Buckinghamshire Countywide Model Update

Traffic Forecasting Technical Note

BRJ10193-TFTN | 1

08/10/21

Buckinghamshire Council

BC

Buckinghamshire Countywide Model Update

Project No:	BRJ10193
Document Title:	Traffic Forecasting Technical Note
Document No.:	BRJ10193-TFTN
Revision:	1
Date:	08/10/21
Client Name:	Buckinghamshire Council
Client No:	BC
Project Manager:	Tom Withey
Author:	Romanos Siatitsas/Michael Hornung (Systra)
File Name:	Bucks_Traffic Forecasting Technical Note_V1.docx

Jacobs U.K. Limited

1180 Eskdale Road
Winnersh, Wokingham
Reading RG41 5TU
United Kingdom
T +44 (0)118 946 7000
F +44 (0)118 946 7001
www.jacobs.com

© Copyright 2019 Jacobs U.K. Limited. The concepts and information contained in this document are the property of Jacobs. Use or copying of this document in whole or in part without the written permission of Jacobs constitutes an infringement of copyright.

Limitation: This document has been prepared on behalf of, and for the exclusive use of Jacobs' client, and is subject to, and issued in accordance with, the provisions of the contract between Jacobs and the client. Jacobs accepts no liability or responsibility whatsoever for, or in respect of, any use of, or reliance upon, this document by any third party.

Document history and status

Revision	Date	Description	Author	Checked	Reviewed	Approved
0	28/06/2021	Traffic Forecasting Technical Note v1.0	RS/MH (Systra)	MH (Systra) / TK	TW / IB (Systra)	TW
1	08/10/2021	Updated following client comments	RS/TT	TW	TW	TW

Contents

Executive Summary ... iii
1. Introduction ... 1
1.1 Report Structure ... 3
2. Forecasting Methodology ... 4
2.1 Forecasting Approach ... 4
2.2 Forecast Years ... 5
2.3 Forecast Scenarios ... 5
2.4 Forecast Demand ... 5
2.5 Forecast Network ... 6
2.6 Forecast Assignment ... 6
3. Forecast Network ... 8
3.1 Committed Transport Infrastructure Schemes ... 8
3.2 Forecast Development Coding ... 8
4. Forecast Demand ... 13
4.1 Overview ... 13
4.2 Future Developments ... 13
4.3 TEMPro Growth ... 18
4.4 Trip Generation by Zone ... 19
4.5 Fuel and Income adjustment factors ... 20
4.6 Trip matrix comparisons ... 20
5. Forecast Assignment ... 23
5.1 Generalised cost changes ... 23
5.2 Assignment convergence ... 24
6. Model Output ... 27
6.1 Flow Plots ... 28
6.2 Volume Capacity Ratio ... 32
6.3 Congestion Ratio Plots ... 36
7. Conclusions ... 40
Appendix A: List of Schemes ... 41
Appendix B: List of Developments ... 42
Appendix C: Sensitivity Test ... 46

Executive Summary

As framework consultants to Buckinghamshire Council (BC), Jacobs UK Limited have been commissioned to develop the required strategic modelling necessary to understand how people currently travel strategically within the Buckinghamshire County and how this might change with future growth and as specific major schemes and developments are implemented. An updated Buckinghamshire Countywide Model (2019) has been developed, achieving a standard closer to TAG guidelines than that of the existing Countywide Model (2013), as a basis and enhancing the detail of network coding across areas such as Slough and Milton Keynes. This report covers the development of the reference case forecast model, derived from that base year model.

The updated Countywide Model (2019) was developed in anticipation of the Buckinghamshire region facing significant growth over the next thirty years, alongside the challenge of meeting increasing travel demands whilst actively encouraging economic growth, protecting the environment, enhancing well-being, increasing housing supply and creating new communities. In order to facilitate these objectives, BC needed a tool to understand how people currently travel strategically within the region, and how this might change with future growth in a forecast scenario and as major transport schemes are implemented.

By pivoting from the base year, one forecast year (2040) has been modelled. This was agreed with BC, taking into consideration that 2040 is sufficiently far into the future to include consideration of local plans for the County. There is a single forecast scenario, with the committed network schemes and developments included reflective of a reference case scenario for 2040. The model has not yet been used for assessing any particular scheme, nor has such a use yet been specified. Therefore, a DM and DS approach is not required, as there is no specific transport scheme to assess as part of this scope of work[1]. This single forecast scenario is referred to as the reference case.

The reference case forecast has been built in accordance with the guidelines set out in TAG unit M4 for the development of a fixed (rather than variable) demand forecast, with this approach also agreed with BC.

Forecast land use growth has been derived from the National Trip End Model (NTEM) v7.2 and planning data from BC. Using the planning data from BC, Jacobs identified the locations of potential new development, and the quantum and type of development proposed. The development locations, quanta and likelihoods were agreed with BC. Similarly, potential road network infrastructure was also included in the forecast. All future growth in jobs and households was capped to NTEM v7.2 levels, which is consistent with what would be required for an appraisal following TAG principals.

The forecast model is developed from the updated base year model, the creation of which is described in a separate Local Model Validation Report (LMVR). To aid analysis of the forecast scenario, the forecast vehicle flows, volume capacity ratio for links, and forecast modelled congestion are shown.

Based on the methodology used, the inputs, and a review of the results, the forecast model is considered a reliable tool for developing future transport strategies and (when supplemented with a Variable Demand Model, as appropriate) forming TAG-compliant business cases to support highway schemes and undertaking assessments of development impacts. These would require new specific forecast scenarios to be developed along the same principles as the forecast described in this report.

[1] Any subsequent assessments using the model will likely require DM and DS models, as part of a scenario based approach to identifying impacts.

1. Introduction

As framework consultants to Buckinghamshire Council (BC), Jacobs have been commissioned to develop the required strategic modelling necessary to understand how people currently travel strategically within the Buckinghamshire region and how this might change with future growth and as specific major schemes are implemented.

The model will be appropriate for the following tasks:

- Help to develop transport strategies across Buckinghamshire
- Help to assess the impact of highway schemes
- Help to access the combined impact of Local Plans on the strategic/primary road network
- Provide evidence for early appraisal and sifting of strategic major scheme options
- Provide a basis for potentially producing corridor microsimulation models in the PTV VISSIM software platform
- Identifying cross boundary impacts a short distance outwith Buckinghamshire.

The Buckinghamshire Countywide Model has been validated to a base year of 2019 and covers the AM peak, inter-peak and PM peak time periods.

The base model Local Model Validation Report (LMVR) summarises the work carried out in the development of the Buckinghamshire Countywide Model, including:

- Key design considerations and features of the model,
- Data sources used in its development,
- Checks that have been undertaken on the demand and supply components of the model,
- Resulting calibration and validation of the model.

The LMVR is the principle document detailing the development of the model. This forecast report relates only to the development of the specific forecast scenario described within.

The Buckinghamshire Countywide Model has been developed in anticipation of:

- The Buckinghamshire region facing significant growth over the next thirty years
- The challenge of meeting increasing travel demands whilst actively encouraging economic growth
- Protecting the environment
- Enhancing wellbeing
- Increasing housing supply and creating new communities.

In order to facilitate these objectives, BC needed a tool to understand how people currently travel strategically within the region, and how this might change with future growth in a forecast scenario and as major transport schemes are implemented.

The Study Area for the forecast modelling is consistent with the area of detailed modelling detailed in the base model LMVR, and comprises the whole of Buckinghamshire, and some extended areas, known as the “bulge areas”. The Study Area is shown in Figure 1-1 below.

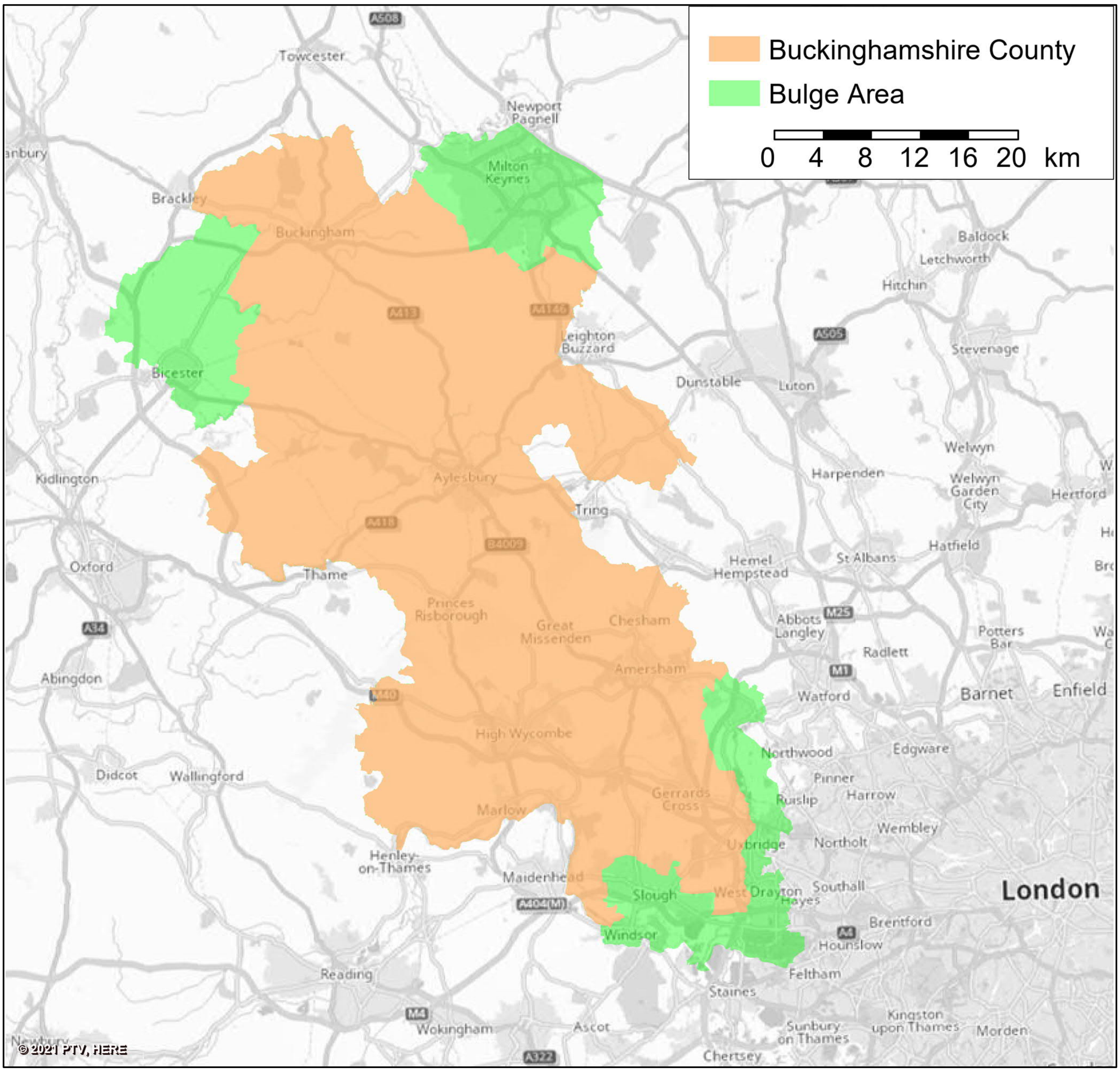

Figure 1-1: Study Area (Buckinghamshire County and Bulge Area)

Within the Study Area identified, the model is likely to be required to serve a number of purposes including:

- Evidence for Local Plan development and hearings (and cumulative impacts once Local Plans are in place); and
- Ability to understand the influences on the performance of transport systems, such as housing and employment growth and major transport schemes, and to identify and assess options for mitigation; and

- Evidence to support Business Case submissions to secure Government funding for new infrastructure and maintenance; and
- Provide evidence to support responses to Government department or company consultations; and
- Support the development consent order and town and country planning process on key schemes; and
- Understand suitable phasing of maintenance and utilities work to manage congestion impacts; and
- Optimisation of the performance of the existing transport network using technology; and
- Accessibility planning for key land uses.

The model also has capability to assess impacts beyond the Study Area, albeit to a reduced level of detail.

Whilst the forecasts described here do not make any specific allowance for future long-term changes in travel patterns due to COVID, this should be a consideration for subsequent uses of the model, making use of possible changes to guidance to account for this.

It should be noted that the purpose of the forecasting described in this report is not specifically to assess a transport scheme or a development test in particular, but instead to model a scenario and thereby set up the processes to be utilised when using the model for specific purposes as required by specific commissions. The scenario described in the report can also provide some useful insights into future travel patterns, however that is not the principal reason for developing the scenario at this stage. Where forecasting for a specific assessment or appraisal purpose is undertaken at a later date, a separate and specific forecast report should be produced to reflect the scope of that new study.

1.1 Report Structure

The remainder of this report is structured as follows:

- Section 2 – Provides an overview of the forecast methodology
- Section 3 – Details the updates to the modelled networks
- Section 4 – Describes the creation of the forecast matrices
- Section 5 – Provides an overview of general cost changes and assignment convergence
- Section 6 – Describes the key outputs from the model
- Section 7 – Contains the conclusions of the modelling work

2. Forecasting Methodology

2.1 Forecasting Approach

The Buckinghamshire Countywide Model has been built in accordance with the guidelines for developing forecast models as set out in TAG unit M4. In summary, the forecasting methodology set out here describes the work done to develop a 'reference case scenario', produced to include larger scale developments and infrastructure across Buckinghamshire, as a means to setting up the forecasting process and gain some insights from the initial forecast modelling.

The developments to be modelled explicitly in the forecast model were identified by Jacobs jointly with BC. The key points to note in the methodology of the development of the forecast reference scenario are:

- The developments were modelled with trip generation based on a Transport Assessment (TA), where available. Where the trip generation was not available from a TA, trip rates were extracted from TRICS 7.7.1 software, which is a widely recognised software package and database detailing typical trip rates for a variety of different development types.
- Trip distribution for land developments was based on the distribution of trips from existing areas of the study area which had similar land uses and geographic locations. These are known as 'donor zones'.
- All land uses included in the reference case scenario were discounted from the default National Trip End Model[2] (NTEM) land uses in order to derive growth factors from the Trip End Modelling Program[3] (TEMPro). The resulting growth forecasts were applied to the base year trips ends to create forecast trip ends for the background growth in car users.
- The DfT's (Department for Transport) Road Traffic Forecasts 2018 (RTF18) were used to determine background growth and thereby forecast trip ends for LGVs and HGVs.
- The base year matrices were then furnessed[4] to match the forecast target trip ends and these were assigned to the network.

Proposed forecast schemes to be included explicitly in the modelling were identified and coded into the base year network as appropriate to the scenario, to derive the forecast networks.

Figure 2-1 provides a full overview of the approach taken in development of the forecast models.

