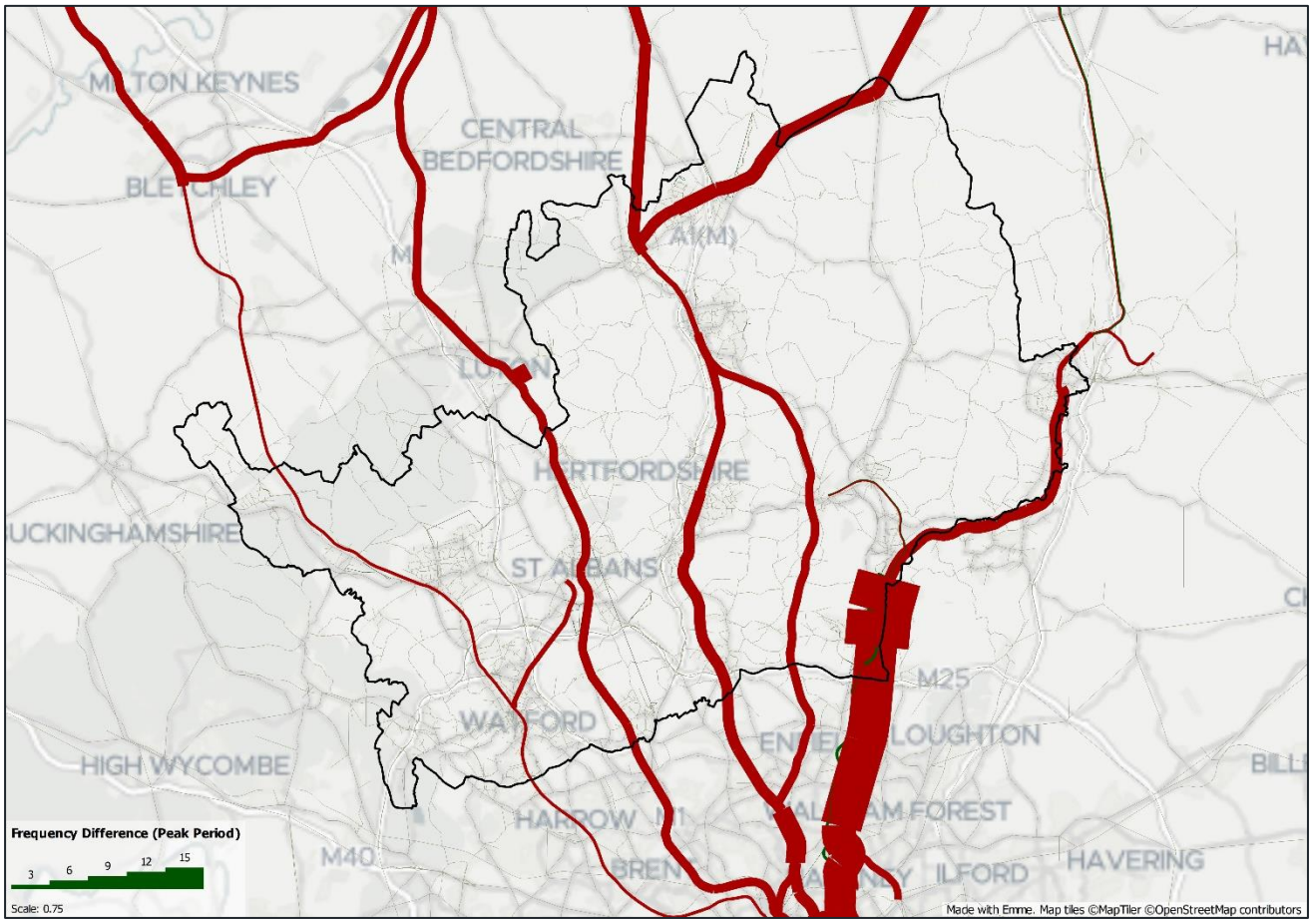


Figure 6-21 - Rail Frequency Change 2036 Local Plan vs 2014 Inter Peak Period

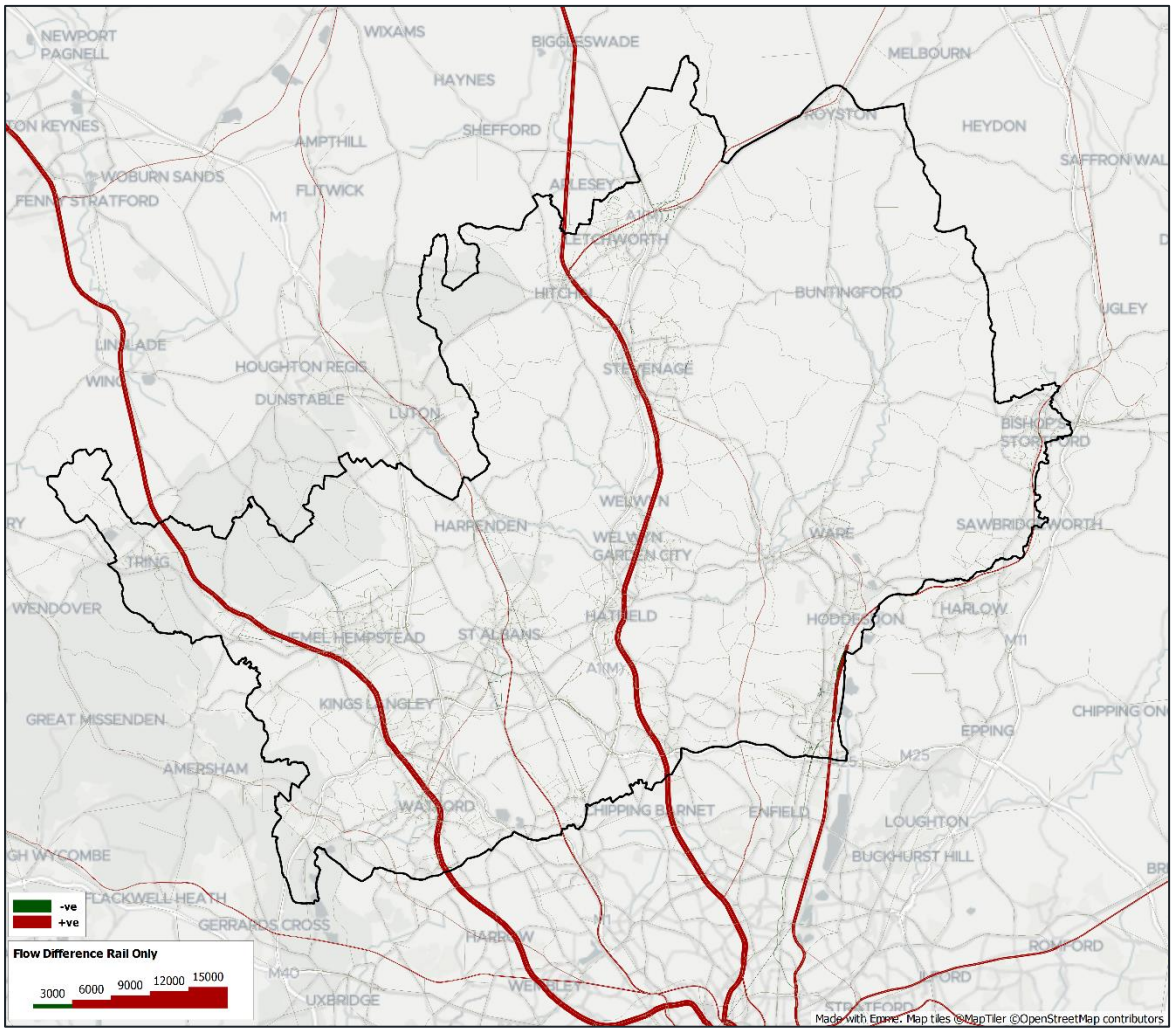


Figure 6-22: Rail Passenger Flow Change 2036 Local Plan vs 2014 Inter Peak Hourly Flow

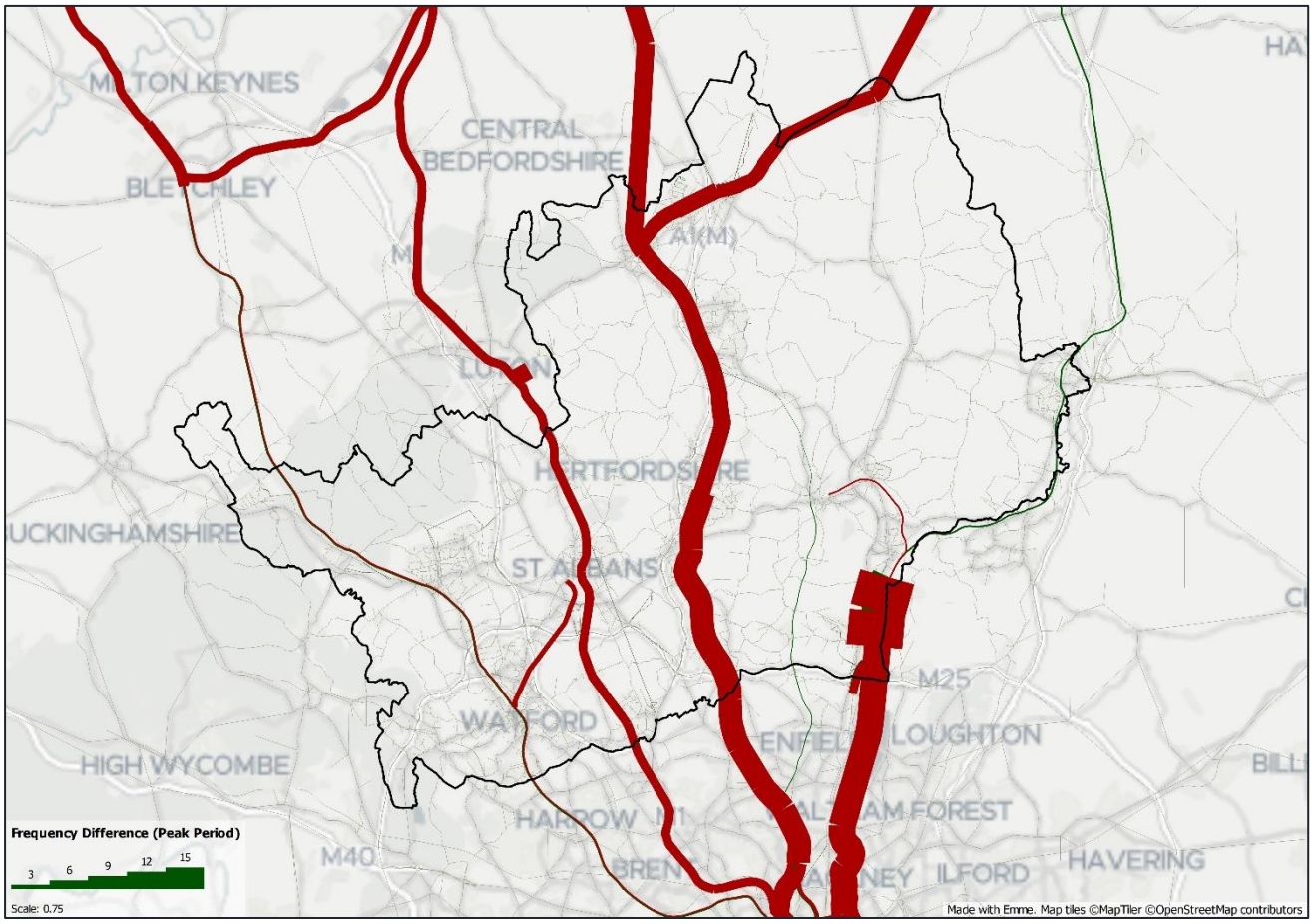


Figure 6-23 - Rail Frequency Change 2036 Local Plan vs 2014 PM Peak Period

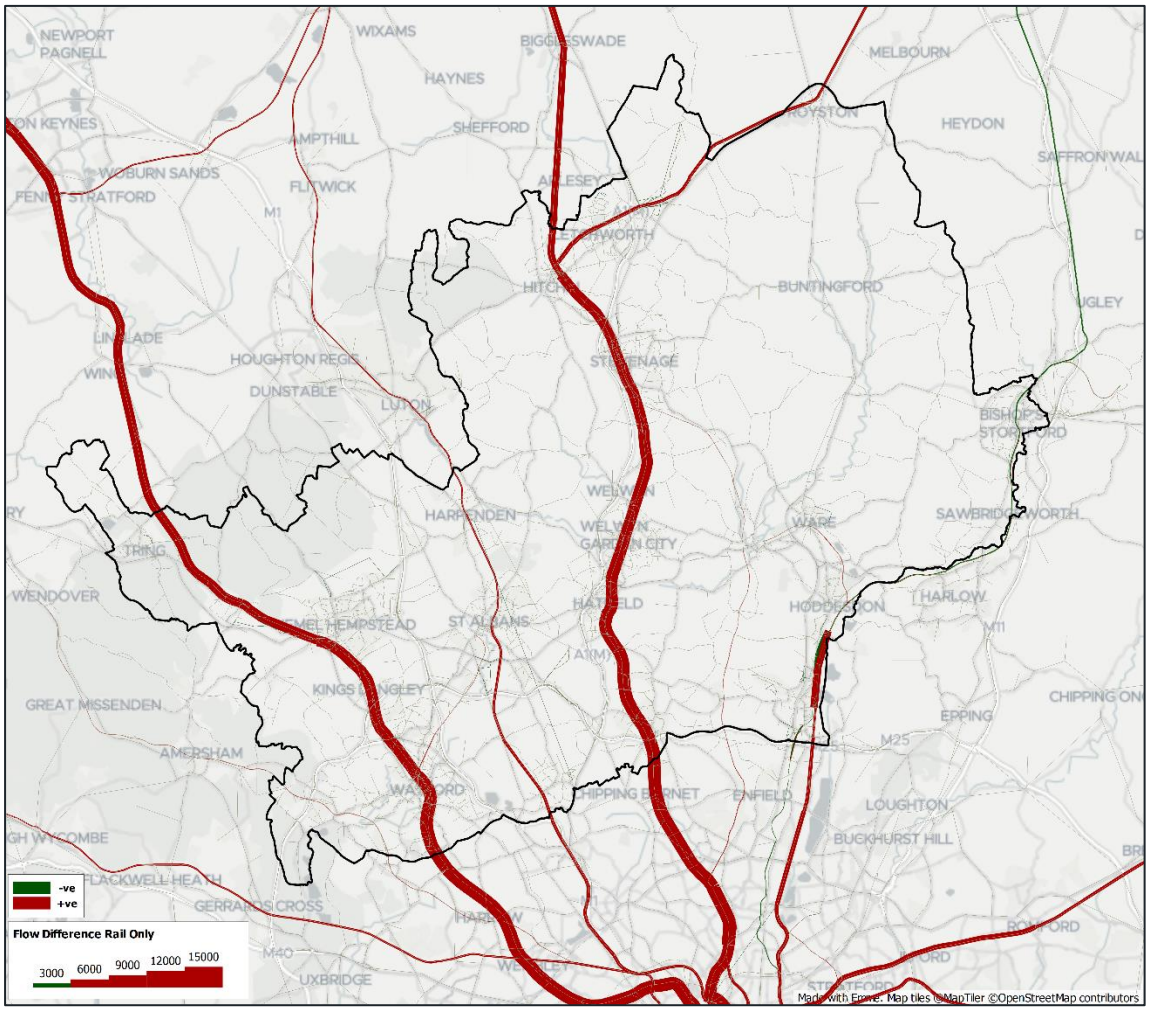


Figure 6-24: Rail Passenger Flow Change 2036 Local Plan vs 2014 PM Peak Hourly Flow

6.3.20. It must be noted that as a multi-modal logit model, COMET is not an ideal tool for assessing most strategic rail schemes this would more usually be done with a rail elasticity model based on the Passenger Demand Forecasting Handbook (PDFH).

6.3.21. The overall rail growth in COMET is significantly lower than might be expected from a rail elasticity model. It would be possible to use the COMET rail assignment model to develop a PDFH-style rail forecasting tool, but this would be outside the scope of this document.

7 SUMMARY AND DISCUSSION

7.1 SUMMARY

7.1.1. COMET 7 is a version of the COMET derived from version 6 with planning and transport schemes assumptions provided by Hertfordshire in Spring 2022. The base model was reviewed, and a variety of changes were made in the base model to improve the representation of reality in the model. Details of the changes are provided in the LMVR Addendum[6].

7.1.2. Two forecast scenarios have been modelled: an NTEM constrained scenario for use in Business Cases and standalone development testing, and a Local Plan scenario to test the cumulative impact of the growth in Hertfordshire. Both scenarios have a forecast year of 2036.

7.1.3. This document has outlined the forecasting approach, development of forecast networks and trip matrices, and presents the results in terms of highway and public transport assignments. This forecast shows that the variable demand, highway and public transport models all behave as expected and provide reasonable results.

7.1.4. The forecast results show significant congestion on key urban and inter-urban roads in 2036. Highway trips originating in Hertfordshire are shown to increase by approximately 15% and 22% between 2014 and 2036 in the NTEM constrained in the AM and PM peaks respectively. For the Local Plan scenario, the growth is significantly higher at 20% and 26% for these peak periods. This increase is accompanied by a rise in travel distance of between 24% and 39% (depending on the scenario and time period, with the longest distances travelled in the IP period), and an increase in travel time of between 40% to 52%, depending on the scenario and time period, although highest in the Local Plan scenario, especially the Interpeak. The relatively sharp rise in travel time compared to travel distance is indicative of increasing congestion and corroborates the maximum fall in average network speed of approximately 12-13% in the AM and PM peaks of the Local Plan scenario.

7.1.5. Forecast results indicate that the rail network in Hertfordshire will experience an increase in passenger boardings between 85% and 176% across the AM, IP and PM peaks between 2014 and 2036. Bus travel is likely to grow at a lower rate (between 61% - 75%) over the same period. Underground in Hertfordshire is predicted an increase between 35% and 58% over the period also.

7.1.6. Passenger distance travelled increases for both bus and rail, however rail more so as rail becomes a more attractive option as rail offers better service in terms of time, cost and connectivity. Some of the main increases are due to the increased frequency on the Thameslink service from Stevenage to Hertford, West Anglia line through the Cross Rail route, the West Coast mainline from Euston to Milton Keynes, and Oxford to Cambridge rail link via London. Bus distances are predicted to increase between 18% and 23% over the forecast period, whilst rail distances are predicted to increase by 50% to 71% over the period.

[6] 2022-03-24 LMVR Addendum COMET 7

7.2 DISCUSSION

7.2.1.1 The forecasts account for changes in population, the number of dwellings and jobs, as well as the changing cost of travel by particular modes, and reflects the impact of the infrastructure schemes that have been modelled in the two scenarios. Both scenarios are cumulative forecasts, and as such the impacts of a particular scheme or development cannot be isolated. It should be noted that due to its early stage of development the HERT Mass Rapid Transit scheme is not yet included in the local plan run

7.2.2. The modelling does not account changes in travel patterns that might result from the recent COVID-19 pandemic, or other potential influences on travel demand such as Autonomous Vehicles. As such the Local Plan and the NTEM scenarios can be viewed as two possible representations of the future in Hertfordshire.

7.2.3. Indeed, going forward one approach could be to consider different levels of growth alongside different groupings of infrastructure schemes. If these were to pivot off the core modelling reported on in this report these would be sensitivity tests of different measures and growth levels rather than a full update of all elements. This would make it easier to isolate out the cause of particular changes within the network from one assignment to the next.

7.2.4. The current approach to modal shift in the model should be revisited in a future run as the detail of potential schemes to achieve the modal shift are developed such that the shift arises from a result of the Variable Demand Model rather than of a parameter change.

Appendix A

INFRASTRUCTURE SCHEMES

Table A-1: Modelled Infrastructure Schemes (sorted by District then Scenario)

HCC REF	District	Location	Description of Scheme	Scenario
HS.05	Broxbourne	Cheshunt/(A10 / College Road)	Implementation of right turn bans between A10 and College Road and free flow LT slip from A10 north to College Road E (MRN Option 2)	LP
HS.06	Broxbourne	Cheshunt	A10 / Church Lane at grade junction improvements (MRN Option 2)	LP
184	Broxbourne	Enfield	Measures associated with the Northern Gateway Access Package in Enfield	LP
Brox_LPS_10tph	Broxbourne	Crossrail 2	10 tph from Broxbourne to Liverpool Street (Potential twin tracking and Crossrail 2)	LP
HS.07	Broxbourne	Cheshunt(Church Lane / High Street)	Reconfiguration of Church Lane / High Street roundabout to provide signalised crossing junction & crossing points for pedestrians	LP
HS.08	Broxbourne	Flamstead End	Reconfiguration of Church Lane / Churchgate Rd roundabout to provide signalised crossing junction & crossing points for pedestrians	LP
HS.09	Broxbourne	Turnford / Brookfield	New 4 lane Link road runs through to Halfhide Lane which then becomes Brookfield Lane W south of the retail park - SB onslip at the Turnford interchange is no longer assumed.	LP
HS.10	Broxbourne	Brookfield Centre	New link road running between Turnford Link Road and A10 providing revised access into Brookfield and Tescos with closure of existing junction between Halfhide Lane and the Links	LP
HS.16	Broxbourne	Goffs Oak(Goff's Lane/ Newgatestreet Road)	Reconfiguration of Goffs Lane / Newgate St junction to provide signalised junction & crossing points for pedestrians	LP
Brox_Figure 3	Broxbourne	Park Plaza to Waltham Cross	New bus route Park Plaza North-Waltham cross bus station	LP
HS.04	Broxbourne	Waltham Cross	New 4 arm junction on Lieutenant Ellis Way to north of Park Plaza	LP
HS.02	Broxbourne	Waltham Cross	Modify existing 3 arm signal junction on A10 to provide at grade 4 arm junction for access into Park Plaza North & West	LP

HCC REF	District	Location	Description of Scheme	Scenario
HS.15	Broxbourne	Waltham Cross(Monarchs Way / WCW / Swanfield Way)	Reconfiguration of Monarchs Way. Winston Churchill Way junction to provide signalised junction & crossing points for pedestrians	LP
Bro_Park Plaza	Broxbourne		New Station at Park Plaza	LP
PT.03	Broxbourne	Waltham Cross to Hertford Regional College	New bus service, Waltham Cross station to Hertford Regional College	LP
Bro_Detection	Broxbourne	Old A10	Selective Vehicle Detection providing priority for buses on old A10 (A1170 /B176) at Station Road / High Road (Broxbourne), A1170 / Vancouver Road, Church Lane / Turners Hill & Old Pond junction (Cheshunt)	LP
Brox_New 1	Broxbourne	Hoddesdon(Pindar Road / Essex Road)	Reconfiguration of junction to provide additional capacity-Right Turn Facility at the P J Widen 2. Proposed right turn facility at the Priority junction of Pindar Road and Essex Road	LP
HS.12	Broxbourne	Turnford	Great Cambridge Road / Halfhide Lane junction improvements	LP
HS.03	Broxbourne	Waltham Cross (A10/LEW/WCW)	A10 / Lieutenant Ellis Way - Reconfiguration of the junction into a hamburger with access into (and out of) the Park Plaza West site at the Great Cambridge Road/Great Eastern Road signals. (MRN Scheme)	LP
Bro_Turnford	Broxbourne	Turnford	New station at Turnford	LP
HCE_BR	Broxbourne	Broxbourne	New bus service Hoddesdon to Enfield via Cheshunt (2 services per hour)	LP
A10_DB	Broxbourne	Hoddesdon	A10_Hoddesdon_Dumbell_Roundabout New roundabout to permit access to High Leigh development	NTEM
C1	Broxbourne	M25 junction 25	M25 junction 25 RIS 2 capacity improvements - Option 2	NTEM
Brox Figure 1	Broxbourne	High Leigh to Broxbourne	Bus service-New Bus service High Leigh - Broxbourne Station	NTEM
HS.20	Broxbourne	Hoddesdon	New Essex Road alignment and bridge	NTEM

