Sevenoaks Local Plan

Forecasting Report

July 2023

Kent County Council

KCC

Document history and status

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Sevenoaks Local Plan

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Limitation Statement

The sole purpose of this technical report is to describe the processes by which initial 2040 demand forecasts have been carried out using the Sevenoaks Local Transport Model. It should be noted that this report has been prepared for use of Kent County Council (KCC) and Sevenoaks District Council (SDC) as an interim version and will be updated once further options have been confirmed and analysed. This report should be read in full with no excerpts out of context deemed to be representative of the report and its findings as a whole. This report has been prepared exclusively for Jacobs and Jacobs' end client (KCC and SDC) and no liability is accepted for any use or reliance on the report by third parties.

Several of the figures within this report have been generated in the PTV VISUM software using OpenStreetMap® open source data, licensed under the Open Data Commons Open Database License (ODbL) by the OpenStreetMap Foundation (OSMF). The data is available under the ODbL. For more information see:

http://www.openstreetmap.org/copyright.

1. Introduction

1.1 Background

Sevenoaks District Council (SDC) and Kent County Council (KCC) are undertaking a Local Plan Review (LPR) for the district to address the latest Government standard methodology for calculating authorities' future housing numbers and extend the Plan period to at least 2040.

The current Sevenoaks District Core Strategy was adopted in 2011 and provides for the housing, employment and retail development needed for 2011-2026. The annual housing requirement will increase from the current Local Plan figure to up to approximately 714 homes/year from 2025 to 2040.

SDC and KCC need to consider, and consult on, reasonable, alternative options for meeting housing and other development needs. As part of this process, SDC and KCC commissioned Jacobs to undertake transport modelling to gather evidence on the transport implications of the emerging draft LPR options.

The overall project objectives are to:

1. Assess the quality and capacity of transport infrastructure across the district and its ability to meet forecast demands – this can be developed through the traffic modelling proposed here.
2. Assess the cumulative impacts of the LP development options on the district's transport network – this can be developed through the traffic modelling proposed here.
3. Identify proposals and potential measures to mitigate the impacts of development to inform the infrastructure requirements associated with the LP. This should include, but is not limited to:
    a. Identification of potential measures to enable and achieve higher levels of sustainable transport mode share across the district.
    b. Identification of the potential barriers to the utilisation of sustainable transport modes across the district.
    c. Identification of potential intervention measures on the transport network

The Sevenoaks Local Transport Model has been checked and enhanced using available data to prepare it for developing forecast scenarios and undertaking spatial assessments. More information can be found in the local base model report[1].

1.2 Purpose of this Document

This Forecast Report describes the principles, assumptions and methodology employed to develop the future year baseline situation using the Sevenoaks Local Transport Model. The forecast baseline has been developed for a single forecast year of 2040, after the completion of the 2019 local base model. This includes a full identification of committed developments and transport schemes.

It should be noted that this report is an interim version and will be updated once additional options have been confirmed and analysed.

[1] Stage 2 Tonbridge and Malling and Sevenoaks - Local Model Validation Report v2.docx

1.3 Document Structure

Following this introduction, the structure of this report is as follows:

- **Chapter 2** – provides an overview of the proposed uses of the model and the key model design considerations;
- **Chapter 3** – provides an overview of the 2019 Local Transport Model
- **Chapter 4** - provides an overview of the network and demand forecasting approach;
- **Chapter 5** – presents the forecast results for the future year scenario;
- **Chapter 6** – provides a summary and recommendations

2. Overview of the Model and Key Model Design Considerations

2.1 Study Area

The Kent Transport Model (KTM) has been updated for the development of the Sevenoaks Local Transport Model. As in standard practice, should a model be required for a specific study within the detailed model area (such as a Local Plan review), then an additional review and updates will be needed to refine the validation in the local area. This enables additional focus on model quality in the specific area of interest.

Therefore, the Sevenoaks Local Transport Model network has been developed based on the KTM using PTV VISUM 2020 software (the same software that was used to develop KTM) with necessary updates to check that the local network replicates base conditions. The base year 2019 has been retained due to Covid-19 impacts and to be consistent with the observed 2019 Teletrac data. More information can be found in the local model validation report.

The highway assignment model represents a 'neutral' weekday in the following modelled time periods:

- AM peak hour (08:00 – 09:00); and
- PM peak hour (17:00 – 18:00)

These modelled hours were derived from the analysis of traffic counts throughout the study area to ascertain which hours contained the highest overall volume of traffic and the hours where the traffic volume was observed to be the highest at the majority of survey locations.

The 2019 base model was developed for both Sevenoaks District and Tonbridge and Malling Borough. Due to geographical proximity and the similarity of the scope of work, an agreement has been made for joint working. However, in developing the 2040 Forecast Baseline, separate models were prepared for Sevenoaks District and Tonbridge and Malling Borough.

Figure 2-1 shows the detailed model area where it includes Tonbridge and Malling Borough, Sevenoaks District and the key junctions outside their boundaries. The detailed model area is where the VISUM Intersection Capacity Assessment (ICA) has been implemented to capture delays generated at urban junctions. Figure 2-2 shows the locations of the junctions with ICA implemented. For areas outside the detailed model area, junctions were not modelled in detail, but delays were captured through network links. Adjustments to the KTM network, zoning and zone connectors were also applied to simplify the external network that did not impact the study area directly (e.g., in Thanet, Dover, rest of London, Surrey, East Sussex etc).

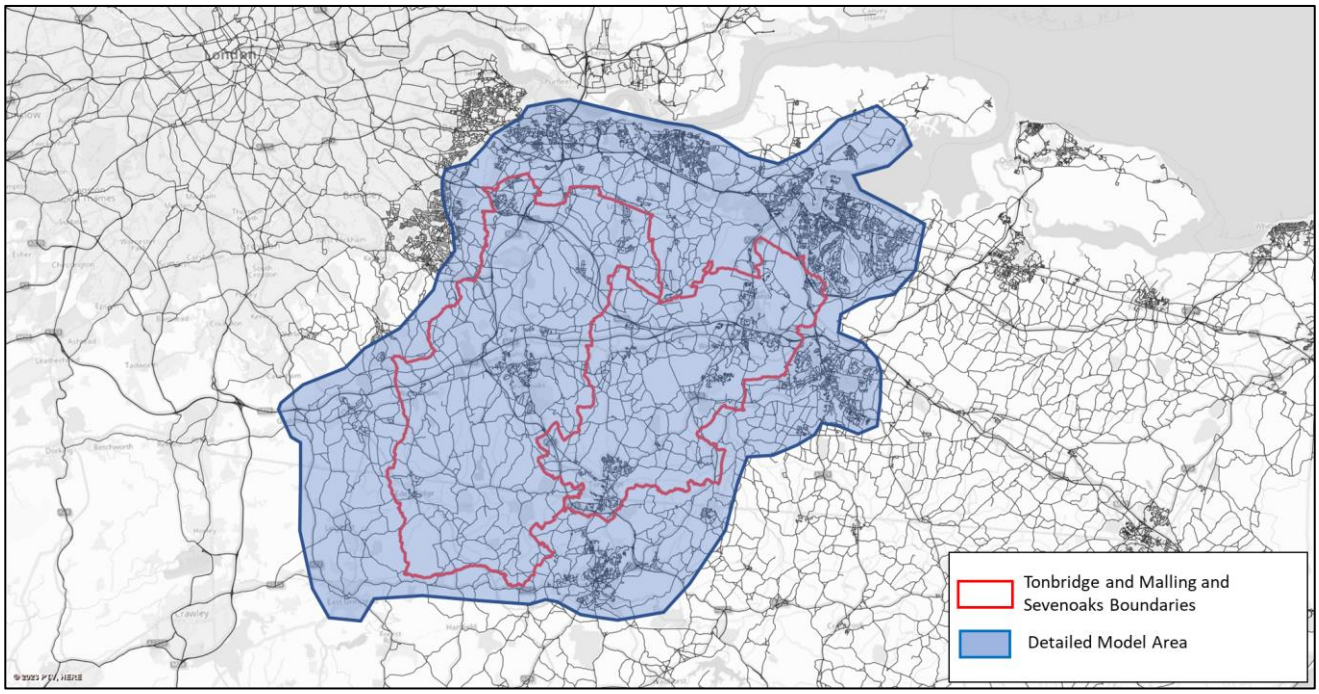

Figure 2-1: Sevenoaks and Tonbridge and Malling Local Model Study Area

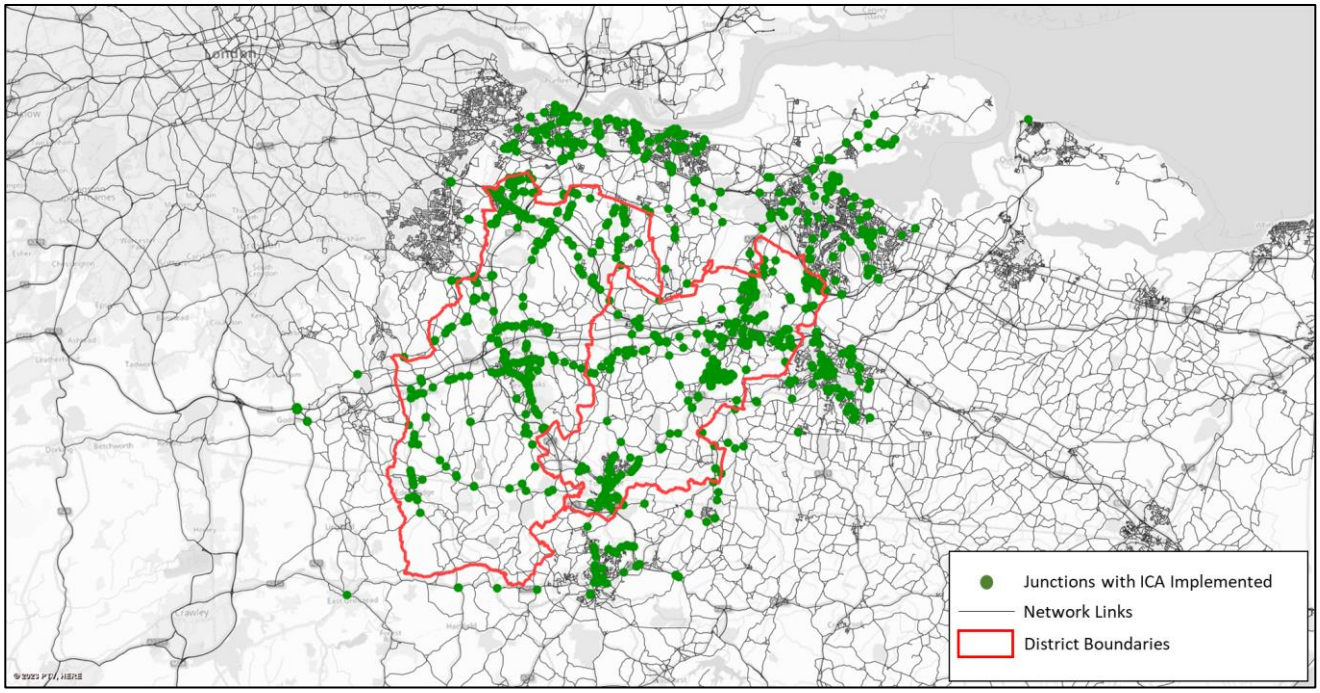

Figure 2-2: Junctions with Intersection Capacity Analysis (ICA) Method Implemented

2.2 Key Model Design Considerations

2.2.1 Software

PTV's VISUM 2020 has been used as the software platform for the highway component of the model. This was also the same software used to develop the KTM. Recognised benefits of using PTV VISUM for this application are:

- The speed with which detailed highway networks can be coded in VISUM;
- The data-handling and visualisation capabilities of VISUM;
- Easy extraction of results to spreadsheet and database formats for analysis and checking;
- The possibility of semi-automatic extraction to interoperable corridor micro-simulation models in the related PTV VISSIM software platform; and
- The possible development of a "real-time" predictive modelling tool based on the VISUM network using the related PTV Optima Software.

2.2.2 Highway Assignment Modelled Responses

The Sevenoaks Local Transport Model is designed to take account of future district and local growth in population and employment and to be capable of predicting likely travel behaviour in terms of trip distribution with one or both trip-ends within Sevenoaks over a temporal scale of a single peak hour. It is intended to allow for the strategic re-routing of the proposed schemes within the study area. No variable demand and public transport models are associated with the Sevenoaks Local Transport Model development, and therefore highway demand remains fixed.