[2] NTEM is developed and maintained by DfT and provides forecasts of land use and trip generation
[3] TEMPro is developed and maintained by DfT and provides access to the NTEM forecasts
[4] A methodology for factoring up trip matrices to preserve underlying trip patterns whilst simultaneously maintain trip end totals at pre-set values

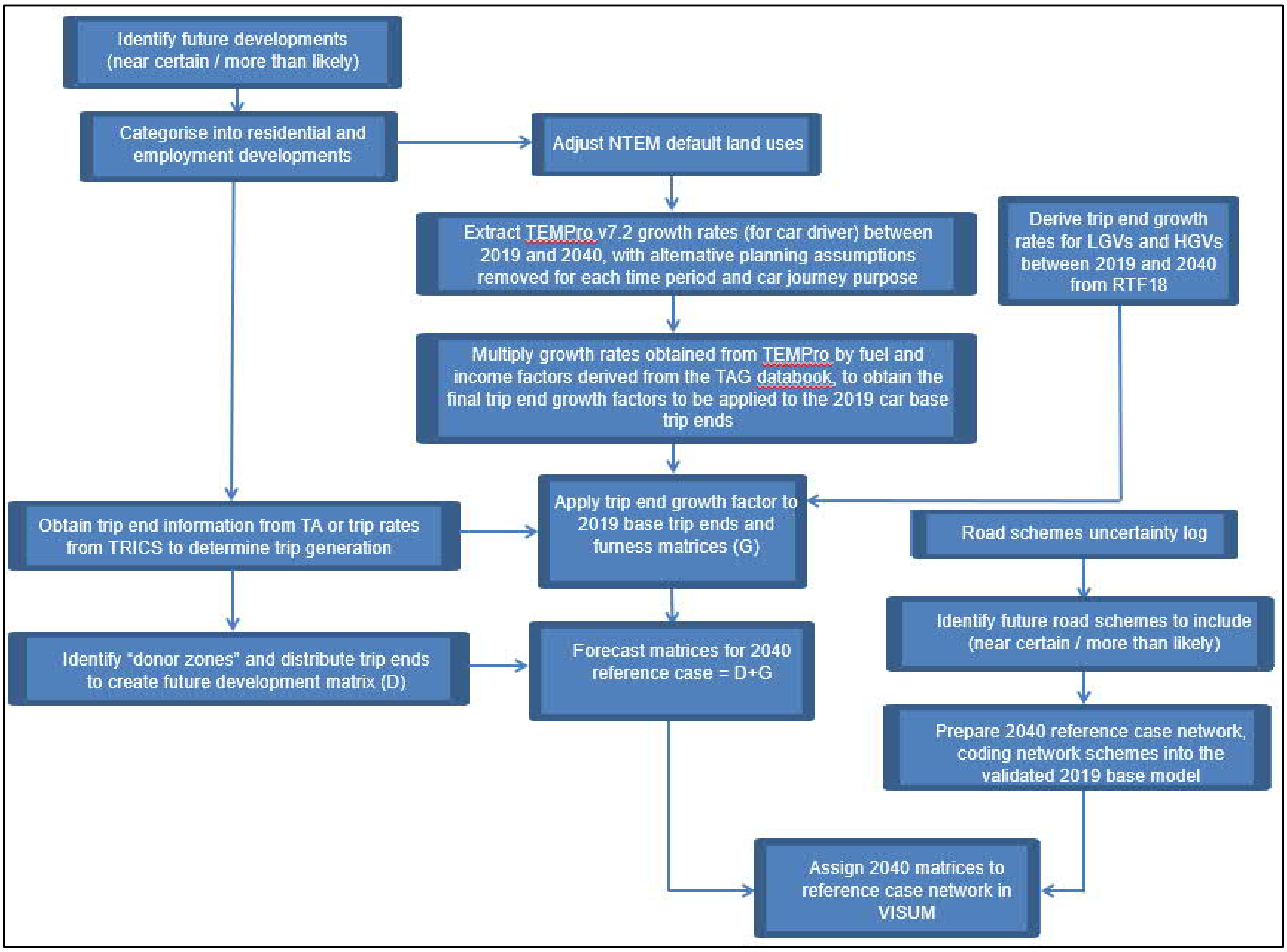

Figure 2-1: Summary of Forecasting Approach

2.2 Forecast Years

One forecast year (2040) has been modelled. This was agreed with BC. The forecast land use and infrastructure assumptions for 2040 were determined from data provided by BC. A full list of the developments included in the model is provided in Appendix B: List of Developments.

2.3 Forecast Scenarios

There is a single forecast scenario, with the committed network schemes and developments included reflective of a reference case scenario for 2040. The model has not yet been used for assessing any particular scheme, therefore a DM and DS approach is not required, as there is no specific transport scheme to assess as part of this scope of work. However, when the model is used for a specific purpose, then a scenario based assessment is highly likely to be required, thus DM and (at least one) DS scenarios would need to be produced.

2.4 Forecast Demand

Forecast demand for travel was generated using local and national data to identify the changes in land use that could be expected in the future.

Background growth in forecast land use was derived from the National Trip End Model (NTEM) v7.2, which is consistent with TAG M4 and is a means to calculate anticipated growth in trips without having to explicitly define all the sources of that growth. Additionally, planning data from BC was used to identify specific land development proposals. This data identified the locations of potential new development, and the size and type of development proposed. A list of the developments included in the model is presented in Appendix B: List of Developments. Based on this, future land uses at a local level could be identified.

The new developments were represented by adding new zones, in addition to the zones from the base year model. The trip generation for those zones was based on data provided in transport assessments (where available) for the respective developments; where a transport assessment wasn't available, assumptions on trip rates were taken from TRICS software (v7.7.1). Trip rates were extracted from TRICS for the AM and PM peak hours (0800-0900 and 1700-1800), and for an average hour from the interpeak period (1000-1600). The trip rates were calculated by using the TRICS database to select land use types consistent with the specific type of development for which trip generation needed to be calculated.

Trip ends for existing base year zones were calculated by applying TEMPro derived growth to the base year matrix trip ends. In addition, since the model utilises a fixed demand approach, adjustment factors for fuel price changes and income growth in the future were also applied to the trip ends.

Base year matrices were then furnessed to match the target trip ends. For new developments the trip distribution was based on that of nearby zones with similar land uses, making use of a "donor zone". A "donor zone" is used in forecasting to duplicate distribution of a development zone from the distribution of a base year zone in close proximity to the development zone. A donor zone will also have similar land use characteristics and geographic locations as the development. For example, a development zone that contains a residential development, should use a donor zone containing housing only and be close to where the proposed development will be located.

The base matrices are based largely on mobile network data (see the LMVR for full details) which mean the trip patterns of base zones are likely to be a more accurate reflection of the on-ground travel patterns, compared to what would be developed through entirely synthetic methods. Use of a donor zone is therefore seen as the best approach to modelling the forecast development trip distribution instead of a traditional gravity model. Establishing the trip distribution for the forecast developments using nearby zones with similar land uses as donor zones is therefore deemed acceptable.

The process for factoring up LGV and HGV trips was slightly different as NTEM only provides trip end data for private car trips. Instead of NTEM, goods vehicles growth was derived from RTF18 (Scenario 1) growth factors for the South East of England, based on the National Transport Model, which is a widely used approach, and has been previously used for scheme appraisal in Buckinghamshire, to the satisfaction of the DfT.

Further detail on the creation of the forecast demand is provided in Section 4.

2.5 Forecast Network

To identify the transport schemes to be considered for inclusion in the forecast network, a list of schemes was drawn up in consultation with BC. The forecast scenario developed was modelled with an appropriate network including relevant transport schemes, and infrastructure associated with new developments. The creation of the forecast network is described in Section 3.

2.6 Forecast Assignment

The forecast demand matrices were assigned to the forecast networks using the same methodologies used in the base year assignment; essentially, this was using VISUM's 'Assignment with ICA' methodology, using the LUCE methodology[5] within each sub-assignment. The generalised cost parameters were updated to reflect that changes in Value of Time (VoT) and Vehicle Operating Costs (VOC) in the future, using values from the TAG data book (July 2020), which was the latest data book available at the time of model commencement. Parameters have been calculated for each user class (Business, Commute, Other, LGV and HGV).

In line with TAG, the stability of model outputs for the last four consecutive iterations were checked, and this is shown in full in section 5.2. In addition, model convergence was further ensured by running an assignment to one iteration fewer than the converged reference case models and comparing the two results. This sensitivity test is explained in more detail in section 5.2 and the results of the comparison of the sensitivity test against the converged models are shown in full for each peak period in Appendix C: Sensitivity Test.

[5] This is a standard, and widely accepted, methodology for assignment modelling, which is consistent with DfT guidance for highway assignment modelling, as detailed in TAG.

3. Forecast Network

3.1 Committed Transport Infrastructure Schemes

Data on potential transport infrastructure schemes within the modelled area has been provided by BC and collated.

The likelihoods associated with the developments are listed in Table 3-1 below, they are taken from TAG unit M4, Table A2. In practice, only schemes (and developments) with a "more than likely" or higher likelihood of coming forwards were provided.

Probability of input	Status
Near certain: The outcome will happen or there is a high probability that it will happen.	Intent announced by proponent to regulatory agencies. Approved development proposals. Project under construction.
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.
Reasonably foreseeable: The outcome may happen, but there is significant uncertainty.	Identified within a development plan. Not directly associated with the transport strategy/ scheme but may occur if the strategy/ scheme is implemented. Development conditional upon the transport strategy/ scheme proceeding. Or, a committed policy goal, subject to tests (e.g. of deliverability) whose outcomes are subject to significant uncertainty.
Hypothetical: There is considerable uncertainty whether the outcome will ever happen.	Conjecture based upon currently available information. Discussed on conceptual basis. One of a number of possible inputs in an initial consultation process. Or, a policy aspiration.

Table 3-1: Classification of future inputs

The schemes contained within the study area and considered 'Near Certain' or 'More than likely' were added to the forecast model. A full list of all schemes included in the model, and for which information was received and verified has been summarised in Appendix A: List of Schemes.

3.2 Forecast Development Coding

The locations of forecast developments were identified from transport assessments where available, or through information on co-ordinates provided by BC. Numerous of these developments had already been previously modelled in pre-existing models covering the County, thus in many cases the previous modelling data could be reused. To ensure all traffic generated from the forecast developments accesses the main VISUM network appropriately, all development accesses were coded as 'uncontrolled' nodes, so that no capacity constraint would be applied at those nodes. The free-flow loading of development traffic onto the network ensures the full potential impact of the forecast development sites on traffic is assessed. Figure 3-1 to Figure 3-4 show the location of these developments and their loading points in the forecast reference case model. The full list of developments is included in Appendix B: List of Developments.