HCC REF	District	Location	Description of Scheme	Scenario
Old Pond	Broxbourne	Cheshunt	Old Pond junction improvement	NTEM
C3	Broxbourne	M25 jct 25-27	Widening of M25 to 4 lanes with hard shoulder running (as implemented since 2014)	NTEM
HS.19	Broxbourne	Hoddesdon(B1197 Hertford Road / Ware Road Hoddesdon)	Roundabout improvements to provide additional eastbound & southbound lanes at B1197 Hertford Road / Ware Road roundabout, Hoddesdon	NTEM
HS.18	Broxbourne	Hoddesdon(Dinant Link Road / Ware Road / Amwell St)	Roundabout improvements to provide additional eastbound & southbound lanes at Dinant Link Road / Ware Road / Amwell Street roundabout, Hoddesdon	NTEM
GTP LP1, LP3, LP10, SM4, SM27, SM5a, Sm32	Dacorum	Hemel Hempstead	A414 Breakspear Way (Hemel) Multi modal corridor & severance reduction (Assume 15 min peak hour frequency bus service in dedicated lane.	LP
MG_SC7	Dacorum	Redbourn	HGV restrictions on B487 and A5183 (as implemented since 2014)	LP
40 (D/32)	Dacorum	Hemel Hempstead	Rearrangement of A414 Two Waters Way/ A4251 London Road junction & signal optimisation	LP
T/18	Dacorum	Berkhamsted	Extension of 20mph zone and pedestrian crossing facilities along High Street Corridor Berkhamsted	LP
SM5b	Dacorum	Hemel Hempstead	Development accesses to North Hemel site from Redbourn Road and Leighton Buzzard Road with through link for buses only	LP
41a	Dacorum	Hemel Hempstead	West of Hemel Development site Secondary site access onto The Avenue (extension of existing spur)	LP
41b	Dacorum	Hemel Hempstead	Main development access from West Hemel via Long Chaulden	LP
43	Dacorum	Hemel Hempstead	New roundabout access from North Hemel development site onto A4147 Link Road	LP
PR14	Dacorum	Hemel Hempstead	Closure of Lawn Lane to vehicles and diversion of vehicles to Durrants Hill Road / London Road (scheme assumes diversion of vehicles to Corner Hall but	LP

HCC REF	District	Location	Description of Scheme	Scenario
			this isn't in model so assume all vehicles divert to Durrants Hill Road instead and take ac	
MGC S2 Sm6/b	Dacorum	Maylands Area, Hemel Hempstead	New spine road from B487 Rebourn Road to A414 St Albans Rd - dual carriageway up to new link from M1. Single carriageway north of here, connecting with Redbourn Road via a roundabout	LP
PR9	Dacorum	Hemel Hempstead	Reduced speed (20mph) along A4251 London Road link to simulate impact of cycle lane and road narrowing	LP
SM4a	Dacorum	Hemel Hempstead	Bus priority lanes on A414 WB, Station Road and Two Waters Road approaches to Plough roundabout	LP
SM7_SW	Dacorum	M1 Junction 8, Hemel Hempstead	M1 Junction 8 - Major reconfiguration to provide direct access into Maylands	LP
SM10_SW	Dacorum	Hemel Hempstead, Luton	M1 dedicated coach service Luton to HH	LP
HH STT	Dacorum	Hemel Hempstead	Hemel Hempstead mode shift assumed to simulate impact of sustainable transport measures	LP
WT_Acc	Dacorum	Tring	New access and north south distributor road for West of Tring development	LP
BS_ISR_MNB	Dacorum	Hemel Hempstead	NB bus lane on Maylands Ave	LP
BS_ISR_LRd	Dacorum	Hemel Hempstead	Short section of bus lane on London Rd on approaches to Two Waters junction	LP
Bi8	Dacorum	Berkhamsted	Major junction enhancement at the Durrants Lane, Durrants Road and Westfield Road roundabout	LP
Bi89	Dacorum	Berkhamsted	Expansion of Shrublands 20mph zone	LP
Bi27	Dacorum	Berkhamsted	Major junction enhancement at the junction of A4241, A416 and Lower Kings Road –Berkhamsted improvements	LP
Bi52	Dacorum	Berkhamsted	20mph zone bounded by A4251 N, Mill Street Castle Street, Station Road, Ellesmere Road, Bank Mill Lane Berkhamsted improvements	LP

HCC REF	District	Location	Description of Scheme	Scenario
Bi53	Dacorum	Berkhamsted	20mph zone along a short section of A4251 and Lower Kings Road	LP
Bi54	Dacorum	Berkhamsted	London Road Corridor - south of Berkhamsted Gateway (Speed reduction to 30mph)	LP
Ti42	Dacorum	Tring	20mph speed limit area in central and western Tring	LP
Ti74	Dacorum	Tring	20mph speed limit in north-east Tring, east of Dundale Road to Brook Street in the west, bounded just inside Icknield Way in the north and High Street in the south.	LP
Ti14	Dacorum	Tring	Signalise Western Road/ Christchurch Rd /High St/ Langdon St Roundabout with new pedestrian crossing facilities at Tring	LP
Ti30	Dacorum	Tring	Replace Icknield Way / Wingrave Rd / Bulbourne Rd roundabout with signals at Tring	LP
DBC_EW2	Dacorum	Tring - Hemel	A4251 bus priority corridor - assumed reduced journey time for bus with doubling in frequency of services and reduced speed for other vehicles	LP
DBC_IDP_HN_1	Dacorum	Hemel Hempstead	Southbound bus lane on Leighton Buzzard Rd north from N Hemel Development access onto Leighton Buzzard Rd to Queensway Junction - assumes road space remains - coded as improved bus journey time	LP
DBC_IDP_HN2	Dacorum	Hemel Hempstead	Traffic calming of Piccotts End Road Hemel (Link Road to LBR) - coded as 20mph	LP
DBC_IDP_HS3	Dacorum	Hemel Hempstead	NB bus lane on Two Waters Rd from reallocation of existing traffic lanes & bus priority signals at Corner Road	LP
DBC_IDP_11_6	Dacorum	Berkhamsted	Local bus link to Berkhamsted South development site (assume 20 min frequency)	LP
DBC_IDP_11_8	Dacorum	Tring	Local bus link serving new development north of Station Road linking with station (assume 20 min frequency)	LP
EH_Bus	Dacorum	Hemel Hempstead	Bus services to serve new development at East Hemel	LP

HCC REF	District	Location	Description of Scheme	Scenario
3CTL	Dacorum	Hemel Hempstead	Junction Signalisation- Three Cherry Trees Lane/Swallowdale Lane (as implemented since 2014)	NTEM
MG SC1H	Dacorum	Hemel Hempstead	Interim at grade signalisation scheme- A414/Green Lane	NTEM
ITP190019	Dacorum	Hemel Hempstead	New link between Boundary Way and Wood Lane End (assume single carriageway with 2 way traffic and 30mph. Buncefield Lane north of Boundary Way (between Boundary Way and Cherry Tree Lane and between the A414 and Green Lane will become a quietway	NTEM
D/29	Dacorum	Hemel Hempstead	Signal optimisation at the A4251 London Road/ Nash Mills Lane junction	NTEM
D/31	Dacorum	Hemel Hempstead	Signal optimisation at A4147 Maylands Avenue/ Wood Lane End junction	NTEM
MG_SC3/ PR28 /PR97 /PR98 /PR99	Dacorum	Maylands Area, Hemel Hempstead	Close the existing narrow country lanes within the industrial area of Cherry Trees Lane, Buncefield Lane (north) and Buncefield Lane (south) to through traffic	NTEM
T/17 Dac_Shooters Way	Dacorum	Berkhamsted	improvements including traffic lights and pedestrian crossings required in association with MU/6: Land at Durrants Lane / Shootersway (Egerton Rothesay School) and Local Allocation LA4: Hanburys.	NTEM
46	Dacorum	A4146 Water End	A4146 HGV ban at Waterend (as implemented)	NTEM
45	Dacorum	A5 Dunstable	M1 A5 Link Road Dunstable (as built)	NTEM
ITP190016 -1	Dacorum	Hemel Hempstead	Durrants Hill / Lawn Lane addition of pedestrian stage at signal	NTEM
A414BW_ SpeedSig	Dacorum	Hemel Hempstead	Reduction of speed limit and implementation of signalised crossing on A414 between Maylands Avenue & Green Lanes (as built)	NTEM
EATF_Bound	Dacorum	Hemel Hempstead	Creation of a Dutch-style roundabout and cycleway at Boundary Way	NTEM
37	East Herts	Ware	North_Ware_Spine_Road for new North Ware development (WARE2) Between A1170 and B1004	LP

HCC REF	District	Location	Description of Scheme	Scenario
EH22 /WH11	East Herts	A414/B195 Birchall Lane/Cole Green Lane	Capacity improvements at A414/B195 Birchall Lane/Cole Green Lane roundabout, Welwyn Garden City, which was identified through WHBC junction design study	LP
EH11	East Herts	Sawbridgeworth	Signalise existing junction- the A1184 / High Wych Road junction, Sawbridgeworth.	LP
EW J	East Herts	Harlow	Eastwick junction Replacement of roundabout with signalised junction and provision of new arm to north providing bus access to Gilston development	LP
EH_New_1	East Herts	Ware	New bus routes serving NW Ware development (45,47,50,41, 48,40)	LP
Hertford East line	East Herts	Hertford East to Liverpool St/Stratford	Increase in train frequency from 2-3 trains per hour	LP
SAWB4	East Herts	Sawbridgeworth	New priority junction on Cambridge Road	LP
EH S St	East Herts	Bishops Stortford	South Street Road, Bishop Stortford closure during peak hours between Bridge Street and Newton Road,	LP
Ware STT	East Herts	Ware	Simulation of mode shift in Ware to represent sustainable travel measures	LP
Hertford STT	East Herts	Hertford	Simulation of mode shift in Hertford to represent impact of sustainable transport measures	LP
EH8a	East Herts	Hertford	Ware Road / Mill Road, Hertford Junction reconfiguration	LP
EH/499/2016	East Herts	Bishops Stortford	Rye Street, Bishop Stortford Traffic Calming & Improvement Works	LP
BStoC_PT	East Herts	Bishops Stortford	Bishops Stortford - Cambridge 2 additional fast trains per hour off-peak	LP
GilstonRoads	East Herts	Gilston area	New accesses onto A414/ Eastwick Road and internal distributor road for Gilston development	LP
A1184_NB_Jct	East Herts	Sawbridgeworth	Upgrades of A1184/West Road/Station Rd junction-Poynton style roundabout	LP
PR50	East Herts	Bishops Stortford	London Road/ South Road Bishops Stortford Intelligent bus actuated signals which can detect approaching buses and	LP

HCC REF	District	Location	Description of Scheme	Scenario
			amend traffic signals to allow buses to get through quicker	
PR16	East Herts	Bishops Stortford	Adderley Road/ The Causeawy . Bishops Stortford - revise turning movement allocations to manage traffic queues by adjusting layout to allow left turn from offside lane on Adderley Road & optimise signals	LP
PR53	East Herts	Bishops Stortford	Increase bus mode share by connecting the outer suburbs to the Bishops Stortford town centre through an enhanced bus service 386	LP
SM244	East Herts	Sawbridgeworth	Extend the 30mph speed limit zone in areas south of A1184 and east of Station Road, Sawbridgeworth	LP
SM177	East Herts	Bishops Stortford	Improved bus journey times and frequencies along B1004 Rye St	LP
SM74_E	East Herts	Bishops Stortford	Improved bus frequencies along Villers-sur-Marne Avenue	LP
28	East Herts	Bishops Stortford	New Link Road through Goods Yard site between London Road and Dane Street	NTEM
13	East Herts	Bishops Stortford	Additional lanes on approach arms to the A120 / A1250 (Hadham Road) - Tesco's junction	NTEM
36	East Herts	Amwell	A10 Amwell Roundabout Bus lane removal (as implemented)	NTEM
2	East Herts	Ware	A602 Phase 1 improvements A10 Junction signalisation (as built)	NTEM
A120NL	East Herts	A120 Little Hadham	New A120 bypass Little Hadham (as built)	NTEM
EH1	East Herts	Bishops Stortford	Station Road, Bishops Stortford -removal of one westbound lane to facilitate widened footways for social distancing.	NTEM
EH9	East Herts	Hertford	Old Cross Junction (St Andrew St / Cowbridge), Hertford Signal optimisation.	NTEM
12	East Herts	Bishops Stortford	Junction capacity improvements associated with Bishops Stortford North development -B1383/A120 junction	NTEM
A602	East Herts		A602 Improvements new offline road section	NTEM

HCC REF	District	Location	Description of Scheme	Scenario
ITP190015-1	East Herts	Buntingford	Buntingford - Reduced speed limit from 40 - 30mph	NTEM
A602	East Herts	A602/Anchor Lane junction	Upgrade of A602 / Anchor Lane junction (as built)	NTEM
EH Hock	East Herts	Bishops Stortford	Hockerill Junction - Signal optimisation	NTEM
EH BS MSCP	East Herts	Bishops Stortford	New MSCP with signalised access & signalisation of A1250 / Northgate End junction	NTEM
EH Stan	East Herts	Standon	Signalisation of A120 / Station Road junction, Standon (as built)	NTEM
Whitt_BS	East Herts	Bishops Stortford	Bishops Storford South - Revise accesses to include roundabout connecting small portion of northern part of development (125 homes) to Whittington Way. Main access now via roundabout on A1184 St James Way and secondary priority access onto Obrey Way with spine road through development	NTEM
EOS_Acc	East Herts	Stevenage	Access to new development at Stevenage	NTEM
BSN_HRd_Acc	East Herts	Bishops Storford	New access from Bishops Stortford North development to A1250 Hadham Road	NTEM
16 BSN Spine Road	East Herts	Bishops Stortford	30mph single carriageway road connecting A1250 Hadham Road with A120 and B1004 Rye Street. Early accesses to existing roads already being built. Full Spine Road and new A120 access assumed by end of development	NTEM
Hertford_Covid	East Herts	Hertford	Closure of Parliament Square and part of Fore Street, Hertford to traffic (as implemented for social distancing)	NTEM
Hmere_5	Hertfordshire/Cross District		M25 J18 to J25 Smart motorway with hard shoulder running (as built since 2014)	NTEM
4	Hertfordshire/Cross District	A1 (M) jct 6-8	Widening of A1(m) motorway to 3 running lanes between junctions 6-8.	LP
PR103_SC	Hertfordshire/Cross District		Welwyn Garden City-Luton Bus Service frequency enhancements	LP

HCC REF	District	Location	Description of Scheme	Scenario
PR104_SC	Hertfordshire/Cross District		Hatfield-Luton Bus Service frequency enhancements	LP
Wat New_1	Hertfordshire/Cross District	Euston to Tring	Post HS2 timetable changes on WCML	LP
AtoW_Bus	Hertfordshire/Cross District	Aylesbury to Watford, and Maple Cross to Watford	Aylesbury to Watford now 20 min frequency on 500 service. 520 retention on section from Maple X to Watford Junction section only (rather than Hemel)	NTEM
EOS_BR	Hertfordshire/Cross District	Stevenage	Diversion of existing SB1 service into new east of Stevenage development	NTEM
Thameslink_Timetable	Hertfordshire/Cross District	East Coast Main Line and Hertford Loop services	Timetable changes for Thameslink services on the ECML. New services to St Pancras and on to Brighton (as implemented)	NTEM
23	Hertsmere	Borehamwood	Elstree Way Corridor Improvements - replacement of Tescos roundabout with signals & bus lane at Shenley Lane roundabout	LP
Pk Rd	Hertsmere	Radlett	Watling Street / Park Road - convert to signalised junction with optimised timings	LP
Bell La	Hertsmere	Shenley	Bell Lane / Harper Lane / Shenleybury - Convert to signalised junction & optimise timings	LP
Da Hill	Hertsmere	Dancers Hill	Dancers Hill / Trotters Bottom - Convert to signalised junction and optimise timings	LP
Ba St Dk La	Hertsmere	Potters Bar	Baker Street / Darkes Lane - Rephase signals	LP
WBS_DA	Hertsmere	Potters Bar	West of Baker Street, new development access	LP
Hmere_24	Hertsmere	Bushey	Little Bushey Lane / Bournehall Ave, New development access	LP
Hmere_19	Hertsmere	Potters Bar	Potters Bar Golf course new development access	LP
Hmere_15	Hertsmere	Bushey	A409 Common Road / A4140 High Road Rephasing of signals	LP
SM117_SC	Hertsmere	Potters Bar	Extend current bus service 298 to Cranbourn Road via Mutton Lane with	LP

HCC REF	District	Location	Description of Scheme	Scenario
			one hour frequency (previously modelled as 20 min frequency)	
PR119_SC	Hertsmere	Potters Bar	Potters Bar-London Bus Services frequency enhancement	LP
PR135_SC	Hertsmere		Improve frequency of Borehamwood-London Bus Services	LP
HEL382a/c	Hertsmere	NE Shenley	Tyttenhanger Estate (HEL382A/C) development access and spine road	LP
HEL362	Hertsmere	Potters Bar	New development access at Potters bar	LP
HeathbournElstree_Jct	Hertsmere	Bushey	Enhanced capacity at Heathbourne Road/Elstree Road junction	LP
LBL_Capacity	Hertsmere	Bushey	New egresses onto Little Bushey Lane from Compass Park development	LP
NR6_48	Hertsmere	North Mymms	Integration and extension of existing bus services surrounding the site at North Mymms and the phased introduction of new shuttle bus routes to connect the development (St Albans to Potters Bar);Code	LP
22 ITP12056	Hertsmere	Borehamwood	Upgrade of junction to continental roundabout at B5378 Shenley Road/ Allum Lane/ Station Road/ Theobald Street	NTEM
HMERE1/ SC 130 & 131	Hertsmere	Borehamwood	Stirling Corner - Changes to signal staging and timing	NTEM
SL jct	Hertsmere		A41 / Sandy Lane junction Rephasing / re optimisation of signals	NTEM
Hmere_28	Hertsmere	M25 Junction 23	M25-J23, junction enhancement	NTEM
New	Hertsmere	Potters Bar	Land east of Southgate Road, New development access	NTEM
Elst_Cross	Hertsmere	Elstree	Elstree Crossroads - A411 Watford Rd / A5183 Elstree Hill, junction improvements (as implemented since 2014)	NTEM
EWCI	Hertsmere	Borehamwood	Junction improvement with replacement of the Borehamwood Tesco roundabout with signals	NTEM

HCC REF	District	Location	Description of Scheme	Scenario
M25_Smart	Hertsmere	M25 junction 18-25	Smart motorway with hard shoulder running (as implemented since 2014)	NTEM
B (EH27)	Non Hertfordshire	M11 junction 8	M11 Junction 8 Capacity Improvements	LP
EH18	Non Hertfordshire	Harlow	Eastwick Crossing in Harlow widen & implement bus priority	LP
EH28	Non Hertfordshire	Harlow	Eastern Stort Crossing in Harlow	LP
HGGT.3b	Non Hertfordshire		Eastern Sustainable Transport Corridor between Town Centre, Enterprise Zones and Harlow East Garden Community.	LP
HGGT.2f	Non Hertfordshire		Gilston Area Sustainable Transport Corridor "inner connection" opening up sustainable access and highway between Village 7 and Village 1.	LP
HGGT.2e	Non Hertfordshire		Access to Gilston Village 7.	LP
HGGT.2d	Non Hertfordshire		Gilston Area Sustainable Transport Corridor "inner loop" connection to Villages 3,4,5	LP
HGGT.2c	Non Hertfordshire		Access to Gilston Area Village 1 (north of Eastwick junction) and creation of STC link within Village 1.	LP
HGGT.2b	Non Hertfordshire		Access to Gilston Area Village 2	LP
HGGT.1e	Non Hertfordshire		Extension of Sustainable Transport Corridor from Burnt Mill Roundabout through HarlowTown Centre	LP
HGGT.1d	Non Hertfordshire		Remainder of Eastern Crossing including River Way Bridge in Harlow	LP
HGGT.1c	Non Hertfordshire		Pye Corner bypass including junction between north-south section and east-west section	LP

HCC REF	District	Location	Description of Scheme	Scenario
Luton_1	Non Hertfordshire	M1 jnc 11a - A6	New link between M1 and A6 around North Luton	LP
HGGT.1a	Non Hertfordshire		Expansion of Central Crossing in Harlow to extend Sustainable Transport Corridor (STC) between Gilston Area and Railway Station and Burnt Mill Roundabout	LP
Lut_2	Non Hertfordshire	Luton	Dualling of Vauxhall Way between Stopsley Way / Hitchin Road and Kimpton Road, Luton	LP
Lut_3	Non Hertfordshire	Luton	Widening of Gipsy Lane, Luton between Kimpton Road to just before link road to New Airport Way to 4 lanes (no central reserve)	LP
StortCrossing	Non Hertfordshire	Harlow	Central Stort crossing (widening of Fifth Avenue between Eastwick Road and Edinburgh Way (Burnt Mill roundabout), Harlow	LP
M11_Jct7	Non Hertfordshire	Harlow	M11 junction 7 short term capacity enhancements	LP
EH16	Non Hertfordshire	Harlow	Velizy Avenue / Second Avenue / Third Avenue in Harlow Junction upgrade	LP
NiSS14	Non Hertfordshire	Oxford Cambridge	New rail link connecting Oxford and Cambridge	LP
A12_to_A120_Col	Non Hertfordshire	Chelmsford	Widening the A12 between junction 19 (Chelmsford) and junction 25 (A120 interchange)	LP
464	Non Hertfordshire	Harlow	M11 Junction 7a - New_Junction (Now Implemented)	NTEM
HGGT_K	Non Hertfordshire	Harlow	A414 Edinburgh Way, Harlow Signal Improvement	NTEM
HGGT_J	Non Hertfordshire	Harlow	A414 Cambridge Road, Harlow Capacity Upgrade	NTEM
HGGT_H	Non Hertfordshire	Harlow	A414 First Avenue Gilden Way, Harlow	NTEM

HCC REF	District	Location	Description of Scheme	Scenario
HGGT_HH	Non Hertfordshire	Harlow	A414 Clocktower, Harlow, Junction improvement	NTEM
HGGT_G	Non Hertfordshire	Harlow	A414 Junction Capacity Upgrade	NTEM
A41_Cam_Hunt	Non Hertfordshire		A14 Cambridge to Huntingdon improvement scheme (Now Implemented)	NTEM
PR35	Non Hertfordshire	Hatfield	M1 J10 SB on slip capacity improvement	NTEM
M1A5_Link	Non Hertfordshire	M1 - A5	New link between M1 and A5 north of Dunstable (built since 2014)	NTEM
A1_Bigg	Non Hertfordshire	Biggleswade	A1 Biggleswade Junction improvements – capacity improvements and dedicated left turn (built since 2014)	NTEM
M1_jct10a	Non Hertfordshire	Luton	New grade-separated junction (built since 2014)	NTEM
HGGT.3c	Non HertfordshireAL165		Western Sustainable Transport Corridor between Harlow Town Centre, PHE/Pinnacles and Water Lane Garden Community.	LP
NH_New14	North Herts	Great Wymondley	Reduce speed coded on these roads to 20mph to simulate impact of traffic calming in Great Wymondley village	LP
NH_New_15	North Herts	Little Wymondley	Reduce speed coded on these roads to 20mph to simulate impact of traffic calming in Little Wymondley village	LP
NH_New_17	North Herts	Codicote	Reduce speed coded on these roads to 20mph to simulate impact of traffic calming in Codicote village	LP
NH New_18	North Herts	Knebworth	Reduce speed coded on these roads to 20mph to simulate impact of traffic calming in Knebworth village	LP
NH_New_4 & NH New_8	North Herts	Hitchin	20mph zone (New 4) & sustainable transport measures (New 8) in Hitchin	LP