3. 2019 Local Base Transport Model

3.1 Overview

This section summarises the outputs gathered from the 2019 Sevenoaks Local Transport Model for the AM and PM peak periods. The objective of this is to identify existing key junction and link issues. Junction Level of Service (LOS) and link Volume / Capacity (V/C) ratio were extracted from the transport model. Delay maps were also extracted from the model to identify existing delays in the study area.

In interpreting the results, it should be noted that in strategic modelling, issues on one junction could reflect delays or congestion of the corridor nearby. Furthermore, the outputs from the strategic model provides a high-level indication of where the capacity of the road will likely to be an issue. Development of the local junction models (to include accurate geometry and visibility information for specific locations is typically recommended as the next step.

3.2 Model Outputs Criteria

Junction Level of Service (LOS) and link Volume / Capacity (VOC) ratio indicators were used as criteria to identify the link and junction "hot spots" in the study area.

Level of service plots provide a qualitative measure of how good the present traffic situation is on a given junction. As actual flow will vary for different days and different times in a day, LOS relates the traffic service quality to a given flow rate of traffic. VISUM defines the LOS based on the mean delay experienced by each vehicle. Table 3-1 defines the LOS by six levels ranging from level A to level F.

LOS Level	Description
A	Level A represents the best quality of traffic where the driver has the freedom to drive with free flow speed.
B	Level B represents good traffic quality where driver can reasonably maintain free flow speed and maneuverability within the traffic stream is slightly restricted.
C	Level C represents stable traffic flows, at or near free flow. Ability to manoeuvre through lanes is noticeably restricted and requires awareness.
D	Level D represents almost unstable traffic flows. Speeds slightly decrease as traffic volume slightly increase. On this level driver comfort decreases.
E	Level E represents unstable traffic flows, operating at capacity. Driver's level of comfort becomes poor.
F	Level F represents the worst traffic quality with forced or breakdown traffic flows. Travel time cannot be predicted, with generally more demand than capacity.

Table 3-1: Level of Service Description

On the other hand, volume / capacity is the ratio of assigned traffic volume to the modelled link capacity and the ranges used are set out below.

V/C Ratio	Description
<= 75%	Stable flow with acceptable delay
<= 85%	Approaching unstable flow but with tolerable delay
<= 100%	Unstable flow
> 100%	Over-capacity

Table 3-2: Level of Service Description

3.3 2019 Junction and Link "Hot-Spots"

Figure 3-1 and Figure 3-2 show the junction LOS and link V/C ratio for 2019 AM and PM peak periods. Detailed plots are presented in Appendix A while Appendix C, shows the detailed LOS and V/C ratio information in some key junctions for reference.

In the AM, the majority of the junctions and links in Sevenoaks display little to moderate levels of delay (LOS B to D and V/C < 85%). However, some of the key junctions and links in the district listed below exhibit severe levels of delay (LOS E and F and V/C > 85%)

- B258, Bartholomew Way, B2173 London Road (Swanley)
- M2 J3 (roundabout link is showing V/C ratio of >100%)
- A25 / A225 St John Hill (Sevenoaks Town)
- A25 / B2019 Seal Hollow Road (Sevenoaks Town) - although the overall junction is showing LOS D, the north-eastern and eastern arms of the junction is showing LOS E and F.

Similar patterns are found in the PM peak, with A20 Main Road / A225 Eynsford Road exhibiting LOS E.

Delay maps were also analysed to identify the existing delays in the study area, and these are presented in Figure 3-3 and Figure 3-4. The result of the analysis confirms the locations highlighted above where delays are observed along B258, Bartholomew Way and B2173 London Road in Swanley, M25 J3, A20 Main Road. Delays are also shown on A25 Westerham Road, A25 Bradbourne Vale Road and A225 High Street in Sevenoaks Town and B2026 Station Road in Edenbridge.

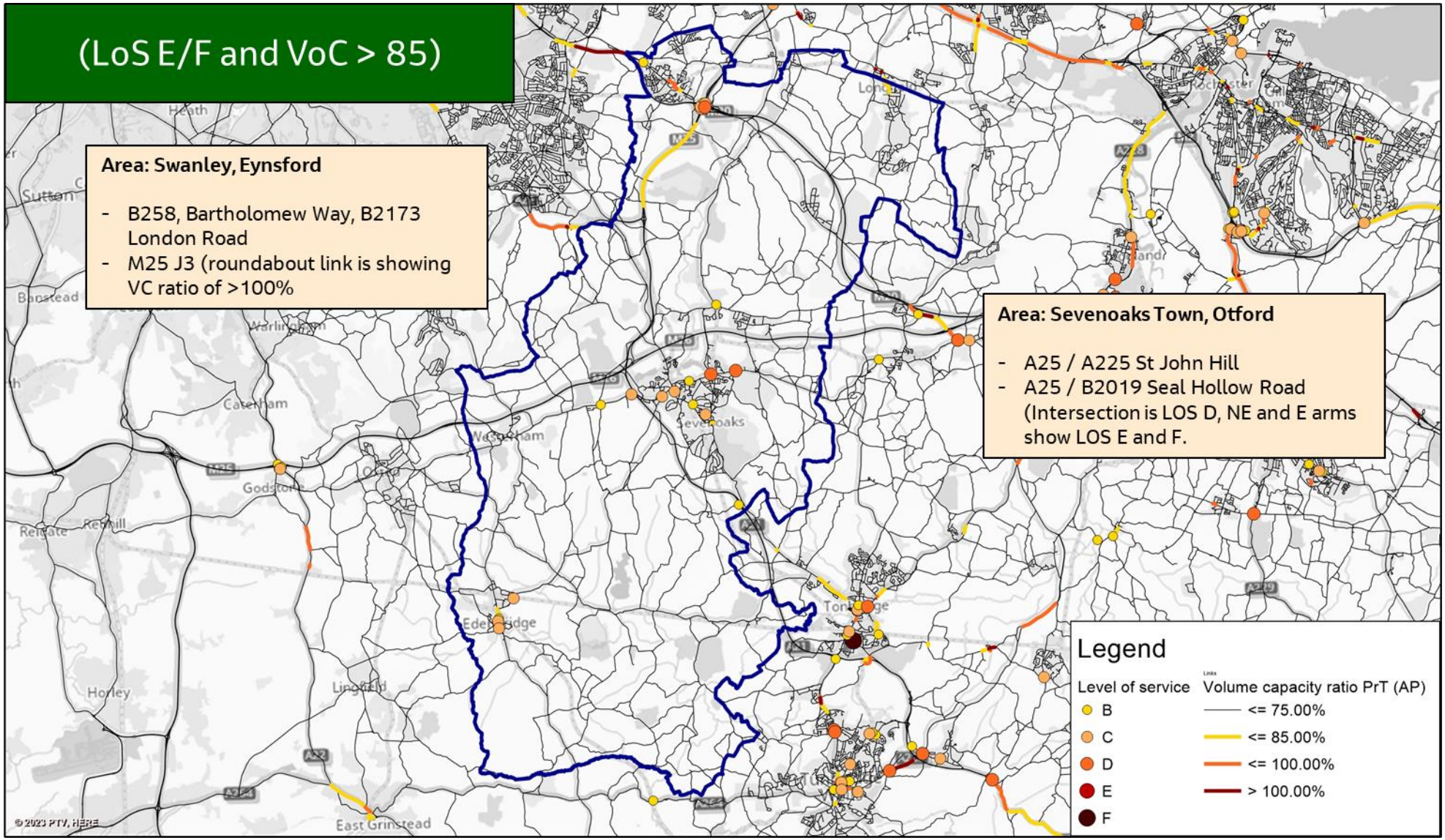

Figure 3-1: 2019 AM Peak Junction and Link "Hot Spots"

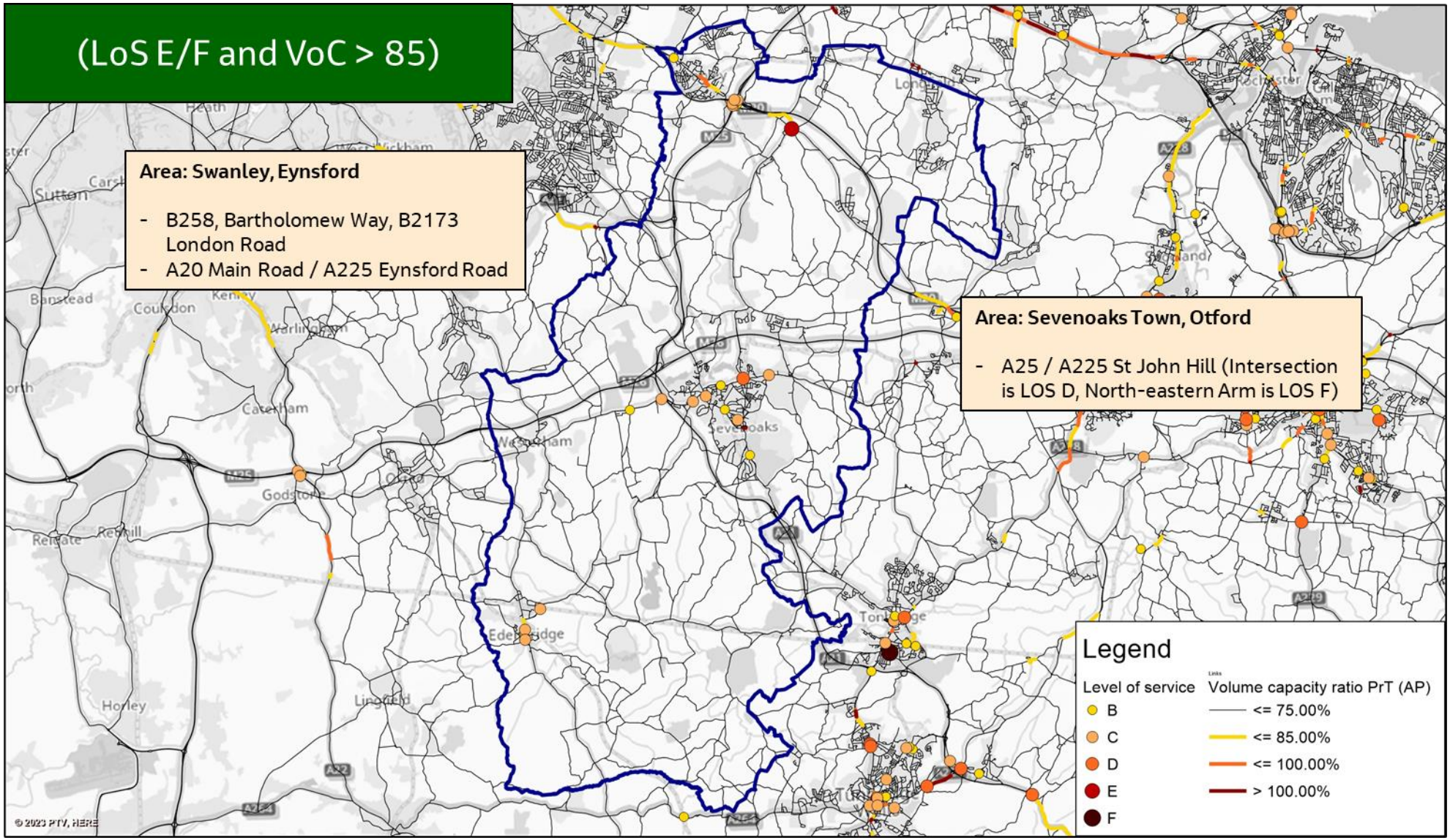

Figure 3-2: 2019 PM Peak Junction and Link "Hot Spots"