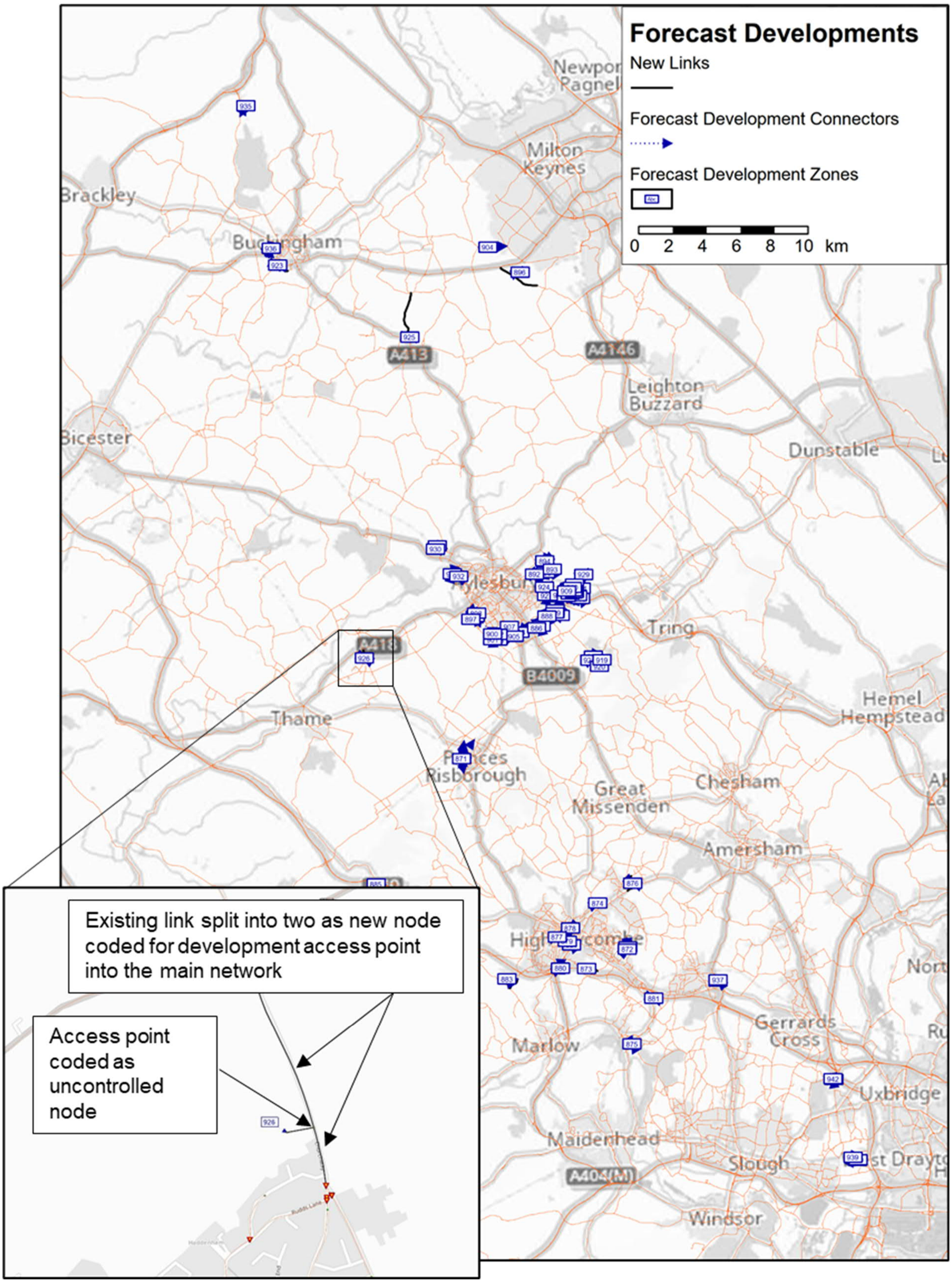

Figure 3-1: Forecast development locations in the model

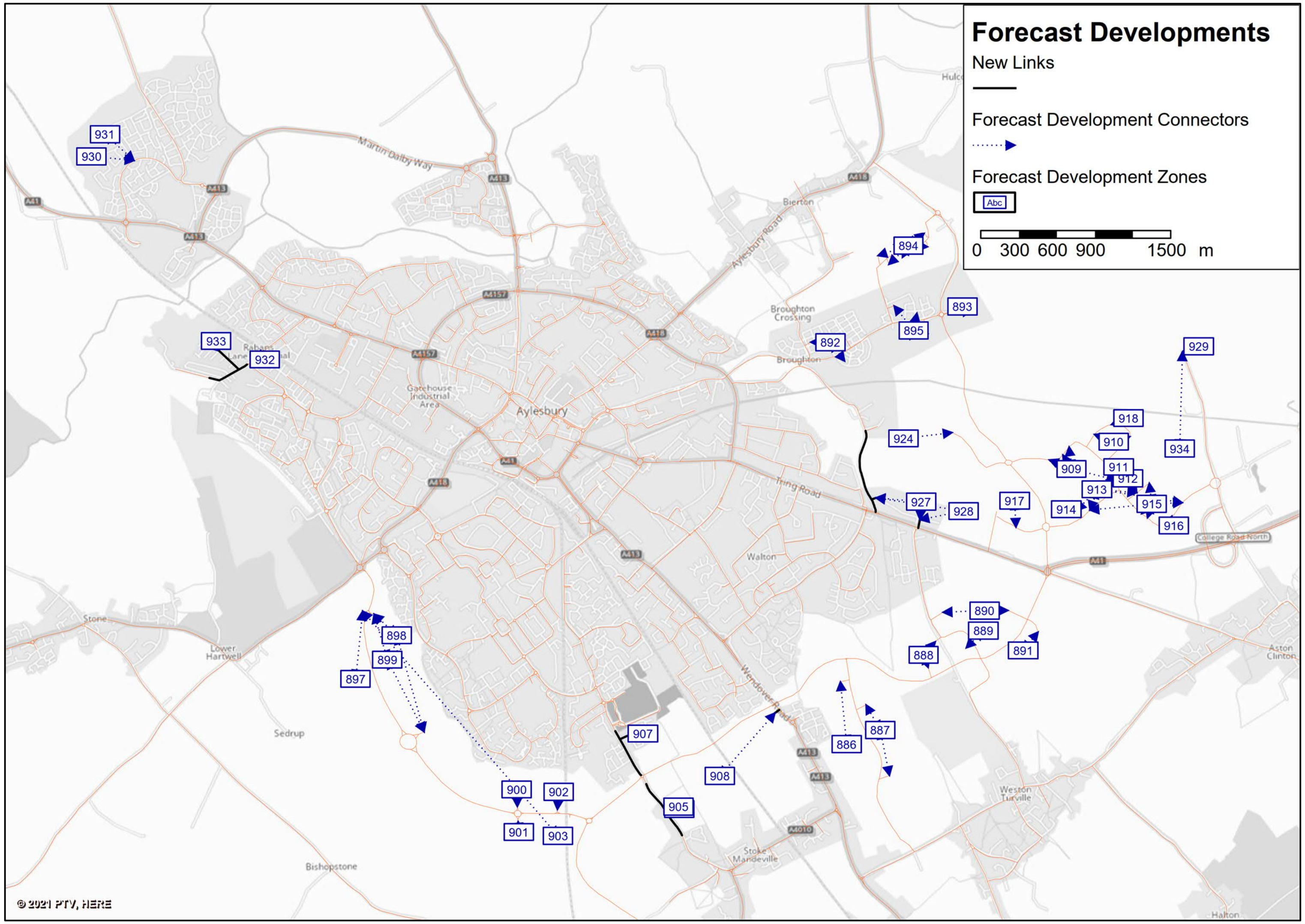

Figure 3-2: Development locations in the model, Aylesbury

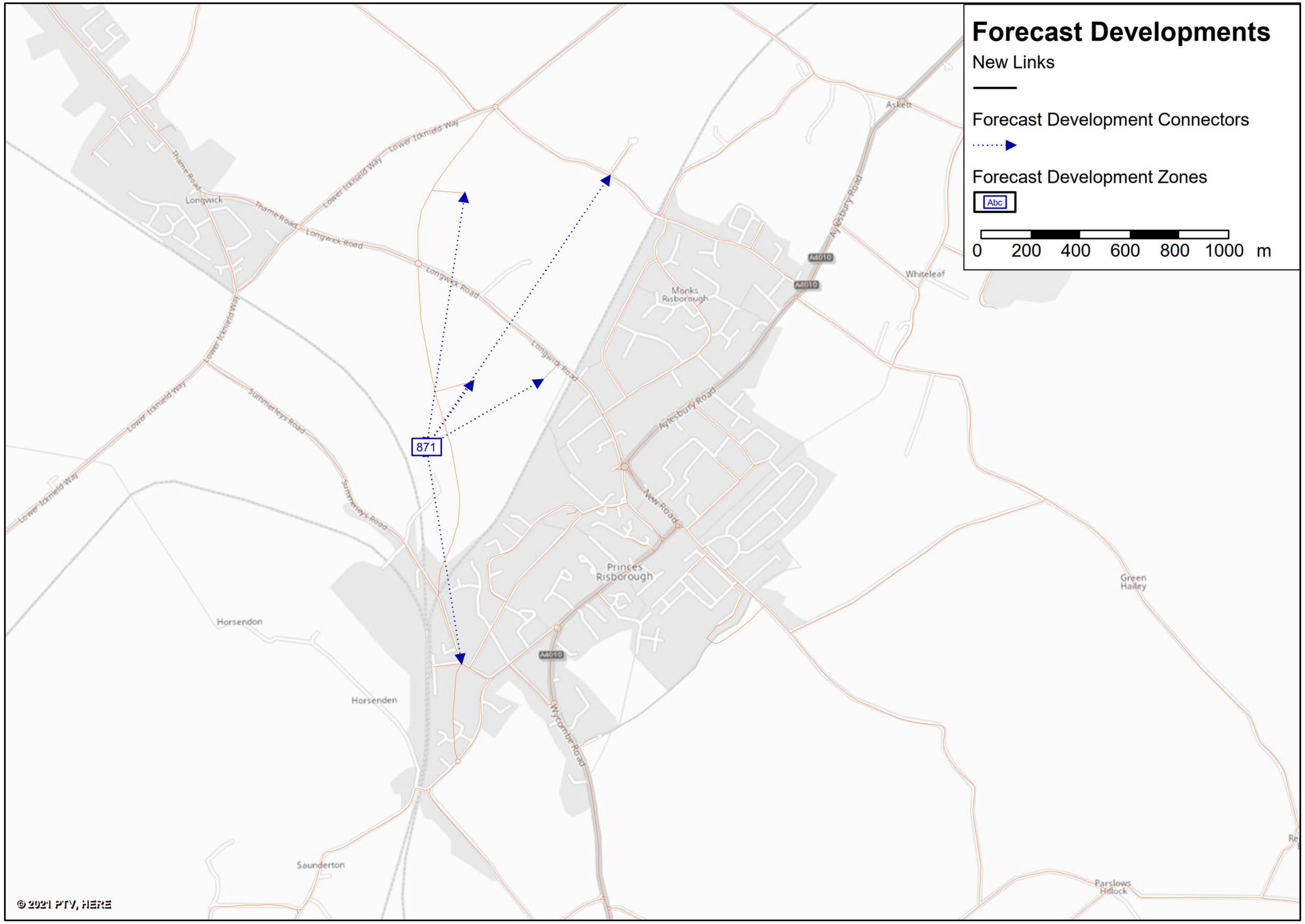

Figure 3-3: Development locations in the model, Princes Risborough

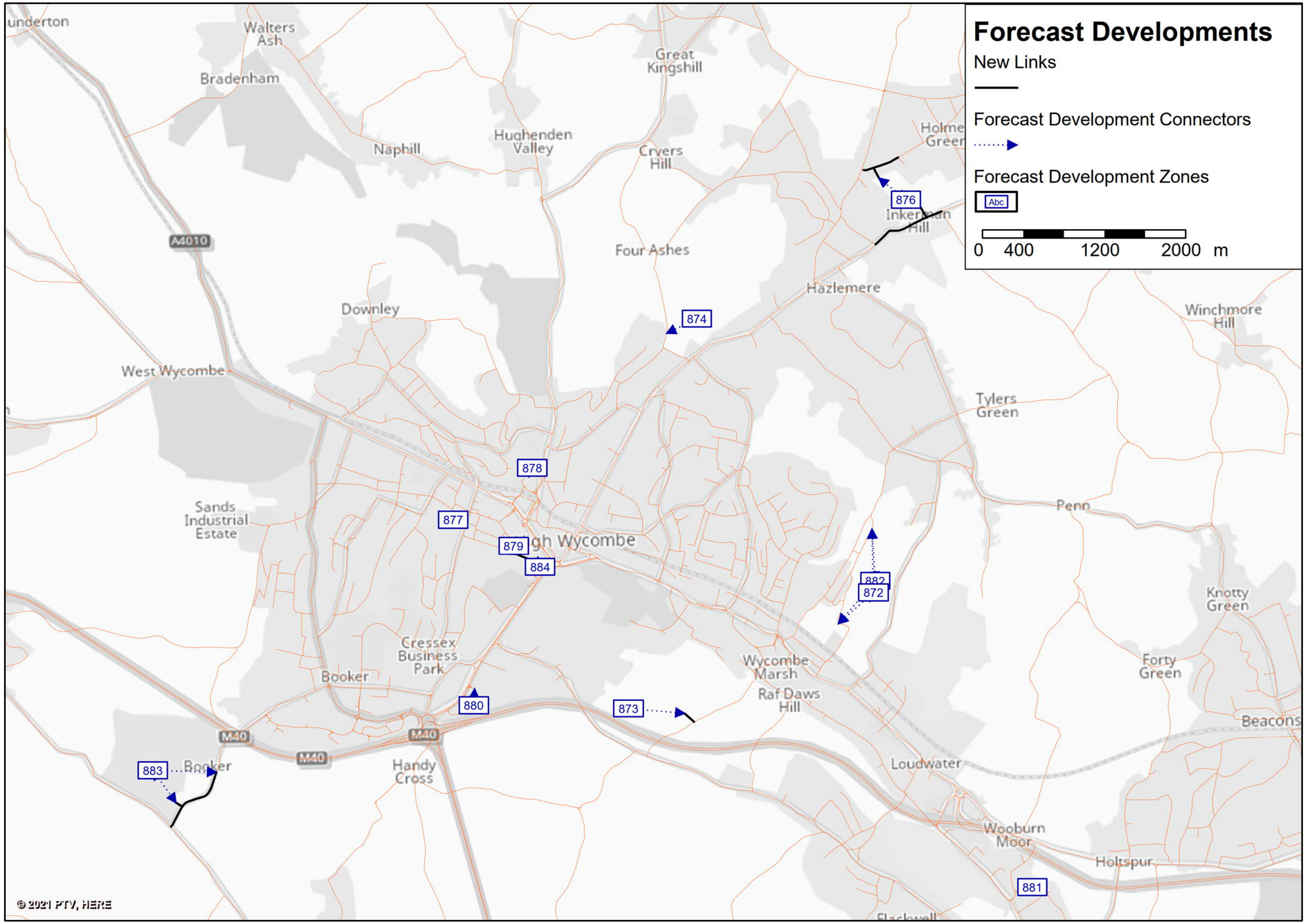

Figure 3-4: Development locations in the model, High Wycombe

4. Forecast Demand

4.1 Overview

Forecast demand was originally calculated using data derived from local authorities on specific land uses, and national data sets for wider growth trends. Those data sets were used to calculate the future trip generation (origins and destinations) at the zonal level and were used as targets against which to furness the base year matrices.

The development of a variable demand model[6] (VDM) is beyond the scope of the current commission, thus the forecasts were produced on the basis of fixed demand. Should VDM be developed as part of a separate piece of work, the demand model process and results will be presented in additional reporting.

4.2 Future Developments

The specific developments to be included were identified through an uncertainty log which was compiled using planning data. The developments and likelihood of each development being built out (according to the classifications detailed in Table 3-1) were verified by the client. In practice, all the developments provided had a status of “more than likely” or higher thus were all included in the forecast model.

The uncertainty log includes all developments identified with the Area of Detailed modelling, which covers the former Aylesbury Vale, Wycombe, South Bucks and Chiltern districts. Housing developments with a full quantum of less than 50 were considered too small to warrant inclusion and be explicitly modelled. This is because they are unlikely to cause a significant impact in any one local area and so growth from these developments was represented through the TEMPro growth factors instead, applied across the study area as a general uplift in traffic growth. This approach ensured that all forecast developments likely to have a significant impact on traffic patterns in the area of detailed modelling are represented in the model.

A full list of the developments included in the model is provided in Appendix B: List of Developments, and they are illustrated in Figure 4-1 to Figure 4-3. The reference numbers correspond to the reference numbers listed the first column of the table provided in Appendix B: List of Developments.

[6] VDM is a way of changing the demand for travel in response to changes in travel cost. e.g. in response to an increase in congestion in the future, a VDM will lower the amount of trips originally calculated, to approximate the effect of mode shift, changes to travel time, or changes to trip distribution patterns.