HCC REF	District	Location	Description of Scheme	Scenario
NH_New_1 (HM20)	North Herts	Graveley	Graveley Road / North Road - signalisation of junction	LP
NH New_6 & NH New_9	North Herts	Letchworth	Assume 20mph as general assumption in Letchworth on non strategic routes	LP
NH_New_7 & NH_New 12	North Herts	Royston	Assume 20mph as general assumption in Royston on non strategic routes	LP
Jct10	North Herts	Baldock	Signalisation of A1m NB off slip and A507W. Provision of 3 lanes under A1 bridge & 2 lanes on A507 W exit	LP
NBLR / BLR1	North Herts	Baldock	New Multimodal Link with new bridge over railway & tie into A505 Baldock Bypass / Royston Road roundabout. Priority junction at North Road end.	LP
HM7	North Herts	Hitchin	Signal controlled System at junction in Hitchin with optimisation of timings	LP
HM8	North Herts	Hitchin	Pirton Road /A505 / Upper Tilehouse Street junction signalisation	LP
HM10	North Herts	Hitchin	Upper Tilehose St /Paynes Park change to junction configuration	LP
HM15	North Herts	Hitchin	Hitchin Hill junction widening approach arms and signalling	LP
NH1	North Herts	Hitchin	Bancroft / Hermitage Road improve signalised junction and pedestrian phasing	LP
NH2	North Herts	Hitchin	Queen Street / Hermitage - Improve signalised junction and pedestrian phasing	LP
HM4	North Herts	Letchworth	A505 / Norton Way. Signal optimisation : add extra stage for the movements from Willian Way	LP
NH New 3 NC PR57	North Herts	Hitchin	Hitchin - Luton bus frequency increase with priority and enhancement of 100/101 service	LP
NH New_5	North Herts	Letchworth	Letchworth - Stevenage bus frequency improvements	LP
NH New 11	North Herts	Baldock	Simulation of mode shift in Baldock to represent impact of sustainable transport measures	LP

HCC REF	District	Location	Description of Scheme	Scenario
NH_New_16	North Herts	Graveley	Reduce speed coded on High Street to 20mph to simulate impact of traffic calming in Graveley village	LP
SM66_NC	North Herts	Letchworth	Bus access to Letchworth North Development	LP
SM39_NH	North Herts	Hitchin	Hitchin Station - Eastern Access	LP
LG1 acc / SM67_NC	North Herts	Letchworth	New access onto Western Way (north of junction with Northfields), new link road exiting site to north and connecting to Norton Road & secondary access via Avocet	LP
SM52	North Herts	Hitchin	Continuous cycle routes with junction treatments to be provided from the Wilbury Industrial estate and from NHDC Local Plan allocation HT1 to the rail station, including links to schools in the area and links to the A505 North Hertfordshire Sustainable	LP
SM36	North Herts	Hatfield	Signalisation + Bus Priority - Stevenage Road/A602	LP
SM85	North Herts	Letchworth	Reconfigure B197/A505 junction to remove the need for buses to complete a U-turn.	LP
SM34a_NC	North Herts	Hitchin	Bus priority junctions A602	LP
SM35_NC	North Herts	Hitchin	Bus only lanes Gosmore Road and London Road (Hitchin)	LP
SM33_NC	North Herts	Hitchin	Assume 20mph as general assumption in Hitchin on non strategic routes	LP
SM43_NC	North Herts	Hitchin	Willow Lane capacity and safety improvements	LP
HT1 acc	North Herts	Hitchin	New accesses serving Highover Farm development and spine road	LP
BLR2	North Herts	Baldock	Baldock Southern link Road	LP
BND_BR	North Herts	Baldock	Bus service 98 to divert into Baldock North development via new spine road. Increased frequency to 20 mins ph and add stops serving development	LP

HCC REF	District	Location	Description of Scheme	Scenario
NS1&HO3_Acc	North Herts	Stevenage	North Road / Graveley Road - Conversion of priority junction to signal junction	LP
TGSG_20 mph	North Herts	Titmore Green / Symonds Green	Reduce speed coded on these roads to 20mph to simulate impact of traffic calming in Titmore Green / Symonds Green village	LP
Letchworth STT	North Herts	Letchworth	Modal shift applied in Letchworth to simulate impact of sustainable travel town measures	LP
Royston STT	North Herts	Royston	Modal shift applied in Royston to simulate impact of sustainable travel town measures	LP
NH4	North Herts	Royston	A10/A505 junction - Widening of roundabout approach arms	NTEM
NH3	North Herts	Royston	A1198 / A505 junction - widening of roundabout approach arms	NTEM
10338_HL_07/08/09	North Herts	Royston	New left in left out access from York Way onto A505	NTEM
HM3	North Herts	Baldock	Whitehorse St / Royston Road / Station Road signal optimisation	NTEM
S278 NH/377/2017	North Herts	Royston	Construction of a new roundabout onto A505,Royston	NTEM
A507_weight	North Herts	Baldock - Buntingford	HGV diversion from A507 weight restriction	NTEM
ALFI /T1	St Albans	St. Albans to Watford	Abbey Line frequency improvements	LP
RR_M25_22	St Albans	M25 junction 22	M25 junction 22 capacity improvements (Radlett Railfreight mitigation)	LP
RRv3	St Albans	A414 North Orbital Road	Radlett Railfreight, new access junction onto A414 and new spine road connecting to A5183 Radlett Road (south of Frogmore)	LP
650534762_SADC_DWG_Site2 / SC SM176	St Albans	London Colney	A414-A1081-London Colney Roundabout junction improvement	LP
60534762_SADC_DWG_Site8	St Albans	St Albans	A5183 redbourn Road/A4147 bluehouse Hill/Batchwood Drive Roundabout junction improvement	LP

HCC REF	District	Location	Description of Scheme	Scenario
60534762_SADC_DWG_Site10	St Albans	Wheathampstead	B653 Cory Wright Way/Marford Road, Wheathampstead junction improvement	LP
60534762-SADC_DWG_A	St Albans	St Albans	A4147 Hemel Hempstead Road / King Harry Lane junction improvement	LP
605347602-SADC_	St Albans	St Albans	Hatfield Road/Station Road, Smallford Roundabout junction improvement	LP
StAlb_14	St Albans	Harpenden	North East Harpenden Access	LP
N_STAD	St Albans	St Albans	New access from North of St Albans development	LP
SM142	St Albans	St Peters Street/Victoria Street	Junction Reconfiguration including footway widening and closure of Victoria Steet (up to the Maltings GP surgery) to through traffic except buses. Change signals to single way working.	LP
PR170	St Albans	Hatfield Road, St.Albans	Hatfield Road bus priority measures & bus stop improvements	LP
SM174	St Albans	London road corridor	Reconfigure the Lattimore Road/ London Raod junction to rationalise surplus road space for example the right turn filter lanes on London Road.	LP
RR SM177	St Albans	Park Street	A414 / A405 (Park Street) roundabout signalisation	LP
SM179	St Albans	A414 Park Street rbt- A1(M) J3	A review of traffic speed limits and measures required to improve compliance along the A414 Between the Park Street Roundabout and the A1(M) Junction 3). This could include adoption of 'expressway' type technology enhancements which can manage traffic speed.	LP
PR193	St Albans	London Colney	A 20mph speed limit introduced on the section of the High Street, London Colney adjacent to the shopping parade.	LP
PR194	St Albans	London Colney	A 20mph speed limit introduced on all roads within London Colney	LP
SM200	St Albans	Chiswell Green Corridor	Watford Road, Chiswell Green - 20mph speed limit to simulate reduction of available road space to provide cycle lanes and new crossing facilities' (Speed reduction to 20mph)	LP

HCC REF	District	Location	Description of Scheme	Scenario
SM201	St Albans	Chiswell Green Corridor	Conversion of the existing roundabout at Chiswell Green to a signal-controlled crossroads with more priority given to the A405 arms.	LP
W_LCD	St Albans	London Colney	New access from West of London Colney development	LP
PR36	St Albans	Harpenden	Narrowing of road, more crossings and speed tables in Harpenden town centre and Station Road (Speed reduction)	LP
PR191_SC	St Albans	St Albans	Improved London Colney-St Albans bus services	LP
PR197_SC	St Albans	St Albans	Bus Route 724 frequency improvements	LP
St Albans STT	St Albans	St Albans	Modal shift applied to simulate the impacts of Sustainable Travel Town measures in St Albans City	LP
10338_HL_07	St Albans	Harpenden	NW Harpenden development access at Roundwood Lane	LP
10338_HL_07	St Albans	Harpenden	North West Harpenden Development access (Cooters End Lane)	LP
CG_Acc	St Albans	Chiswell Green	New access from Chiswell Green development (site CG)	LP
A414CHL/SM178	St Albans	Colney Heath	A414 Colney Heath longabout safety scheme (as implemented)	NTEM
SL 1	St Albans	St Albans	Oaklands development new access onto Sandpit Lane	NTEM
SL 5	St Albans	St Albans	Sandpit Lane / Barnfield Road junction improvement	NTEM
SL 2	St Albans	St Albans	Sandpit Lane / House Lane enlargement of existing roundabout	NTEM
SL 4	St Albans	St Albans	Sandpit Lane / Coopers Green Lane enlargement of existing roundabout	NTEM
RR_M25_21a	St Albans	M25 junction 21a	M25 junction 21a capacity improvements (Radlett Railfreight mitigation)	NTEM
60534762-SADC-DWG_Site 6	St Albans	St Albans	St Albans Road/Sandridge Road/Marshalswick Lane/Beech Road - junction improvement	NTEM

HCC REF	District	Location	Description of Scheme	Scenario
PR140	St Albans	St Albans	St Albans City Centre 20mph zone expansion	NTEM
LRd_PHill_TheCommon	St Albans	Harpenden	A1081 Luton Road/ Park Hill Junction optimisation	NTEM
StAlbans_TC_Covid	St Albans	St Albans	Social distancing measures in St Albans high street area (Closure of roads for through traffic)	NTEM
STV42	Stevenage		Close Lytton Way between Swingate and Six Hills Way to traffic except buses.	LP
EH new_4	Stevenage	Stevenage	Upgrading of the existing Gresley Way/A602 roundabout to signals	LP
NC-SM84	Stevenage	A1 (M) jct 8	Widening of circulatory+ addition of a bus lane. Signalisation of Stevenage Rd & Graveley Road approaches.	LP
PR24_NC	Stevenage	Stevenage	Extend current bus services terminating at Lister hospital into development north of Stevenage	LP
HO4_Acc	Stevenage	Bragbury End	New development access (SE Stevenage site HO4)	LP
Stevenage STT	Stevenage	Stevenage	Mode shift applied to Stevenage to simulate impacts of Sustainable Town Measures	LP
ATF_NR_MS	Stevenage	Stevenage	North Road ATF cycle route - central section	LP
STV29	Stevenage	Stevenage	Signalisation and capacity improvements at existing junction (A602 phase 1 improvement works)	NTEM
GSK junction	Stevenage	Stevenage	Upgrade of A602 / Gunnels Wood Road / GSK junction to hamburger layout	NTEM
NC SM4 PK02	Stevenage	Stevenage	Increased capacity of station with 5th platform and associated timetable changes (as implemented)	NTEM
EH EOSb	Stevenage	Stevenage	New signalised access with ped and cycle crossings the White Way/Gresley Way	NTEM
EH EOSc	Stevenage	Stevenage	New signalised access with pedestrian & cycle provision opposite Beane Walk providing access to East of Stevenage (Land of Gresley Way Development)	NTEM

HCC REF	District	Location	Description of Scheme	Scenario
SM3	Stevenage	Stevenage	Changes to Lytton Way and new bus station (as recently implemented)	NTEM
EH EOSa	Stevenage	Stevenage	New signalised junction with ped and cycle crossings at Gresley Way / Uplands to provide access to East of Stevenage (Land of Gresley way development)	NTEM
HRBG	Stevenage	Stevenage	Hertford Road Speed reduction measures & bus gate (as built since 2014)	NTEM
AFT_NR_SE	Stevenage	Stevenage	North Road ATF cycle route - southern extension	NTEM
ATF_NR_NE	Stevenage	Stevenage	North Road ATF cycle route - northern extension	NTEM
GTP SM1 & SM30	Three Rivers	M25 junction 20	Capacity improvements at M25 Junction 20	LP
PR86_SW	Three Rivers	Rickmansworth	A404 Riverside Drive / Church Street roundabout partial signalisation	LP
Hemp_Way	Three Rivers	Watford	Provision of additional right turn lanes into and out of Grove Mill Lane at their junctions with A411 Hempstead Road.	LP
PR72_SW	Watford	Watford	Watford Ring-Road Gateway Junction enhancements (Minor roads connecting to the ring road is modelled with 20mph speed limit)	LP
Wat STT	Watford	Watford	Mode shift applied to simulate the impact of measures in TTIW strategy	LP
BR_ISR_Dome	Watford	Watford	Bus priority at Dome roundabout	LP
BS_ISR_RR	Watford	Watford	Bus priority on town centre ring road (Additional lanes which were dedicated to bus were modelled)	LP
BS_ISR_DW	Watford	Watford	Lower High St/Dalton Way bus priority	LP
WBC_IDP_WJ_9	Watford	Watford	Watford junction Eastern mobility hub	LP
WBC_IDP_WJ_4	Watford	Watford	Watford Junction - new access via extension of Clive Way	LP
WBC_IDP_WJ_2	Watford	Watford	Watford Jct development access from St Albans Road	LP

HCC REF	District	Location	Description of Scheme	Scenario
WBC_IDP_WJ_13	Watford	Watford	Watford Jct - signalise existing access to station car park	LP
WBC_IDP_CI_Rt_3	Watford	Watford	Vicarage Rd - Rickmansworth Rd (Section between Wiggenhall Road and Exchange Road EB is banned for general traffic but allow bus only - Option 1 in intalink Schemes in Watford December 2021)	LP
WBC_IDP_DA	Watford	Watford	Development accesses onto existing road network for proposed developments over 300 dwellings	LP
G-I1303.63-015	Watford	Watford	Clarendon Road -urban Realm improvement -narrowing carriageway and new pedestrian phase at Beechen Grove /Claredon Road (as implemented)	NTEM
Wat_20_Zones	Watford	Watford	Implement 20 mph zone in defined areas	NTEM
Wat_20_a	Watford	Watford	20mph zones in Greenbank Road area	NTEM
Wat_20_b	Watford	Watford	20mph zone in Nascot Wood Road area	NTEM
HealthCampusLink_a	Watford	Watford	New link road from Dalton Way providing access to Watford Health Campus (as built since 2014)	NTEM
WH12 / EH21	Welwyn Hatfield	A414/Holwell Lane roundabout	New development access and minor capacity improvements at A414/Holwell Lane roundabout	LP
WH14	Welwyn Hatfield	Coopers Green Lane / Green Lane, near Hatfield	Coopers Green Lane/ Green Lane - Additional lanes on all approaches	LP
WH15/SM7	Welwyn Hatfield	Hatfield	St Albans Road / Ellenbrook Lane - Junction signalisation & additional lane for EB approach	LP
WH17	Welwyn Hatfield	Welwyn Garden City	A1000 Chequers /Broadwater Road - Extend flare on Broadwater Road SB approach and on A1000 NB approach	LP
WH10	Welwyn Hatfield	A414 / A1000, Mill Green	Extension of 2 lane approach to T junction on A414 EB off-slip	LP
WH16	Welwyn Hatfield	South Hatfield	A1000 / South Way - Extend SB on-slip to provide extra slip capacity and for safety improvement. Modelled approximately by	LP

HCC REF	District	Location	Description of Scheme	Scenario
			addition of some widening south of junction to allow easier merge	
WH1 rev	Welwyn Hatfield	A1m junction 6 / B656 Codicote Road / Great North Road (Clock roundabout)	Reduced to a single lane in each direction and put the new crossing on (the north east side)clock roundabout.	LP
WH_D	Welwyn Hatfield	Brookmans Park	A1000 /Hawkshead Road - Provision of Right turn flare from A1000 N to Hawkshead Road	LP
WH_D /WH3 /PR97	Welwyn Hatfield	Welwyn Garden City	Broadwater Road / Bridge Road - Octabout Arrangement in place of signals	LP
WH_G	Welwyn Hatfield	Welham Green	A1000 /Dixons Hill Road junction improvement with provision of 4th arm into Marshmoor development & capacity enhancements	LP
WH2 Rev	Welwyn Hatfield	Welwyn Garden City	Mundells gyratory improvements – Waterside merge improvements & additional capacity on Black Fan Road & Herns Way approach	LP
SM98	Welwyn Hatfield	B197 corridor	B197 Sustainable Travel Corridor with footway / cycleway improvements, traffic calming & bus priority	LP
SM70	Welwyn Hatfield	Lemsford	Green Lane / Brocket Road - Junction improvements to reduce congestion and improve capacity and reliability	LP
SM20_SC	Welwyn Hatfield	Hatfield	C2-4 Implementation of bus lane (Cavendish Way) / Cavendish Way bus lane	LP
SM23	Welwyn Hatfield	Hatfield	C2-7 junction reconfiguration / Cavendish Way-Bishops Rise junction reconfiguration	LP
SM36	Welwyn Hatfield	Hatfield	C4-6 New at-grade crossing in Hatfield	LP
SM38	Welwyn Hatfield	Hatfield	C4-8 Traffic calming measures (Travellers Lane) / Traffic calming measures along length of corridor	LP
SM54	Welwyn Hatfield	Hatfield	C6-6 Implementation of Wellfield Road bus lane	LP

HCC REF	District	Location	Description of Scheme	Scenario
SM69	Welwyn Hatfield	Symondshyde	Symondshyde Highway Access	LP
HAT STT	Welwyn Hatfield	Hatfield	Modal shift in Hatfield to simulate the impacts of Sustainable town measures	LP
WGC STT	Welwyn Hatfield	Welwyn Garden City	Modal shift in Welwyn Garden City to simulate the impacts of Sustainable town measures	LP
Birchall devel access	Welwyn Hatfield	B195 Birchall Lane,	Birchall Lane improvements and new development accesses	LP
CGL_ATC	Welwyn Hatfield	Coopers Green Lane	Coopers Green Lane Active Travel Infrastructure - multimodal corridor with reduced traffic speeds and pedestrian and cycle provision	LP
Old_M_Grn	Welwyn Hatfield	A414 Mill Green junction to Jack Oldings roundabout	A414 section between Mill Green & Tescos reconfiguration	LP
WelRd_ComWay	Welwyn Hatfield	Hatfield	Wellfield Road/Comet Way junction improvements	LP
WH_B_a	Welwyn Hatfield	Cuffley	Plough Hill/Station Road Cuffley Priority Changes	LP
WH6 rev / 297	Welwyn Hatfield	A1(M) Junction 4	Short term capacity / safety measures on overbridge between Junction 4 NB slips and Jack Oldings. Now has 2 lanes EB diverging into 4 at stopline	NTEM
WH7 rev /EH23	Welwyn Hatfield	A1 (m) junction 3	Optimise signals on junction in addition to dualling Comet Way NB	NTEM
WH8 rev	Welwyn Hatfield	Hatfield	Comet Way / Hatfield Road roundabout improvements	NTEM
WH19	Welwyn Hatfield	Hatfield	A1000 Great North Road / B6426 St Albans Road East (Red Lion junction), Hatfield - signal optimisation	NTEM
WH_F	Welwyn Hatfield	A1000 /Shepherds Way, Brookmans Park	A1000 / Shepherds Way junction improvement - signal optimisation	NTEM
EATF_BR	Welwyn Hatfield	Welwyn Garden City	Reduce Bridge Road / Huntes Bridge to one lane in each direction for traffic and install cycle lanes - John Lewis roundabout to Broadwater Road signals (as implemented)	NTEM

HCC REF	District	Location	Description of Scheme	Scenario
EATF_DPR	Welwyn Hatfield	Digswell	Closure of Digswell Park Road to through traffic (as implemented)	NTEM
Welwyn_Covid	Welwyn Hatfield	Welwyn	20mph speed limit on Welwyn High Street (social distancing measures)	NTEM

Appendix B

DEVELOPMENT ZONES

Zone	District	NTEM / LP	Development	Scheme Description	Type
9000	Empty Zone				
9001	Broxbourne	LP	BR2	Brookfield Garden Village (1250)	Housing
9002	East Hertfordshire	LP	GA1	The Gilston Area, north of A414	Housing
9003	East Hertfordshire	NTEM	3/18/2253/OUT	Land At Bishops Stortford South	Housing
9004	North Hertfordshire	LP	BA1	Land north of Baldock	Housing
9005	North Hertfordshire	Empty development zone			Housing
9006	Broxbourne	NTEM	07/17/0864/O	Tudor Nurseries, Burton Lane, Offs Oak, EN7 6SH	Housing
9007	St Albans	LP	EHHS	East Hemel Hempstead South	Housing
9008	St Albans	LP	EHHN	East Hemel Hempstead North	Housing
9009	Broxbourne	NTEM	07/18/0461/O	Land at Delamare Road, Cheshunt	Housing
9010	East Hertfordshire	LP	WARE2	Land North and East of Ware	Housing
9011	Broxbourne	NTEM	07/13/0899/O	Land to the west of Hoddesdon and east of the A10 incorporating land to the north and south of the Dinant EN11 8SG	Housing
9012	Empty Zone				
9013	Dacorum	LP	NH	North Hemel (Phase 1)	Housing
9014	Dacorum	LP	SB_GUI	Land South of Berkhamsted GUI Land	Housing
9015	Dacorum	LP	WT	East of Tring (New Mill, Marshcroft Lane and Station Road)	Housing
9016	East Hertfordshire	LP	EWEL1	Land North and South of Birchall Lane, Hertingfordbury	Housing
9017	Hertsmere	LP	HEL181	Land adj Little Bushey Lane & Bournehall Ave	Housing
9018	Dacorum	NTEM	4/02539/16/MOA	Spencers park phase 2, land between, three cherry trees lane and cherry tree lane, Hemel Hempstead	Housing
9019	Hertsmere	LP	HEL355	Land south of Elstree road	Housing
9020	Hertsmere	LP	HEL347	Wrotham Park Land off Cowley Hill	Housing
9021	Empty development zone				
9022	Hertsmere	LP	HEL382a/c	Tyttenhanger Estate	Housing
9023	North Hertfordshire	LP	LG1	Letchworth North	Housing
9024	Stevenage	LP	HO3	North of Stevenage	Housing
9025	St Albans	LP	NWH	North West Harpenden	Housing
9026	St Albans	LP	NSA	North St Albans	Housing

Zone	District	NTEM / LP	Development	Scheme Description	Type
9027	St Albans	LP	WLC	West of London Colney	Housing
9028	Stevenage	LP	HO2	Stevenage West	Housing
9029	Watford	LP	MU06	Land at Watford Junction	Housing
9030	Welwyn Hatfield	NTEM	6/2018/0171/MAJ	Former Shredded Wheat Factory, Welwyn Garden City, AL8 6UN	Housing
9030	Welwyn Hatfield	NTEM	Pea02b	Former Shredded Wheat Factory, Welwyn Garden City, AL8 6UN	Housing
9031	Welwyn Hatfield	LP	WGC5	S of WGC (Birchall W)	Housing
9032	Welwyn Hatfield	LP	HAT1	Stanboroughbury	Housing
9032	Welwyn Hatfield	LP	HAT1	Stanboroughbury	Housing
9033	Dacorum	LP	LA1	Marchmont Farm, Hemel Hempstead	Housing
9034	Dacorum	LP	LA3	West Hemel, Adj Pouchen End Lane	Housing
9035	Dacorum	LP	MU/2	Hemel Hempstead Hospital Site, Hillfield Road	Housing
9036	Dacorum	LP	MU/3	Paradise Wood Lane, Hemel Hempstead	Housing
9037	Dacorum	LP	TWN	Two Waters Site 4	Housing
9038	Dacorum	LP	TW_LRE	Two Waters Site 2 London Road E	Housing
9039	Empty Blank Zone				
9040	Dacorum	LP	HH17	Cupid Green Depot, Redbourn Road, Hemel Hempstead	Housing
9041	Dacorum	LP	PL1	Polehanger Lane	Housing
9042	Dacorum	LP	TC1_Gen	Town Centre (General Area)	Housing
9043	Dacorum	LP	TW1_Gen	Two Waters (General Area)	Housing
9044	East Hertfordshire	NTEM	3/15/0300/OUT	Former Sainsburys Distribution Depot, London Road, Buntingford, SG9 9JR	Housing
9045	East Hertfordshire	NTEM	3/13/0804/OP	Land at Bishops Stortford North, Bishops Stortford	Housing
9046	East Hertfordshire	NTEM	3/17/2588/OUT	Bishops Stortford Goods Yard, Station Road, Bishops Stortford, CM23 3BL	Housing
9047	East Hertfordshire	NTEM	3/18/2465/OUT	(HERT2) Land East Of, Marshgate Drive, Hertford	Housing
9048	Empty development zone				
9049	East Hertfordshire	Empty development zone			Housing
9050	East Hertfordshire	LP	HERT3A	Welwyn Road, Hertford, SG14 2HQ (North)	Housing
9051	Hertsmere	LP	HEL251	Potters Bar Golf Course	Housing