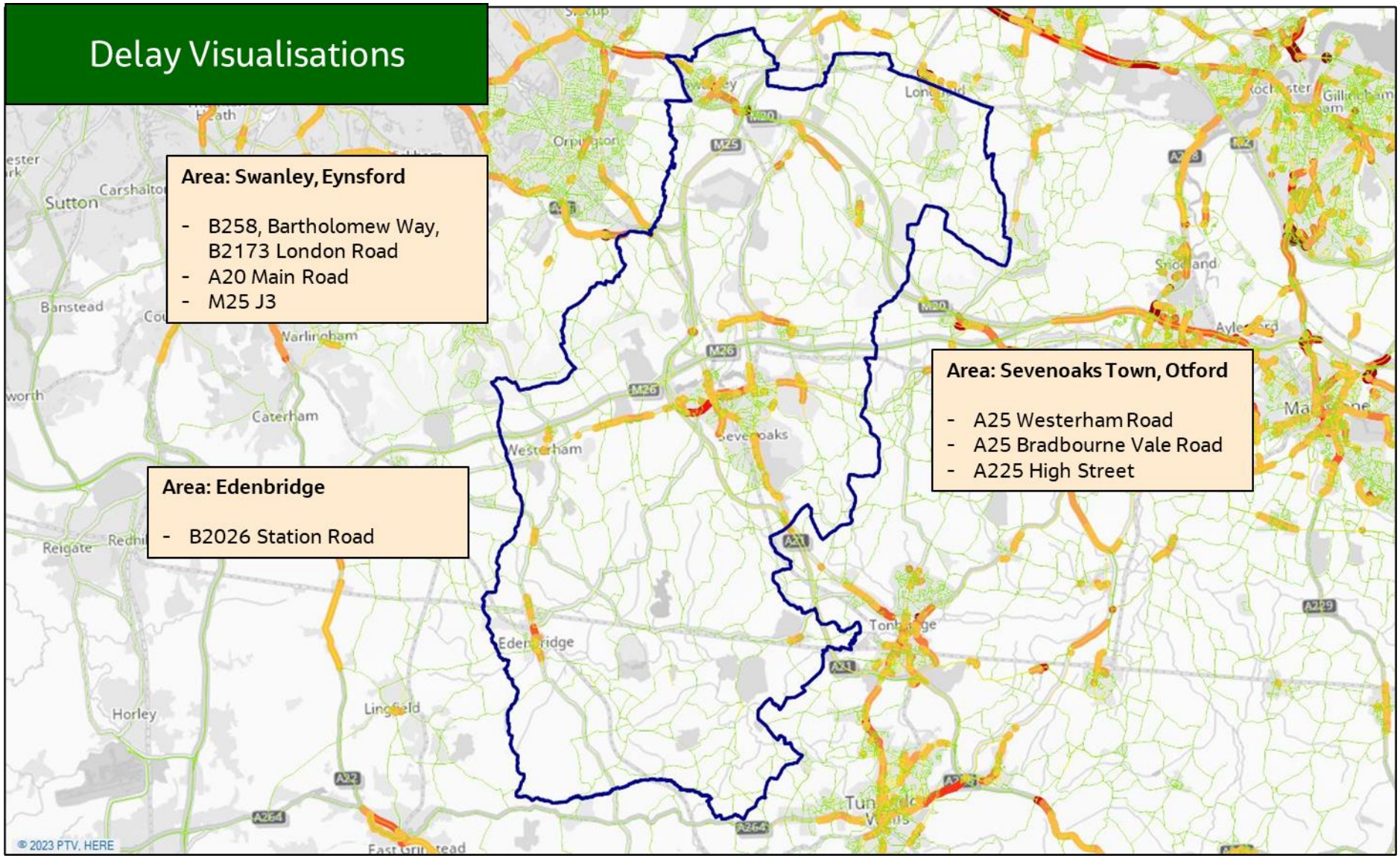

Figure 3-3: 2019 AM Peak Delay Visualisation

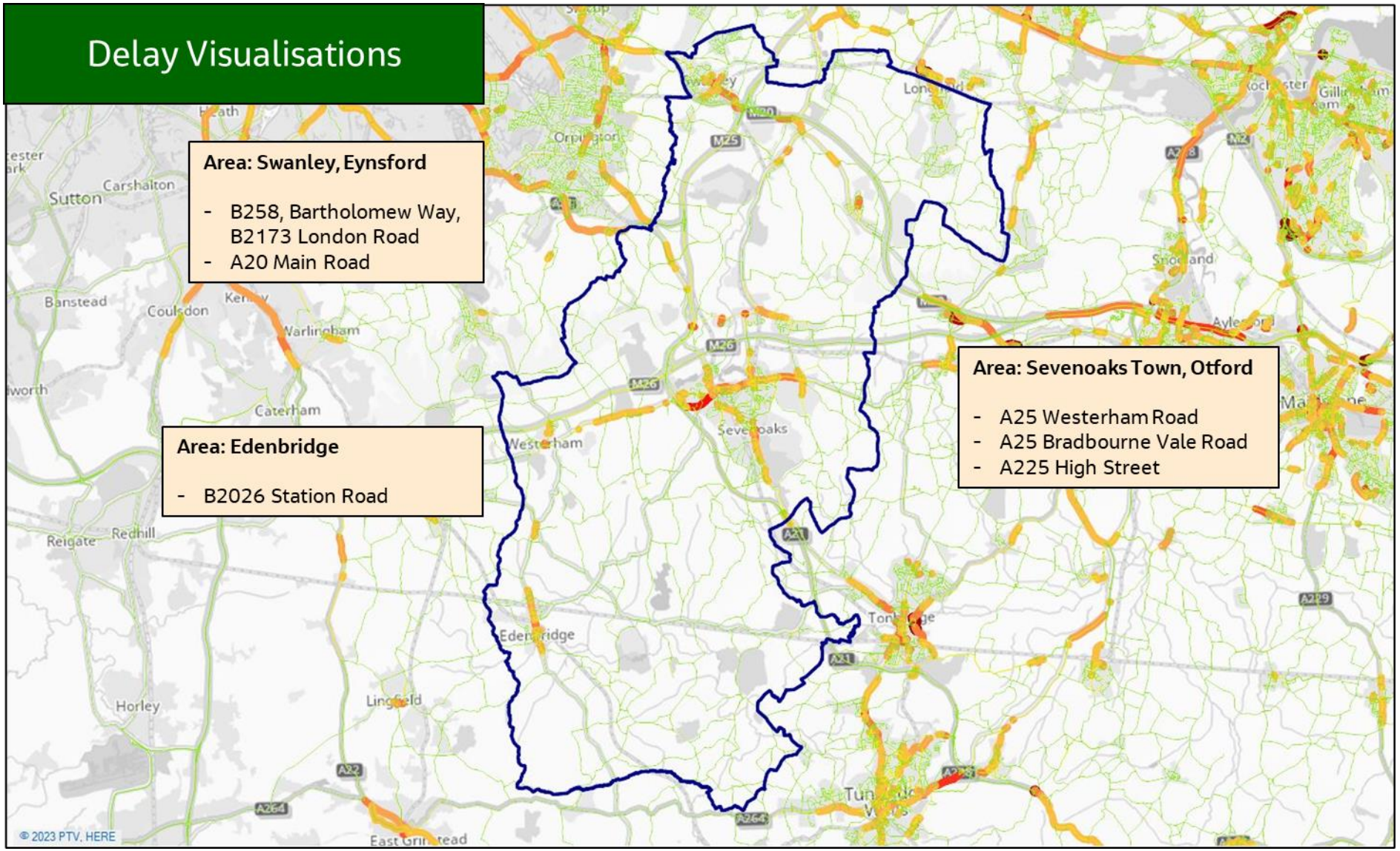

Figure 3-4: 2019 PM Peak Delay Visualisation

4. Approach to Forecasting

4.1 Overview

In accordance with TAG Unit M3.1 guidance, the forecasting approach for the Sevenoaks Local Transport Model involves three basic elements:

- Development of a future year network;
- Derivation of future year demand; and
- Demand assignment.

4.2 Forecast Scenario

A 'Forecast Baseline' has been developed using local growth assumptions in Sevenoaks. This includes completions and consented developments and infrastructure planned for the 2019 to 2040 growth period within Sevenoaks, combined with the growth assumptions in neighbouring authorities and external areas. More details on the highway growth assumptions are discussed in Section 4.4 of this report.

At this stage, this report only includes the outcome of the Forecast Baseline scenario. It is expected that this report will be updated to include the LPR option testing and other relevant scenarios.

4.3 Forecast Network Development

A 2040 future year network has been prepared for the purposes of Sevenoaks Local Transport Model forecasts. The network for the forecast year was based on the calibrated and validated base year network and includes additional schemes that may be in place by the forecast year.

A list of potential infrastructure projects based on this guidance were collated and confirmed, in consultation with SDC and KCC for inclusion in the transport networks.

4.3.1 Highway Schemes

Following consultation with SDC and KCC, the proposed improvements at Bat and Ball Junction converting it into a roundabout has been included in the Forecast Baseline. Figure 4-1 show the location of the junction in Sevenoaks Town.

Figure 4-1: Implemented Forecast Baseline Infrastructure Scheme in Sevenoaks

4.3.2 Highway Forecast Year Values of Time and Vehicle Operating Costs

The values of the pence per minute (ppm) as Value of Time (VoT) and pence per kilometre (ppk) as Vehicle Operating Costs (VOC) parameters used for the Sevenoaks Local Transport Model highway assignment are based on the latest TAG Unit A1.3 guidance and Data Book available at the time of model development (November 2022 v1.20.1). Network average speed and OGV1/OGV2 proportions were inherited from the base model. The HGV Value of Time (VoT) values are doubled, consistent with the base model.

The final calculated values for highway VoT and VOC for the 2040 forecast year of the Sevenoaks Local Transport Model are provided in Table 4-1.

The final input for implementation in VISUM is also shown in the table; the formats required being a coefficient for pence per metre (ppmetre) for VOC as a weighted ratio of the VoT pence per second (pps).

Time Period	User Class	2040 Base Year TAG Databook Value		2040 Base Year VISUM Units		2040 Base Year Final VISUM Coefficients	
		VoT (ppm)	VOC (ppk)	VoT (pps)	VOC (ppmetre)	VOT	VoT (ppm)
AM	UC1 Car Commute	27.5701	4.3676	0.4595	0.0044	1	0.0044
	UC2 Car Business	41.1110	9.1928	0.6852	0.0092	1	0.0092
	UC3 Car Other	19.0212	4.3676	0.3170	0.0044	1	0.0044
	LGV	29.7938	11.0812	0.4966	0.0111	1	0.0111
	HGV (doubled VoT)	59.3434	38.9364	0.9891	0.0389	1	0.0389
PM	UC1 Car Commute	27.6652	4.3903	0.4611	0.0044	1	0.0044
	UC2 Car Business	41.7043	9.2711	0.6951	0.0093	1	0.0093
	UC3 Car Other	19.9192	4.3903	0.3320	0.0044	1	0.0044
	LGV	29.7938	11.1266	0.4966	0.0111	1	0.0111
	HGV (doubled VoT)	59.3434	39.2915	0.9891	0.0393	1	0.0393

Table 4-1: 2040 Highway Generalised Cost Parameters

4.4 Forecast Demand Development

This section describes how future year fixed demand matrices have been developed. A forecast year of 2040 has been modelled with TEMPro v8 and local growth assumptions.

4.4.1 Overview

Table 4-2 summarises the approach undertaken in developing the future demand for Sevenoaks Local Transport Model forecast baseline. The assumptions used were split into three categories to cover the study area, neighbouring authorities and other/external areas. Each component mentioned below (i.e uncertainty log, TEMPro, trip rates, etc) was also discussed in the succeeding sections in detail.

Area	Assumptions	Purpose
Sevenoaks	Only committed developments and infrastructure schemes were assumed in the forecast baseline and no TEMPro uplift was included. In accordance with TAG Unite M4, developments with "Near Certain" and "More Than Likely" status within Sevenoaks were included.	Assumed a hypothetical situation of no further growth in the District, to establish the baseline for the local plan.
Neighbouring Authorities (Tonbridge and Malling, Maidstone, Tunbridge Wells, Gravesham, Medway, Dartford, Surrey and Southeast London)	TEMPro v8 (with adjustment of the default Housing and Job assumptions to match updated housing need/LP targets where known). In the neighbouring authorities, "Near Certain" developments and potential larger LP sites (which could fall under "More than Likely" or "Reasonably Foreseeable") were included together with background growth from TEMPro v8 using the alternative assumptions tool (subtracted from TEMPro v8 to avoid double-counting).	Takes in to account the likely level of expected growth in the key neighbouring areas.
Other Areas	TEMPro v8 growth was applied.	Takes in to account broader general 'background growth' in area further away from the study area.