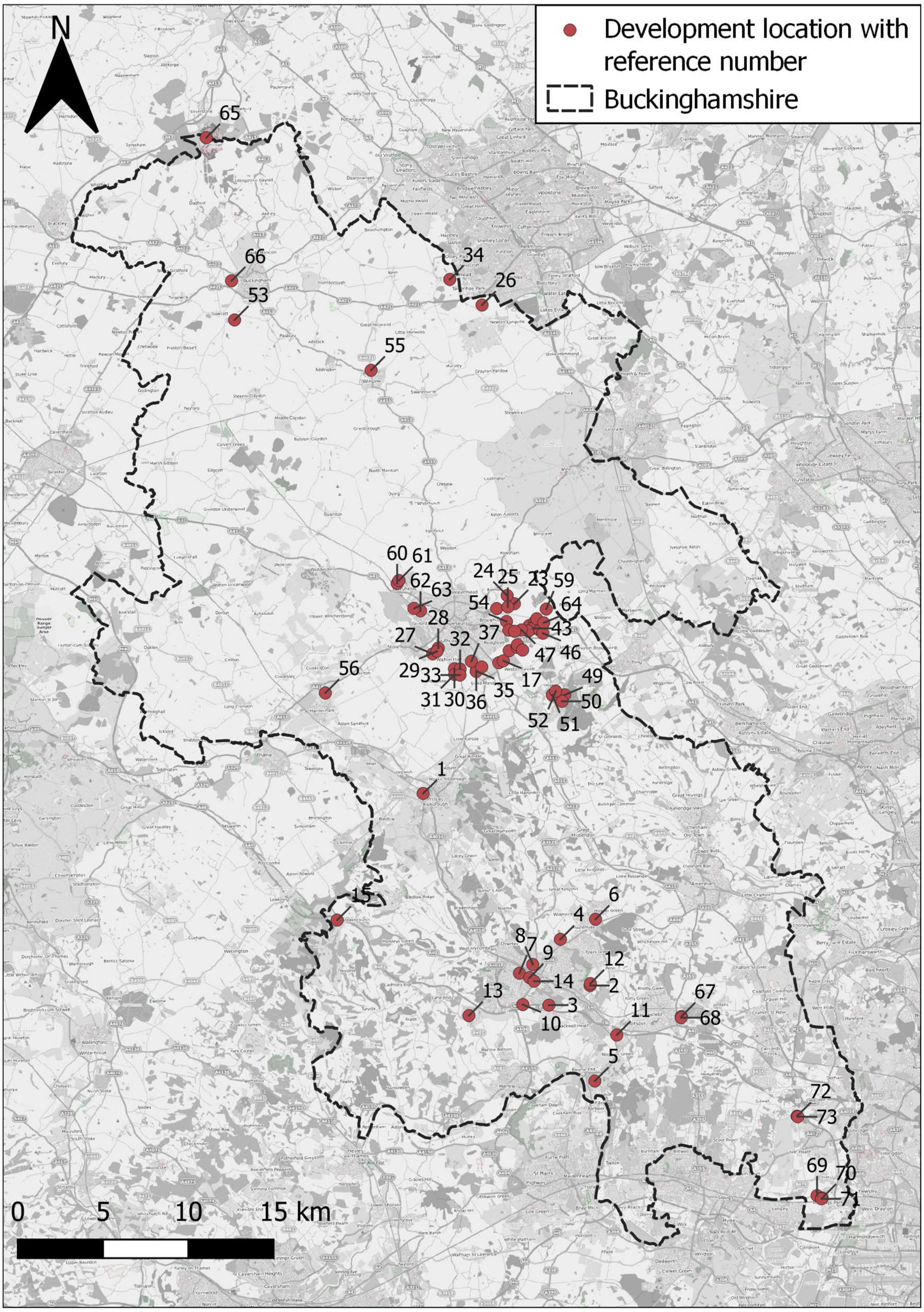

Figure 4-1: Locations of developments included in the forecast model

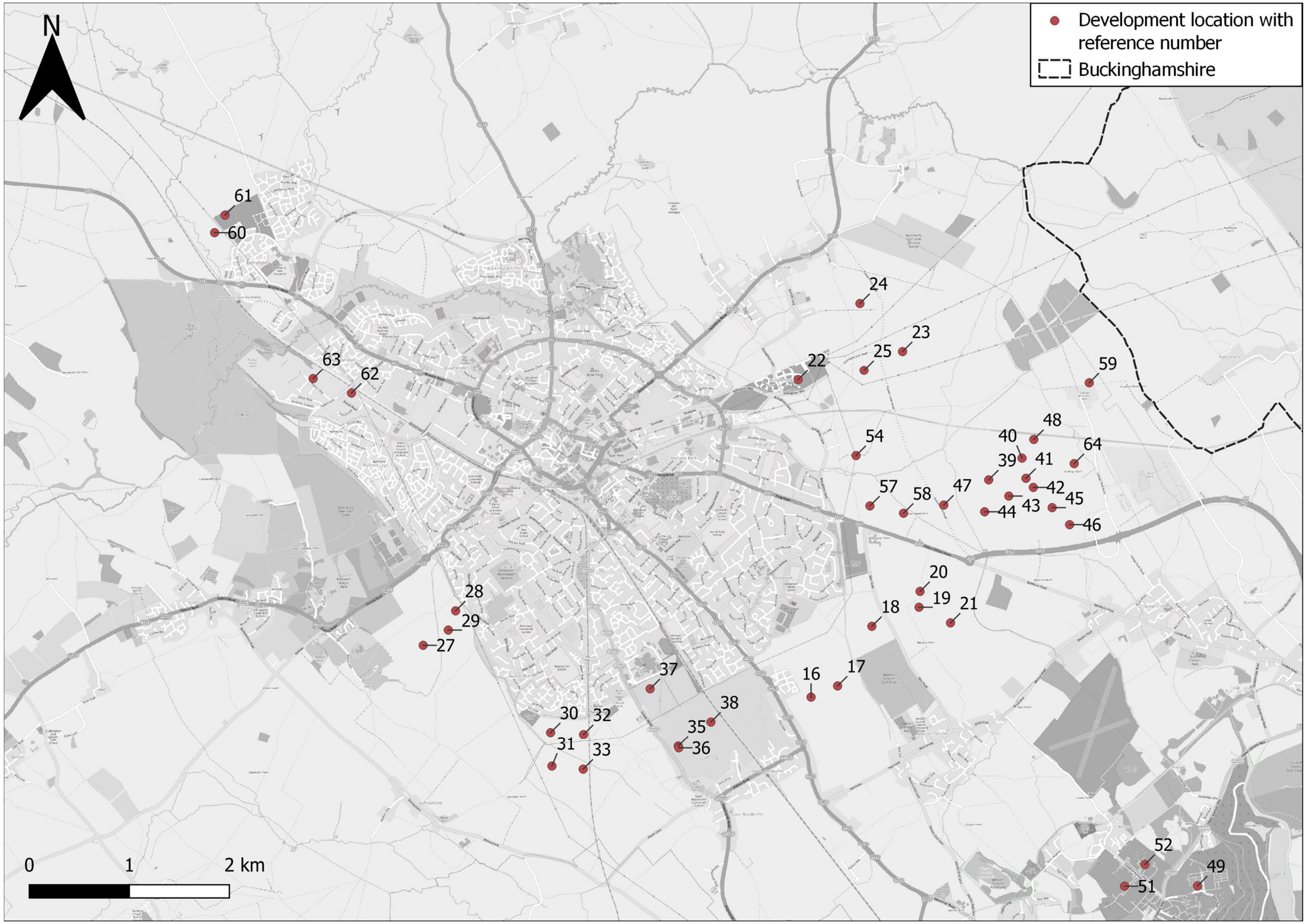

Figure 4-2: Locations of developments included in the forecast model, focused on Aylesbury

Figure 4-3: Locations of developments included in the forecast model, focused on High Wycombe

The development build out rates were agreed with BC in terms of identifying the amount of each development anticipated to be completed by 2040.

The key pieces of development information required in order to generate the trip rates was taken from Transport Assessments (TAs). The TAs also confirmed, for residential developments, the number of households, and for employment developments, the gross floor area (GFA). Where a TA was not available, trip generation rates for the development were taken from TRICS (v7.7.1), using rates that were consistent with previous modelling work in the local area. TRICS reports for all vehicles were extracted for each of the AM and PM peak hours (0800-0900 and 1700-1800), while an hourly average of the trip rate between 1000-1600 was applied to obtain IP trip generation for the developments. For major residential and employment land use types for which a TA was not available, the TRICS rates used for each forecast peak hour are detailed in Table 4-1 below.

Land Use Type	Unit	Arrivals			Departures		
		AM	IP	PM	AM	IP	PM
Privately Owned Houses	1 dwelling	0.090	0.140	0.351	0.348	0.129	0.152
Mixed Private/Affordable Housing	1 dwelling	0.106	0.115	0.215	0.287	0.120	0.117
Office	100sqm	0.662	0.113	0.082	0.098	0.121	0.702
Business Park	100sqm	1.596	0.183	0.105	0.128	0.230	1.236
Food Retail (Convenience)	100sqm	8.012	4.802	7.095	7.143	4.859	6.612
Food Retail (Superstore excl. Petrol station)	100sqm	1.861	3.301	3.347	1.395	3.269	3.522
General Retail (shopping centre - local shops)	100sqm	6.286	5.295	4.571	5.943	5.171	5.543
General Retail (Retail Park excl. food)	100sqm	0.150	0.416	0.138	0.035	0.412	0.127
Industrial	100sqm	0.263	0.193	0.094	0.142	0.192	0.245
Commercial Warehouse	100sqm	0.763	0.195	0.237	0.104	0.201	0.733
Hotel	100sqm	0.357	0.214	0.229	0.529	0.236	0.129

Table 4-1: TRICs (v7.7.1) rates for major land uses

Development sizes for employment sites were given in terms of square metres of GFA for each land use class (B1, B2, B8. etc.). In order to discount employment land uses from NTEM forecasts for the purposes of deriving background growth, an indication of the number of jobs was required. Where the number of jobs was not otherwise described in a TA, they were estimated using data on employment densities from the Homes & Communities Agency (HCA)[7].

For retail land uses, the densities assumed for employment uses in the model per full-time equivalent (FTE) job are shown below in Table 4-2.

[7] Employment Densities Guide, 3[red] Edition, 2015

Use type	Area (m^2) per FTE
B1 (Office)	12
B2 (Industrial)	36
B8 (Commercial Warehouse)	70
Mixed B (Business Park)	30-60
All Retail (Store)	15-20
All Retail (Warehouse)	90
Hotel	1 emp. per 3 bedrooms

Table 4-2: Employment Densities

It is noted that changes to the Use Classes Order have been introduced which group together different trip generating uses into a new Class E. However, it is considered useful for transport modelling purposes to retain the use types in Table 4-2.

For each development, a new modelled zone was created; where the development was mixed, a separate zone was created for each land use type (residential or employment), which ensured that separate trip distributions could be applied. The total amount of new development by district was summarised and used to inform the discounting of land uses from NTEM background growth assumptions, used for the reference case scenario, as described in the following sections.

Table 4-3 shows the increases from specific development included in the model for the 2040 forecast year scenario.

Former District Area	Household increases (no. households)	Job increases (no. jobs)
Aylesbury Vale	15,815	13,608
South Bucks & Chiltern	1,504	1,540
Wycombe	4,776	5,406

Table 4-3: Increases from specific development 2019 to 2040

4.3 TEMPro Growth

The DfT's Trip End Modelling Programme (TEMPro) was used to provide background growth rates in the model forecasts, derived from NTEM v7.2, i.e. growth arising from sources other than the specific developments described in the previous section. It was agreed with BC that all developments explicitly modelled (as summarised in the previous table) should be discounted from the TEMPro forecasts in order to ensure that there was no double counting of development growth.

The Table 4-4 below summarises the default household and job increase assumptions from the latest version of NTEM (v7.2).

Former District Area	Household increases (no. households)	Job increases (no. jobs)
Aylesbury Vale	30,714	6,080
South Bucks & Chiltern	2,693	2,639
Wycombe	13,231	6,035

Table 4-4: Default land use increases between 2019 and 2040

The Table 4-5 below summarises the alternative assumptions input into TEMPro, after the increases from specific development were subtracted from the default land use increases detailed in the table above. The background growth rates applied to the base trip ends were based off these alternative assumptions.

Former District Area	Household increases (no. households)	Job increases (no. jobs)
Aylesbury Vale	14,899	-7,528
South Bucks & Chiltern	1,189	1,098
Wycombe	8,455	899

Table 4-5: TEMPro alternative assumptions for 2019-2040

The overall increase in land use in the reference case scenario was therefore consistent with the default NTEM land uses. For all areas outside of the Area of Detailed Modelling (including the bulge areas), no specific development was modelled, and growth was based on default NTEM land use assumptions.

It should be noted that for Aylesbury Vale, the amount of employment development specifically modelled exceeded that of the NTEM default land uses, therefore, negative growth had to be assumed in the background in order to maintain NTEM default levels. In practice, this represents an assumption that new employment development includes some displacement of existing employment land uses.

4.4 Trip Generation by Zone

To derive forecast matrices for each scenario, growth was applied to the trip matrices from the validated base year model. The trip ends from the base year matrices, by time period and trip purpose, were factored up to forecast levels using NTEM growth as described in the previous section.

New zones were added to represent new development with trip end totals based on the trip generation identified through a TA or from TRICS as described in the future developments section. Trip purpose splits for the new zones were based on proportions from an existing base year zone which had similar land use characteristics. Forecast zones were seeded with the trip distribution from an appropriate donor zone, which was similar in terms of both characteristics and geography, and the entire matrix was then furnessed to match the forecast trip ends.

For goods vehicles, alternative methods to derive the background growth had to be employed as NTEM only provides trip end data for car trips. Instead of NTEM, goods vehicle growth was derived from RTF18 growth factors at the regional level.

Since there is no methodology for discounting trips from specific development for HGVs, these RTF18 growth factors were used unadjusted for the 2040 scenarios. The regional factors were applied to the base year trip ends appropriately based on geography.

4.5 Fuel and Income adjustment factors

As the model uses fixed highway demand, it was necessary to adjust the matrices to take account of future changes in income and fuel price. The factors applied were derived in accordance with TAG, using the TAG data book (July 2020). The income adjustment factors for the base year and forecast years are given below in Table 4-6.

Year	Income adjustment factor (A)	Fuel cost adjustment (B)	Applied adjustment (C= AxB)
2019	1.017	1.071	-
2040	1.068	1.127	-
2019 to 2040 growth	1.053	1.050	1.106

Table 4-6: Fuel and Income adjustment factors

The factor that was applied was therefore 1.106. This factor was applied to base year car trips ends prior to furnessing.

4.6 Trip matrix comparisons

The trip totals for the base year are presented in Table 4-7. The percentage growth for the forecast scenarios are also presented in the table.

Vehicle type	Base Matrix Totals			Forecast Reference Case Matrix Totals			% Change		
	2019 AM	2019 IP	2019 PM	2040 AM	2040 IP	2040 PM	2040 AM	2040 IP	2040 PM
Car – Commute	170,587	49,198	159,882	212,017	60,535	197,432	24%	23%	23%
Car – Business	26,819	18,584	26,899	33,894	23,375	33,915	26%	26%	26%
Car – Other	208,711	156,619	229,003	284,682	216,343	308,013	36%	38%	35%
LGV	575,486	555,887	459,008	743,613	718,068	593,106	29%	29%	29%
HGV	272,451	260,980	171,408	284,693	272,351	179,128	4%	4%	5%

Table 4-7: Trip Matrix Totals

The growth in the table is for all trips in the matrix, including those with an origin or destination outside of the Buckinghamshire detailed modelled simulation area which pass through the modelled area, as well as those which do not pass through the study area at all. The growth is inclusive of background growth and trips from specific developments.

Table 4-8 details the trips at origin/ destination level in Buckinghamshire. The effect of fuel and income adjustment factors are removed to aid the comparison of the underlying growth against unadjusted NTEM growth and RTF18 growth in good vehicles.

Vehicle type	2019 Base Trip End		% Change 2040 - TEMPro/RTF 18 growth		Modelled % Change 2040 (exc. Fuel and income factor)	
AM	Origin	Destination	Origin	Destination	Origin	Destination
Car – Commute	23,512	23,540	13%	12%	18%	17%
Car – Business	5241	4924	14%	13%	21%	18%
Car – Other	29,796	30,377	23%	22%	28%	26%
LGV	5,998	5,892	29%		50%	48%
HGV	1,321	1,253	11%		28%	27%
IP	Origin	Destination	Origin	Destination	Origin	Destination
Car – Commute	7,478	7,428	11%	11%	16%	16%
Car – Business	3,487	3,592	13%	13%	19%	18%
Car – Other	25,551	25,741	24%	24%	30%	29%
LGV	5,394	5,426	29%		48%	49%
HGV	1,129	1,122	11%		25%	29%
PM	Origin	Destination	Origin	Destination	Origin	Destination
Car – Commute	21,803	22,214	11%	12%	18%	16%
Car – Business	4,730	5,365	13%	13%	21%	20%
Car – Other	33,000	33,500	21%	21%	27%	26%
LGV	4,986	4,908	29%		52%	52%
HGV	711	685	11%		25%	28%

Table 4-8: Buckinghamshire Trip Matrix Comparison

For the modelled 2040 Core scenario, committed land uses have been discounted from the TEMPro growth figures. However, there are still differences in growth between the 2040 matrices and undiscounted TEMPro figures. The reason for this is that discounting of land uses doesn't account for differences between the trip generation rates from individual development TAs or TRICS rates, compared to assumed trip generation rates from TEMPro (which are derived from the National Travel Survey). Also, as discussed in section 4.4, once the

TA/TRICS rates are applied to obtain the developments' car trips, the trip purpose splits were based on proportions from an existing base year zone, and these purpose splits will be different to the assumed split if undiscounted TEMPro growth was applied instead.

It is also notable that growth in goods vehicles exceeds the RTF 18 estimates in the 2040 Core scenario. In this case, there is no mechanism for discounting RTF growth, hence total growth exceeds the forecasts as the LGV and HGV trips generated from new development sites are simply added to the base zones, which are already uplifted by the RTF factors.

Given the exceedance of TEMPro/RTF growth in the forecasts, when the model is used as an evidence base for a TAG business case, consideration should be given to applying a further adjustment to the outturn trip ends to ensure that growth is not significantly higher than TEMPro/RTF.

5. Forecast Assignment

5.1 Generalised cost changes

The Values of Time (VoT) and Vehicle Operating Costs (VOC) used in the base year and detailed in the LMVR have been updated to reflect changes in the perceived VoT's and VOC's in the future, as detailed in the latest TAG data book (July 2020). Parameters have been calculated for each user class (business, commute, other, LGV and HGV). The VoT for the HGV user class has been doubled, as per guidance contained in TAG unit M3.1 paragraph 2.8.8 to take account of the influence of owners on routing. The costs used in the base year are shown in Table 5-1 and the forecast VoT's and VOC's are presented in Table 5-2.

Vehicle type	Trip Purpose	Time Period	Value of Time (p/min)	Vehicle Operating Cost (p/km)	Generalised cost coefficient for time (per second)	Generalised cost coefficient for distance (per metre)
Car	Business	AM	31.03	12.45	1	0.0265
Car	Commute	AM	20.81	5.90	1	0.0187
Car	Other	AM	14.36	5.90	1	0.0271
LGV	Business	AM	22.49	14.03	1	0.0398
HGV	Business	AM	44.79	40.64	1	0.0609
Car	Business	IP	31.79	12.15	1	0.0247
Car	Commute	IP	21.15	5.76	1	0.0176
Car	Other	IP	15.29	5.76	1	0.0243
LGV	Business	IP	22.49	13.86	1	0.0386
HGV	Business	IP	44.79	39.49	1	0.0577
Car	Business	PM	31.47	12.71	1	0.0261
Car	Commute	PM	20.88	6.02	1	0.0186
Car	Other	PM	15.03	6.02	1	0.0258
LGV	Business	PM	22.49	14.20	1	0.0398
HGV	Business	PM	44.79	41.65	1	0.0609

Table 5-1: 2019 Base Year Cost Parameters

Vehicle type	Trip Purpose	Time Period	Value of Time (p/min)	Vehicle Operating Cost (p/km)	Generalised cost coefficient for time (per second)	Generalised cost coefficient for distance (per metre)
Car	Business	AM	43.79	9.35	1	0.0143
Car	Commute	AM	29.37	4.51	1	0.0100
Car	Other	AM	20.26	4.51	1	0.0145
LGV	Business	AM	31.74	13.03	1	0.0261
HGV	Business	AM	63.21	44.40	1	0.0471
Car	Business	IP	44.88	9.09	1	0.0132
Car	Commute	IP	29.85	4.42	1	0.0095
Car	Other	IP	21.58	4.42	1	0.0131
LGV	Business	IP	31.74	12.87	1	0.0253
HGV	Business	IP	63.21	43.15	1	0.0446
Car	Business	PM	44.42	9.58	1	0.0141
Car	Commute	PM	29.47	4.59	1	0.0100
Car	Other	PM	21.22	4.59	1	0.0138
LGV	Business	PM	31.74	13.18	1	0.0261
HGV	Business	PM	63.21	45.50	1	0.0471

Table 5-2: 2040 Cost Parameters

5.2 Assignment convergence

A high level of model convergence is key to ensuring that the results contained within the model are a true reflection of the demand and modelled network. A model that is not sufficiently converged will include a large amount of random bias and white noise due to appropriate trip routing not yet having been achieved. To avoid that situation, the modelled assignments have been run with the intention to achieve a high level of convergence, attempting to obey Wardrop's First Principle of Traffic Equilibrium as per TAG Unit M3.1 paragraph 2.7.3:

"Traffic arranges itself on networks such that the cost of travel on all routes used between each OD pair is equal to the minimum cost of travel and all unused routes have equal or greater cost."