Zone	District	NTEM / LP	Development	Scheme Description	Type
9052	Hertsmere	Empty development zone			Housing
9053	Hertsmere	LP	HEL362	Wrotham Park West Barnet Road East Baker Street I&O	Housing
9054	Hertsmere	LP	HEL392		Housing
9055	North Hertfordshire	NTEM	17/00110/1	Land Surrounding Burloes Cottages, Newmarket Road, Royston	Housing
9056	North Hertfordshire	LP	GA1	NES 3 Stevenage	Housing
9057	North Hertfordshire	LP	GA2	Land off Mendip Way, Great Ashby, Stevenage	Housing
9058	North Hertfordshire	LP	HT1	Stotfold Road, Highover Farm, Hitchin	Housing
9059	North Hertfordshire	LP	NS1	Land North of Stevenage (part), Stevenage	Housing
9060	North Hertfordshire	LP	WY1	Land South of Little Wymondley	Housing
9061	St Albans	LP	NEH	North East Harpenden	Housing
9062	St Albans	LP	ESA	East St Albans	Housing
9063	St Albans	LP	CG	Chiswell Green	Housing
9064	Empty development zone				
9065	Stevenage	NTEM	14/00559/OPM	Matalan Retail Park, Danestrete, Stevenage, SG1 1XB	Housing
9066	Stevenage	LP	HO4_A	South East of Stevenage 1 - Land South Of A602	Housing
9067	Empty development zone				
9068	Stevenage	LP	SG1_P1	Plots A & K	Housing
9069	Stevenage	LP	SG1_P4	Plots C, E & H	Housing
9070	Stevenage	LP	TOWN_CENTRE_B	Leisure Park	Housing
9071	Empty development zone				
9072	Three Rivers	LP	EOS12.2	Land South of Hornhill Road and Woodland Road, Maple Cross	Housing
9073	Three Rivers	LP	CFS3	Land adjacent to Fortunes Farm, High Elms Lane, Abbots Langley	Housing
9074	Empty development zone				
9075	Three Rivers	LP	CFS26c	Land to the west of the Kings Langley Estate	Housing
9076	Empty development zone				
9077	Three Rivers	LP	EOS7.0	Land to the south of Shepherds Lane and west of M25	Housing
9078	Watford	NTEM	17/01511/FULM	Land to the South of Thomas Sawyer Way, Comprising The	Housing

Zone	District	NTEM / LP	Development	Scheme Description	Type
				Waterside Area and part of The Watford Riverwell Development	
9079	Watford	NTEM	18/00703/NONMAT	Land to The East of Ascot Road, Watford	Housing
9080	Watford	LP	HS21	Land at Waterfields Retail Park	Housing
9081	Watford	LP	HS28	Wiggenhall Depot	Housing
9082	Watford	Empty development zone			Housing
9083	Watford	LP	MU16	Tesco Lower High Street	Housing
9084	Watford	LP	MU18	Land at Colne Valley Retail Park	Housing
9085	Watford	LP	MU21	Land at Riverwell	Housing
9086	Welwyn Hatfield	LP	HAT15	Symondshyde	Housing
9087	Welwyn Hatfield	NTEM	6/2018/0873/OUTLINE	Land to North East of Welwyn Garden City Panshanger Welwyn Garden City, AL7 2QJ	Housing
9087	Welwyn Hatfield	NTEM	WGC4/WGC4a	Land to North East of Welwyn Garden City Panshanger Welwyn Garden City AL7 2QJ	Housing
9088	Welwyn Hatfield	LP	WGC1	South of Boundary Lane	Housing
9089	Welwyn Hatfield	LP	BrP4	Land west of Brookmans Park	Housing
9090	St Albans	LP	NHH	North Hemel Hempstead	Housing
9091	Empty Development Zone				
9092	Welwyn Hatfield	LP	LP2.11	Jobs at Oldings Corner retail park	Employment
9093	Welwyn Hatfield	LP	LP2.10	Jobs at existing Galleria Site	Employment
9094	Welwyn Hatfield	LP	LP2.9	Retail within Hatfield town centre	Employment
9095	Welwyn Hatfield	LP	LP2.3	Within Existing Employment area at Bessemer Rd	Employment
9096	Welwyn Hatfield	LP	HAT1	North West Hatfield	Employment
9097	Welwyn Hatfield	LP	Pea02b & c	Broadwater Rd West (Spen HIll Tesco dev)	Employment
9098	Welwyn Hatfield	NTEM	6/2015/2043/OUTLINE	Plots 4100, 5000, 5600, 6000 Hatfield Business Park, Hatfield, AL10 9UH	Employment
9099	Watford	LP	EM01	Cassiobury House, 11-19 Station Road	Employment
9100	Broxbourne	LP	PP1	Park Plaza West - Release of Green Belt Land to meet medium and long term employment needs	Employment
9100	Broxbourne	LP	PP1	Park Plaza West - Release of Green Belt Land to meet medium and long term employment needs	Employment
9101	Broxbourne	LP	PP2	Park Plaza North Development	Employment

Zone	District	NTEM / LP	Development	Scheme Description	Type
9102	Broxbourne	LP	PP3	Park Plaza South	Employment
9103	Broxbourne	LP	GBR1	Greater Brookfield Riverside Retail and Leisure Development	Employment
9104	Broxbourne	LP	CH1b	Delamare Road/Cheshunt Lakeside	Employment
9105	East Hertfordshire	NTEM	3/13/0804/OP	Land at Bishops Stortford North, Bishops Stortford	Employment
9106	Empty development zone				
9107	North Hertfordshire	LP	RY9	Land North of York Way	Employment
9108	North Hertfordshire	LP	BA10	Royston Road	Employment
9109	St Albans	LP	Maylands_East	East Hemel Hempstead (Central) BL	Employment
9110	St Albans	NTEM	5/2016/3006	Proposed Rail Freight, North Orbital Road, Chiswell Green	Employment
9111	Stevenage	LP	EC1/5	Stevenage central	Employment
9112	Stevenage	NTEM	07/00810/OP	Town Centre, Stevenage	Employment
9113	Stevenage	Empty development zone			Employment
9114	Empty development zone				
9115	Watford	NTEM	18/00935/FULM	Gresham House 53, Clarendon Road, Watford, WD17 1LA	Employment
9116	Watford	NTEM	16/00076/VAR	Charter Place, Watford, WD17 2RN	Employment
9117	Watford	NTEM	17/00091/OUT	The Tech Site Land Bound By, Hatters Lane, Blackmoor Lane, and The River Gade, Croxley Park, Watford	Employment
9118	Watford	NTEM	17/00558/FULM	Land at 64 &, 73-77 Clarendon Road, Watford, WD17 1DS	Employment
9119	Watford	Empty development zone			Employment
9120	Welwyn Hatfield	LP	LP2.1	Marshmoor, part of mixed scheme	Employment
9121	Empty development zone				
9122	Empty development zone				
9123	Broxbourne	LP	MFW	Maxwells Farm West & Rush Meadow (500 new jobs)	Employment
9124	Dacorum	LP	DF	Dunsley Farm	Employment
9125	Dacorum	LP	NS_HH	New Schools Hemel Hempstead	Employment
9126	Dacorum	NTEM	4/00064/17/MFA	Maylands Gateway, Maylands Avenue, Hemel Hempstead, HP2 4FQ	Employment
9127	Dacorum	NTEM	4/03355/14/MFA	Library and adjacent land, Combe street, Hemel Hempstead	Employment

Zone	District	NTEM / LP	Development	Scheme Description	Type
9128	Dacorum	NTEM	4/00595/18/MFA	jarmans fields, St Albans road, Hemel Hempstead, HP2 4JS	Employment
9129	Dacorum	LP	EA41	Land east of A41	Employment
9130	East Hertfordshire	LP	BISH5	Bishops Stortford South	Employment
9131	Hertsmere	LP	SADM7	Centennial Park, Elstree	Employment
9132	Hertsmere	LP	HEL387	Rowley Lane (includes safeguarded land)	Employment
9133	Hertsmere	NTEM	18/0479/FUL	Regency House And, 203-205 Watling Street, Radlett	Employment
9134	Empty development zone				
9135	Hertsmere	LP	SADM6a	Elstree Way, Borehamwood	Employment
9136	St Albans	NTEM	5/2016/0264	St Albans Retail Park, Griffiths Way, St Albans, AL1 2RJ	Employment
9137	Stevenage	LP	EC1/1	GSK/Stevenage Bioscience Catalyst	Employment
9138	Stevenage	LP	EC1/2	South of Bessemer Drive, Gunnels Wood	Employment
9139	Three Rivers	LP	OSPF6	Land west of Leavesden Aerodrome	Employment
9140	Three Rivers	LP	CFS28	Land at Gypsy Lane, Hunton Bridge	Employment
9141	Three Rivers	NTEM	15/1427/FUL	Building 1 & 2, Marlins Meadow, Watford	Employment
9142	Empty development zone				
9143	Three Rivers	LP	TL	Tolpits Lane	Employment
9144	Empty development zone				
9145	Empty development zone				
9146	Broxbourne	NTEM	07/17/0352/O	Land North and South of Andrew's Lane and, South of Peakes Way, Cheshunt, EN7 6SP	Housing
9146	Broxbourne	NTEM	07/17/0352/O	Land North and South of Andrew's Lane and, South of Peakes Way, Cheshunt, EN7 6SP	Residential
9147	Dacorum	LP	MU/4		Residential
9148	Hertsmere	LP	HEL379	Kemprow Farm	Residential
9149	Stevenage	LP	TOWN_CENTRE_G	Bus Station and The Plaza	Residential
9150	Stevenage	LP	Lway	Land west of Lytton Way (Icon)	Residential
9151	Three Rivers	NTEM	19/2133/FUL	Demolition of existing buildings and provision of 345 residential units on St Andrews Road, South Oxhey	Residential

Zone	District	NTEM / LP	Development	Scheme Description	Type
9152	Three Rivers	LP	CFS69a	Land at Carpenders Park Farm - Revised Bounday	Residential
9153	Three Rivers	LP	EOS4.0	Land adjacent to Bedmond Road	Residential
9154	Three Rivers	LP	OSPF22	Land at Batchworth Golf Course	Residential
9155	Three Rivers	LP	PCS47	South of Little Oxhey Lane, Carpenders Park	Residential
9156	North Herts	LP	EL1	Wandon Park	Residential
9157	North Herts	LP	EL3	Land West of Cockernhoe	Residential
9158	North Herts	LP	EL2	Land East of Brickkiln Lane	Residential
9171	Broxbourne	NTEM	07/18/1181/O	Application for construction of a employment development at Maxwells Farm West	Employment
9172	Hertsmere	NTEM	20/1540/MA	Application for non-material amendments, Land East of Rowley Lane, Borehamwood	Employment
9173	Hertsmere	LP	HEL818	Land South of Rowley Lane, Borehamwood	Employment
9174	Hertsmere	LP	HEL809	Land East of Rowley Lane, Borehamwood	Employment
9175	Three Rivers	NTEM	15/1852/FUL	Extension to Warner Bros. Studios Leavesden, Warner Drive, Leavesden, WD25 7LP	Employment
9176	Watford	NTEM	20/00663	Demolition of existing building and development of two linked buildings: Cassiobury House 11 - 19 Station Road Watford, WD17 1AP	Employment
9177	Watford	LP	MU06	Land at Watford Junction	Employment

Appendix C

SATURN HIGHWAY ASSIGNMENT PARAMETERS

LOGICAL PARAMETERS			
AMY = F	ASHORT = T	ATLAS = F	AUTNUC = T
AUTOK = T	AUTONA = T	AUTOX = F	AUTOZ = F
BANKER = F	BB109 = T	BEAKER = T	BUSKER = T
CLIMAX = T	COMPAS = F	CROWCC = F	CUMULO = F
DCSV = F	DIDDLE = T	DOUBLE = T	DUALEX = T
DUTCH = F	ERTM = F	EXPERT = T	EZBUS = T
FIFO = T	FOZZY = T	FREDDY = F	FREEKY = F
FREEXY = T	FREE77 = F	FREE88 = F	FUNNEL = F
ICING = F	ILOVEU = T	KERMIT = F	KINKY = T
KONAL = F	LCR108 = T	LEFTDR = T	LIST = T
MINDER = F	MONACO = T	M108 = T	MULTIC = T
NOXYC = F	NO333C = F	PARTAN = F	PHILIP = F
PRINT = T	PRINTF = F	PRSFD = F	QUEEN = F
QUIKSA = F	QRTP = F	Q105 = T	RAGS = T
RB106 = T	REDMEN = F	REFFUB = F	ROSIE = F
RTP108 = T	SATOFF = F	SATTIT = T	SAVEIT = T
SAVUFO = F	SECRET = F	SHANDY = T	SIGOPT = F
SIM109 = T	SIM111 = F	SOWHAT = F	SPARSE = T
SPEEDS = T	SPIDER = T	STOLL = F	STUART = F
SUZIE = F	SUZIEQ = T	TOPUP = T	UFC109 = T
UFC111 = T	UNIQUE = F	UPBUS = T	USEUFO = F
WHATHO = F	WINDY = T	WRIGHT = T	ZILCH = F
GIS7 = T			

INTEGER PARAMETERS			
IBUSVC = 1	IFCC = 2	IFRL = 1	IPERT = 0
IROCKY = 0	KANGA = 9999	KARL = 50	
KDF = 1	KLUNK = 1	KNOBS = 0	KOB = 0
KOMBI = 0	KONSTP = 5	KORN = 0	KPHMIN = 10
KPHMAX = 120	LCY = 120	LRTP = 60	LTP = 60
MANOFF = 0	MASL = 401	MASL_F = 0	MASL_M = 1

INTEGER PARAMETERS			
MAXDTP = 10	MAXLSF = 3000	MAXQCT = 60	MAXSPA = 30
MAXZN =99999	MCALG = 1	MCNUM = 0	MCCS = 3
MCGILL = 0	MCUBC = 0	MET = 0	MINLSF = 300
MINRED = 10	MINSAT = 500	MODET = 1	MYTVV = 5
NFT = 113	NIPS = 2	NISTOP = 4	NITA = 30
NITA_C = 256	NITA_F = 0	NITA_M = 3	NITA_S = 256
NITS = 20	NITS_M = 5	NOMADS = 5	NOPD = 0
NOPMAX = 1	NOTUK = 0	NUC = 25	NUCMIN = 1

REAL PARAMETERS		
AFTERS = 0.5000	AK_MIN = 0.2000	ALEX = 5.7500
APRESV = 1.0000	BBKING = 0.9500	BCRP = 2.0000
BETA = 0.1000	BETA_2 = 0.1000	BETA_D = 0.1000
BETA_T = 0.1000	BTKNOB = 0.0000	BUSPCU = 2.2000
BUSSPK = 0.0000	CAPMIN = 30.0000	
COBAF = 1.0000	DEFCAP = 1250.0000	DMWL = 300.0000
DMWL2 = 2000.0000	FISTOP = 0.0500	FLAREF = 2.0000
FLAREX = 2.0000	FLPK = 0.0700	FLPH = 1.2000
FLPPS = 0.0160	FLPSS = 0.0050	FRED = 1.0000
GAP = 2.0000	GAPM = 1.0000	GAPR = 2.0000
GAPRF = 1.0000	GONZO = 1.0000*	OBAMAX = 0.1000
PCNEAR = 1.0000	PMAX = 5.0000	POWER = -1.0000
PPK = 0.0000	PPM = 1.0000	QDMAX = 227.0000
QVCMIN = 0.7500	RESIDD = 0.0000	RESIDR = 0.0000
RSTOP = 98.0000	SHADOW = 0.0000	STPCPU = 1000.0000
STPGAP = 0.0100	SUET = 0.2000	TAX = 2.0000
TDEL = 3.0000	TIJMIN = 0.0000	UNCRTS = 0.0050
VCPCU = 1.0000	VCPCU(2) = 1.0000	VCPCU(3) = 2.2000
WLMIN = 300.0000	WLMAX = 2000.0000	W32D = 0.0010
W32T = 0.1000	W32KPH = 1.5000	XFSTOP = 0.0500
XYUNIT = 1.0000		

*GONZO factor is 0.9240 in PQ networks.