Table 4-2: Sevenoaks - 2040 Highway Growth Assumptions

4.4.2 Identification of Planning Data (Uncertainty Log Development)

The primary purpose for developing the Uncertainly Log is to provide spatial distribution of planned developments and transport schemes by using Local Authority planning data for housing and employment.

In order to develop the forecast baseline, Uncertainty Log information has been provided by SDC and includes information on completions/demolitions since the base year and a list of future committed developments and infrastructure schemes within Sevenoaks and key neighbouring areas.

The Uncertainty Log information includes:

- Latest available information at the time of model development on completions/demolitions since 2019, including location and size;

- Committed development locations, land use and size (number of dwellings or floorspace);
- Access arrangements and any changes to the existing network related to developments; and
- Committed infrastructure schemes or network changes (i.e major junction upgrade, new link road or local speed reductions).

The Uncertain Log was prepared in accordance with TAG Unit M4 which provides classifications of probability of a development shown in Table 4-3. Table includes the development status and the assumption to include in core or alternative scenarios.

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

Table 4-3: Classification of Future Development Inputs from TAG Unit M4, Table A2

In accordance with TAG Unite M4, developments with "Near Certain" and "More Than Likely" within Sevenoaks were included in the forecast baseline, which formed the car growth in the district.

In the neighbouring authorities, "Near Certain" developments and potential larger LP sites (which could fall under "More than Likely" or "Reasonably Foreseeable") were included together with background growth from TEMPro v8

using the alternative assumptions tool to deduct the housing and jobs associated with committed and larger LP sites developments.

Growth outside of Sevenoaks and neighbouring authorities come solely from TEMPro and Road Traffic Forecast (RTF) 22. More details can be found in Sections 4.4.4 and 4.4.5.

4.4.3 Forecast Baseline Developments

As described in the previous section, the Uncertainty Log has been provided by SDC and analysed to understand the committed development to be completed before 2040. The final increase of dwellings and employment space between 2019 and 2040 for Sevenoaks is shown in Table 4-4. The location of these developments is shown in Figure 4-2 and the complete list is presented in Appendix D. This represents the latest available information at the time of model development. For employment, several sites have been proposed to be demolished and replaced by housing or other developments. These changes in the use were taken into consideration to avoid double counting. Hence, the table below presents a reduction in the employment sites.

	Dwellings Units	Floorspace (sqm)
Committed Developments	2,929	-6,789

Table 4-4: Sevenoaks Uncertainty Log 2019-2040

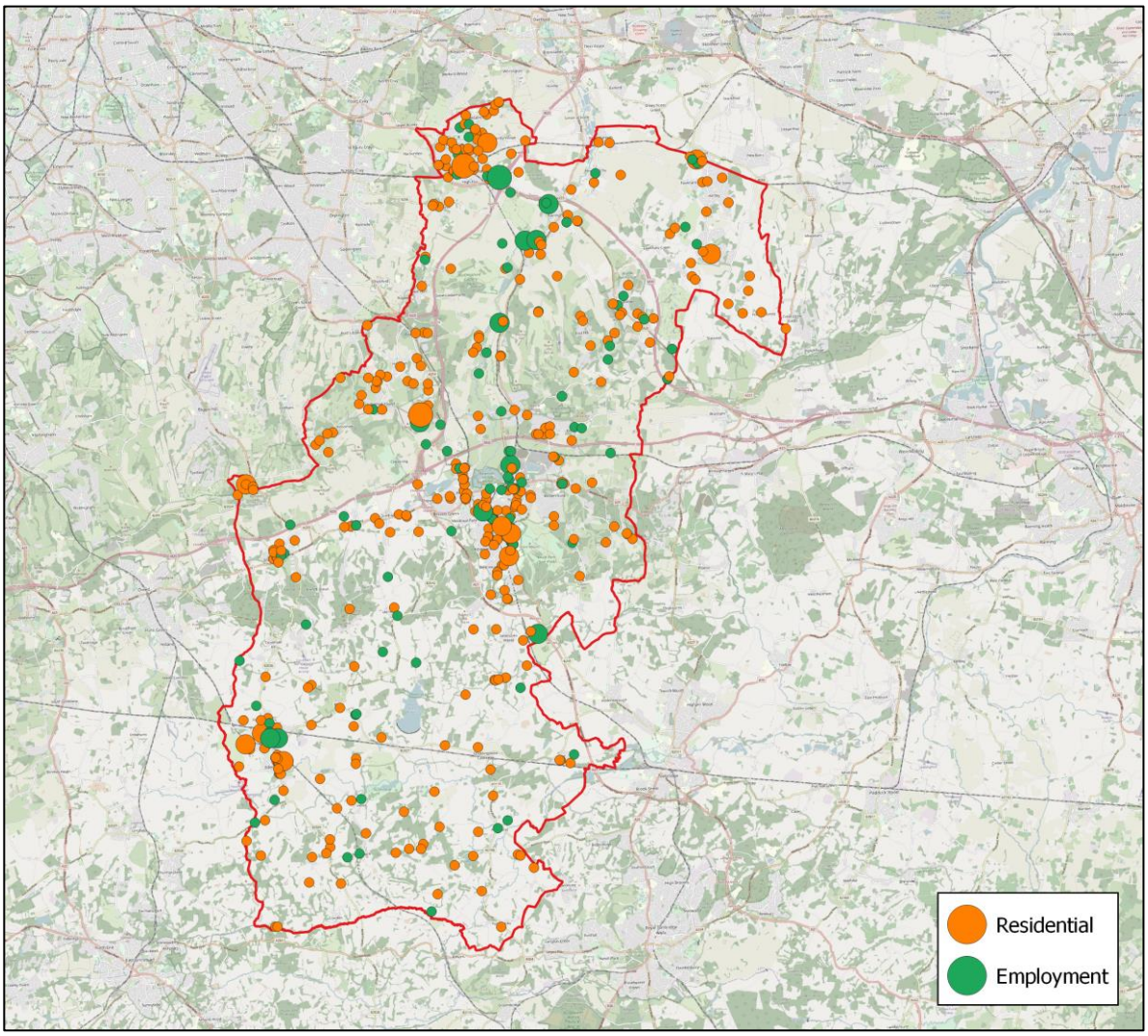

Figure 4-2: Location of Committed Developments in Sevenoaks District

4.4.4 TEMPro and Background Growth Calculation

Trip End Model Presentation Program (TEMPro) is a software that summarises the growth forecast from the National Trip End Model (NTEM). This data takes into account national projections of population, employment, housing, car ownership and trip rates. TEMPro v8 datasets were used to calculate the background growth for 2040 forecast year. The number of households or jobs associated with specific developments in the neighbouring authorities was subtracted from NTEM using the 'alternative planning assumptions' within TEMPro to produce factors for the NTEM-based background growth in trip ends. These factors were used to calculate the reduced background growth to avoid double-counting. For the rest of the areas outside the neighbouring authorities, unadjusted TEMPro growth were applied.

4.4.5 Trip Generation

As discussed with KCC and SDC, trip rates information from TRICS (Trip Rate Information Computer System) were used to calculate the baseline trips, taking into account both proposed and demolished developments as advised by SDC. This included surveys from 2015 (the current default date set in the software in order to cut off old data from the calculation) up to 2022. Manual edits were made to exclude sites surveyed during the pandemic period and on weekends (Saturday and Sunday).

Where possible, the preferred approach was to exclude sites located outside England or within London, however, the opportunity to apply this was constrained to just a handful of site selections, due to the limited number of surveys available in TRICS for the required land uses. This was also the case when looking to adjust the town centre site selections to reflect the impact of proposed sites with no or low parking provision. With a low number of surveys available when selecting the town centre parameter, this was only able to be applied in one instance (for B1 office land use). In general, where available surveys were limited, it was considered more representative to apply greater number of surveys than to narrow the search selection down to a single survey, and so where possible a minimum of 3 surveys per selection was retained.

For flats and houses, the information from SDC did not specify what proportion were to be private and what proportion were to be affordable, and so a generalised 40% affordable and 60% private split was applied.

Specific trip rates were also used for the developments based on their location (i.e., Town Centre, Edge of Town Centre, Suburban Area, and Neighbourhood area). While there were houses shown to be located in the town centre locations, this parameter selection was unavailable in the TRICS database. It was agreed to apply the assumption that there would be flats only in the town centre, and both flats and houses outside the town centre due to the TRICS survey limitations.

For a number of land uses, there were no surveys available either for the required location or in general, and so alternative trip rates were used. Although not preferable, these substitutions were considered to represent the next best available trip rate for the land uses when no other options were available.

Table 4-5 summarises the updated trip rates used in the forecast demand modelling. Trip rates shown are for hourly AM and PM peak periods.

Land Use	Land Use	Units	Location	Sub-category		Trip Rates					
						AM Peak			PM Peak		
						Arrival	Departure	Total	Arrival	Departure	Total
Residential	C3	per dwelling	Town Centre	Flats	*Private*	0.023	0.056	0.079	0.048	0.020	0.068
Residential	C3	per dwelling	Town Centre	Flats	*Affordable*	0.023	0.056	0.079	0.048	0.020	0.068
Residential	C3	per dwelling	Edge of Town Centre	Flats	*Private*	0.043	0.189	0.232	0.170	0.082	0.252
Residential	C3	per dwelling	Edge of Town Centre	Flats	*Affordable*	0.074	0.105	0.179	0.087	0.087	0.174
Residential	C3	per dwelling	Suburban Area	Flats	*Private*	0.051	0.190	0.241	0.148	0.079	0.227
Residential	C3	per dwelling	Suburban Area	Flats	*Affordable*	0.091	0.155	0.246	0.127	0.182	0.309
Residential	C3	per dwelling	Neighbourhood Centre	Flats	*Private*	0.000	0.111	0.111	0.222	0.000	0.222
Residential	C3	per dwelling	Neighbourhood Centre	Flats	*Affordable*	0.000	0.111	0.111	0.222	0.000	0.222
Residential	C3	per dwelling	Town Centre	Houses	*Private*	unavailable in TRICs					
Residential	C3	per dwelling	Town Centre	Houses	*Affordable*	unavailable in TRICs					
Residential	C3	per dwelling	Edge of Town Centre	Houses	*Private*	0.138	0.291	0.429	0.283	0.170	0.453
Residential	C3	per dwelling	Edge of Town Centre	Houses	*Affordable*	0.078	0.094	0.172	0.133	0.102	0.235
Residential	C3	per dwelling	Suburban Area	Houses	*Private*	0.117	0.394	0.511	0.371	0.187	0.558
Residential	C3	per dwelling	Suburban Area	Houses	*Affordable*	0.186	0.276	0.462	0.436	0.340	0.776
Residential	C3	per dwelling	Neighbourhood Centre	Houses	*Private*	0.139	0.296	0.435	0.271	0.141	0.412
Residential	C3	per dwelling	Neighbourhood Centre	Houses	*Affordable*	0.077	0.219	0.296	0.190	0.116	0.306
Residential	C3	per dwelling	Suburban Area	Mixed accommodation	*Private*	0.014	0.16	0.174	0.123	0.042	0.165
Residential	C3	per dwelling	Neighbourhood Centre	Mixed accommodation	*Private*	0.112	0.335	0.447	0.311	0.158	0.469
Residential	C3	per dwelling	Suburban Area	Retirement Flats		0.057	0.062	0.119	0.041	0.047	0.088
Residential	C3	per dwelling	Neighbourhood Centre	Assisted Living		0.084	0.034	0.118	0.034	0.084	0.118
Residential	C3	per dwelling	Suburban Area	Assisted Living		0.085	0.040	0.125	0.068	0.091	0.159
Retail	Ea	per 100sqm	Town Centre	Convenience store		0.500	0.500	1.000	0.000	0.000	0.000