In order to meet TAG criteria, Unit M3.1 section 3.3, the convergence analysis was done by using the following measures of convergence:

- Proximity to the assignment objective; and

- Stability of model outputs between consecutive iterations.

Proximity to the assignment objective is measured by how close the model is to a particular converged solution. In VISUM this equates to how close the model is to Wardrop's Principle of Equilibrium and is measured using the GAP function. GAP (denoted δ) is calculated according to the formula below:

$$\delta = \frac{\sum T_{pij}(C_{pij} - C^*_{ij})}{\sum T_{ij} C^*_{ij}}$$

Where:

Tpij	is the flow on route p from origin to destination
Tij	is the total travel from I to j
Cpij	is the congested cost of travelling from i to j on path p
C*ij	is the minimum cost of travelling from I to j

The GAP value therefore represents the excess cost incurred by failing to travel on the route with the lowest generalised cost and is expressed relative to that minimum route cost. The excess cost is summed over each route between each origin-destination (O/D) pair and multiplied by the number of trips between each O/D pair. This is divided by the minimum cost summed over each route between each O/D pair, also multiplied by the number of trips between each O/D pair.

TAG states that GAP is the single most valuable indicator of overall model convergence. It requires that reasonable levels of convergence are achieved, and that a GAP value of 0.1% or less is required. In addition to Delta and GAP, TAG recommends a series of tests be run to assess the model's stability and demonstrate the level of flow change on links between consecutive iterations, percentage of links with flow and cost change.

Table 5-3 summarises the TAG requirements for convergence.

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

Table 5-3: TAG convergence measures

The assignment convergence statistics achieved for the model scenarios are summarised below in Table 5-4.

Time Period	Last four iterations	Final %GAP	Percentage of links with flow change < 1%	Percentage of links with cost change < 1%
AM	27	0.0196%	97.040679%	98.599315%
	28	0.0188%	96.709879%	98.515869%
	29	0.0194%	97.630755%	98.813888%
	30	0.0200%	96.250931%	98.357920%
IP	11	0.0083%	98.822828%	99.645358%
	12	0.0083%	98.861571%	99.648339%
	13	0.0084%	98.828789%	99.654299%
	14	0.0084%	98.870511%	99.636418%
PM	18	0.0207%	98.703621%	99.222173%
	19	0.0203%	99.073163%	99.409924%
	20	0.0204%	99.079124%	99.448666%
	21	0.0201%	99.028461%	99.412904%

Table 5-4: Assignment statistics for the last 4 iterations

The results of the convergence shown above demonstrate that the model has a level of convergence in line with guidance from TAG for IP and PM peaks. However, for the AM peak, the percentage of links with flow change less than 1% fails to meet the TAG criteria of 98% and instead is around 97%. This could be due to there being more demand than the network could absorb in 2040. The convergence criteria for the AM peak model should therefore be further tightened up in future, in order to ensure sufficient levels of convergence when the model is used to assess a specific impact.

In addition to the convergence statistics above, a sensitivity test was carried out for which the models were run to the n-1th iteration, where n is the final number of iterations for the converged assignment, as shown in Table 5-4. Flow comparison plots are shown in Appendix C between the test model and the model for the reference case scenario, for all time periods. The results show that there is very little difference in flows across the majority of the network in the IP and PM peaks, with some differences observed around High Wycombe in the AM peak. This provides another indication of the stability of the model.

6. Model Output

The traffic flows and congestion for each time period are summarised in Section 6.1 and 6.3 respectively. In addition, the Congestion Ratio plots for each time period are summarised in Section 6.2.

It was observed, that with the inclusion of explicit housing and employment developments in the study area and the application of TEMPro background growth for 2040, the modelled flows have increased compared against the base model.

The increase in flows results in a subsequent reduction in available link capacity, particularly on the M25, M40, the A413 south of Aylesbury and the A404 east of High Wycombe. Similarly, the effect this has on congestion is demonstrated through the congestion ratio plots in Section 6.2.

As discussed above, while there is the expected impact of a general increase in flows and delays in the forecast reference case, the models also demonstrate non-generalised impacts on the flows, as a result of committed forecast road schemes described in Section 3.1.

6.1 Flow Plots

Figure 6-1 to Figure 6-3 show the actual flows for all time periods in 2040. Flow volumes are represented by the green bars. The darker green colours indicate higher flow volumes, and as expected the highest flows are found on the main strategic routes (M25, M40, A41, A413) in the study area.

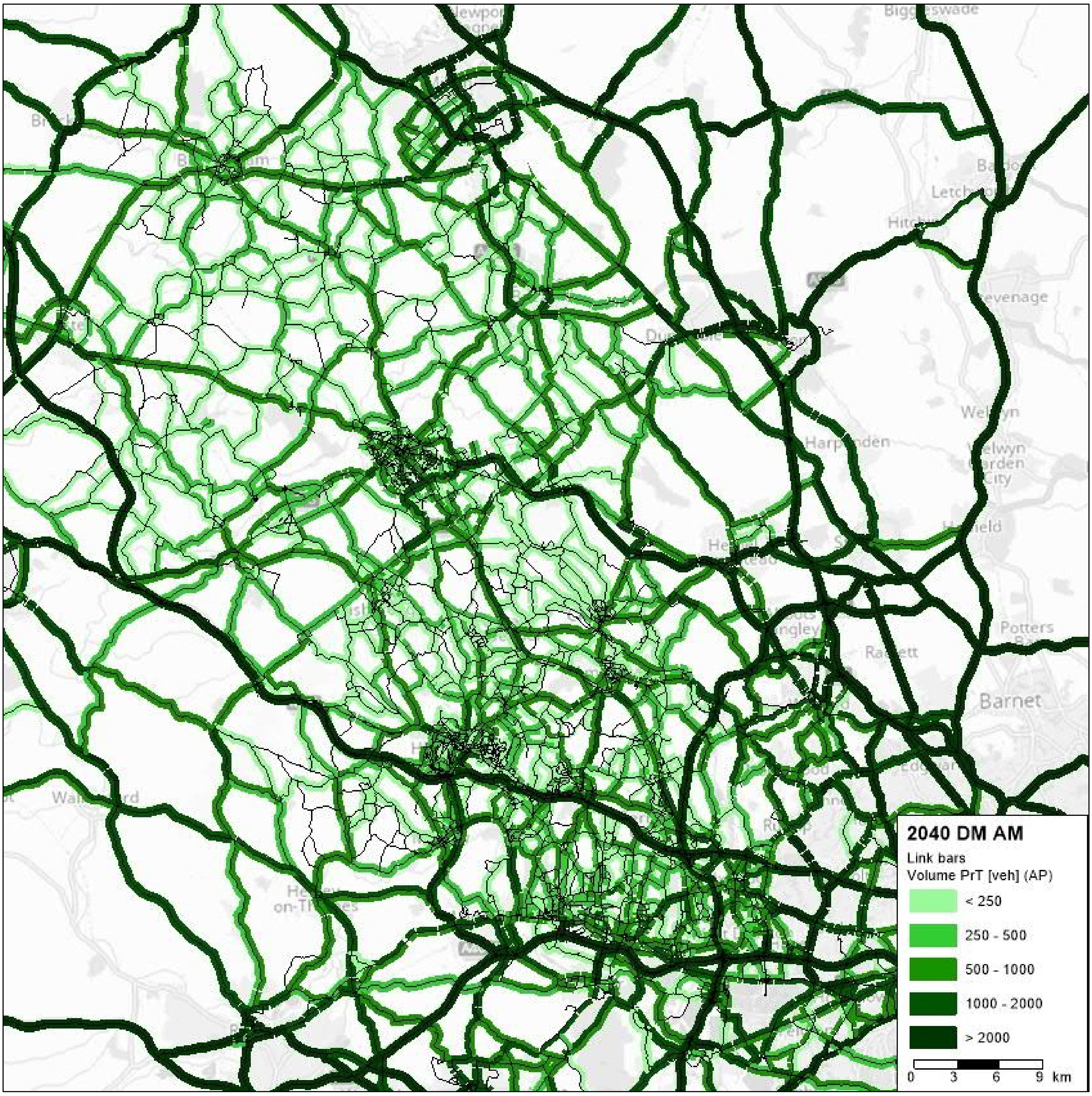

Figure 6-1: Actual Flows 2040 AM Peak

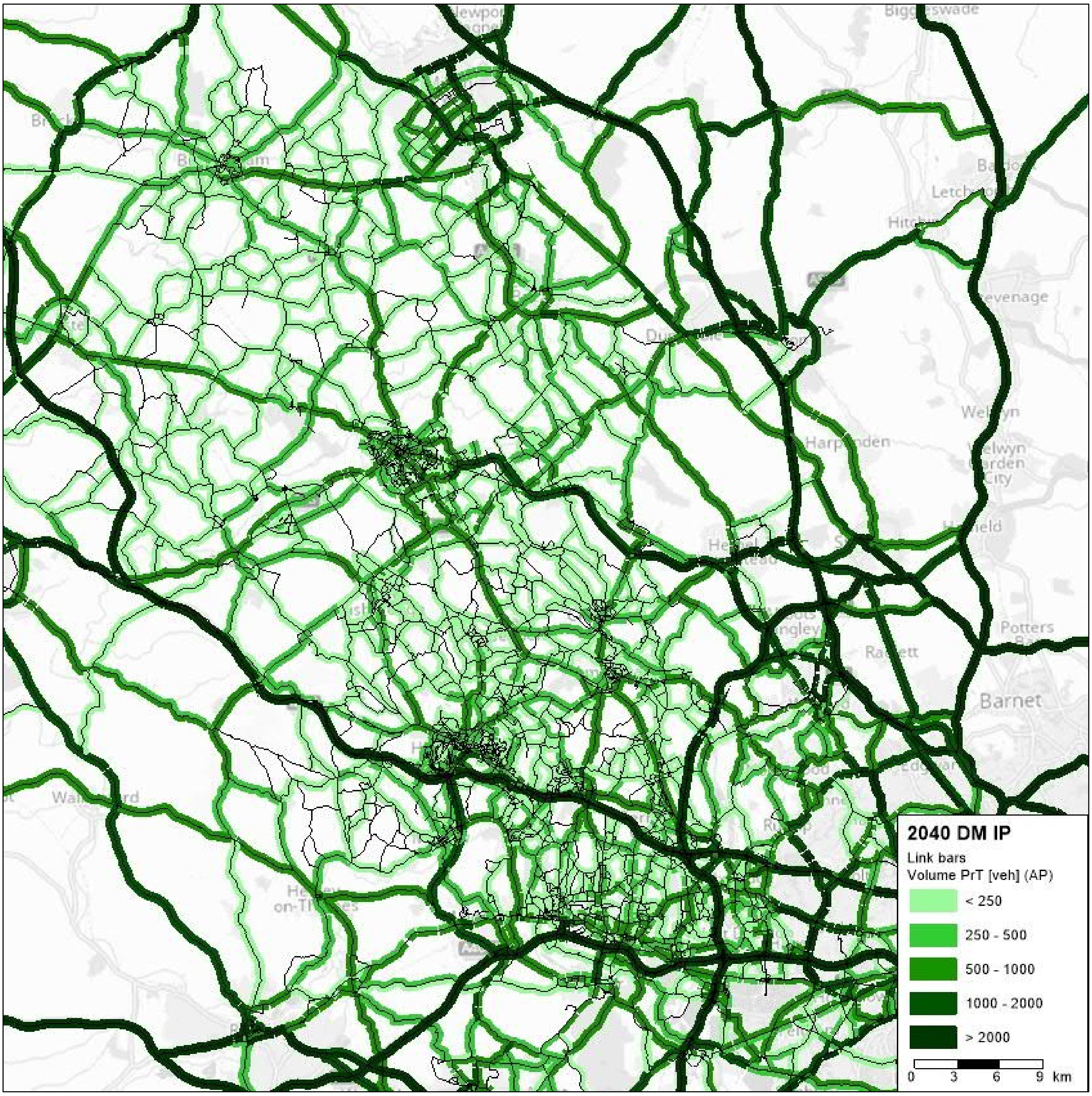

Figure 6-2: Actual Flows 2040 Interpeak

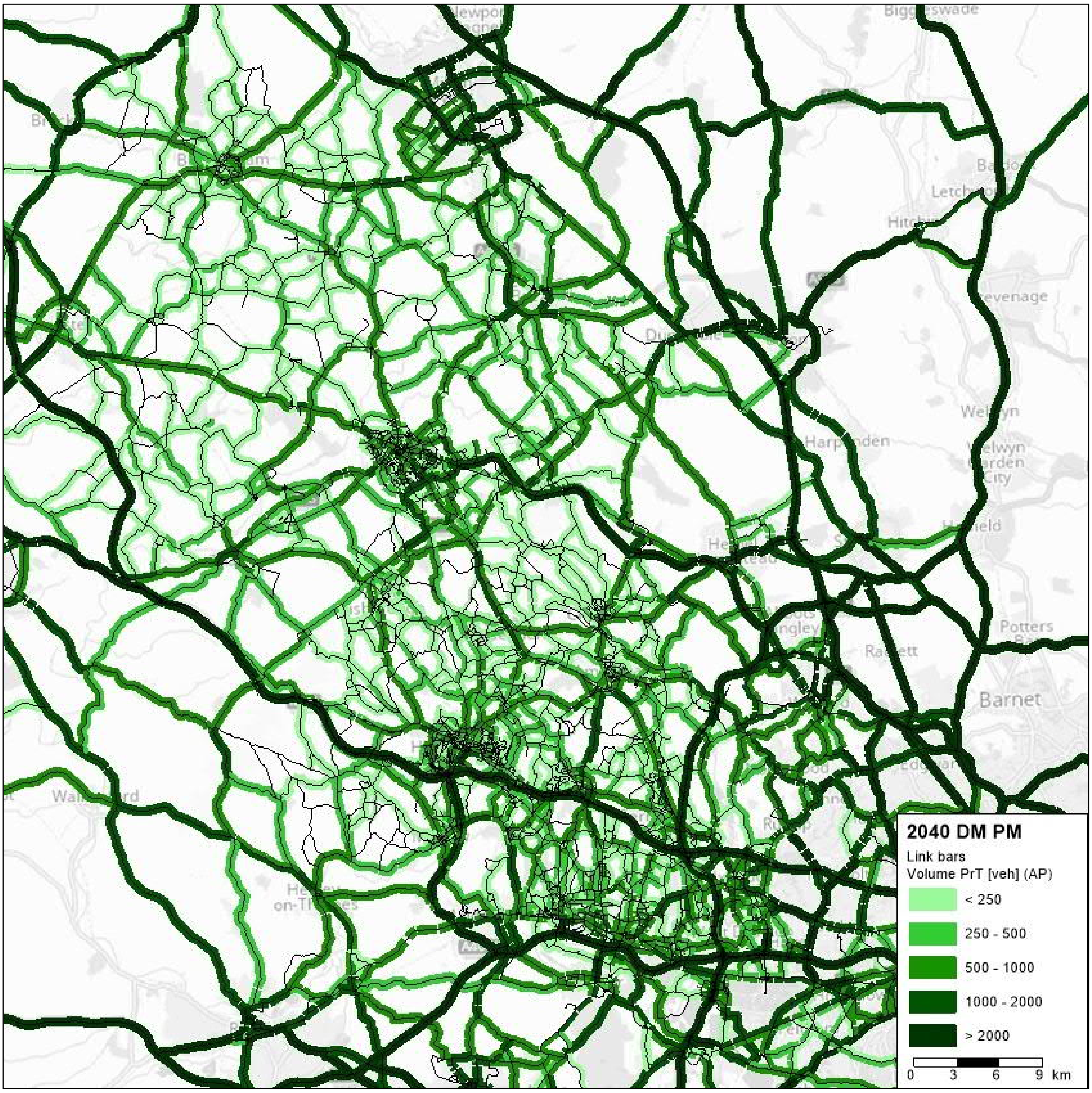

Figure 6-3: Actual Flows 2040 PM Peak

6.2 Volume Capacity Ratio

The volume capacity ratio (VCR) is a ratio representing the degree of saturation of a particular stretch of road, with values closer to 0 representing free flow conditions and values approaching or greater than 100 indicating high levels of congestion. Figure 6-4 to Figure 6-6 show the Volume Capacity Ratio (VCR) for all time periods in 2040.