Appendix D

HIGHWAY ASSIGNMENT RESULTS

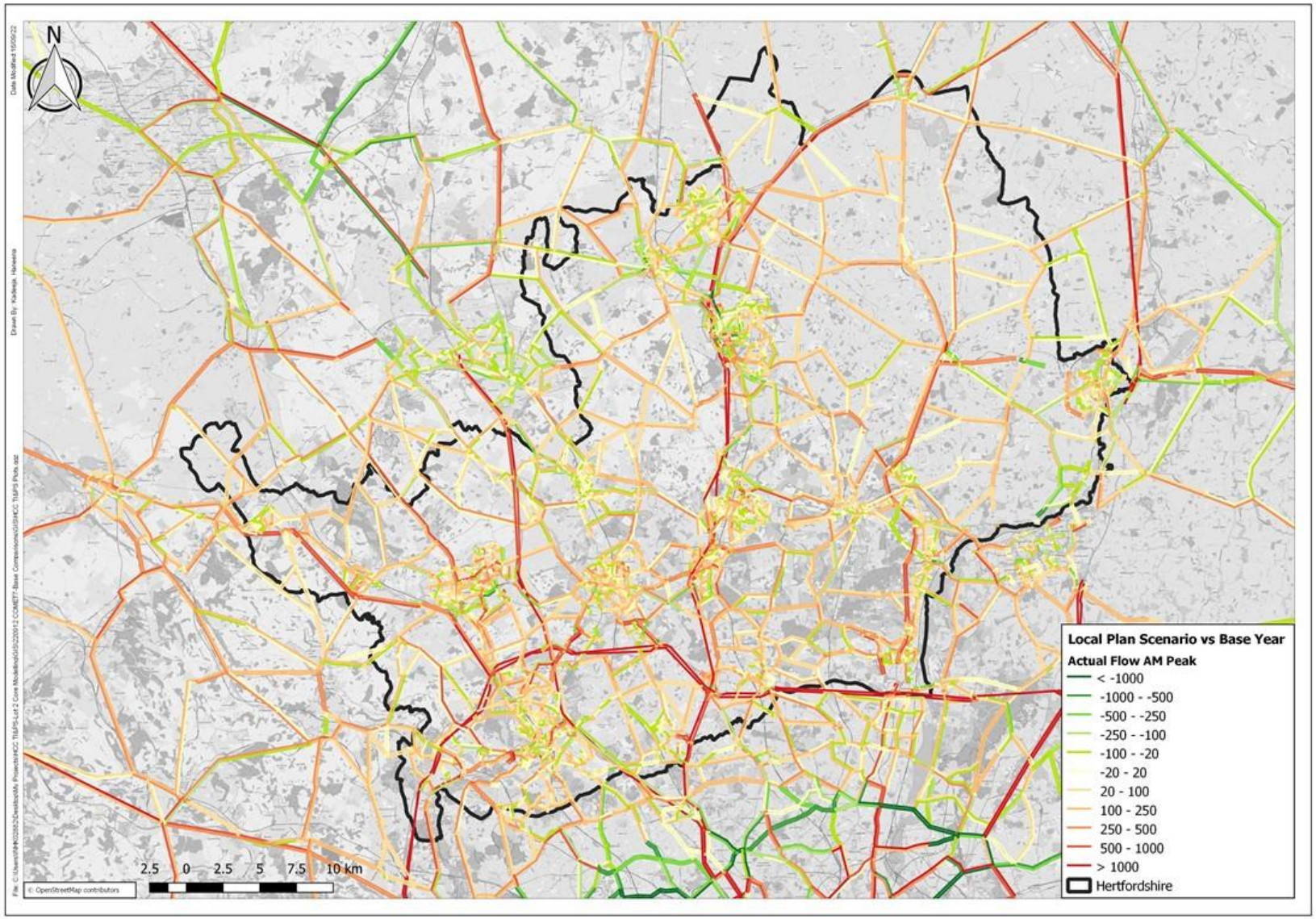


Figure D-1: 2036 Local Plan Scenario vs 2014 AM Peak Flow

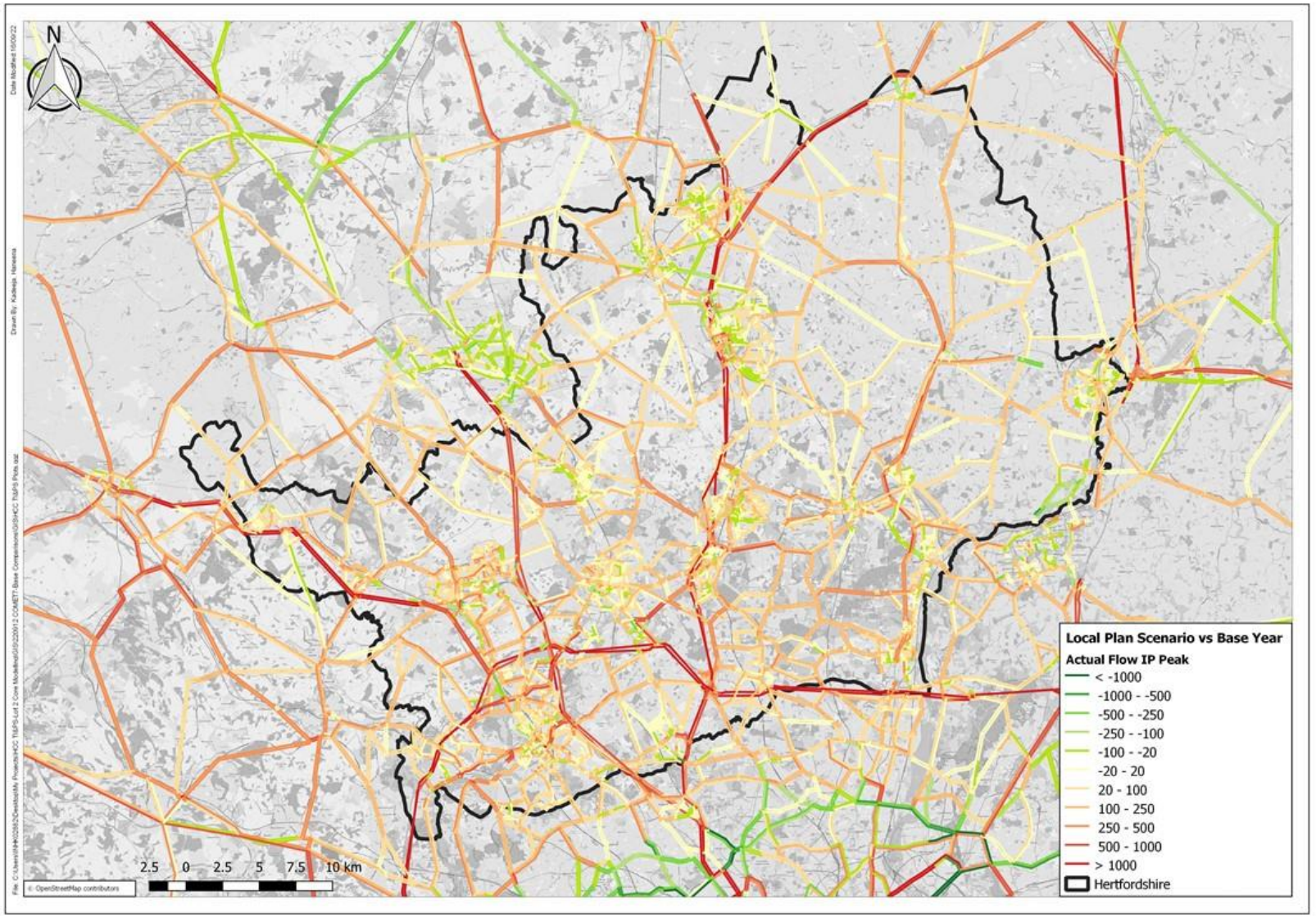


Figure D-2: 2036 Local Plan Scenario vs 2014 Inter Peak Flow

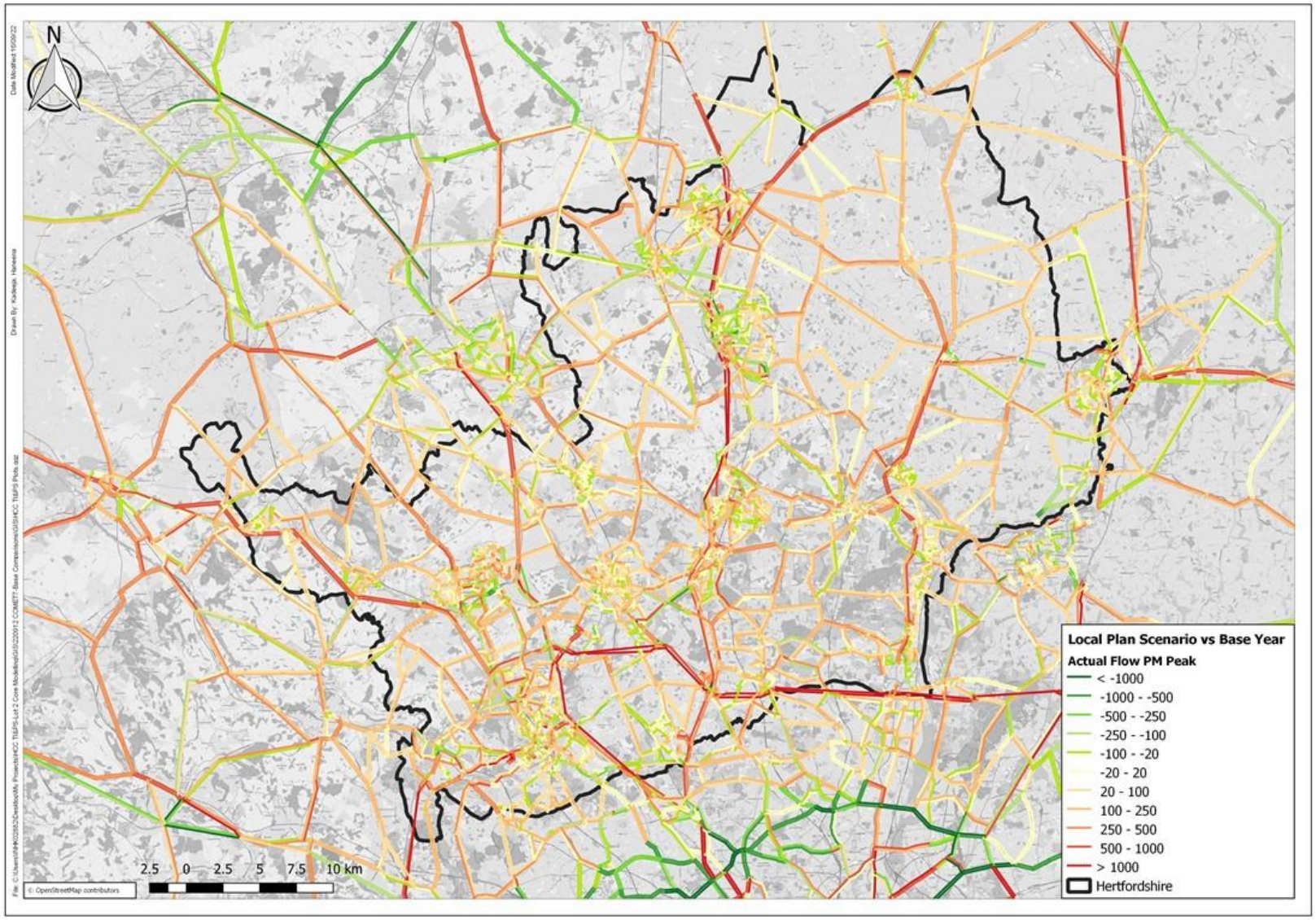


Figure D-3: 2036 Local Plan Scenario vs 2014 PM Peak Flow

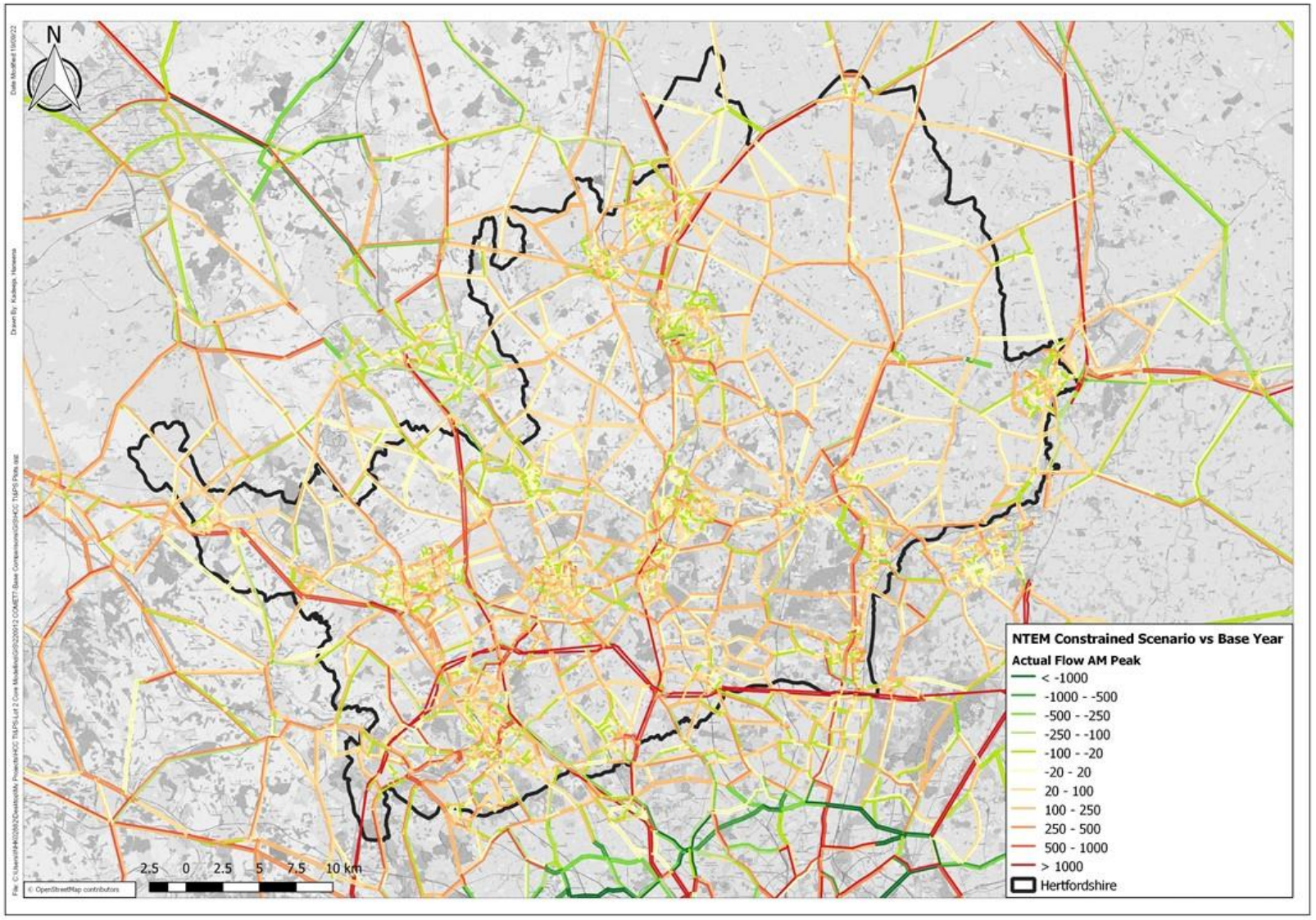


Figure D-4: 2036 NTEM Constrained Scenario vs 2014 AM Peak Flow

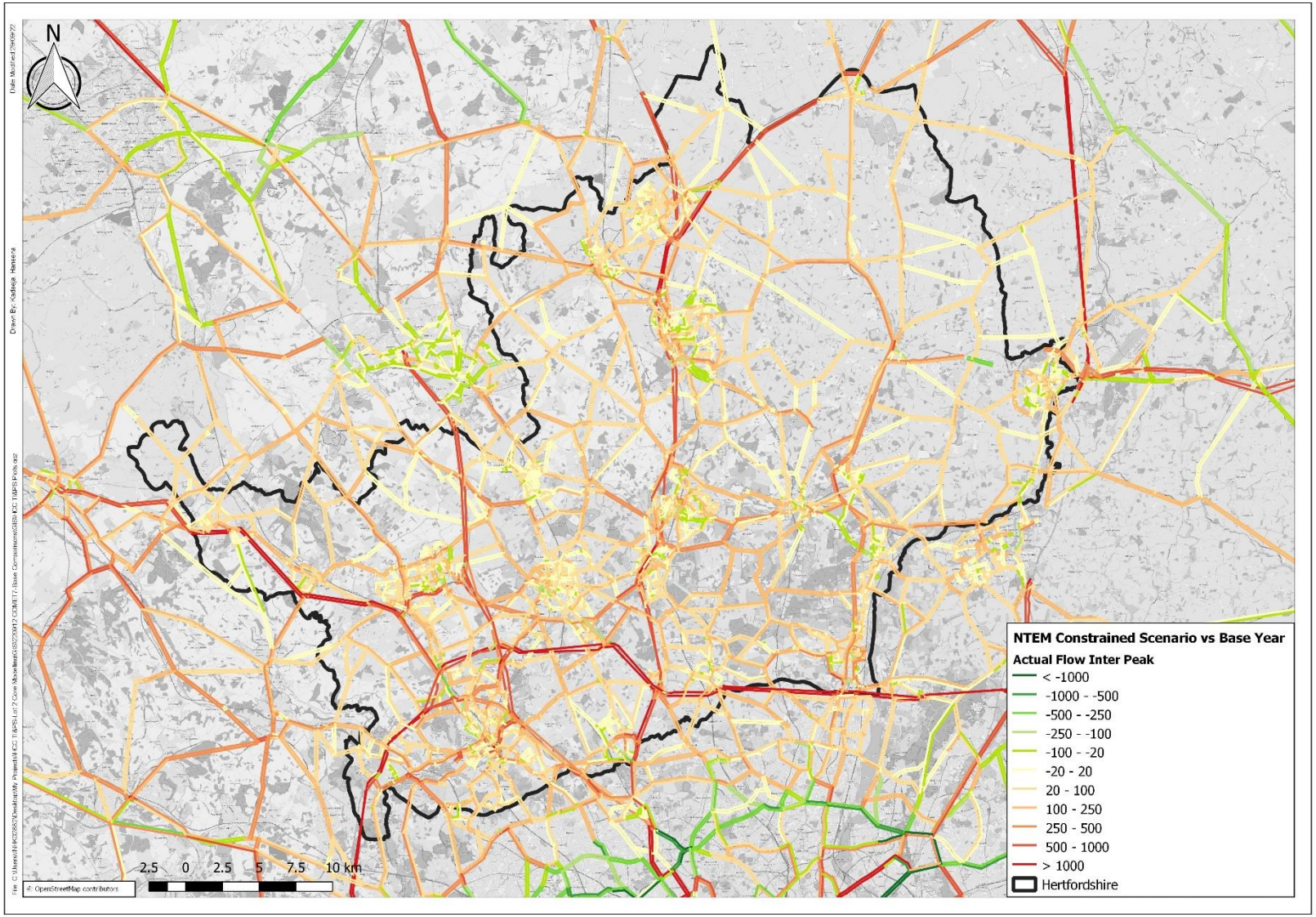


Figure D-5: 2036 NTEM Constrained Scenario vs 2014 Inter Peak Flow

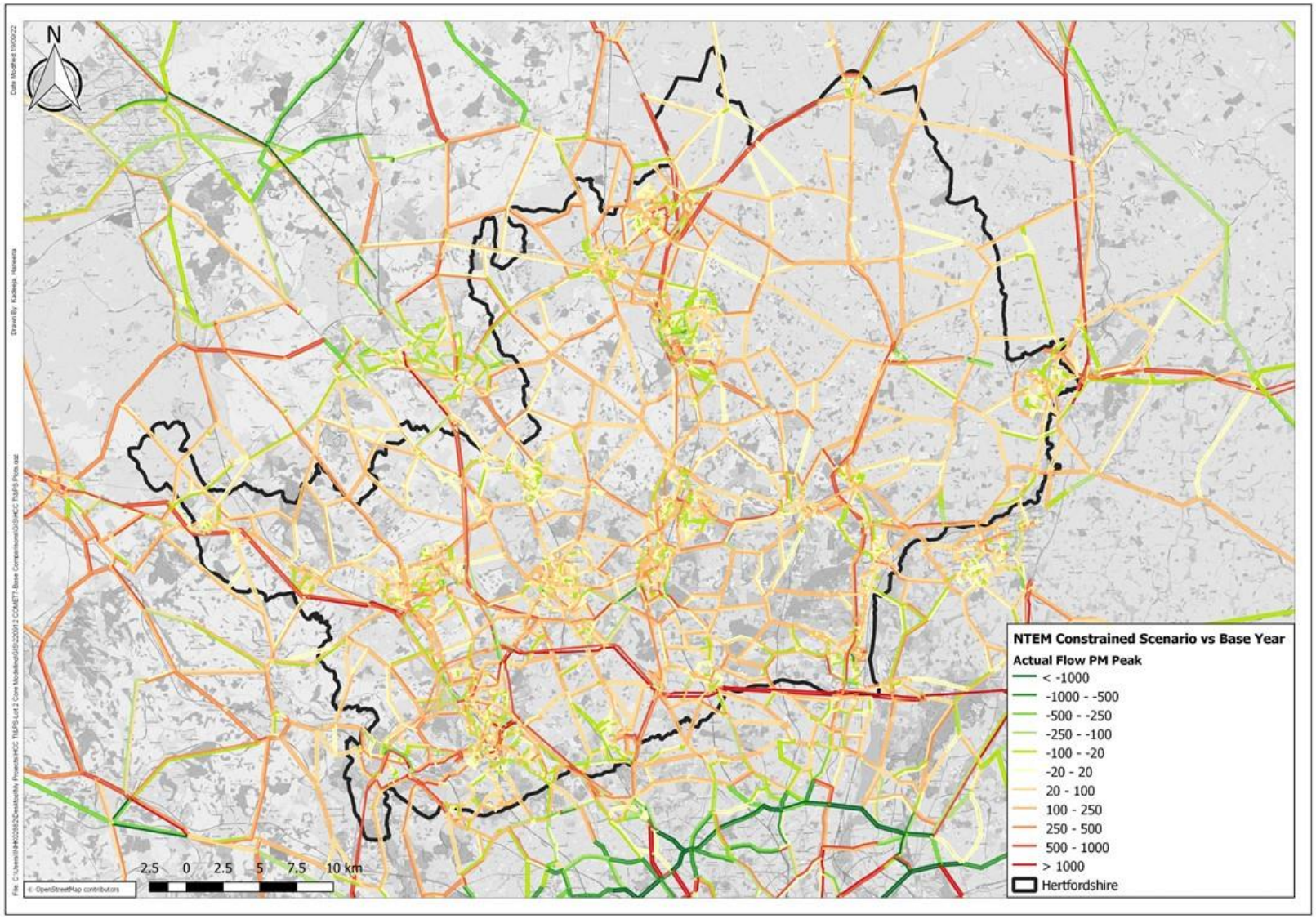


Figure D-6: 2036 NTEM Constrained Scenario vs 2014 PM Peak Flow

LINK V/Cs

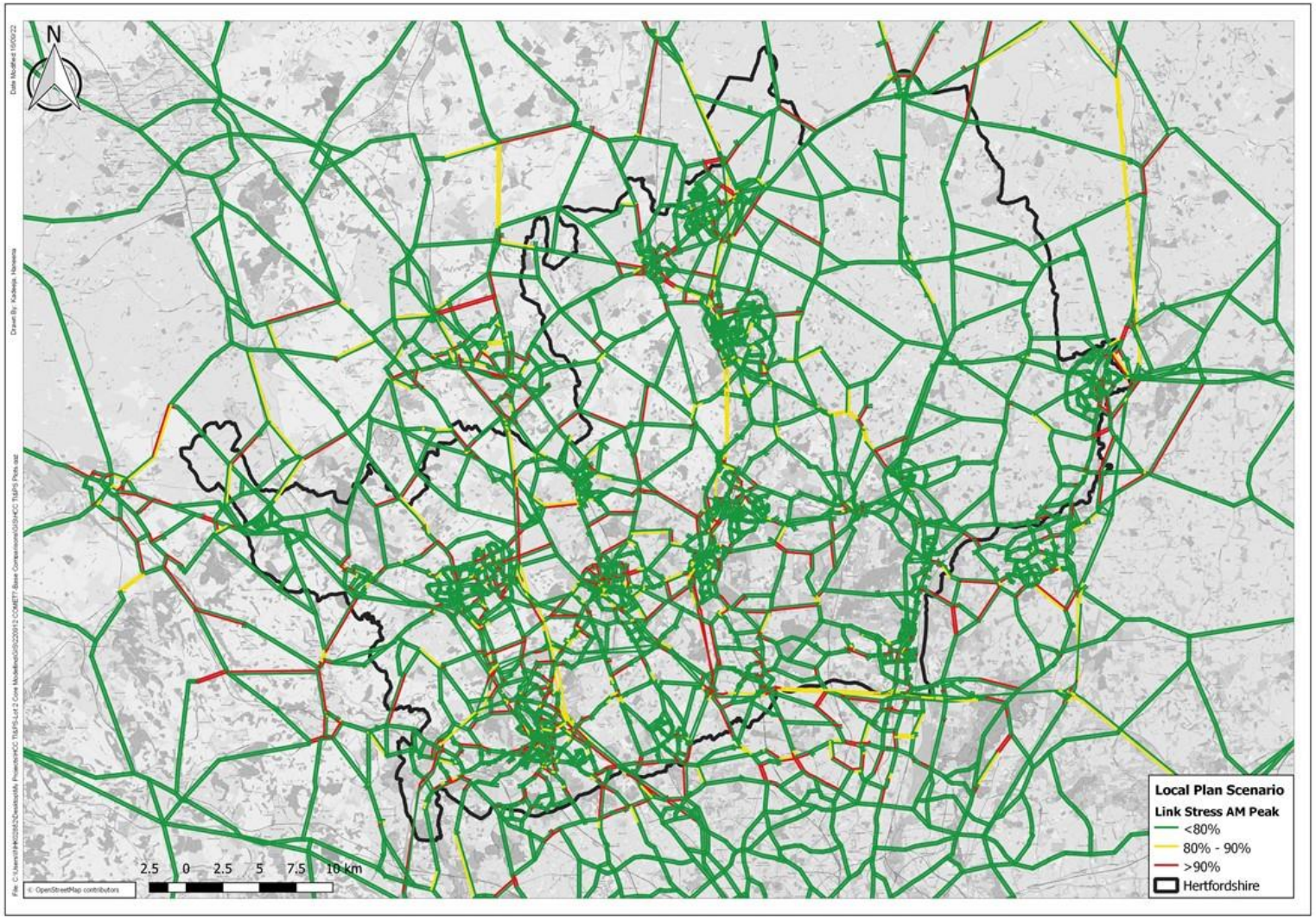


Figure D-7: COMET 2036 Local Plan AM Peak Link V/C