Land Use	Land Use	Units	Location	Sub-category		Trip Rates					
						AM Peak			PM Peak		
						Arrival	Departure	Total	Arrival	Departure	Total
Retail	Ea	per 100sqm	Suburban Area	Convenience store		9.493	9.817	19.310	8.091	8.091	16.182
Retail	Ea	per 100sqm	Neighbourhood Centre	Convenience store		6.406	6.156	12.562	8.108	8.709	16.817
Retail		per 100sqm	Suburban Area	Food superstore		1.517	1.295	2.812	2.001	2.217	4.218
Retail		per 100sqm	Town Centre	local shop-shopping centre		unavailable in TRICs					
Retail		per 100sqm	Suburban Area	motorist DIY		unavailable in TRICs					
Employment	B1a	per 100sqm	Town Centre	Office		0.188	0.022	0.199	0.022	0.122	0.133
Employment	B1a	per 100sqm	Edge of Town Centre	Office		0.461	0.071	0.532	0.510	0.357	0.407
Employment	B1a	per 100sqm	Suburban Area	Office		0.634	0.062	0.696	0.089	0.373	0.462
Employment	B1a	per 100sqm	Neighbourhood Centre	Office		1.085	0.075	1.160	0.050	1.062	1.112
Employment	B2	per 100sqm	Town Centre	Industrial		0.180	0.024	0.204	0.004	0.085	0.089
Employment	B2	per 100sqm	Edge of Town Centre	Industrial		0.180	0.024	0.204	0.004	0.085	0.089
Employment	B2	per 100sqm	Suburban Area	Industrial		0.180	0.024	0.204	0.004	0.085	0.089
Employment	B2	per 100sqm	Neighbourhood Centre	Industrial		0.103	0.031	0.134	0.036	0.106	0.142
Employment	B8	per 100sqm	Town Centre	Warehouse-Storage		0.060	0.042	0.102	0.030	0.072	0.102
Employment	B8	per 100sqm	Edge of Town Centre	Warehouse-Storage		0.060	0.042	0.102	0.030	0.072	0.102
Employment	B8	per 100sqm	Suburban Area	Warehouse-Storage		0.060	0.042	0.102	0.030	0.072	0.102
Employment	B8	per 100sqm	Neighbourhood Centre	Warehouse-Storage		0.232	0.040	0.272	0.020	0.192	0.212
Employment	B8	per 100sqm	Suburban Area	Commercial Warehouse		0.027	0.018	0.045	0.035	0.021	0.056
Hotel-food-drink	A3	per 100sqm	Town Centre	Cafes		0.636	0.000	0.636	0.000	0.500	0.500
Hotel-food-drink	A3	per 100sqm	Suburban Area	Cafes		1.149	0.000	1.149	0.000	0.000	0.000
Hotel-food-drink	A3	per 100sqm	Edge of Town Centre	Restaurants		0.000	0.000	0.000	0.968	0.261	1.229

Land Use	Land Use	Units	Location	Sub-category		Trip Rates					
						AM Peak			PM Peak		
						Arrival	Departure	Total	Arrival	Departure	Total
Hotel-food-drink	A3	per 100sqm	Suburban Area	Restaurants		0.000	0.000	0.000	1.340	0.515	1.855
Hotel-food-drink	A3	per 100sqm	Neighbourhood Centre	Restaurants		0.000	0.000	0.000	0.894	0.335	1.229
Hotel-food-drink	A3	per 100sqm	Town Centre	Pub/Restaurants		0.000	0.000	0.000	0.824	1.059	1.883
Hotel-food-drink	A3	per 100sqm	Suburban Area	Pub/Restaurants		0.305	0.000	0.305	2.035	1.319	3.354
Hotel-food-drink	A3	per 100sqm	Neighbourhood Centre	Pub/Restaurants		0.000	0.000	0.000	2.438	1.343	3.781
Hotel-food-drink	A3	per 100sqm	Neighbourhood Centre	Fast food drive through		27.143	28.571	55.714	12.420	14.331	26.751
Hotel-food-drink	A3	per 100sqm	Town Centre	Take away shop		0.000	0.000	0.000	25.000	23.000	48.000
Hotel-food-drink	C1	per 100sqm	Suburban Area	Hotel		0.083	0.187	0.27	0.208	0.104	0.312
Health	C2	per beds	Suburban Area	Care home		0.066	0.038	0.104	0.019	0.047	0.066
Health	C2	per beds	Neighbourhood Centre	Care home		0.064	0.064	0.128	0.037	0.048	0.085
Health	Ee	per 100sqm	Suburban Area	GP surgery		3.058	2.048	5.106	1.443	2.077	3.520
Health	Ee	per 100sqm	Suburban Area	NHS		2.043	0.553	2.596	0.553	1.319	1.872
Health	Ee	per 100sqm	Edge of Town Centre	Veterinary surgery		2.016	1.613	3.629	2.218	2.823	5.041
Health	Ee	per 100sqm	Suburban Area	Veterinary surgery		2.857	0.357	3.214	1.071	0.714	1.785
Education	F1a	per 100sqm	Edge of Town Centre	Primary school		6.695	3.811	10.506	0.000	0.126	0.126
Education	F1a	per 100sqm	Suburban Area	Primary school		3.212	2.902	6.114	0.072	0.238	0.310
Education	F1a	per 100sqm	Neighbourhood Centre	Primary school		5.178	4.355	9.533	0.164	0.424	0.588
Education	F1a	per 100sqm	Suburban Area	Secondary school		0.819	0.636	1.455	0.130	0.192	0.322
Education	F1a	per 100sqm	Neighbourhood Centre	Secondary school		1.341	0.915	2.256	0.256	0.22	0.476
Education	F1a	per 100sqm	Neighbourhood Centre	Community education		unavailable in TRICs					
Education	F1a	per 100sqm	Suburban Area	Nursery		1.896	1.272	3.168	1.387	2.035	3.422

Land Use	Land Use	Units	Location	Sub-category		Trip Rates					
						AM Peak			PM Peak		
						Arrival	Departure	Total	Arrival	Departure	Total
Leisure	F2b	per site area	Suburban Area	Equestrian Centre		unavailable in TRICs					
Leisure	F2b	per site area	Suburban Area	Football		0.143	0.000	0.143	6.250	1.500	7.750
Leisure	Ed	per 100sqm	Suburban Area	Fitness club		33.333	25.000	58.333	97.222	58.333	155.555
Leisure	Ed	per 100sqm	Neighbourhood Centre	Play centre		unavailable in TRICs					
Car Showroom		per 100sqm	Suburban Area	car showroom		1.711	0.589	2.3	0.370	1.465	1.835
Vehicle Services		site area	Suburban Area	car wash		36.066	24.59	60.656	54.098	78.689	132.787
Vehicle Services		no of bays	Suburban Area	car wash		0.947	0.632	1.579	1.211	1.632	2.843
Petrol Filling Station		site area	Town Centre	petrol filling station		unavailable in TRICs					

Table 4-5: New Hourly Forecasting TRICS Trip Rates per Time Period

4.4.6 Trip Distribution

For each development zone, a donor zone from the base year was chosen to duplicate its trip pattern. The selected donor zone was one that shared the same land use as the proposed development zone, and it was located in reasonable proximity to the zone. This process was undertaken in order to replicate the trip distribution of the developments' zones. This also allowed the future land use of zones to be robustly modelled once the matrix furnessing had been applied. The AM and PM development OD trips developments were divided between purposes based on the donor zone purpose proportion.

4.4.7 Good Vehicle Growth Factors

General growth in LGV and HGV demand has been produced using the growth factors derived from the Road Traffic Forecasts (RTF) 2022 published by DfT. The RTF traffic mileage data for all road types was extracted from the Core scenario for LGV and HGV and then interpolated to derive growth factors for 2040 from 2019. The resulting growth factors are shown in Table 4-6 and applied at an assignment (peak hour) matrix level.

Region	2019 – 2040 Growth Factor	
	LGV	HGV
East Midlands	1.32	1.09
Eastern England	1.31	1.12
London	1.29	1.07
North East	1.34	1.08
North West	1.28	1.10
South East	1.33	1.13
South West	1.28	1.07
West Midlands	1.34	1.10
Yorks & Humber	1.28	1.10
Wales	1.29	1.08
Scotland	-	-

Table 4-6: 2040 LGV and HGV Factors

4.4.8 Forecast Baseline Total Matrix

Table 4-7 provides a summary of highway matrix trip totals at the peak hour level for each highway assignment user class and the percentage change between base and forecast scenarios totals.

Time Period	Segment	Base (2019)	Forecast Baseline (2040)		
		Matrix Total	Matrix Total	Difference to Base	% Difference to Base
AM Peak	Car Commute	136,411	155,518	19,107	14%
	Car Employers' Business	42,159	48,508	6,349	15%
	Car Other	125,705	145,331	19,626	16%
	LGV	225,684	314,944	89,260	40%
	HGV	44,426	52,218	7,792	18%
	Total	574,385	716,520	142,135	25%
PM Peak	Car Commute	118,816	135,970	17,154	14%
	Car Employers' Business	40,842	47,172	6,330	15%
	Car Other	201,015	233,704	32,689	16%
	LGV	189,199	263,924	74,725	39%
	HGV	28,583	33,382	4,799	17%
	Total	578,455	714,152	135,697	23%

Table 4-7: Base and Forecast Baseline Matrices Comparison

5. Forecast Results

5.1 Overview

This section describes the forecast results for the Forecast Baseline scenario. A set of output plots have been produced to show the flow difference, node level of service and change in travel time in order to help identify key "hot-spot" areas from additional growth and developments in the 2040 Forecast Baseline.

5.2 Forecasts Baseline Results

5.2.1 Flow Difference Plots

Flow difference plots have been produced to show the difference in actual flows between the 2040 Forecast Baseline and 2019 Base models. These are presented in Figure 5-1 and Figure 5-2.

Comparing the 2040 and 2019 models, significant increase in traffic is predicted along major corridors such as M25, M20, M26 and A21. These are then followed by increases in traffic predicted along A224 London Road, Shoreham Road, A224 Orpington By-Pass, A225 Dartford Road, A225 Sevenoaks Road, A25 Westerham Road, A25 Bradbourne Vale Road, A25 Seal Road and in local roads around the town centre in Swanley, Sevenoaks and Edenbridge.