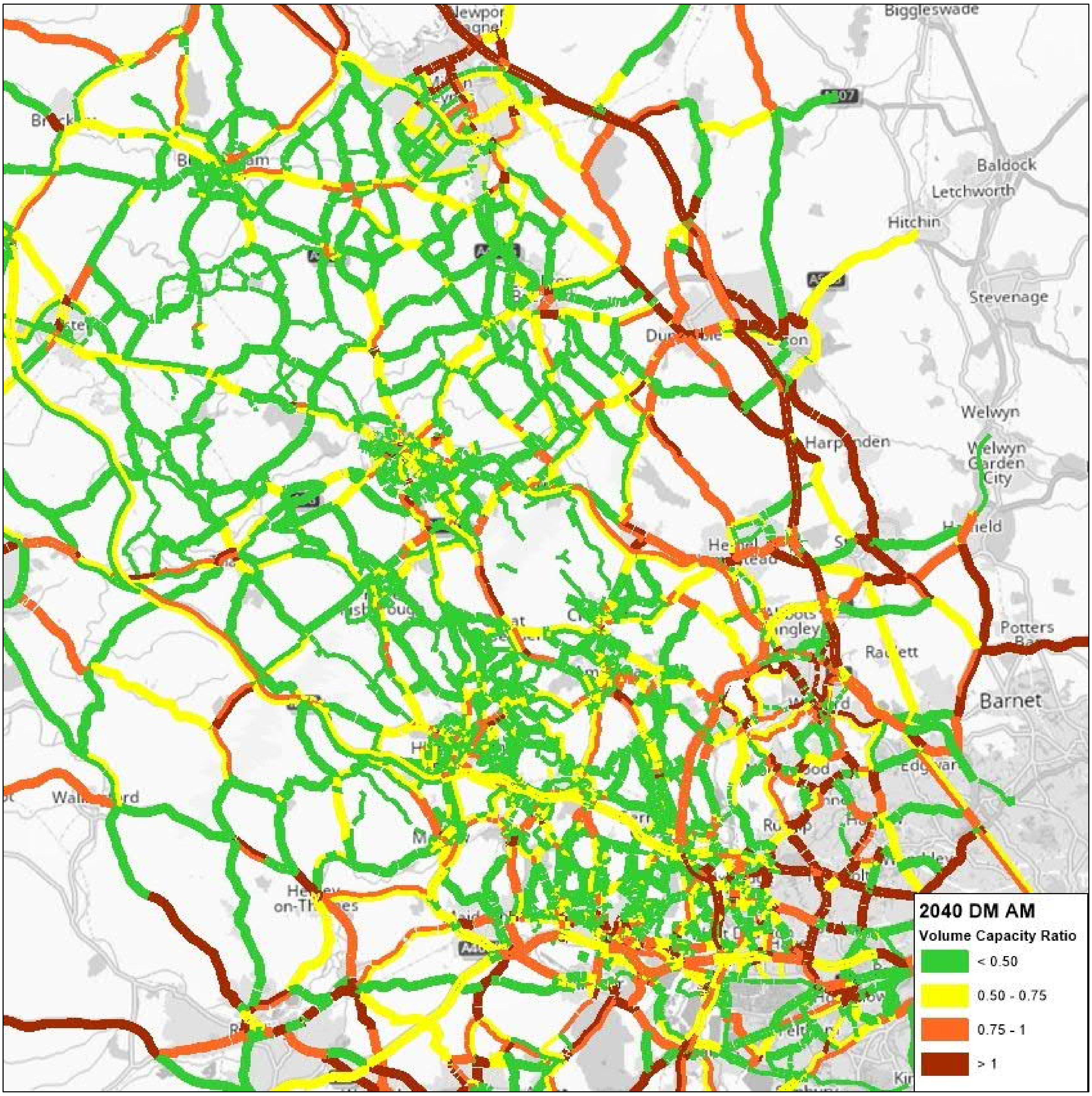

Figure 6-4: Volume Capacity Ratio 2040 AM Peak

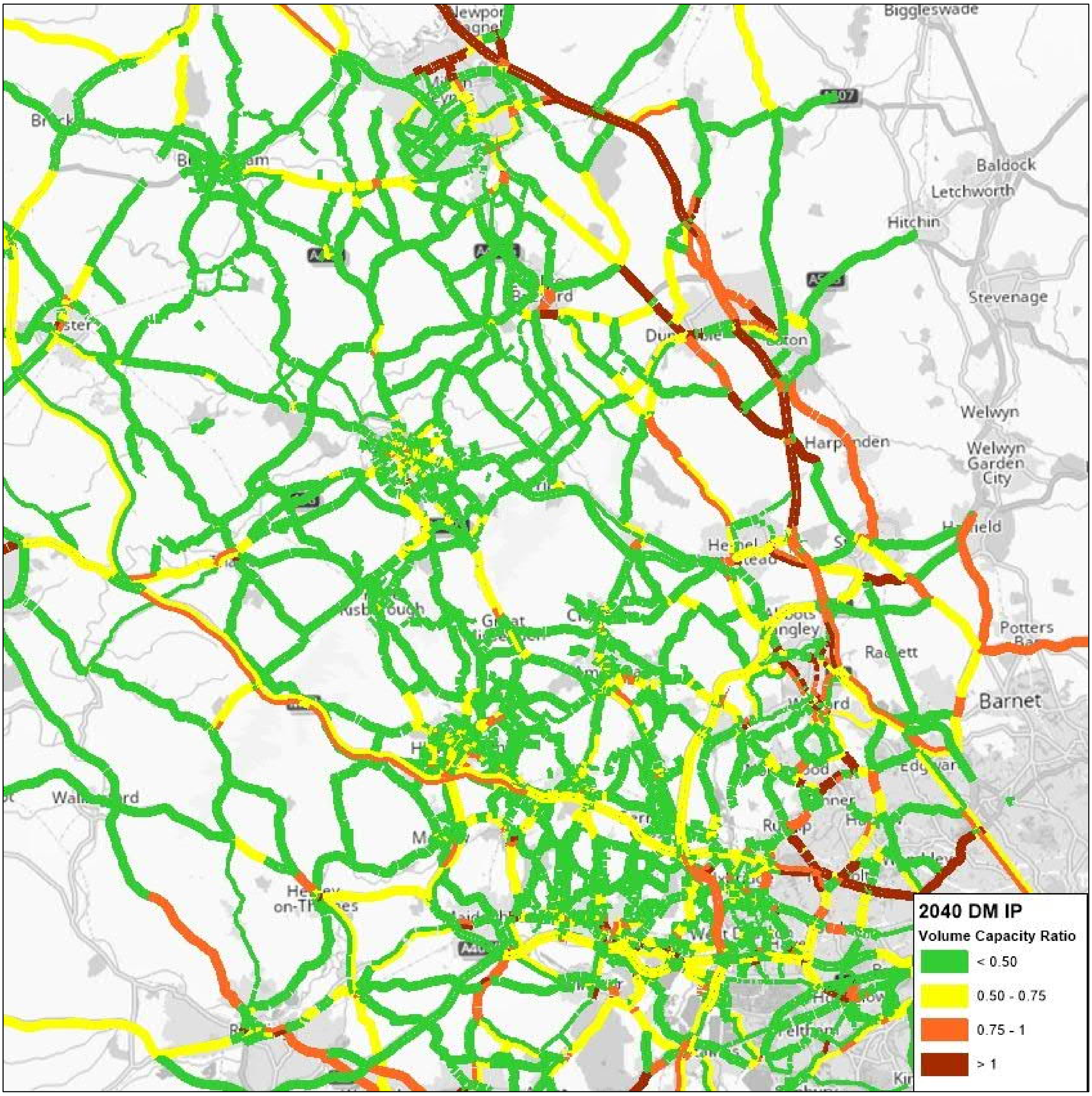

Figure 6-5: Volume Capacity Ratio 2040 Interpeak

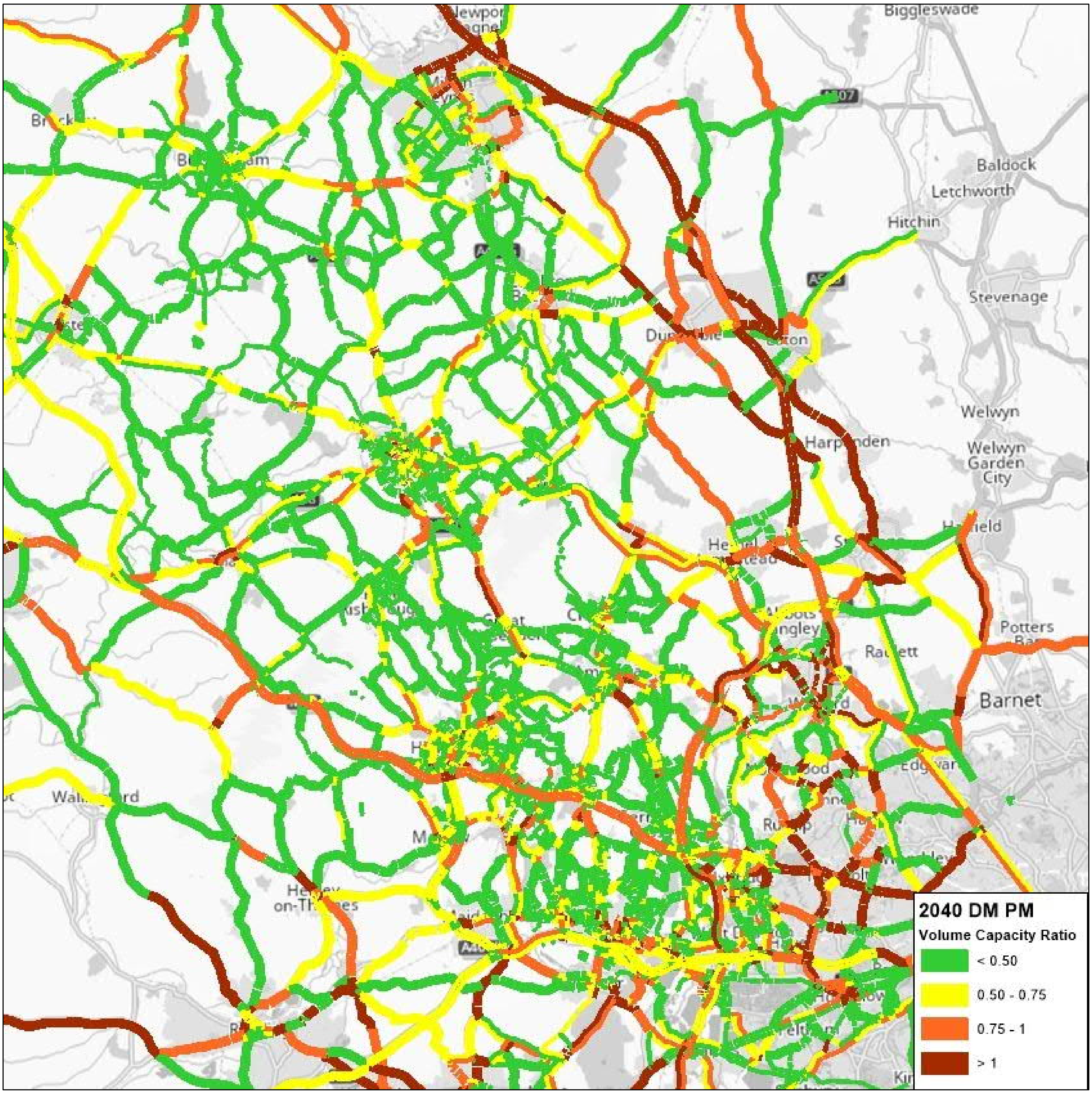

Figure 6-6: Volume Capacity Ratio 2040 PM Peak

6.3 Congestion Ratio Plots

The congestion ratio plots show the ratio of the congested travel time to the free flow travel time on each modelled link. An increase in the congested travel time on a link is not only affected by increases in flow, but also by delays at the downstream junction. As a result, it is possible, where junctions are constrained, to see congestion on a particular link, without any significant increase in demand flow. Figure 6-7 to Figure 6-9 show the congestion ratio for each time period in 2040.