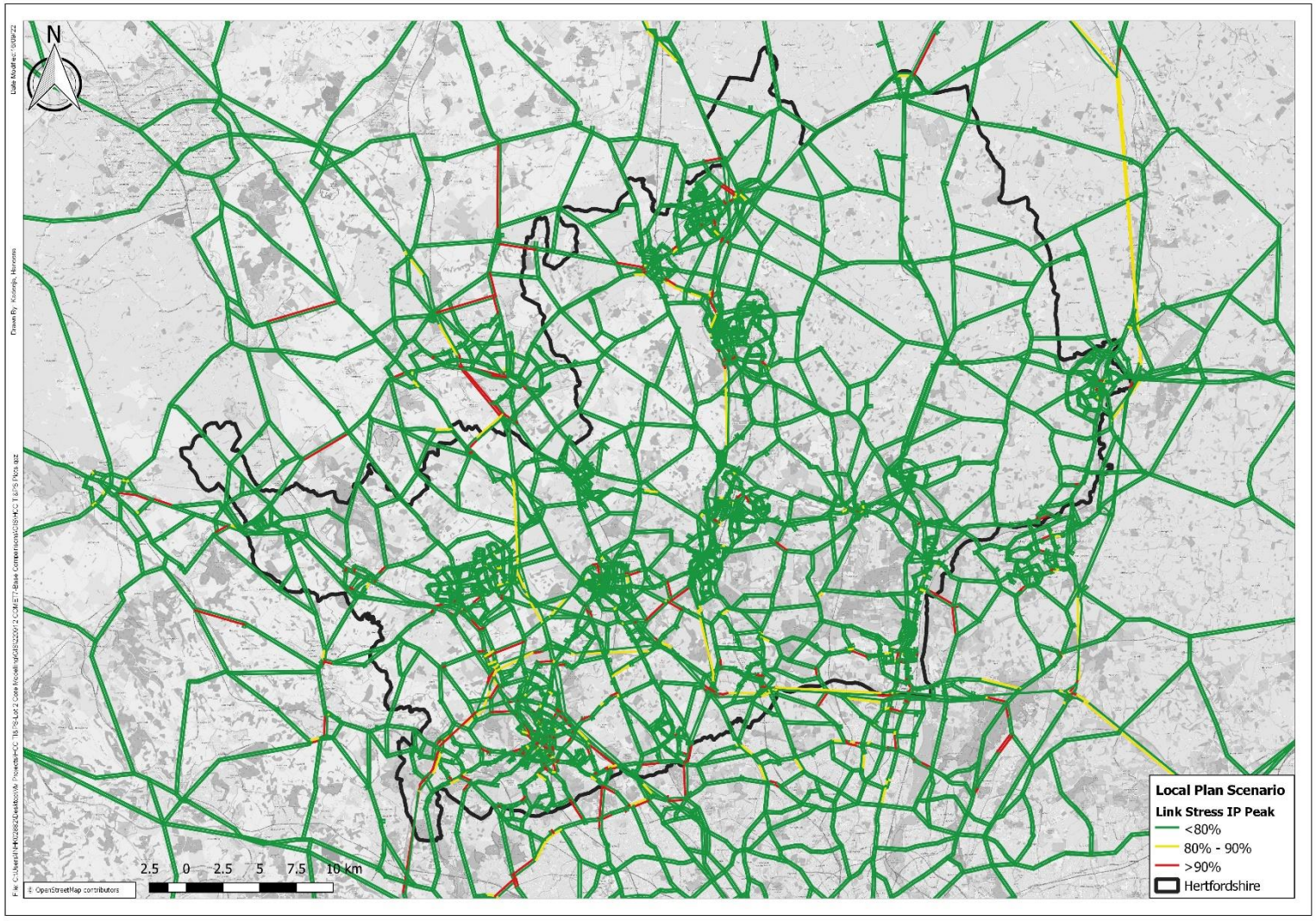


Figure D-8: COMET 2036 Local Plan Inter-Peak Link V/C

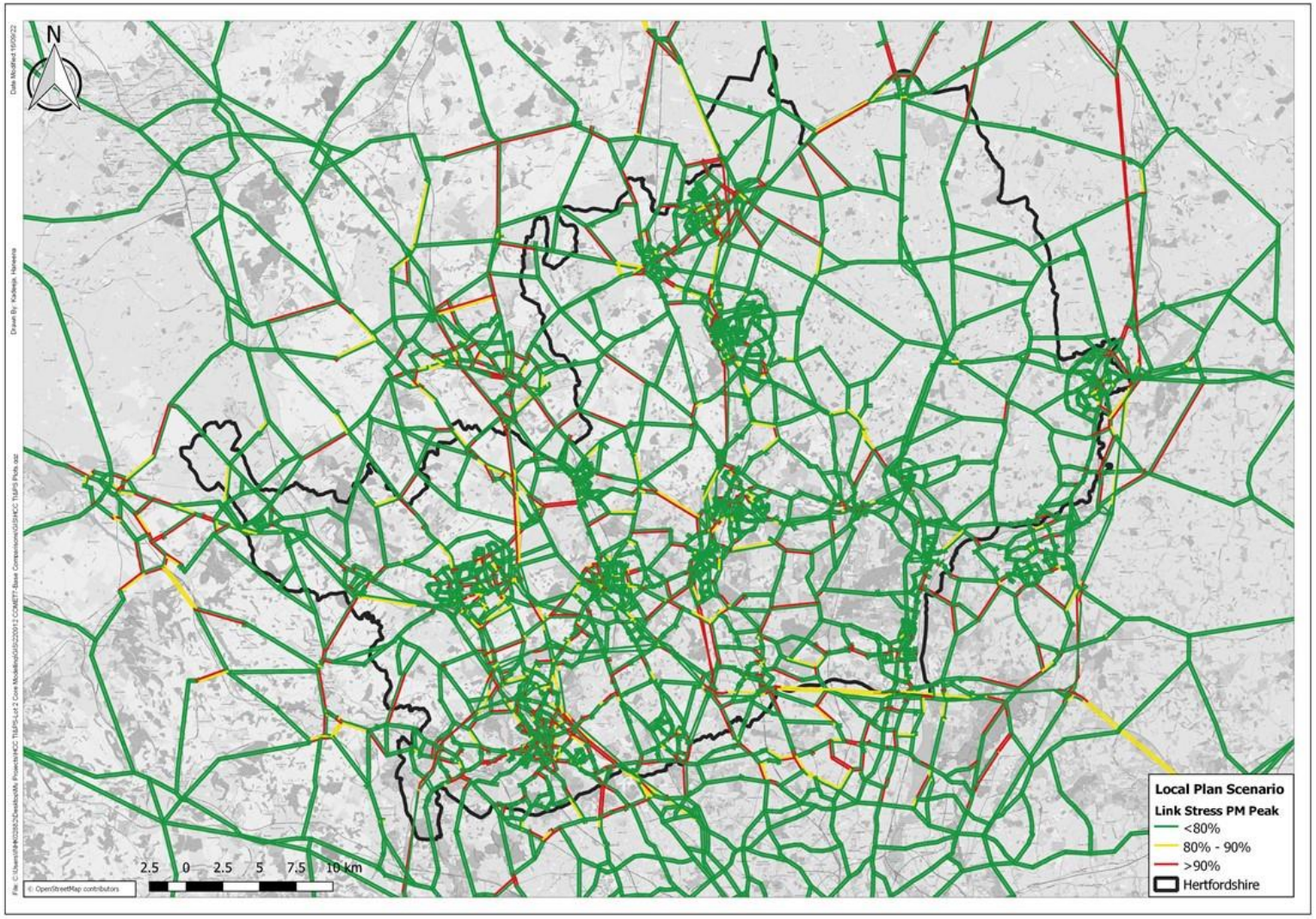


Figure D-9: COMET 2036 Local Plan PM Peak Link V/C

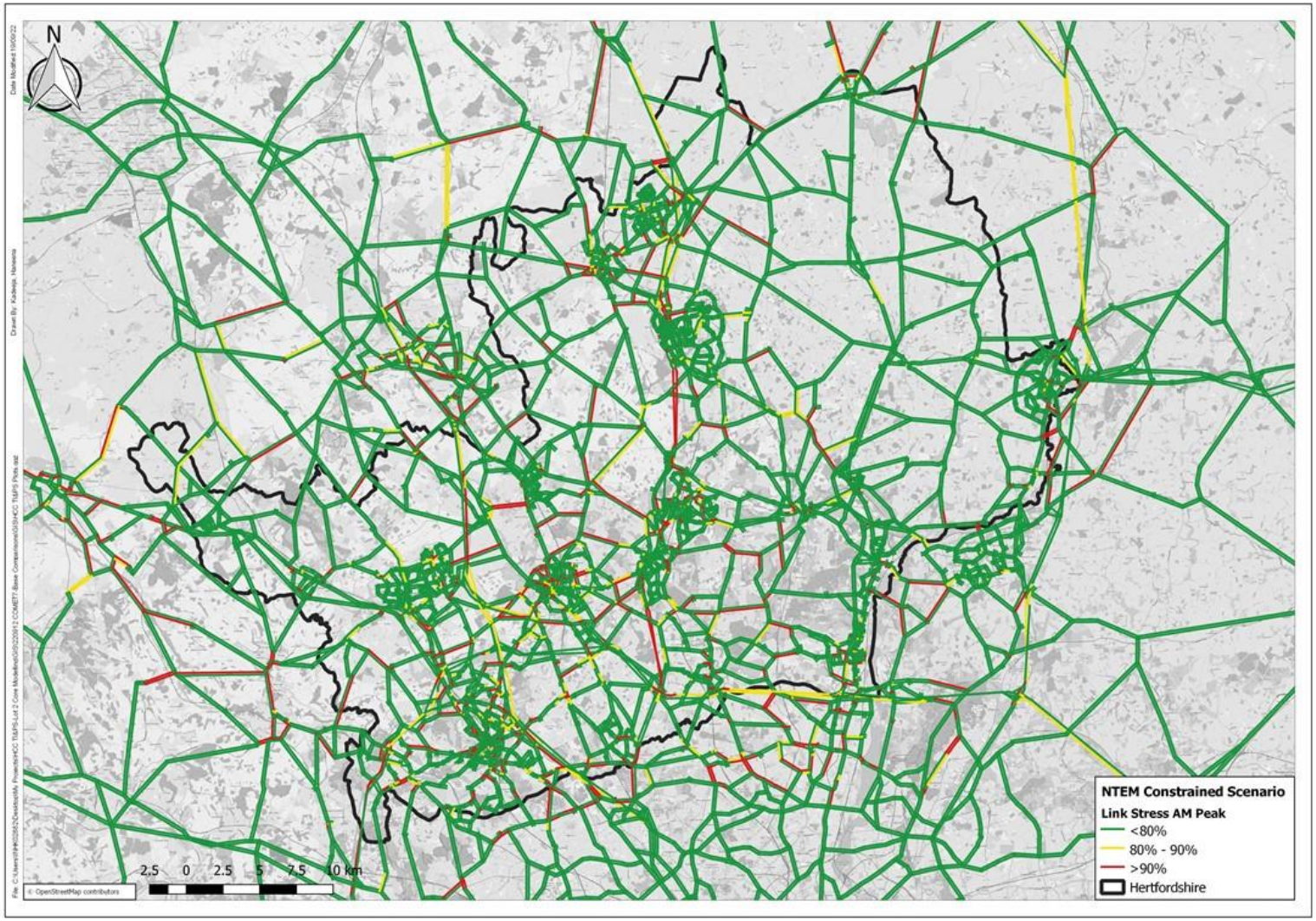


Figure D-10: COMET 2036 NTEM Constrained Scenario AM Peak Link V/C

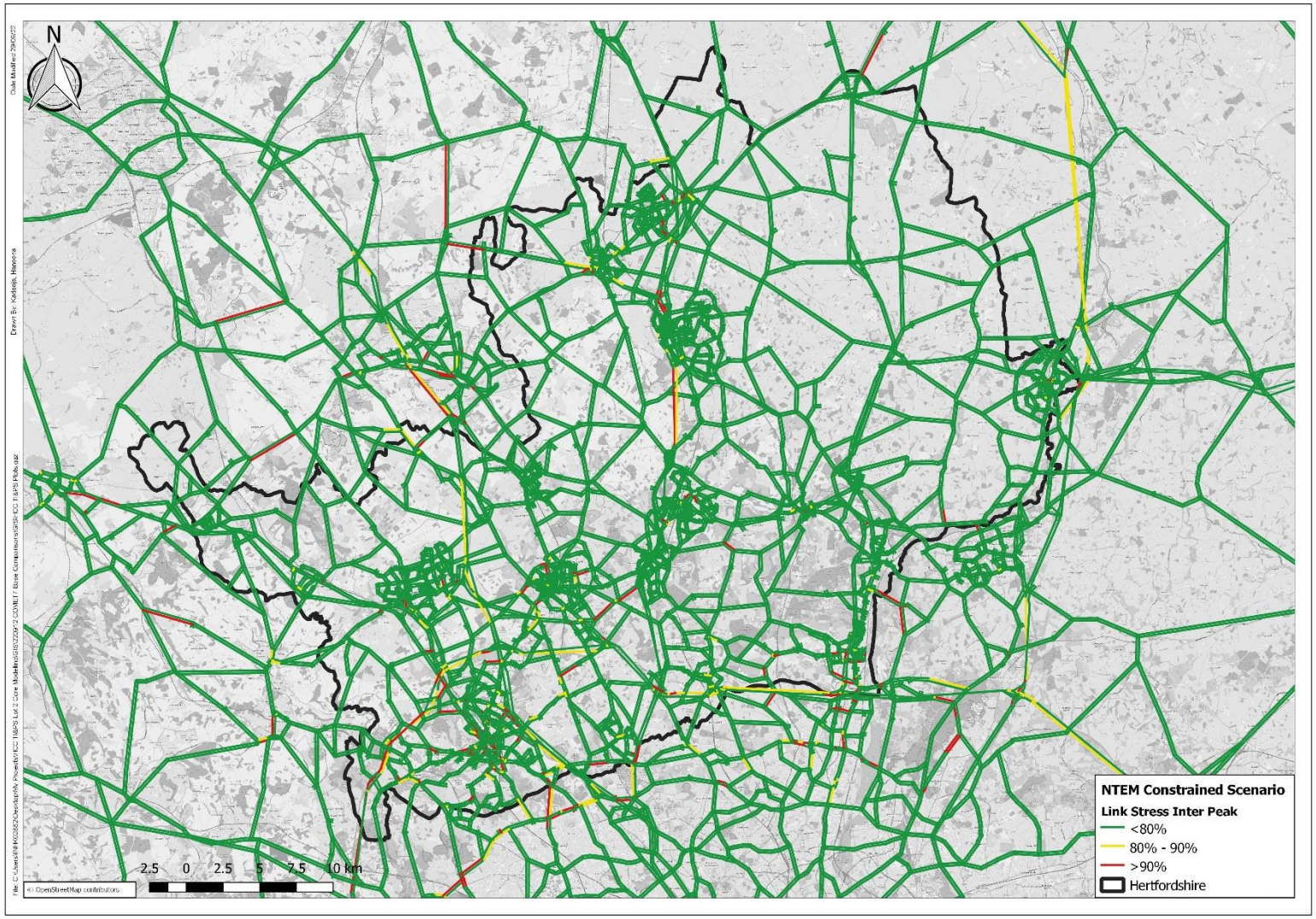


Figure D-11: COMET 2036 NTEM Constrained Scenario Inter-Peak Link V/C

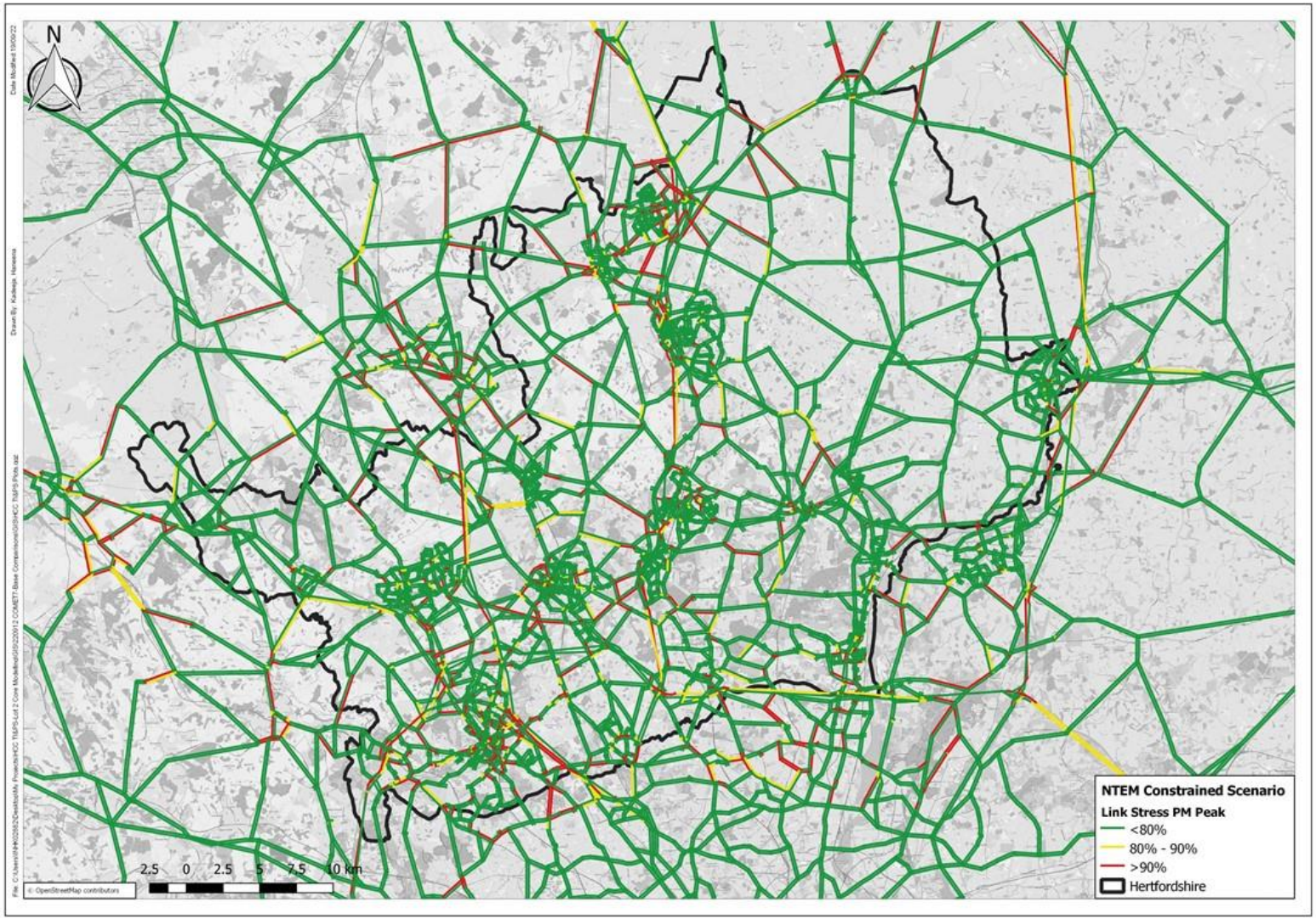


Figure D-12: COMET 2036 NTEM Constrained Scenario PM Peak Link V/C

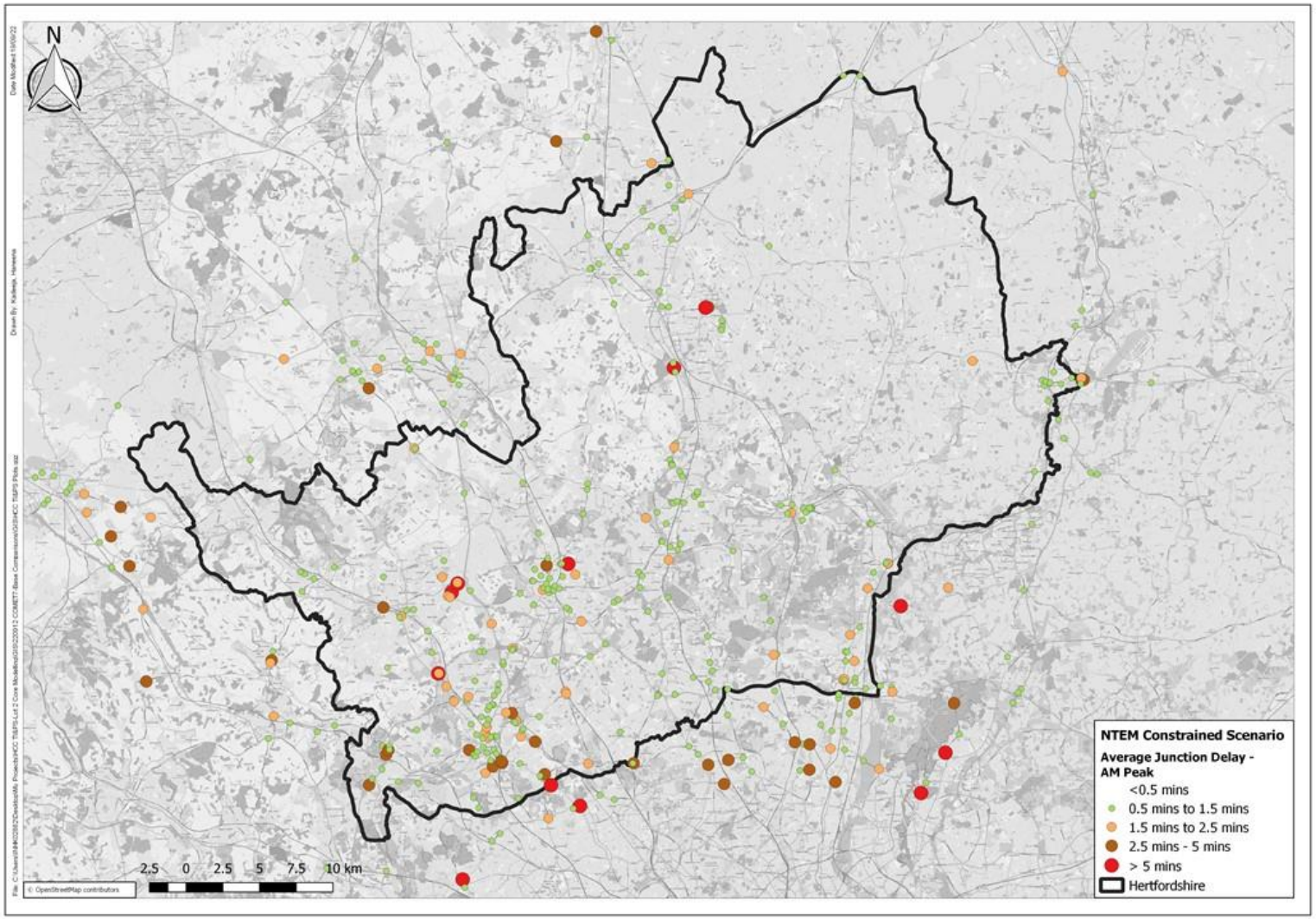


Figure D-13: COMET 2036 NTEM Constrained Scenario AM Peak Average Junction Delay

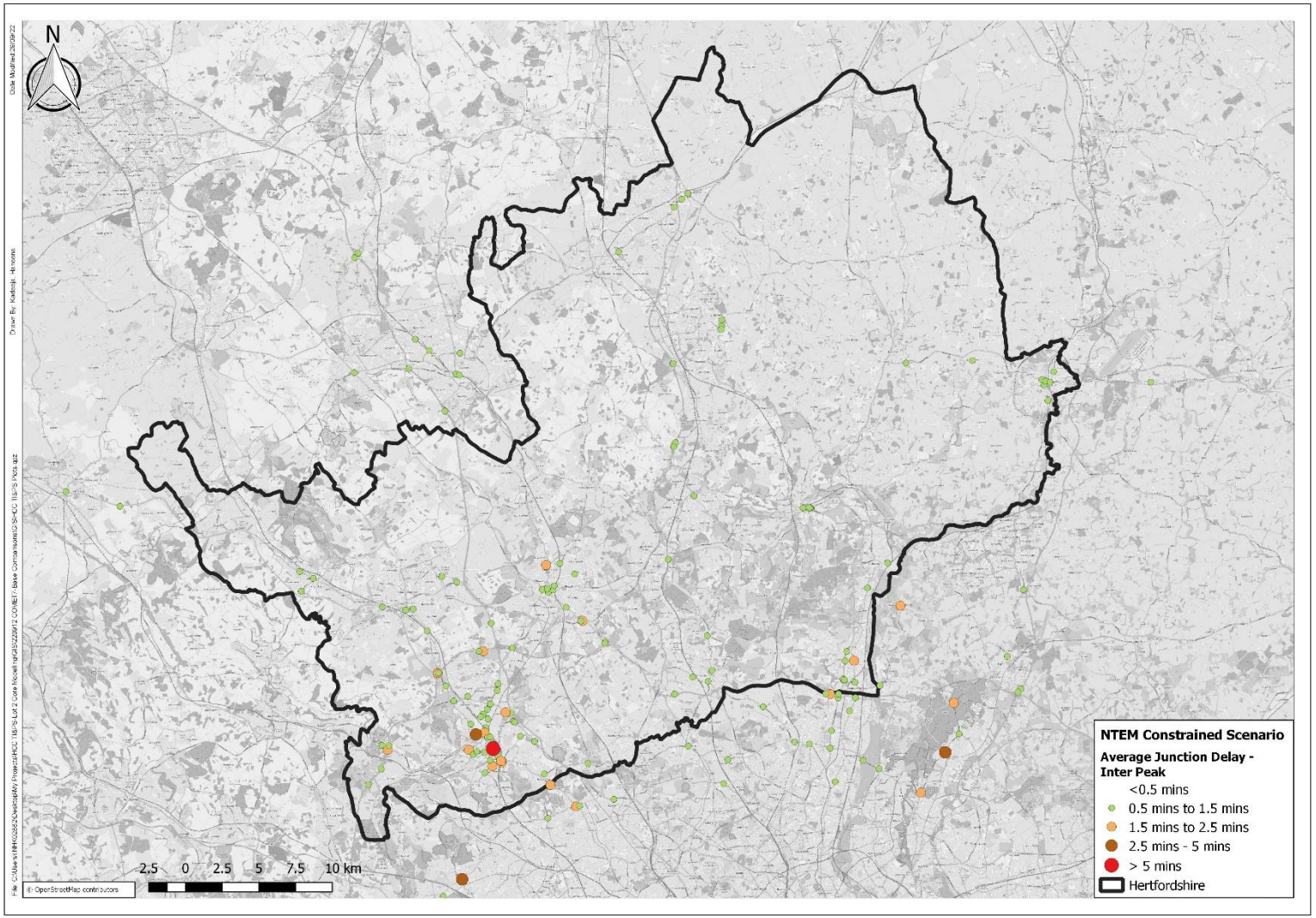


Figure D-14: COMET 2036 NTEM Constrained Scenario Interpeak Average Junction Delay