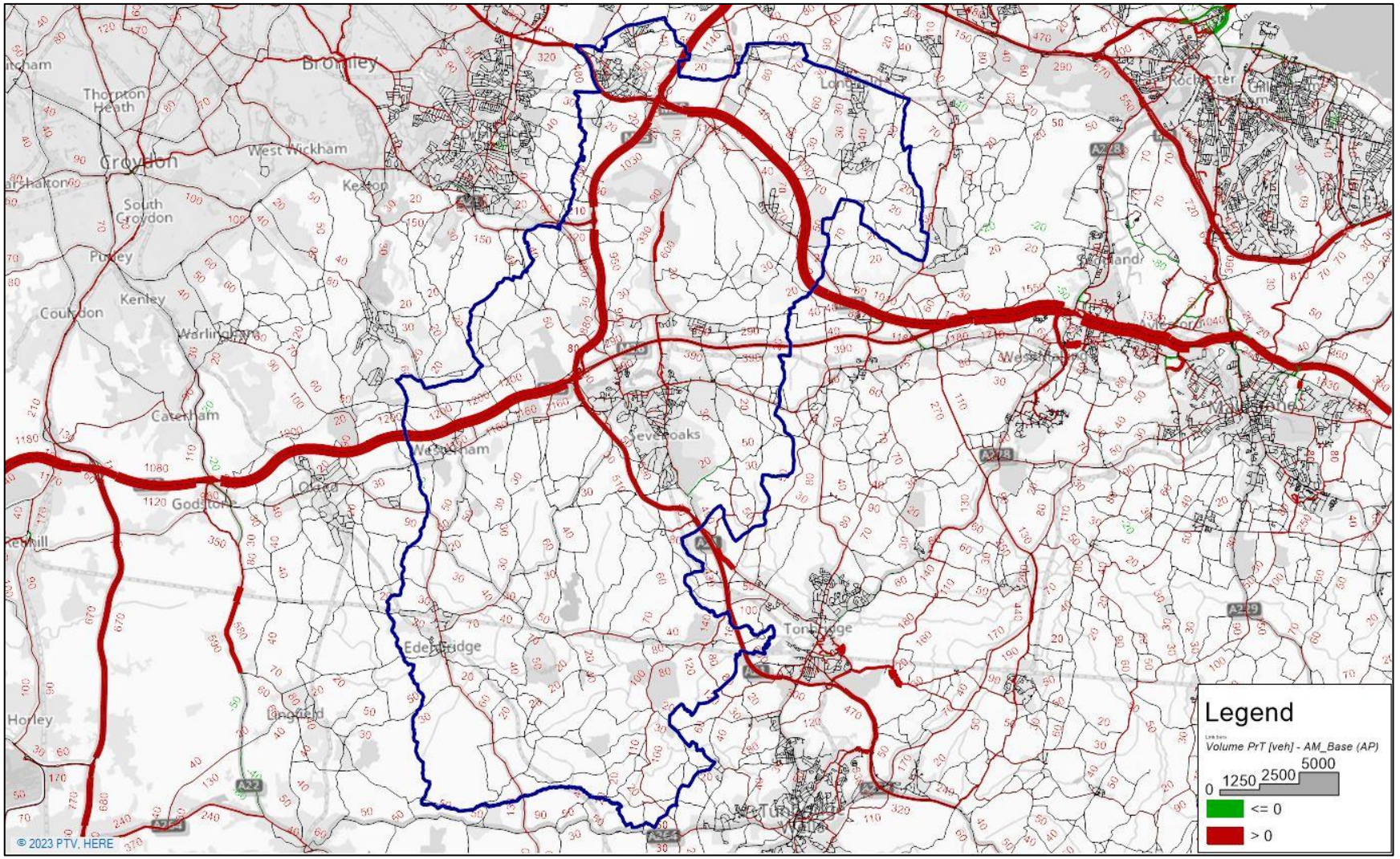

Figure 5-1 – 2040 vs 2019 Flow Difference - AM Peak

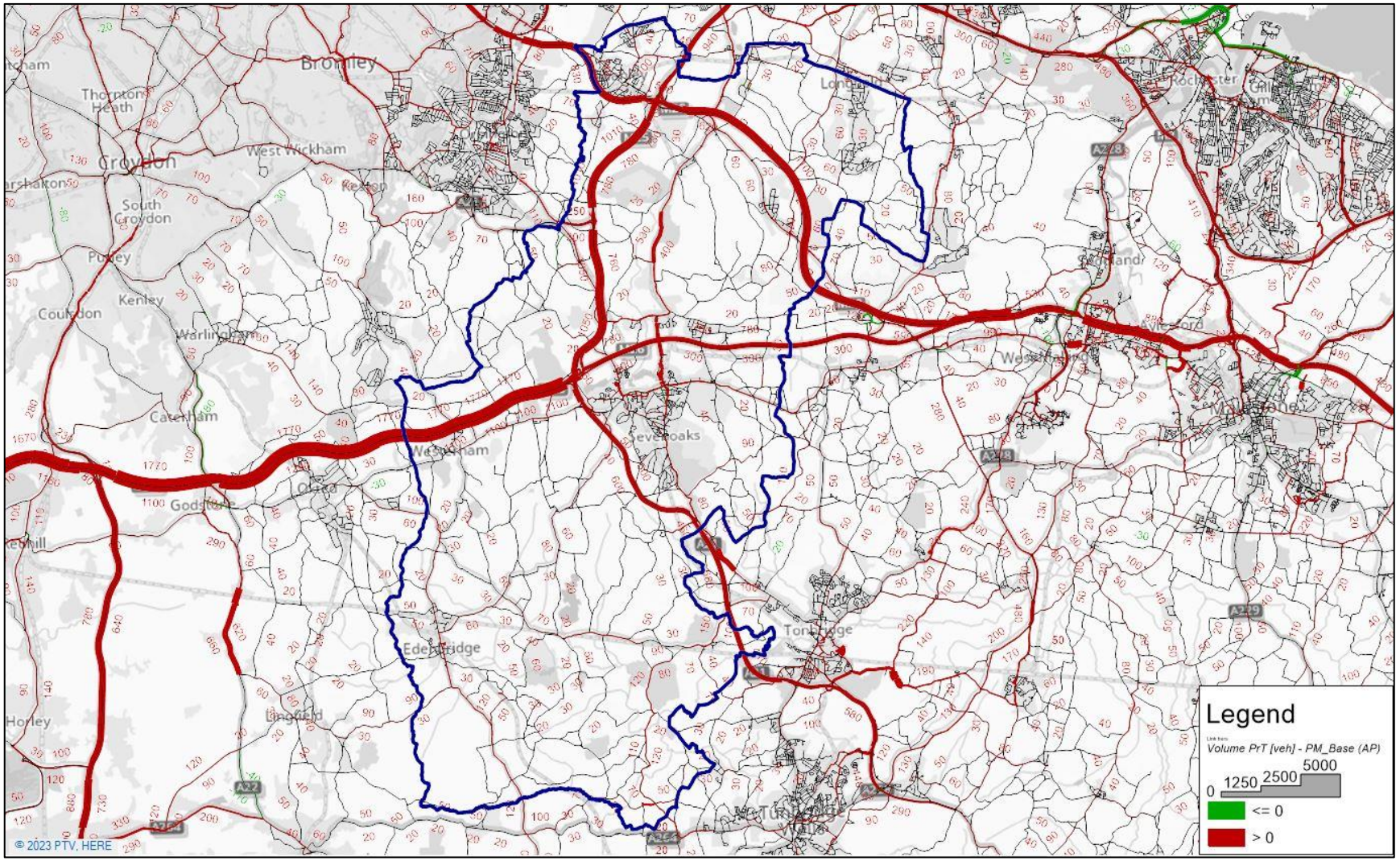

Figure 5-2 – 2040 vs 2019 Flow Difference - PM Peak

5.2.2 2040 Junction and Link "Hot Spots"

Figure 5-3 and Figure 5-4 show the junction LOS and link V/C ratio for 2040 AM and PM peak periods. These include the list of key junctions and links showing LOS E and F and V/C > 85%. Detailed plots are presented in Appendix B while Appendix C, shows the detailed LOS and V/C ratio information in some key junctions for reference

In the AM peak, most of the junction and link "hot spots" identified in the base model also exist in the 2040 models (highlighted in black on the map). These include junctions and links in the towns of Swanley and Sevenoaks. In addition to these locations, a number of junctions and links in the 2040 Forecast Baseline were added to the list, which exhibits severe levels of delay (highlighted in blue on the map). These include M25 J3, A20 Main Road in Farningham, A20/ Eynsford Road junction and M26 (between J3 and J4) near Swanley and Eynsford. LOS E and F and V/C > 85% are also predicted along A25 / B2019 Seal Hollow Road and A225 High Street / Pembroke Road junctions in Sevenoaks Town and B245 London Road (near Morley's Roundabout). In addition, B2026 Station Road in Edenbridge also predicted V/C ratio > 85%. On the other hand, the scheme implemented at Bat and Ball junction improves the LOS from D to C.

Similar patterns are found in the PM peak with the slip roads at M25 J5 exhibiting V/C ratio >85% along its two ramps and A25 / Church Road exhibiting LOS E.

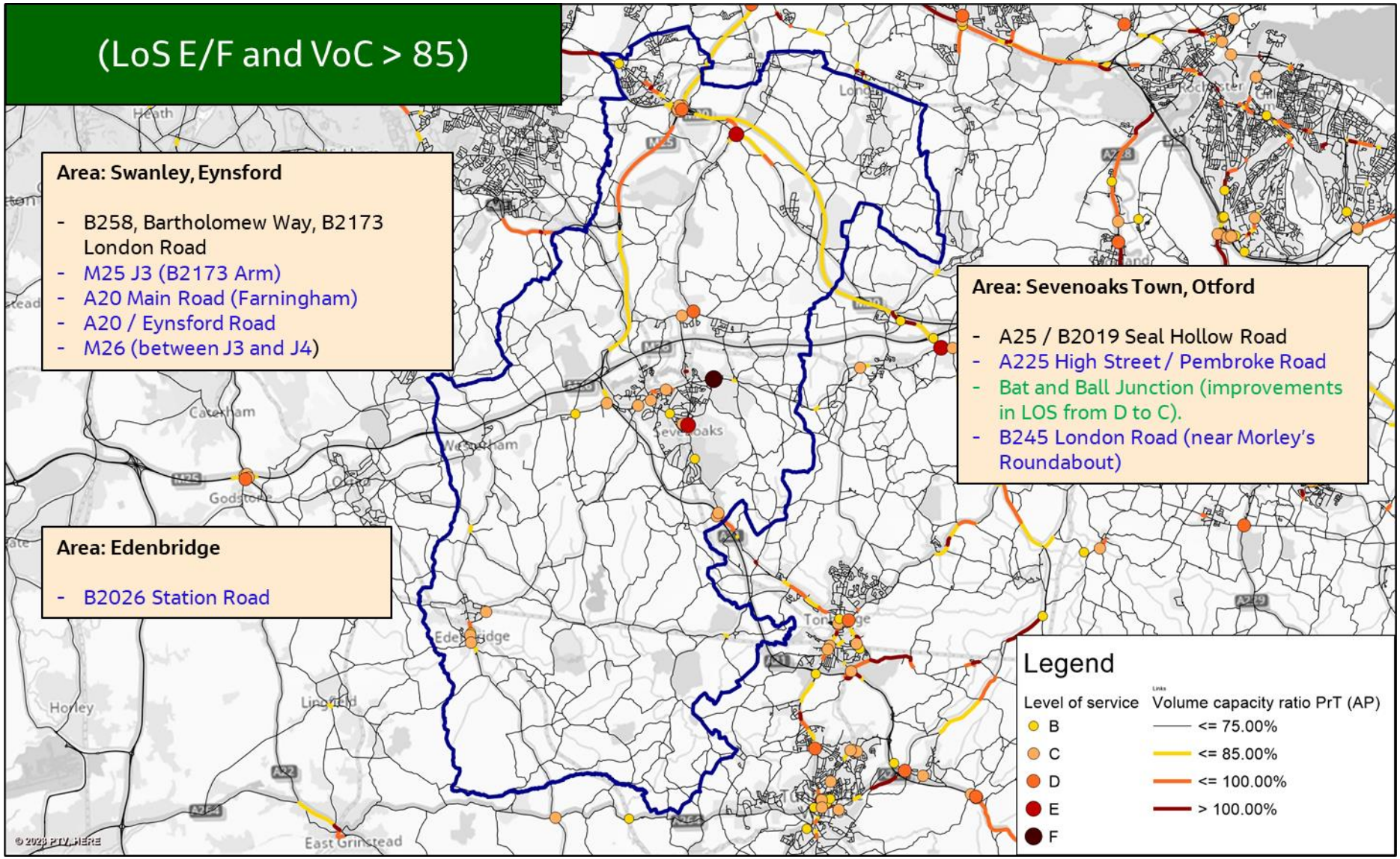

Figure 5-3: 2040 AM Peak Junction and Link "Hot Spots"