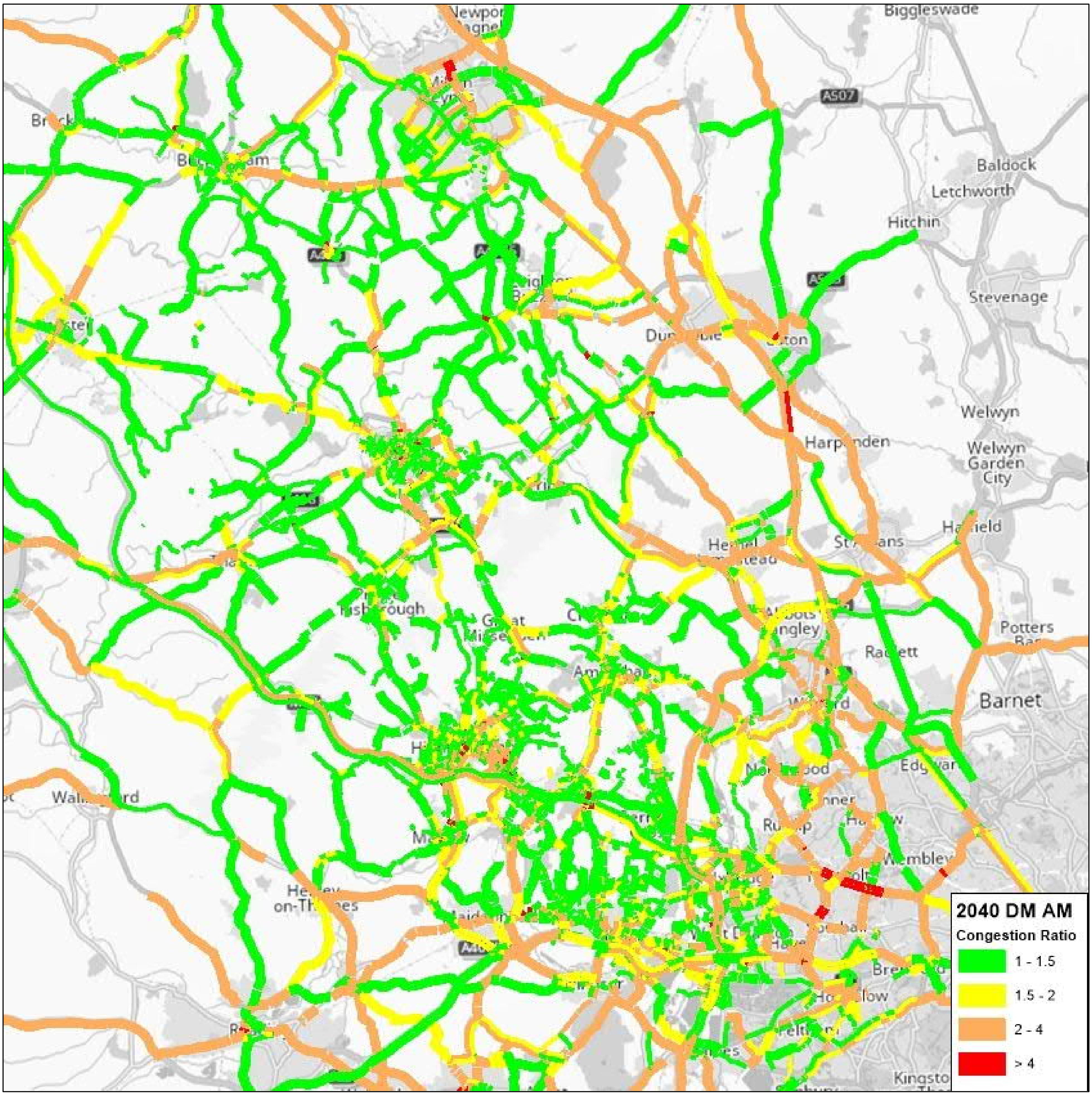

Figure 6-7: Congestion Ratio 2040 AM Peak

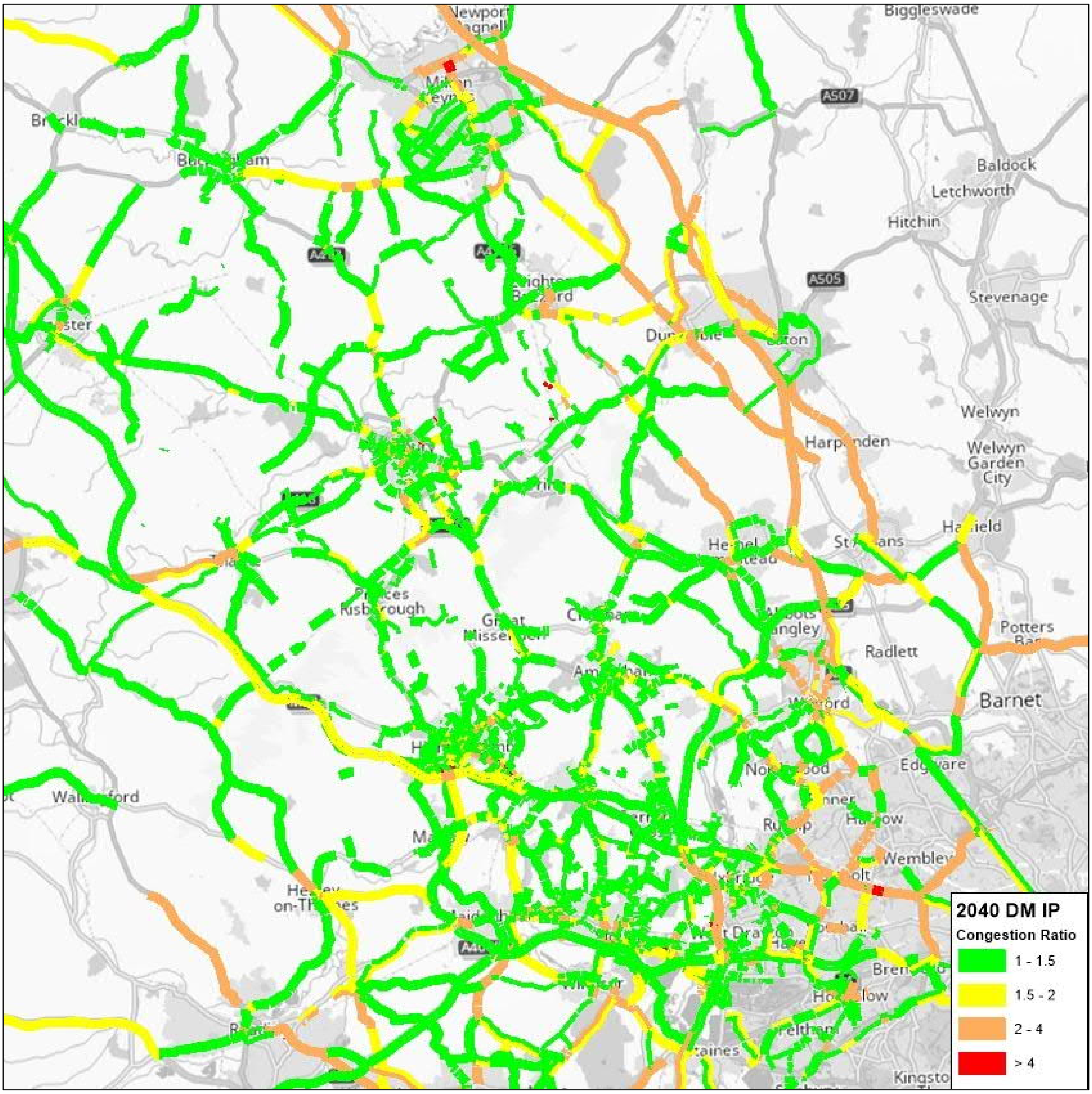

Figure 6-8: Congestion Ratio 2040 Interpeak

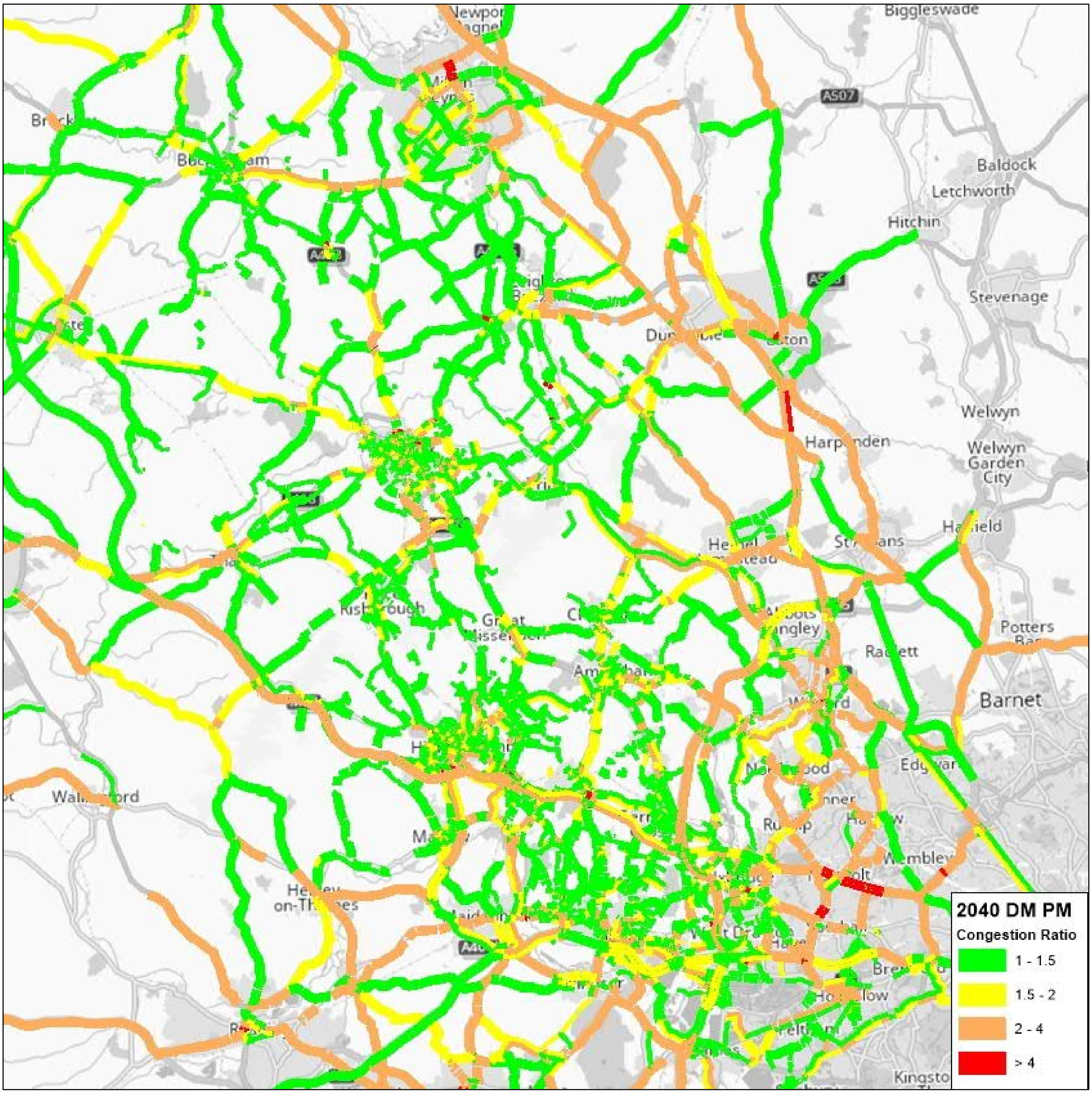

Figure 6-9: Congestion Ratio 2040 PM Peak

7. Conclusions

The methodologies used in building the Buckinghamshire Countywide reference case forecast model are consistent with TAG guidance for fixed demand models. The modelled network gave due consideration to all proposed future transport schemes and where there was enough certainty over these schemes being delivered.

Modelled demand was developed using guidance from TAG and utilises appropriate future land use data sources in the form of Transport Assessments in conjunction with data from NTEM extracted via TEMPro v7.2, and for Goods Vehicles, the Road Traffic Forecasts (RTF) 18 based on the National Transport Model.

As agreed with BC, one forecast year of 2040 was modelled, with the schemes and land use developments included appropriately to generate a reference case scenario.

The methodology to produce the forecast networks and the modelled demand has been described in this report. Based on the evidence contained within the Buckinghamshire Countywide Model Update LMVR and the detail of this forecasting note, the forecast models are considered a suitable tool for assessing the impacts of development and transport schemes in the study area, for development management purposes, or for Strategic Outline Business Cases, subject to the development of appropriate scenarios specific to the needs of the particular assessment. A new forecast report would be required for such assessments.

Appendix A: List of Schemes

Scheme Name	Description	Location	Likelihood
Eastern Link Road (North)	Road scheme	Aylesbury Vale	Certain
Eastern Link Road (South)	Road scheme	Aylesbury Vale	Near Certain
Southern Link Road	Road scheme	Aylesbury Vale	Near Certain
SEALR	Road scheme	Aylesbury Vale	Near Certain
Stoke Mandeville Bypass	Road scheme	Aylesbury Vale	Near Certain
South Western Link Road	Road scheme	Aylesbury Vale	More than likely
Stocklake Road	Road scheme	Aylesbury Vale	Certain
Gomm Valley Spine Road	Road scheme	Wycombe	More than likely
Holland Farm Spine Road	Road scheme	Wycombe	More than likely
Princes Risborough Infrastructure Package	Road scheme	Wycombe	More than likely
A355 Relief Road	Road scheme	South Bucks	Certain
M4 Smart Motorway	Road scheme	South Bucks	Near Certain
Hollow Hill Lane	Road closure	South Bucks	More than likely
Seven Hills Improvement	Road scheme	South Bucks	More than likely
Iver Relief Road	Road scheme	South Bucks	More than likely

Appendix B: List of Developments

Reference to Figure 4-1	Description	District	Quantum of development		Likelihood
			Residential (Dwellings)	Commercial (Jobs)	
1	Princes Risborough Expansion	Wycombe	1662	0	Near Certain/More than likely
2	Gomm Valley, High Wycombe	Wycombe	520	0	Near Certain/More than likely
3	Abbey Barn South, High Wycombe	Wycombe	550	0	Near Certain/More than likely
4	Land At Terriers Farm Kingshill Road, High Wycombe	Wycombe	500	0	Near Certain/More than likely
5	Bourne End, Hallands Farm	Wycombe	467	0	Near Certain/More than likely
6	Land off Amersham Road incl. Tralee Farm.	Wycombe	350	0	Near Certain/More than likely
7	Remainder of Leigh Street Employment Area	Wycombe	228	0	Near Certain/More than likely
8	Compair Broomwade, Hughenden Avenue, High Wycombe	Wycombe	260	0	Near Certain/More than likely
9	Lillys Walk	Wycombe	239	0	Near Certain/More than likely
10	Wycombe Sports Centre Marlow Hill High Wycombe Buckinghamshire HP11 1TJ	Wycombe	0	2899	Near Certain/More than likely
11	Glory Park Avenue Wooburn Green Bucks	Wycombe	0	906	Near Certain/More than likely
12	Part of Gomm Valley and Ashwells, High Wycombe	Wycombe	0	667	Near Certain/More than likely
13	Wycombe Airpark (2)	Wycombe	0	391	Near Certain/More than likely
14	Staples, Queen Alexandra Road	Wycombe	0	292	Near Certain/More than likely
15	Stokenchurch business park expansion	Wycombe	0	251	Near Certain/More than likely
16	Land at Hampden Fields A	Aylesbury Vale	450	0	Near Certain/More than likely

17	Land at Hampden Fields B	Aylesbury Vale	1050	0	Near Certain/More than likely
18	Land at Hampden Fields C	Aylesbury Vale	300	0	Near Certain/More than likely
19	Land at Hampden Fields D	Aylesbury Vale	0	171	Near Certain/More than likely
20	Land at Hampden Fields E	Aylesbury Vale	1200	0	Near Certain/More than likely
21	Land at Hampden Fields F	Aylesbury Vale	0	1843	Near Certain/More than likely
22	Land East Of Aylesbury (Kingsbrook) Broughton Crossing Bierton_Phase 1	Aylesbury Vale	615	0	Near Certain/More than likely
23	Land East Of Aylesbury (Kingsbrook) Broughton Crossing Bierton_Employment	Aylesbury Vale	0	402	Near Certain/More than likely
24	Land East Of Aylesbury (Kingsbrook) Broughton Crossing Bierton_Phase 2	Aylesbury Vale	623	0	Near Certain/More than likely
25	Land East Of Aylesbury (Kingsbrook) Broughton Crossing Bierton_Phase 3	Aylesbury Vale	719	0	Near Certain/More than likely
26	Site west of Far Bletchley, at the south western edge of Milton Keynes. Boundary A421 & A4034, disused railway and Whaddon Road. Adjoins residential of west Bletchley.	Aylesbury Vale	1885	0	Near Certain/More than likely
27	Land between Oxford Road and Wendover Road 1	Aylesbury Vale	71	0	Near Certain/More than likely
28	Land between Oxford Road and Wendover Road 2	Aylesbury Vale	384	0	Near Certain/More than likely
29	Land between Oxford Road and Wendover Road 3	Aylesbury Vale	272	28	Near Certain/More than likely
30	Land between Oxford Road and Wendover Road 4	Aylesbury Vale	308	0	Near Certain/More than likely
31	Land between Oxford Road and Wendover Road 5	Aylesbury Vale	191	0	Near Certain/More than likely
32	Land between Oxford Road and Wendover Road 6	Aylesbury Vale	173	0	Near Certain/More than likely
33	Land between Oxford Road and Wendover Road 7	Aylesbury Vale	0	73	Near Certain/More than likely
34	Shenley Road	Aylesbury Vale	1150	0	Near Certain/More than likely
35	AGT1_Land East of lower road 1	Aylesbury Vale	750	0	Near Certain/More than likely