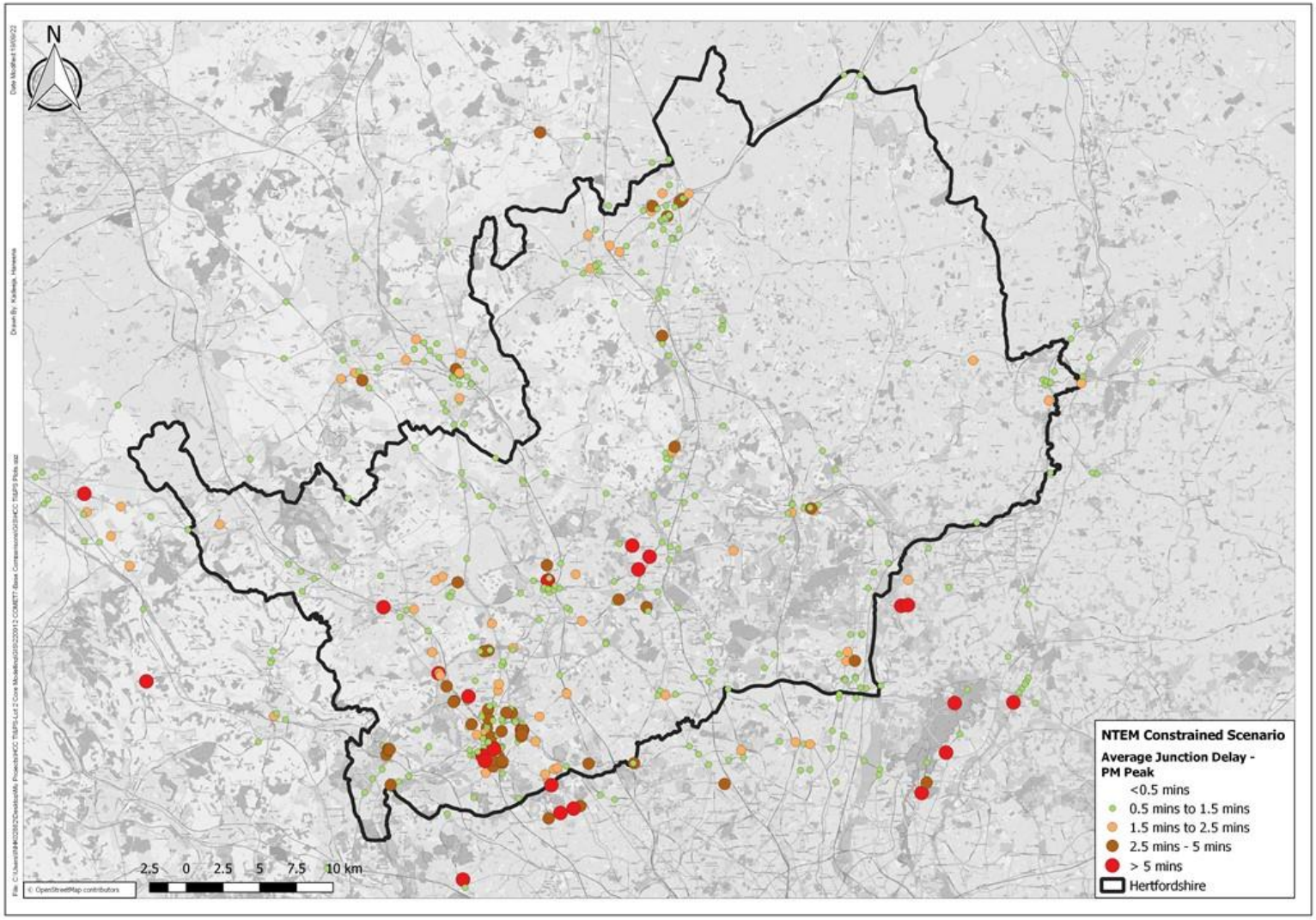


Figure D-15: COMET 2036 NTEM Constrained Scenario PM Peak Average Junction Delay

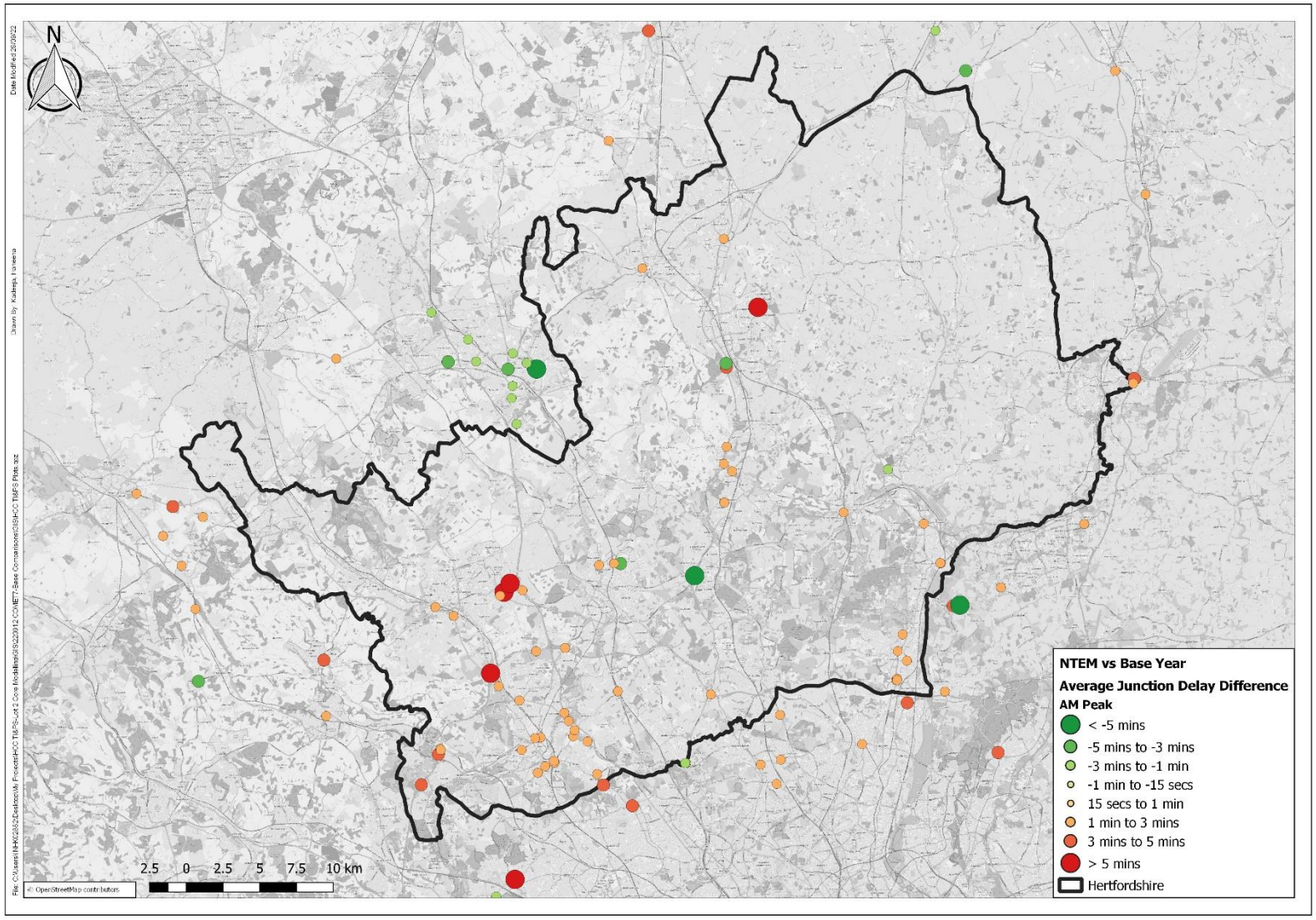


Figure D-16: 2036 NTEM Constrained Scenario vs 2014 AM Peak Changes of Average Junction Delay

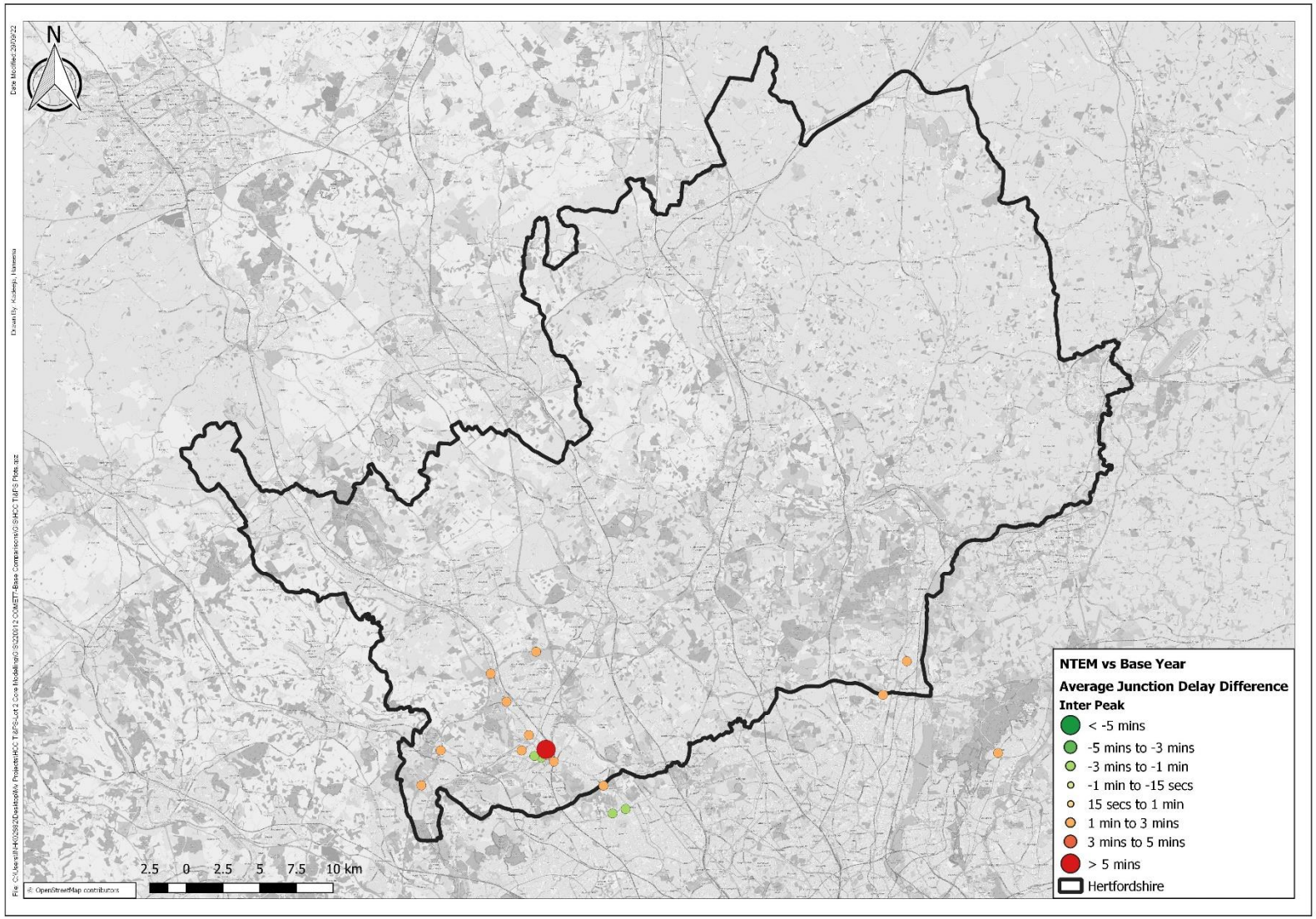


Figure D-17: 2036 NTEM Constrained Scenario vs 2014 Inter peak Changes of Average Junction Delay

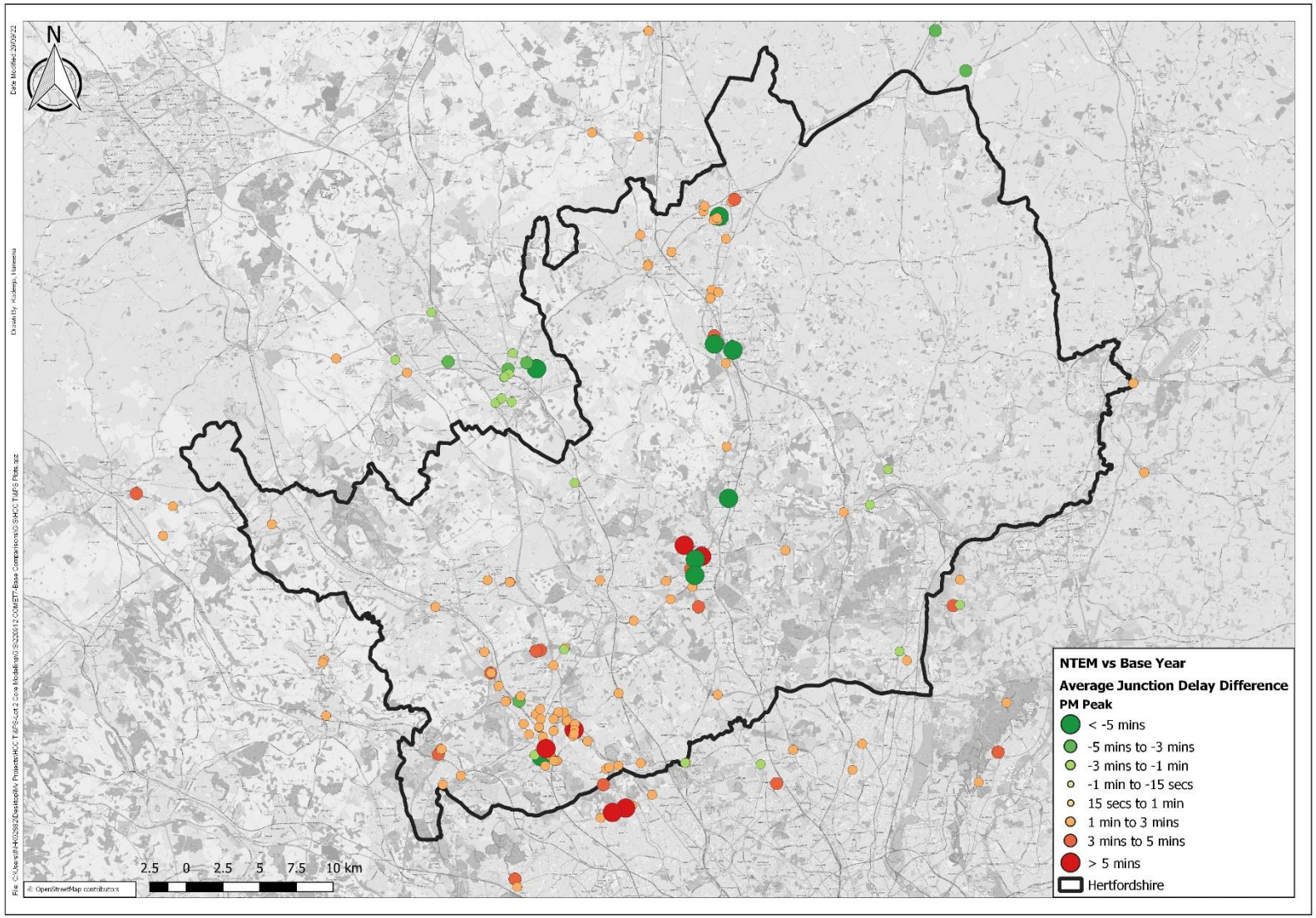


Figure D-18: 2036 NTEM Constrained Scenario vs 2014 PM Peak Changes of Average Junction Delay

Appendix E

FURTHER INTER URBAN JOURNEY TIME ANALYSIS

Table E-1: Journey time comparisons between Local Plan Scenario and Base Year in AM Peak (mins)

	Bishops Stortford	Borehamwood	Cheshunt	Hemel Hempstead	Hertford	Hitchin	Rickmansworth	St Albans	Stevenage	Watford	Welwyn Garden City
Bishops Stortford	-	11	-1	15	-1	7	12	7	1	13	3
Borehamwood	9	-	11	12	8	7	9	5	8	8	8
Cheshunt	4	17	-	23	6	9	21	17	9	22	12
Hemel Hempstead	9	9	16	-	10	4	9	6	9	10	9
Hertford	-1	4	-1	15	-	4	12	7	2	10	4
Hitchin	9	4	3	9	5	-	10	5	5	9	6
Rickmansworth	6	4	13	7	12	6	-	7	12	7	12
St Albans	4	2	11	7	6	4	10	-	6	9	6
Stevenage	1	1	-1	10	2	1	8	3	-	7	4
Watford	6	4	13	8	11	3	5	5	12	-	11
Welwyn Garden City	2	3	7	10	4	0	11	4	2	10	-

Table E-2: Journey time comparisons between Local Plan Scenario and Base Year in Inter-Peak (mins)

	Bishops Stortford	Borehamwood	Cheshunt	Hemel Hempstead	Hertford	Hitchin	Rickmansworth	St Albans	Stevenage	Watford	Welwyn Garden City
Bishops Stortford	-	7	0	8	2	6	7	4	2	5	2
Borehamwood	4	-	8	5	2	2	3	1	2	2	2
Cheshunt	1	9	-	13	3	5	13	9	3	11	3
Hemel Hempstead	7	5	13	-	6	4	6	2	7	5	4
Hertford	1	1	1	6	-	1	8	3	0	4	1
Hitchin	4	2	4	4	2	-	4	1	4	2	2
Rickmansworth	3	2	11	4	6	4	-	5	6	4	6
St Albans	3	1	10	1	2	1	9	-	3	4	2
Stevenage	1	1	1	7	1	2	9	2	-	4	2
Watford	5	2	11	6	5	3	2	3	5	-	5
Welwyn Garden City	0	1	2	4	0	0	9	2	1	4	-

Table E-3: Journey time comparisons between Local Plan and Base Year in PM Peak (mins)

	Bishops Stortford	Borehamwood	Cheshunt	Hemel Hempstead	Hertford	Hitchin	Rickmansworth	St Albans	Stevenage	Watford	Welwyn Garden City
Bishops Stortford	-	10	-1	8	0	7	14	5	1	11	2
Borehamwood	9	-	11	5	7	5	13	3	4	8	6
Cheshunt	4	15	-	16	4	8	23	13	5	20	6
Hemel Hempstead	13	11	18	-	13	6	11	8	8	10	8
Hertford	2	7	0	11	-	4	19	5	1	12	2
Hitchin	9	10	5	6	5	-	11	3	5	6	3
Rickmansworth	11	9	17	8	13	7	-	12	10	7	12
St Albans	6	3	10	2	5	2	15	-	3	9	3
Stevenage	3	7	2	11	3	4	19	6	-	13	0
Watford	23	18	26	21	21	18	12	17	18	-	20
Welwyn Garden City	4	8	7	11	4	1	20	4	1	14	-

Table E-4: Journey time comparisons between NTEM Constrained Scenario and Base Year in AM Peak (mins)

	Bishops Stortford	Borehamwood	Cheshunt	Hemel Hempstead	Hertford	Hitchin	Rickmansworth	St Albans	Stevenage	Watford	Welwyn Garden City
Bishops Stortford	-	9	-1	9	-1	6	11	5	0	13	2
Borehamwood	6	-	8	7	4	9	7	3	7	5	3
Cheshunt	2	10	-	13	3	8	13	10	6	15	9
Hemel Hempstead	6	6	12	-	7	3	9	4	7	7	5
Hertford	-1	2	-1	10	-	6	9	5	2	9	3
Hitchin	3	4	3	4	4	-	7	3	2	5	5
Rickmansworth	6	4	12	9	9	6	-	8	13	6	10
St Albans	3	2	8	3	4	4	8	-	6	7	4
Stevenage	0	0	-1	5	2	3	7	2	-	7	2
Watford	5	3	11	6	8	3	6	4	12	-	9
Welwyn Garden City	1	1	6	6	4	5	8	3	4	7	-

Table E-5: Journey time comparisons between NTEM Constrained Scenario and Base Year in Inter-Peak (mins)

	Bishops Stortford	Borehamwood	Cheshunt	Hemel Hempstead	Hertford	Hitchin	Rickmansworth	St Albans	Stevenage	Watford	Welwyn Garden City
Bishops Stortford	-	6	0	4	1	2	6	2	1	3	1
Borehamwood	4	-	4	2	0	3	2	0	3	1	1
Cheshunt	2	5	-	7	4	5	8	5	4	6	3
Hemel Hempstead	3	2	6	-	2	3	4	1	4	3	2
Hertford	1	0	1	3	-	1	7	1	1	2	0
Hitchin	1	1	1	1	2	-	3	1	1	0	1
Rickmansworth	4	2	6	3	4	3	-	4	7	3	4
St Albans	2	1	6	1	1	1	6	-	3	2	1
Stevenage	0	0	1	3	0	1	6	1	-	2	1
Watford	4	2	6	4	2	3	2	2	4	-	2
Welwyn Garden City	0	0	1	3	0	2	6	1	2	2	-

Table E-6: Journey time comparisons between NTEM Constrained Scenario and Base Year in PM Peak (mins)

	Bishops Stortford	Borehamwood	Cheshunt	Hemel Hempstead	Hertford	Hitchin	Rickmansworth	St Albans	Stevenage	Watford	Welwyn Garden City
Bishops Stortford	-	7	0	5	0	6	13	5	0	8	0
Borehamwood	7	-	4	2	4	7	11	1	2	4	2
Cheshunt	5	7	-	7	5	12	16	6	6	12	5
Hemel Hempstead	8	7	8	-	7	5	10	3	4	7	4
Hertford	2	6	1	8	-	7	18	5	1	10	1
Hitchin	3	7	4	3	4	-	10	3	1	4	2
Rickmansworth	12	9	12	10	11	9	-	12	11	7	10
St Albans	5	3	4	2	4	6	13	-	3	6	2
Stevenage	2	7	3	8	1	5	18	7	-	10	2
Watford	23	17	20	20	19	19	12	16	18	-	17
Welwyn Garden City	3	6	5	7	3	5	17	3	2	10	-

Table E-7: Journey time comparisons between NTEM Constrained Scenario and Base Year in AM Peak (%)

	Bishops Stortford	Borehamwood	Cheshunt	Hemel Hempstead	Hertford	Hitchin	Rickmansworth	St Albans	Stevenage	Watford	Welwyn Garden City
Bishops Stortford		20%	-4%	14%	-3%	12%	18%	8%	1%	19%	5%
Borehamwood	13%		36%	25%	16%	27%	24%	15%	23%	20%	16%
Cheshunt	4%	43%		36%	15%	17%	38%	33%	18%	38%	29%
Hemel Hempstead	8%	20%	31%		16%	9%	37%	18%	14%	26%	14%
Hertford	-4%	8%	-3%	26%		17%	23%	17%	7%	20%	18%
Hitchin	7%	11%	6%	10%	11%		16%	8%	17%	12%	20%
Rickmansworth	9%	13%	33%	34%	21%	14%		27%	30%	36%	27%
St Albans	5%	8%	27%	15%	14%	12%	29%		19%	23%	17%
Stevenage	0%	1%	-3%	11%	7%	19%	15%	7%		13%	10%
Watford	9%	14%	35%	28%	20%	8%	32%	19%	30%		27%
Welwyn Garden City	3%	3%	20%	20%	21%	25%	22%	12%	24%	19%	

Table E-8: Journey Time Comparisons between NTEM Constrained Scenario and Base Year in Inter-Peak (%)

	Bishops Stortford	Borehamwood	Cheshunt	Hemel Hempstead	Hertford	Hitchin	Rickmansworth	St Albans	Stevenage	Watford	Welwyn Garden City
Bishops Stortford		12%	-1%	6%	3%	5%	10%	4%	3%	5%	2%
Borehamwood	9%		19%	7%	2%	9%	8%	2%	9%	5%	3%
Cheshunt	6%	22%		19%	19%	13%	24%	18%	11%	18%	9%
Hemel Hempstead	5%	9%	16%		6%	8%	16%	7%	11%	13%	8%
Hertford	2%	2%	7%	8%		4%	17%	5%	2%	7%	2%
Hitchin	2%	4%	4%	4%	7%		7%	2%	7%	1%	7%
Rickmansworth	7%	7%	19%	12%	11%	8%		17%	15%	22%	13%
St Albans	4%	5%	21%	7%	5%	4%	25%		11%	9%	6%
Stevenage	1%	1%	2%	7%	2%	10%	16%	4%		6%	7%
Watford	7%	11%	21%	19%	6%	9%	13%	8%	11%		7%
Welwyn Garden City	-1%	1%	4%	9%	2%	8%	19%	5%	14%	8%	

Table E-9: Journey time comparisons between NTEM Constrained Scenario and Base Year in PM Peak (%)

	Bishops Stortford	Borehamwood	Cheshunt	Hemel Hempstead	Hertford	Hitchin	Rickmansworth	St Albans	Stevenage	Watford	Welwyn Garden City
Bishops Stortford		14%	0%	8%	-1%	12%	20%	8%	1%	12%	1%
Borehamwood	15%		15%	5%	14%	18%	37%	5%	6%	16%	8%
Cheshunt	13%	30%		18%	25%	24%	42%	20%	14%	35%	14%
Hemel Hempstead	11%	22%	20%		18%	13%	38%	12%	7%	29%	11%
Hertford	5%	20%	4%	20%		20%	43%	16%	2%	28%	6%
Hitchin	7%	20%	8%	9%	12%		22%	9%	9%	11%	8%
Rickmansworth	17%	29%	32%	35%	26%	19%		44%	21%	42%	28%
St Albans	8%	13%	12%	10%	15%	17%	49%		7%	26%	11%
Stevenage	5%	22%	7%	21%	6%	32%	43%	22%		28%	11%
Watford	35%	71%	54%	79%	44%	43%	57%	52%	33%		46%
Welwyn Garden City	7%	26%	15%	23%	20%	22%	49%	15%	8%	33%	