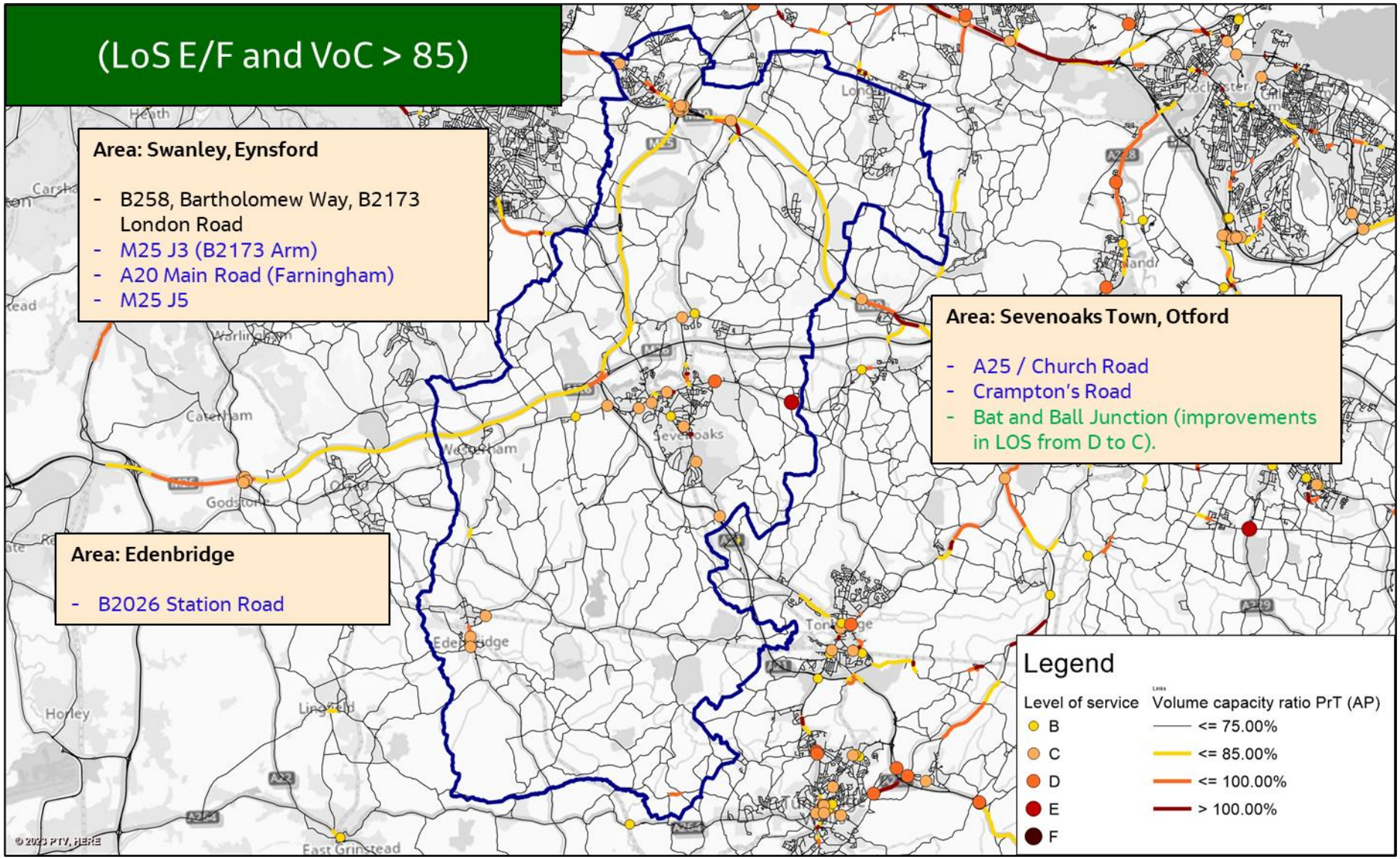

Figure 5-4: 2040 PM Peak Junction and Link "Hot Spots"

5.2.3 Journey Time Comparison

This section focuses on the journey time comparison for local routes in Sevenoaks between the 2040 Forecast Baseline and 2019 Base. The routes used for this analysis are shown in Figure 5-5 and the detailed comparisons for each time period are presented in Table 5-1 and Table 5-2. Delay visualisation maps are also presented in Figure 5-6 and Figure 5-7 for reference.

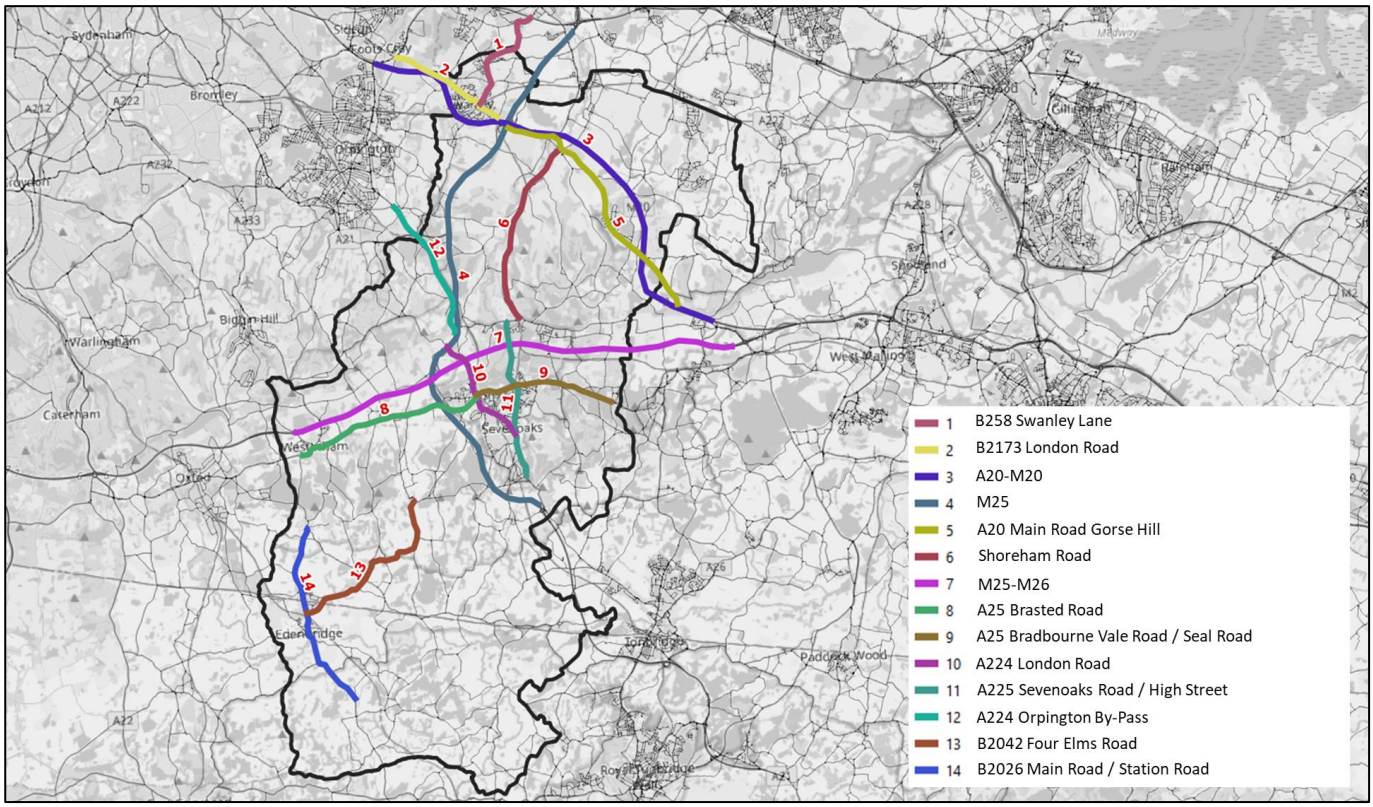

Figure 5-5: Journey Time Routes in Sevenoaks

In the AM peak, the following routes exhibit travel time increase of greater than 10% between the 2040 Forecast Baseline and 2019 Base.

- Route 3 along A20 and M20 westbound direction shows an increase of 17% or around 2 minutes of increase in the journey time.
- Route 4 along M25 shows an increase of 16% or an additional 2 minutes and 20 seconds in the journey time in the southbound direction and 10% or an additional 1 minute and 15 seconds in the northbound direction.
- Route 14 along B2026 Main Road and Station Road southbound direction shows an increase of 10% or around 1 minute of increase in the journey time.

In the PM peak, in addition to the routes mentioned above in AM peak, the following routes exhibit travel time of greater than 10% between the 2040 Forecast Baseline and 2019 Base.

- Route 7 along M25 and M26 eastbound direction shows an increase of 10% or around 1 minute of increase in the journey time.
- Route 9 along A25 Bradbourne Vale Road / Seal Road eastbound direction shows an increase of 10% or around 1 minute of increase in the journey time.
- Route 11 along A225 Sevenoaks Road / High Street northbound direction shows an increase of 10% or around 1 minute of increase in the journey time.

- Route 14 along B2026 Main Road and Station Road northbound direction shows an increase of 12% or around 1 minute of increase in the journey time.

Although the report highlights the routes with a journey time difference of greater that 10%, it should be noted that a low percentage increase can still have impacts in the junction delays, especially on areas where congestion currently exists.

For example, in the AM peak, the following routes shows journey time increase of less than 10%, however, the actual time difference is close to 1 minute.

- Route 5 along A20 Main Road Gorse Hill (northbound)
- Route 6 along Shoreham Road (southbound)
- Route 7 along M25 and M26 (westbound)
- Route 8 along A25 Brasted Road (westbound)
- Route 9 along A25 Bradbourne Vale Road / Seal Road (westbound)

Similar to the PM peak, with Route 5 along A20 Main Road Gorse Hill (southbound) and Route 9 along A25 Bradbourne Vale Road / Seal Road (eastbound) showing journey time increase of less than 10% but the actual time difference is close to 1 minute.

Route	Description	Direction	AM Peak			
			2019 Base Model [min:sec]	2040 Forecast Baseline [min:sec]	Actual Difference [min:sec]	% Difference
			AM	AM	AM	AM
1	B258 Swanley Lane – B258 High Road	1_SB	07:04	07:11	00:07	2%
	B258 Swanley Lane – B258 High Road	1_NB	07:04	07:15	00:11	3%
2	B2173 London Road	2_EB	07:36	07:57	00:21	5%
	B2173 London Road	2_WB	07:55	08:15	00:20	4%
3	A20-M20	3_EB	12:05	12:27	00:22	3%
	A20-M20	3_WB	12:15	14:17	02:02	17%
4	M25	4_SB	14:43	17:03	02:20	16%
	M25	4_NB	13:46	15:01	01:15	10%
5	A20 Main Road Gorse Hill	5_SB	09:50	10:05	00:15	3%
	A20 Main Road Gorse Hill	5_NB	10:47	11:27	00:40	6%
6	Shoreham Road	6_SB	09:20	10:07	00:47	8%
	Shoreham Road	6_NB	08:56	09:15	00:19	4%
7	M25-M26	7_EB	10:36	10:53	00:17	3%
	M25-M26	7_WB	11:11	12:01	00:50	7%
8	A25 Brasted Road	8_EB	13:33	14:04	00:31	4%
	A25 Brasted Road	8_WB	13:15	14:00	00:45	6%
9	A25 Bradbourne Vale Road / Seal Road	9_EB	08:47	09:13	00:26	5%
	A25 Bradbourne Vale Road / Seal Road	9_WB	11:51	12:31	00:40	6%
10	A224 London Road	10_SB	08:16	08:46	00:30	6%
	A224 London Road	10_NB	08:38	08:56	00:18	3%
11	A225 Sevenoaks Road / High Street	11_SB	11:43	11:46	00:03	0%
	A225 Sevenoaks Road / High Street	11_NB	10:56	11:02	00:06	1%
12	A224 Orpington By-Pass	12_NB	06:17	06:51	00:34	9%
	A224 Orpington By-Pass	12_SB	06:13	06:38	00:25	7%
13	B2042 Four Elms Road	13_SB	08:49	08:58	00:09	2%
	B2042 Four Elms Road	13_NB	08:48	09:03	00:15	3%
14	B2026 Main Road – Station Road	14_NB	09:54	10:26	00:32	5%
	B2026 Main Road – Station Road	14_SB	09:43	10:39	00:56	10%

Table 5-1: Modelled Journey Time Comparison – AM Peak

Route	Description	Direction	AM Peak			
			2019 Base Model [min:sec]	2040 Forecast Baseline [min:sec]	Actual Difference [min:sec]	% Difference
			AM	AM	AM	AM
1	B258 Swanley Lane – B258 High Road	1_SB	07:03	07:11	00:08	2%
	B258 Swanley Lane – B258 High Road	1_NB	07:03	07:18	00:15	4%
2	B2173 London Road	2_EB	08:02	08:32	00:30	6%
	B2173 London Road	2_WB	07:36	08:00	00:24	5%
3	A20-M20	3_EB	12:51	14:01	01:10	10%
	A20-M20	3_WB	11:03	11:31	00:28	4%
4	M25	4_SB	14:11	15:10	00:59	7%
	M25	4_NB	14:01	16:43	02:42	19%
5	A20 Main Road Gorse Hill	5_SB	10:33	11:25	00:52	8%
	A20 Main Road Gorse Hill	5_NB	10:00	10:29	00:29	5%
6	Shoreham Road	6_SB	08:51	09:28	00:37	7%
	Shoreham Road	6_NB	09:23	09:57	00:34	6%
7	M25-M26	7_EB	11:07	12:17	01:10	10%
	M25-M26	7_WB	10:46	11:16	00:30	5%
8	A25 Brasted Road	8_EB	13:55	14:35	00:40	5%
	A25 Brasted Road	8_WB	12:38	13:00	00:22	3%
9	A25 Bradbourne Vale Road / Seal Road	9_EB	09:30	10:26	00:56	10%
	A25 Bradbourne Vale Road / Seal Road	9_WB	09:55	10:16	00:21	4%
10	A224 London Road	10_SB	07:58	08:31	00:33	7%
	A224 London Road	10_NB	09:03	09:34	00:31	6%
11	A225 Sevenoaks Road / High Street	11_SB	11:20	11:34	00:14	2%
	A225 Sevenoaks Road / High Street	11_NB	10:54	11:58	01:04	10%
12	A224 Orpington By-Pass	12_NB	06:24	06:42	00:18	5%
	A224 Orpington By-Pass	12_SB	06:14	06:45	00:31	8%
13	B2042 Four Elms Road	13_SB	08:43	08:51	00:08	2%
	B2042 Four Elms Road	13_NB	08:41	08:53	00:12	2%
14	B2026 Main Road – Station Road	14_NB	09:35	10:42	01:07	12%
	B2026 Main Road – Station Road	14_SB	10:03	10:07	00:04	1%