36	AGT1_Land East of lower road 1a (school)	Aylesbury Vale	0	28	Near Certain/More than likely
37	AGT1_Land off Lower Road, Stoke Mandeville	Aylesbury Vale	125	0	Near Certain/More than likely
38	AGT1_South of Aylesbury	Aylesbury Vale	125	0	Near Certain/More than likely
39	Woodlands 1	Aylesbury Vale	530	0	Near Certain/More than likely
40	Woodlands 2	Aylesbury Vale	570	20	Near Certain/More than likely
41	Woodlands 3	Aylesbury Vale	0	28	Near Certain/More than likely
42	Woodlands 4	Aylesbury Vale	0	391	Near Certain/More than likely
43	Woodlands 5	Aylesbury Vale	0	1857	Near Certain/More than likely
44	Woodlands 6	Aylesbury Vale	0	172	Near Certain/More than likely
45	Woodlands 7	Aylesbury Vale	0	1235	Near Certain/More than likely
46	Woodlands 8	Aylesbury Vale	0	353	Near Certain/More than likely
47	Woodlands 9 (recreation area)	Aylesbury Vale	0	0	Near Certain/More than likely
48	Woodlands 10	Aylesbury Vale	0	122	Near Certain/More than likely
49	RAF Halton 1	Aylesbury Vale	250	0	Near Certain/More than likely
50	RAF Halton 2	Aylesbury Vale	250	0	Near Certain/More than likely
51	RAF Halton 3	Aylesbury Vale	250	0	Near Certain/More than likely
52	RAF Halton 4	Aylesbury Vale	250	0	Near Certain/More than likely
53	Land off Osier Way (south of A421 and east of Gawcott Road) Buckingham,	Aylesbury Vale	420	0	Near Certain/More than likely
54	Manor Farm, land south of GU Canal Aylesbury Arm	Aylesbury Vale	350	0	Near Certain/More than likely

55	Land to east of B4033, Great Horwood Road	Aylesbury Vale	315	0	Near Certain/More than likely
56	Land north of Rosemary Lane	Aylesbury Vale	273	0	Near Certain/More than likely
57	Aston Clinton MDA 1	Aylesbury Vale	386	0	Near Certain/More than likely
58	Aston Clinton MDA 2	Aylesbury Vale	0	486	Near Certain/More than likely
59	College Farm, Aylesbury (part of AGT3)	Aylesbury Vale	250	0	Near Certain/More than likely
60	Berryfields Major Development Area (MDA) Aylesbury 1	Aylesbury Vale	678	0	Near Certain/More than likely
61	Berryfields Major Development Area (MDA) Aylesbury 2	Aylesbury Vale	0	209	Near Certain/More than likely
62	Rabans Lane adj railway ln 1	Aylesbury Vale	200	0	Near Certain/More than likely
63	Rabans Lane adj railway ln 2	Aylesbury Vale	0	148	Near Certain/More than likely
64	Arla	Aylesbury Vale	0	1889	Near Certain/More than likely
65	Silverstone	Aylesbury Vale	0	4152	Near Certain/More than likely
66	Land North Of A421 Tingewick Road Buckingham Buckinghamshire	Aylesbury Vale	450	0	Near Certain/More than likely
67	Wilton Park 1	South Bucks	304	0	Near Certain/More than likely
68	Wilton Park 2	South Bucks	0	101	Near Certain/More than likely
69	SP BP11- Area North of Iver Station 1	South Bucks	1200	0	Near Certain/More than likely
70	SP BP11- Area North of Iver Station 2	South Bucks	0	359	Near Certain/More than likely
71	SP BP11- Area North of Iver Station 3	South Bucks	0	45	Near Certain/More than likely
72	Pinewood 1	South Bucks	0	759	Near Certain/More than likely
73	Pinewood 2	South Bucks	0	277	Near Certain/More than likely

Appendix C: Sensitivity Test

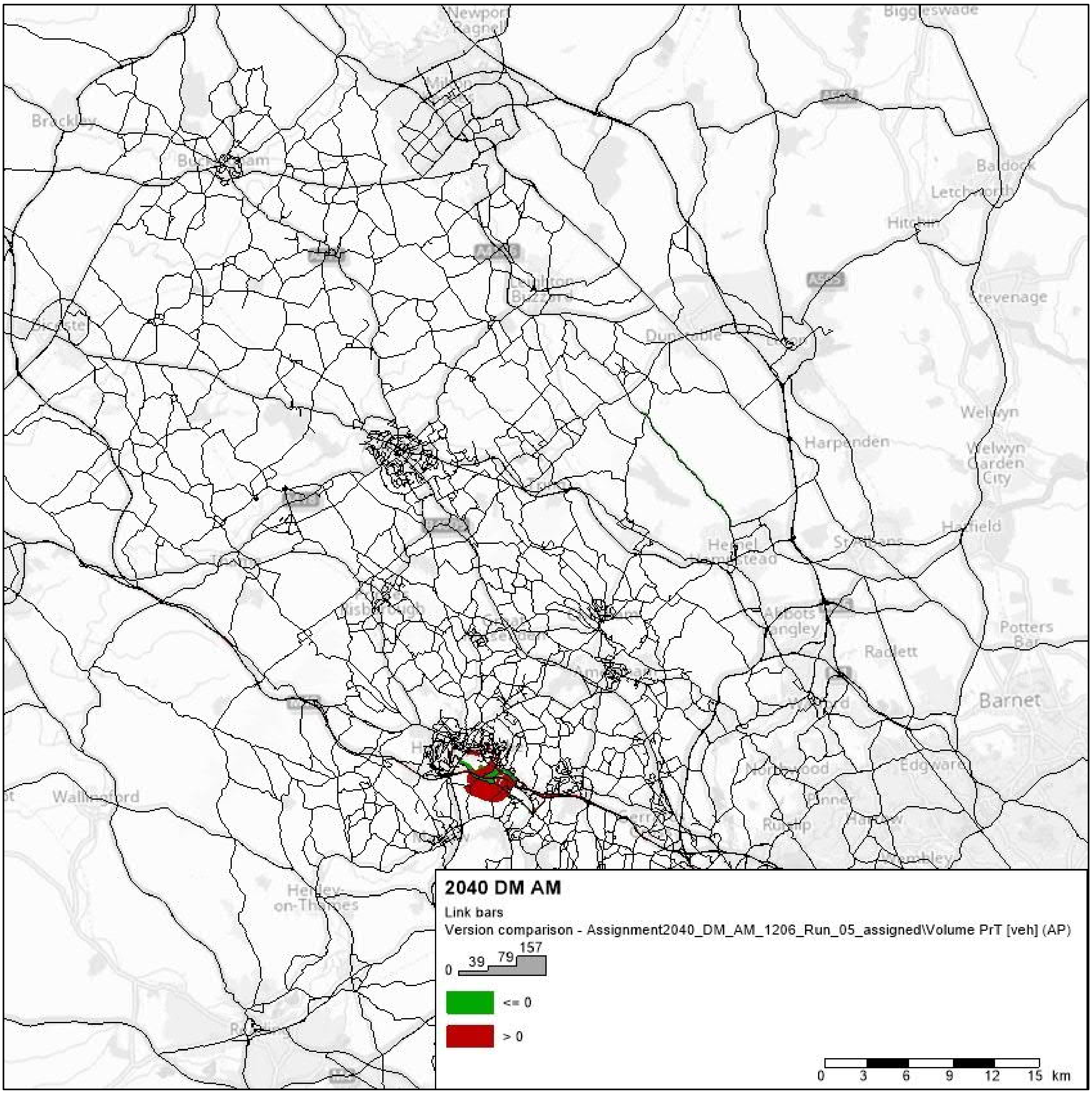

Figure 0-1: Sensitivity Test 2040 AM Peak

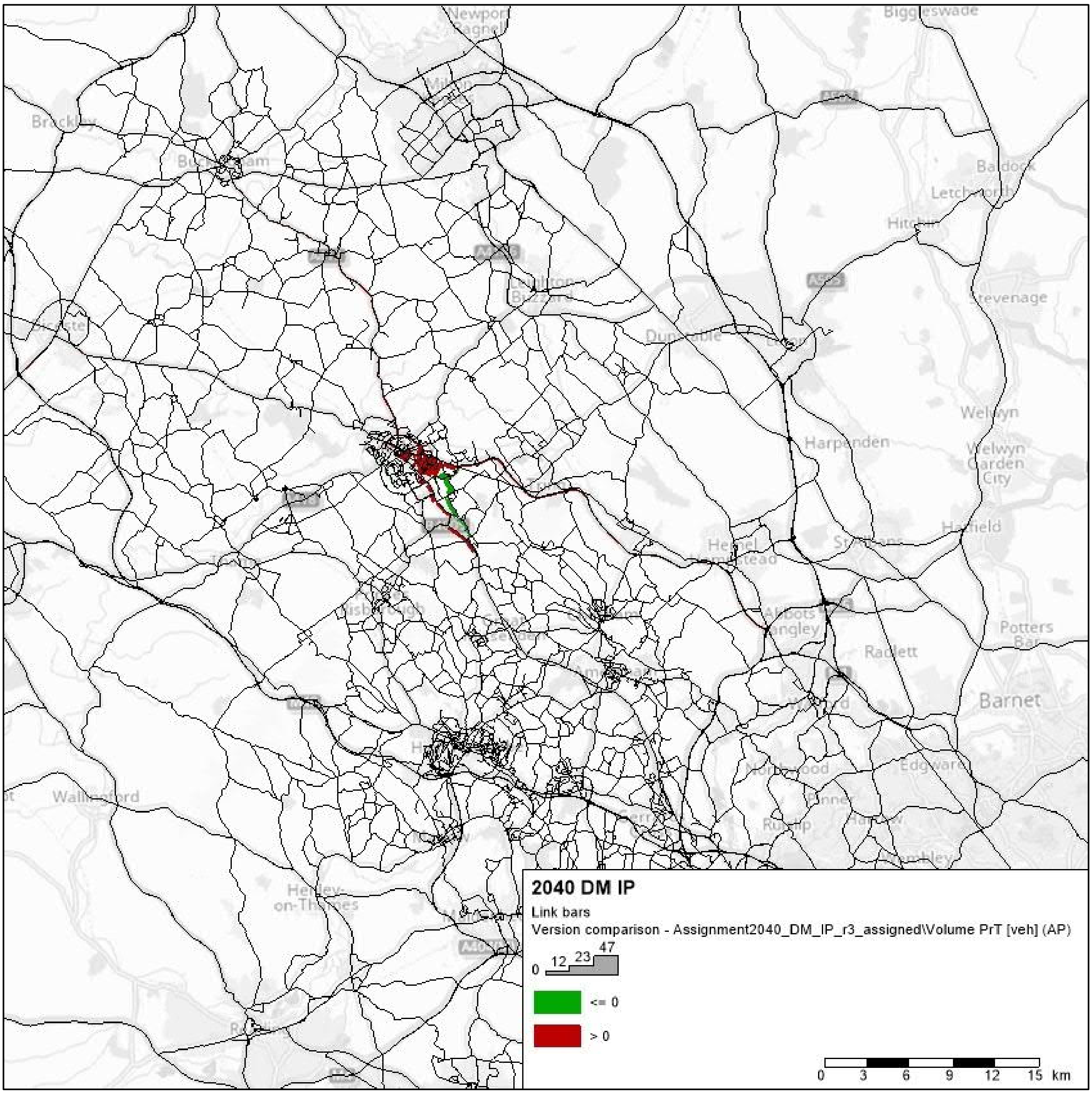

Figure 0-2: Sensitivity Test 2040 Interpeak

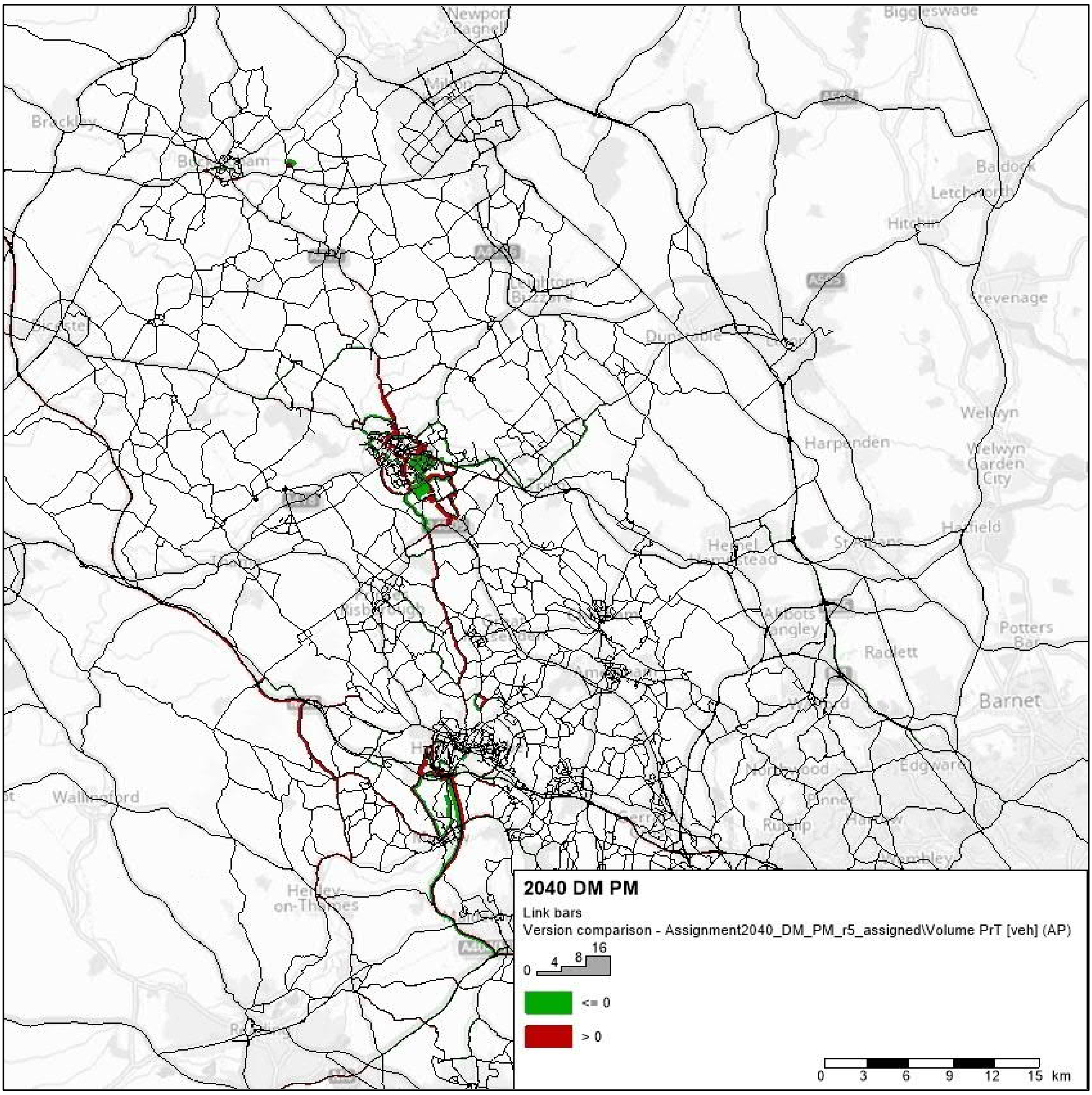

Figure 0-3: Sensitivity Test 2040 PM Peak