Appendix F

NTEM PUBLIC TRANSPORT ASSIGNMENT RESULTS

BUS PASSENGER FLOW

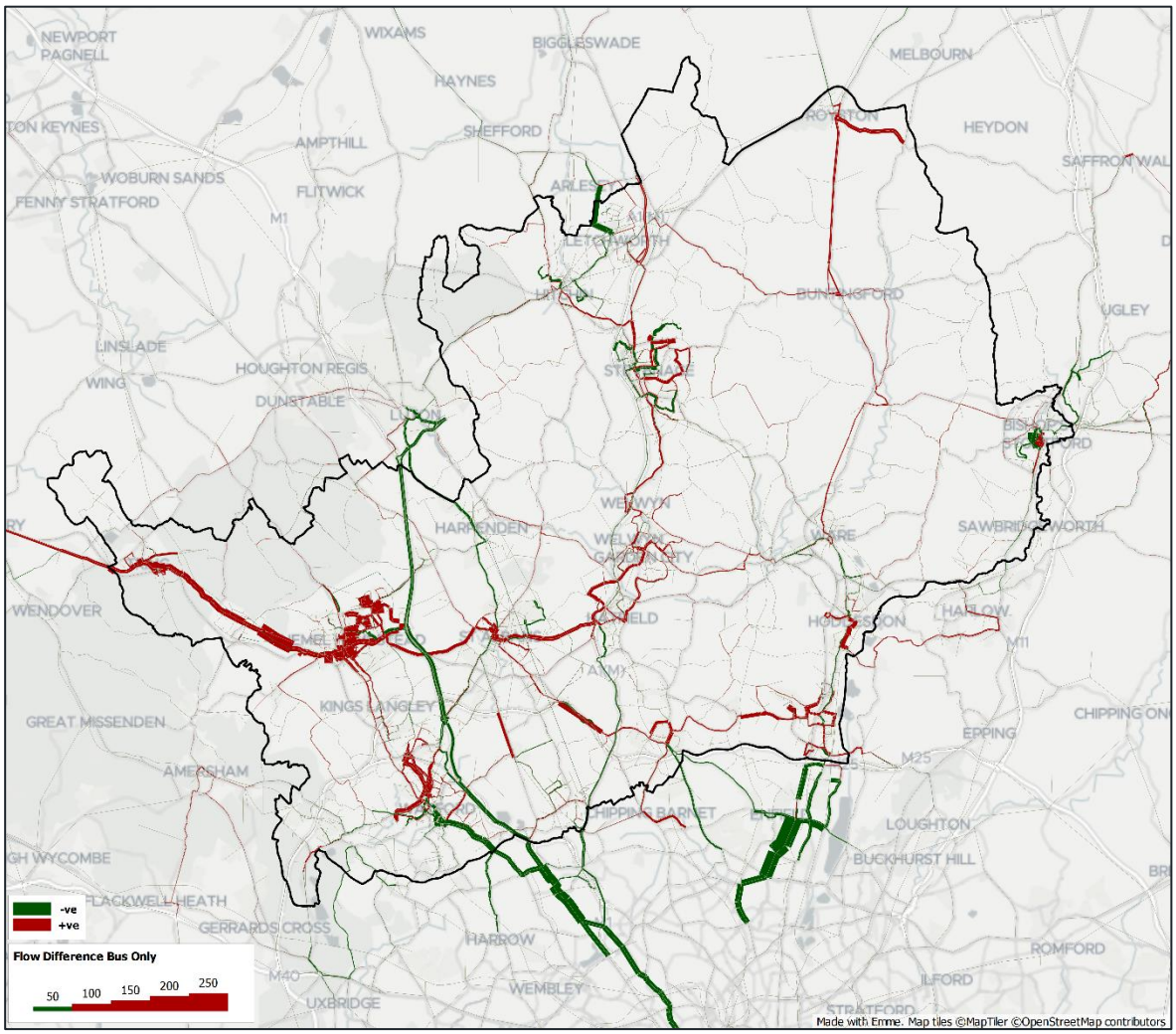


Figure F-1: Bus Passenger Flow Change 2014 vs 2036 NTEM Constrained Scenario AM Peak Hourly Flow

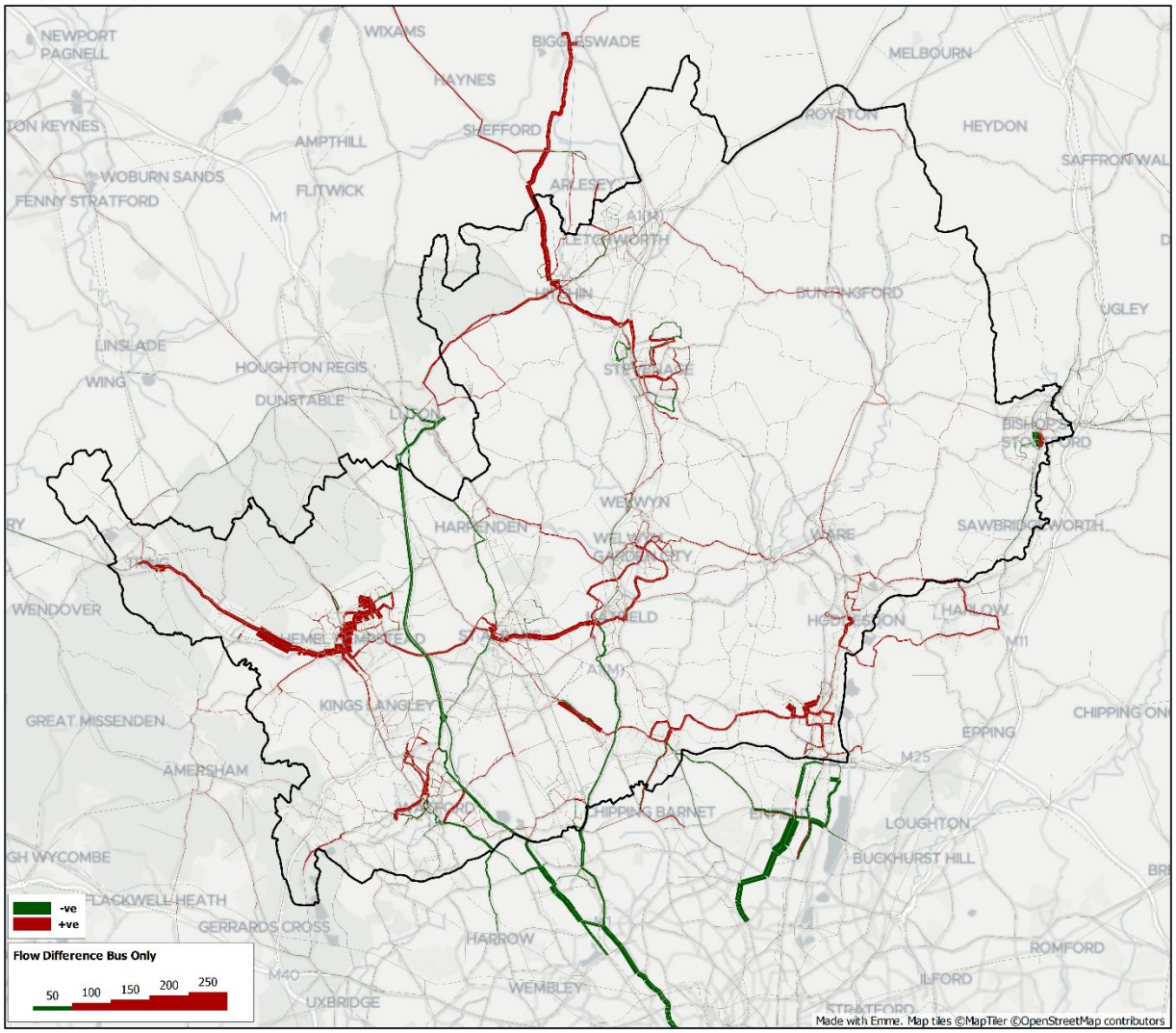


Figure F-2: Bus Passenger Flow Change 2014 vs 2036 NTEM Constrained Scenario Inter-Peak Hourly Flow

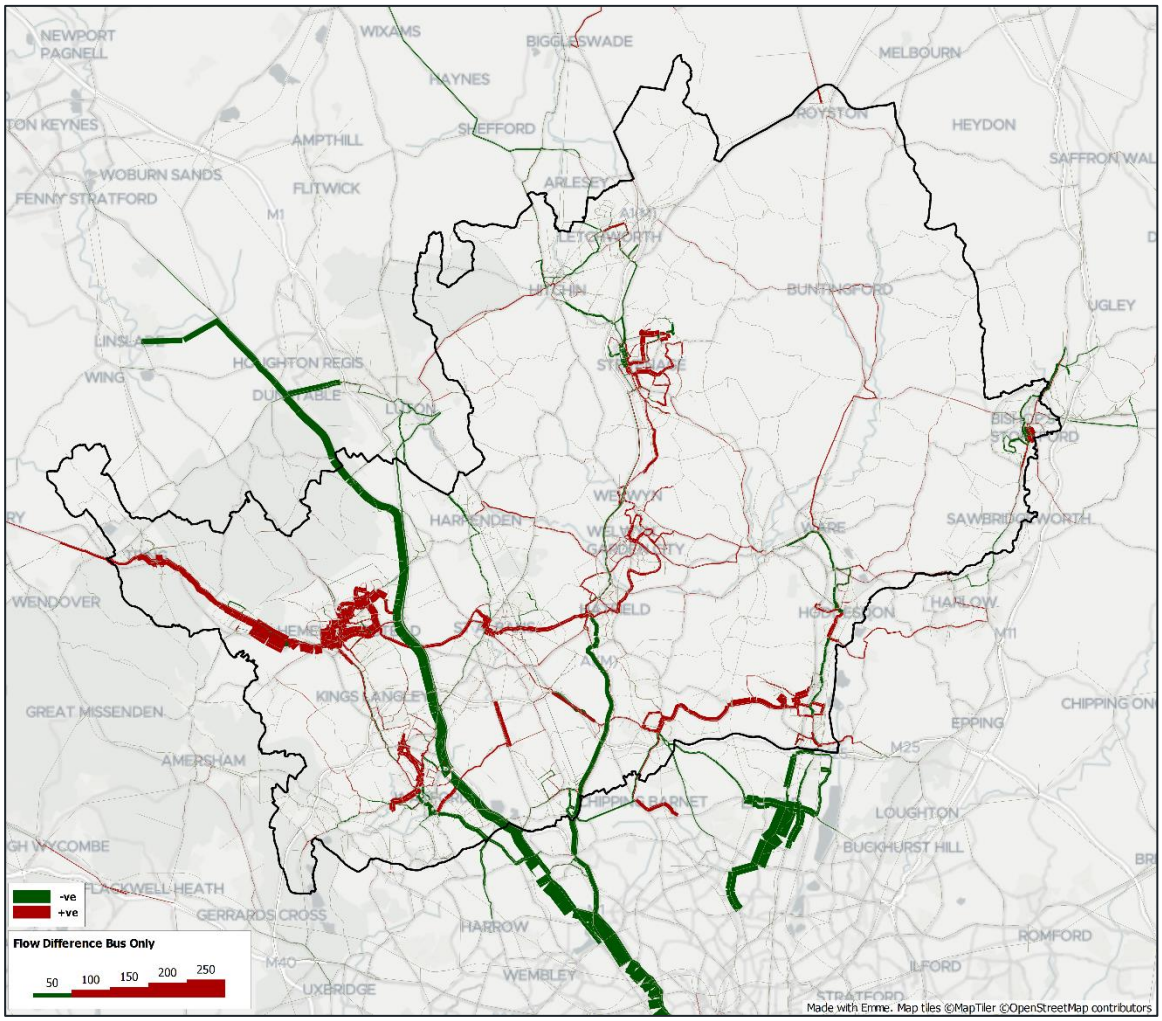


Figure F-3: Bus Passenger Flow Change 2014 vs 2036 NTEM Constrained Scenario PM Peak Hourly Flow

RAIL PASSENGER FLOW

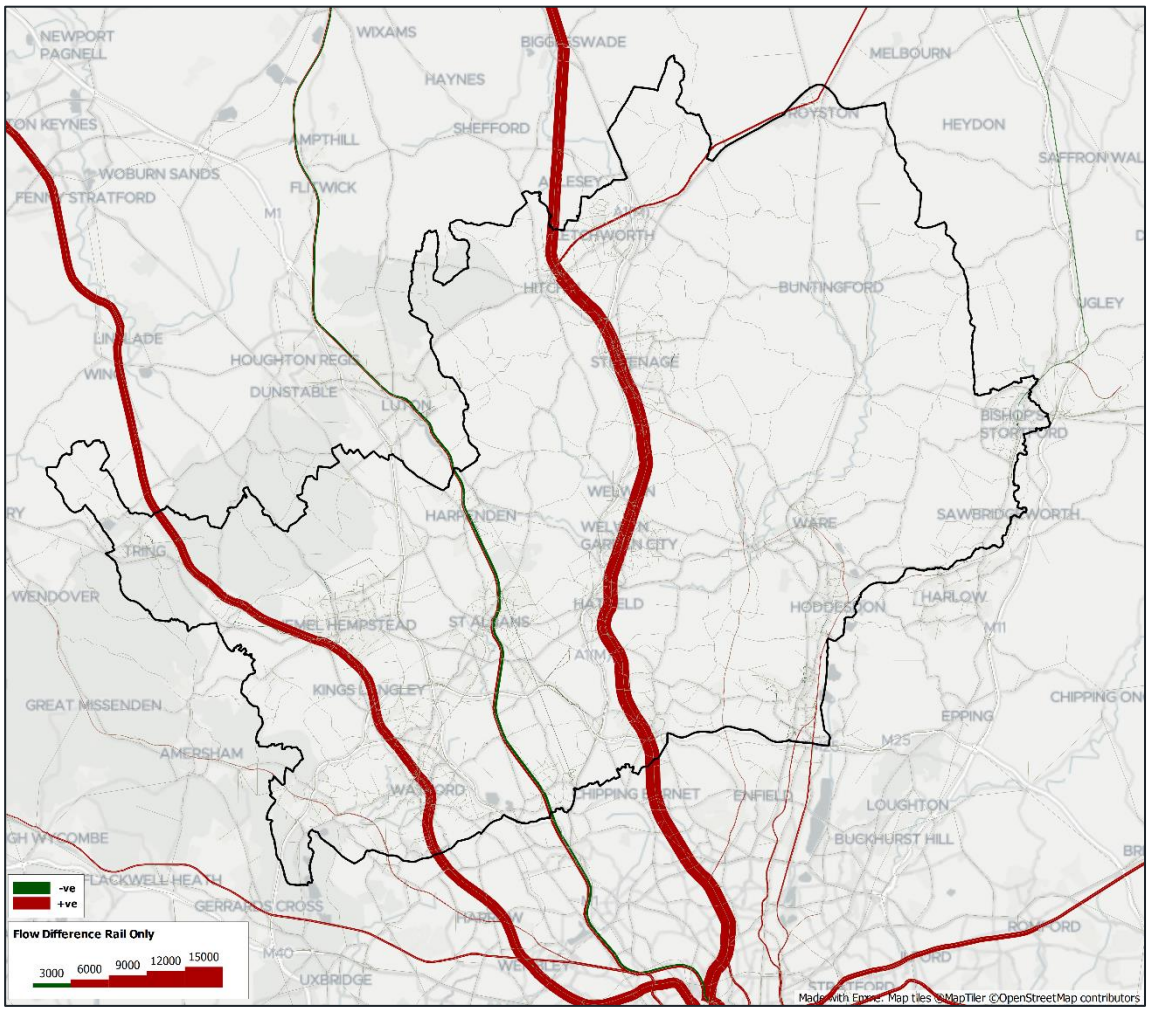


Figure F-4: Rail Passenger Flow Change 2036 NTEM Constrained Scenario vs 2014 AM Peak Hourly Flow

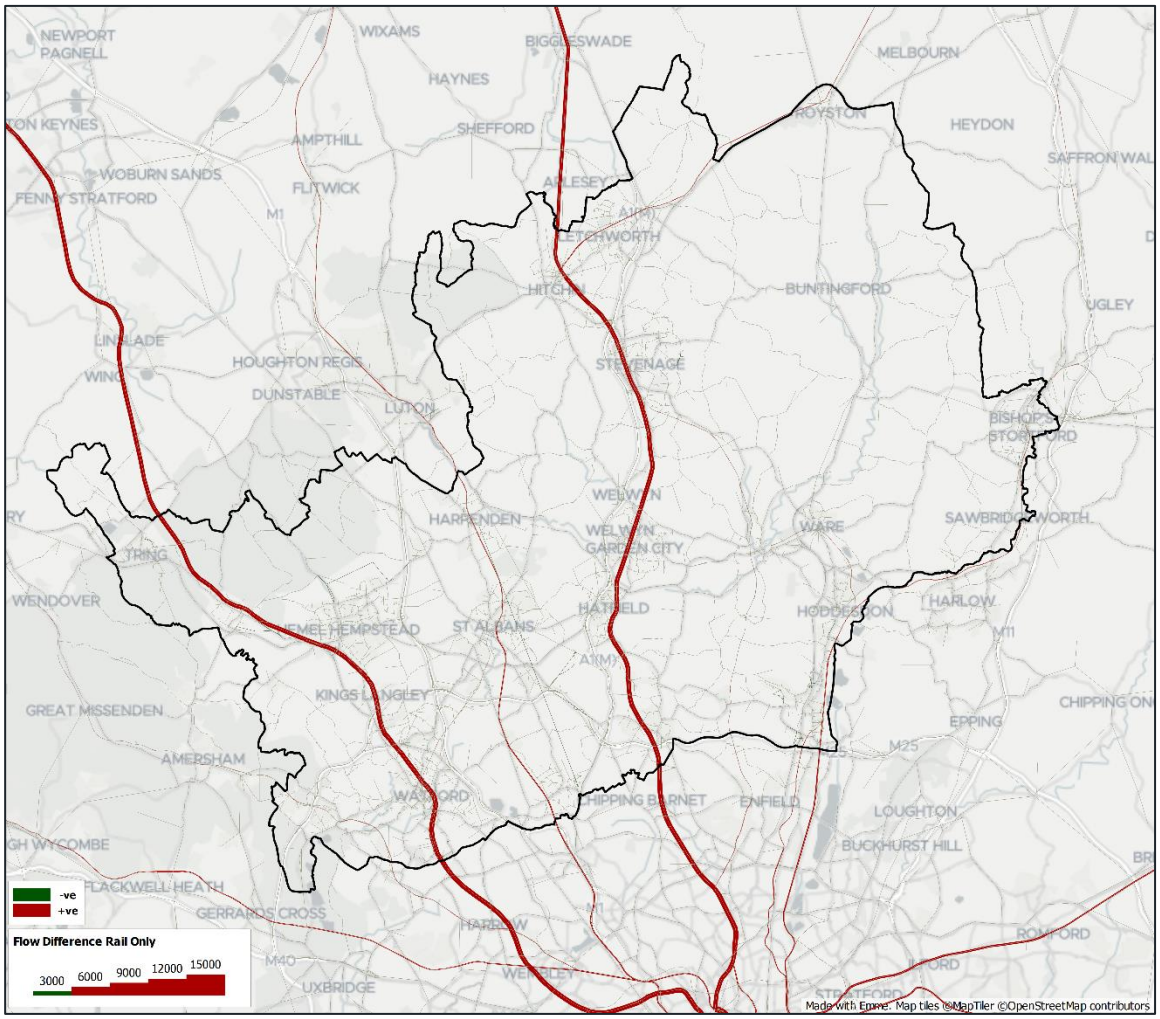


Figure F-5: Rail Passenger Flow Change 2036 NTEM Constrained Scenario vs 2014 Inter Peak Hourly Flow

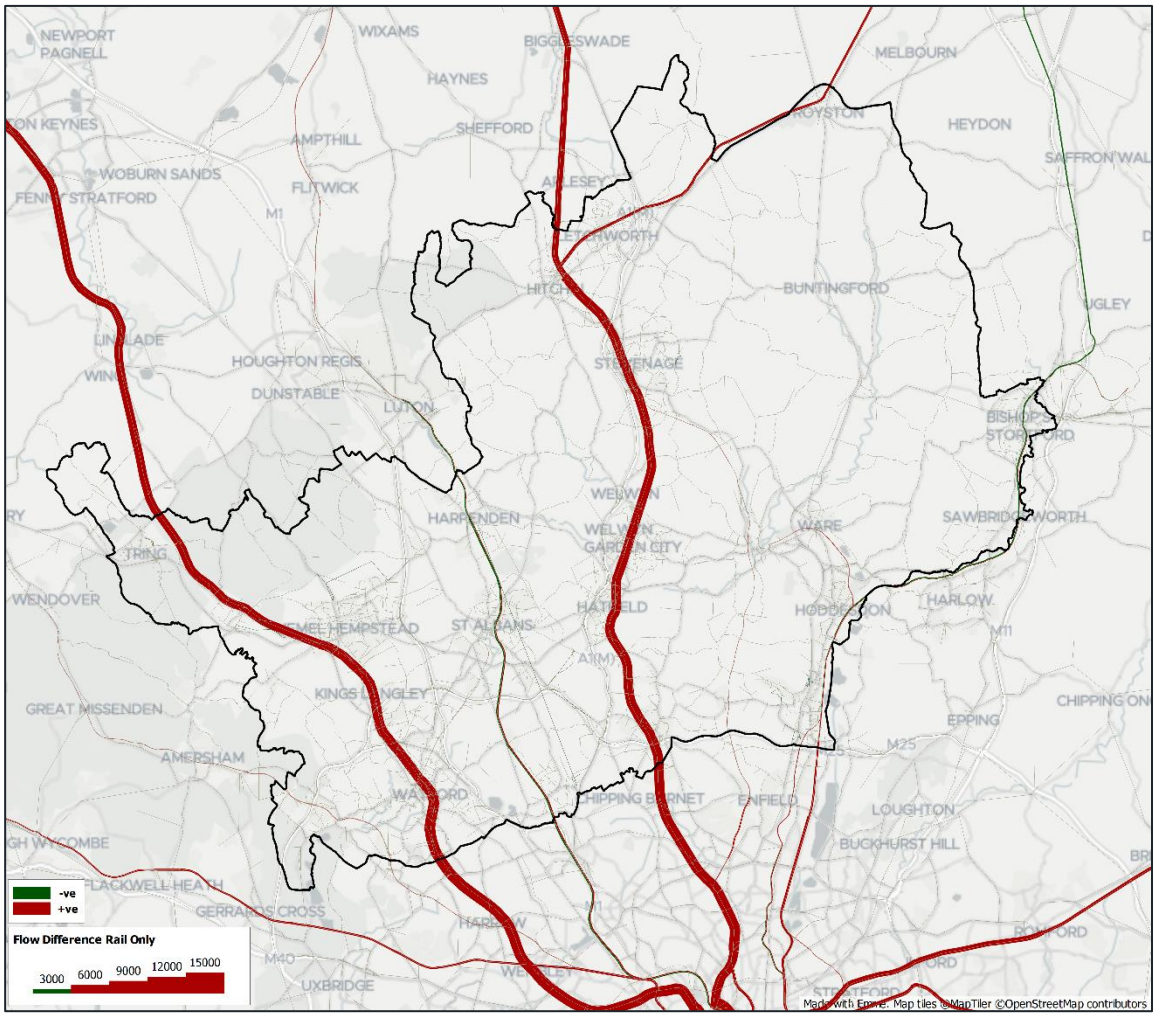


Figure F-6: Rail Passenger Flow Change 2036 NTEM Constrained Scenario vs 2014 PM Peak Hourly Flow

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