Table 5-2: Modelled Journey Time Comparison – PM Peak

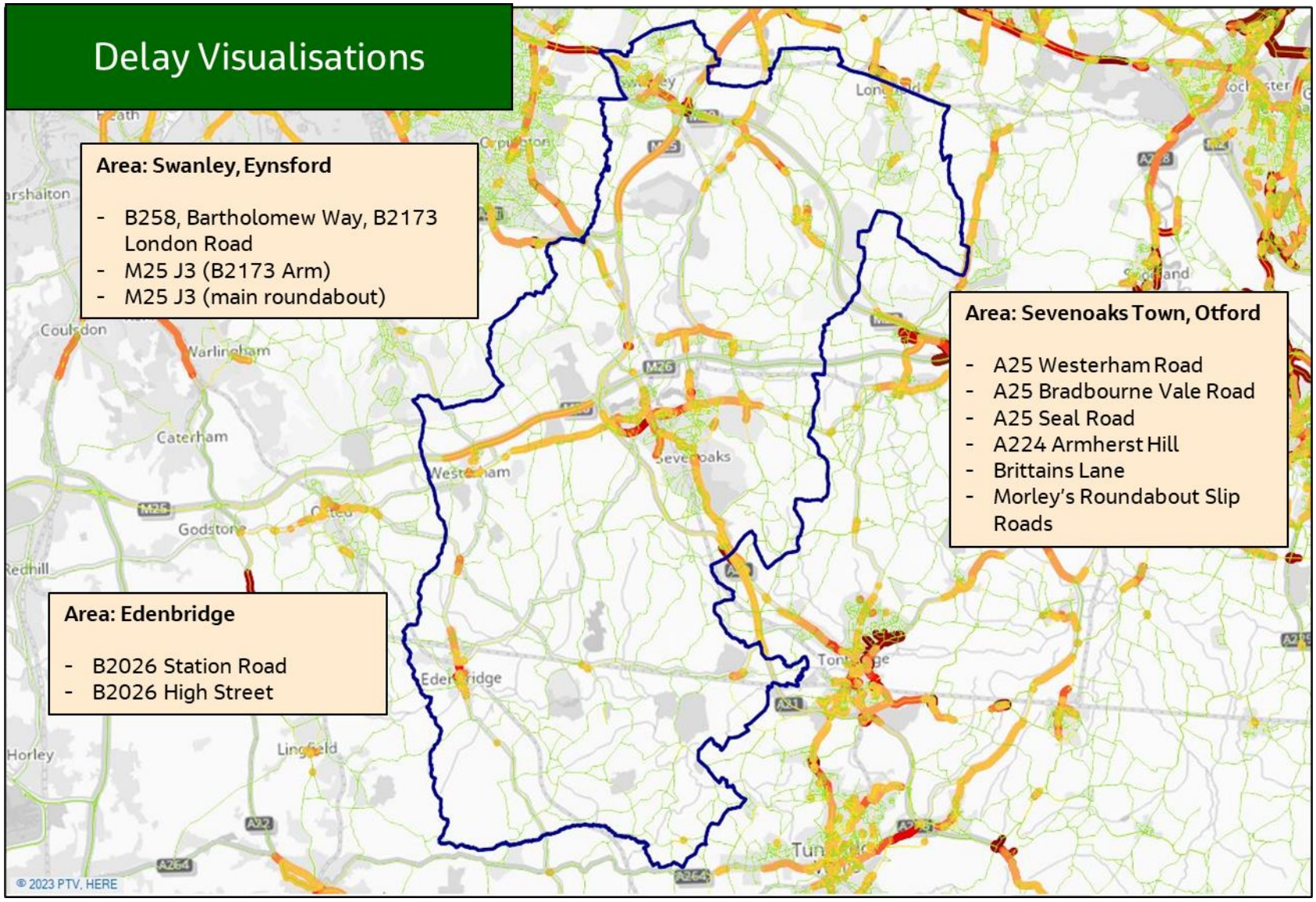

Figure 5-6: 2040 AM Peak Delay Visualisation

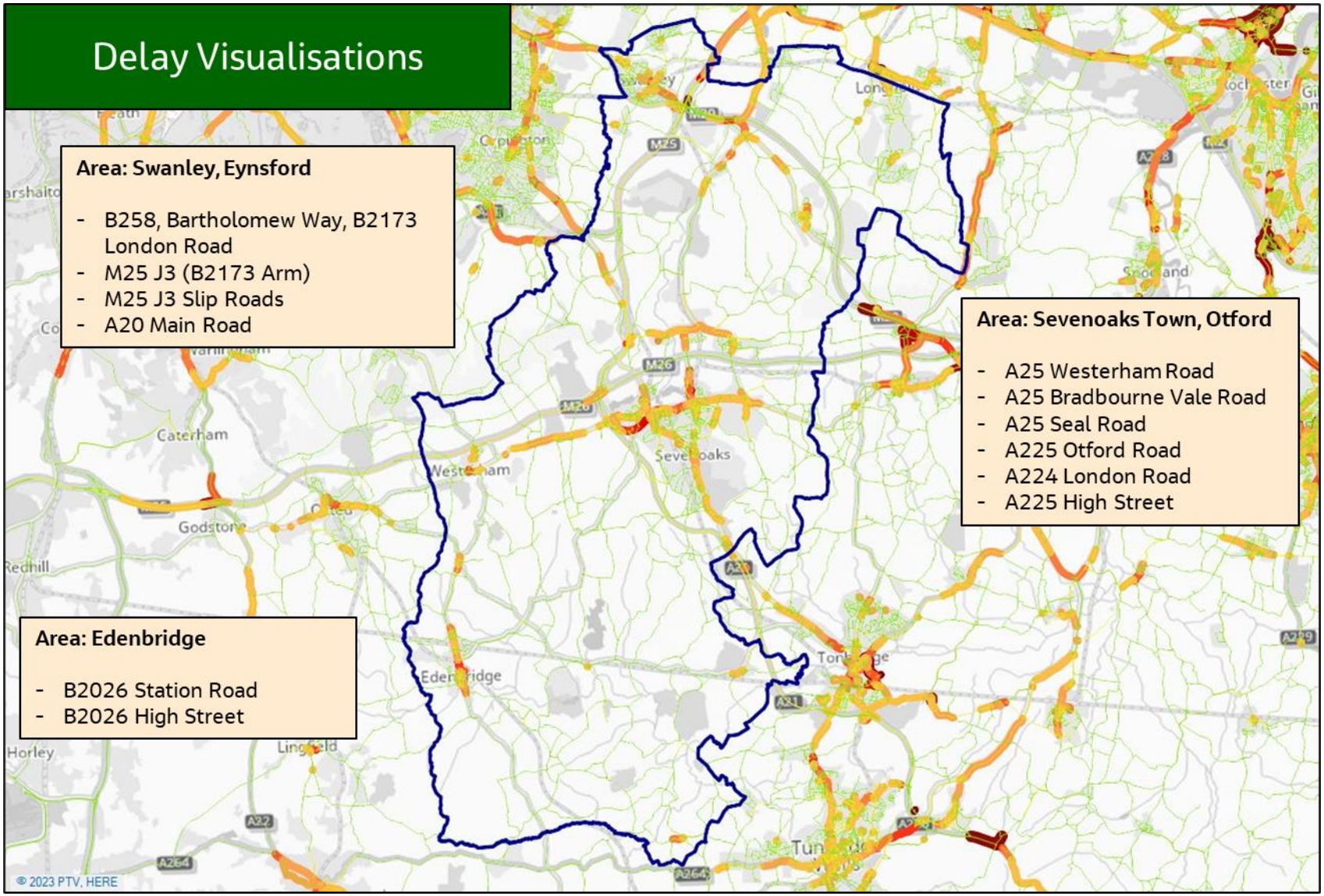

Figure 5-7: 2040 PM Peak Delay Visualisation

6. Summary and Recommendations

This Report describes the methods used to develop the Initial 2040 Forecast Baseline and approach taken to identify the key junction and link "hots spots" in Sevenoaks district.

Overall, the 2019 AM and PM outputs present similar locations of junction and link "hot spots". The majority of the junctions exhibiting LOS E and F, or links displaying unstable flows (>85%) or which are over capacity (>100%), are located along:

- B258, Bartholomew Way, B2173 London Road (Swanley)
- M25 J3 (roundabout link is showing V/C ratio of >100%)
- A25 / A225 St John Hill – Bat and Ball Junction (Sevenoaks Town)
- A25 / B2019 Seal Hollow Road (Sevenoaks Town) - although the overall junction is showing LOS D, the north-eastern and eastern arms of the junction is showing LOS E and F.
- A20 Main Road / A225 Eynsford Road

The developments categorised as "near certain" and "more than likely" and highway schemes were identified in collaboration with KCC and SDC were implemented in the Initial 2040 Forecast Baseline together with the growth in the neighbouring authorities and other external areas. The 2040 model shows increase in traffic flows in major corridors, particularly around M25, M20, M26 and A21. Increases in traffic flows are also predicted along A224 London Road, Shoreham Road, A224 Orpington By-Pass, A225 Dartford Road, A225 Sevenoaks Road, A25 Westerham Road, A25 Bradbourne Vale Road, A25 Seal Road and in local roads around the town centre in Swanley, Sevenoaks and Edenbridge.

In terms of junction and link "hot spots" in 2040, the majority of those locations identified in 2019 are still problematic in 2040. However, due to the overall growth assumed, additional junctions and links were identified:

- M25 J3 - B2173 Arm (Swanley)
- A20 Main Road (Eynsford)
- M26 (between J3 and J4)
- A225 High Street / Pembroke Road (Sevenoaks Town)
- B245 London Road (near Morley's Roundabout)
- B2026 Station Road (Edenbridge)
- M25 J5 (the two ramps from the western leg of the junction)
- A25 / Church Road (East of Sevenoaks Town)
- Crampton's Road (Sevenoaks Town)

The following journey time routes show more than 10% travel time increases. Most of these routes cover the hot-spots areas mentioned above.

- Route 3 - A20 and M20
- Route 4 - M25
- Route 7 - M25 and M26
- Route 9 - A25 Bradbourne Vale Road / Seal Road
- Route 11 along A225 Sevenoaks Road / High Street
- Route 14 along B2026 Main Road and Station Road

In addition, consideration should also be given on the following routes showing journey time increases close to 1 minute. Although the total journey time increase of these routes is less than 10%, the actual time difference could still have impacts in the junction delays, especially on areas where congestion currently exists

- Route 5 - A20 Main Road Gorse Hill
- Route 6 - Shoreham Road
- Route 7 - M25 and M26
- Route 8 - A25 Brasted Road

This initial forecast scenario has been developed in order to test the impacts of the developments and overall growth in neighbouring districts to Sevenoaks. In interpreting the results, it should be noted that in strategic modelling, issues on one junction could reflect delays or congestion of the corridor nearby. Furthermore, the outputs from the strategic model provides a high-level indication of where the capacity of the road will likely be an issue. Development of the local junction models (to include accurate geometry and visibility information for specific locations) is recommended as the next step. In addition to option testing, further work can also be considered to assess environmental and public transport impacts.

Appendix A. 2019 Detailed Plots

Appendix B. 2040 Detailed Plots

Appendix C. V/C Ratio and LOS

Appendix D. List of Committed Developments in Sevenoaks